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Two-mode brokerage in policy networks

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ABSTRACT

Gould and Fernandez (1989) developed a widely used operationalization of brokerage for one-mode networks. The basic idea of brokerage is that the central actor or 'broker' benefits from spanning the gap (or structural hole) between two disconnected parties. However, it is not always advantageous to limit the systems studied to only one mode. We develop an operationalization of two-mode brokerage in which we can classify the structures according to the heterogeneity of the types of actors involved. We apply this conception to water policy networks in the San Joaquin–Sacramento River Delta in California where two-mode networks represent organizations participating in multiple policy institutions. The potential benefits of brokerage are high in these types of fragmented systems where multiple institutions and organizations are involved with policy decisions. Of particular interest is the role of collaborative partnership institutions, which are hypothesized to broker the most heterogeneous structures. We use our two-mode version of brokerage to construct a scale of brokerage from most homogeneous to most heterogeneous. This scale lets us categorize both the role of these collaborative partnerships as well as the nature of brokerage in the system overall.

1. Introduction

The brokerage role, where one node acts as a bridge, intermediary, or boundary spanner between two otherwise disconnected nodes (thus forming a "chain" of three nodes), is an important concept in social network analysis. Ronald Burt's theory of structural holes is premised on the idea that a brokering individual or organization has access to different resources and information than non-brokering actors (Burt, 2001, 2005). Gould and Fernandez (1989) developed one of the most widely used definitions of brokerage, which categorizes brokerage chains into distinct roles based on the classification of the nodes into different groupings (usually a categorical vertex attribute). In an example from health policy in the United States, they show that brokerage roles are associated with greater reputations for influence over the policy process (Fernandez and Gould, 1994). Thus brokers can benefit from their positions by gaining access to diverse resources and information as well as acquiring a better reputation among others in the network.

Here we extend this idea from one-mode networks, defined by a set of nodes and the edges that connect those nodes, to two-mode networks. A two-mode network is made up of two different sets of nodes (called modes), where ties only connect nodes of different sets (see Section 1.2). Gould and Fernandez (1989) used a one-mode network (generated from a survey question), but explained that they could have used a two-mode network consisting of the organizations and different events the organizations co-attended. They did not use the two-mode approach because (a) they chose to test hypotheses in which event participation was viewed as an attribute, and (b) they argued that co-participation in events reflects only short-term goals (Fernandez and Gould, 1994, pp 1467). Although they were far more interested in the first mode (organizations) than the second mode (events), in many other cases, including the one to be described here, this choice is not so clear.

The method developed in this paper permits the investigation of brokerage chains using the data on both modes. The theoretical importance of our two-mode version of brokerage relies on similar reasoning as other definitions of brokerage. The benefits of brokerage are higher when they include more diverse groups, which serve as non-redundant sources of information, ideas, and other resources. Keeping the full two-mode structure permits us to examine the diversity of both modes, and allows us to empirically characterize the types of brokerage chains expected to provide the greatest benefits.

We apply our two-mode version of brokerage to an empirical case of water policy networks, where brokerage is particularly

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relevant. A defining feature of water governance is institutional fragmentation, which occurs when different governing institutions have overlapping responsibility for policy issues that span administrative boundaries, or work independently on issues that are in reality interconnected—what Lubell (2013; see also Long, 1958) calls an "ecology of games." Within each policy "institution" (which other researchers have called "policy processes" or "venues") multiple participating organizations make collective decisions about various issues. The existence of interdependent policy institutions creates a large potential for "institutional externalities" in which organizations making decisions in one policy institution fail to consider the costs and benefits imposed on others. Although we focus on water policy, institutional fragmentation is a major challenge in most other policy domains, and brokerage provides benefits by helping to coordinate diverse actors and institutions.

This article focuses particularly on the idea of "institutional" brokerage, in which policy institutions emerge to forge connections between institutions that were otherwise fragmented. Brokering institutions helps alleviate fragmentation by providing opportunities to negotiate over the benefits and costs of coordinated decisions (Berkes, 2002; Carlsson and Sandstrom, 2008; Crona and Parker, 2012; Manring, 2007; Stovel and Shaw, 2012) and share information across different types of boundaries. Since the 1990s, environmental policy has witnessed the evolution of a massive number of "collaborative" institutions, which seek to play exactly this brokering role (Ansell and Gash, 2008; Hughes and Pincetl, 2013; Leach et al., 2002). These institutions are designed specifically to take advantage of the potential benefits of a brokering position (Schneider et al., 2003).

In the next section, we will discuss the general idea of brokerage as it has emerged from the sociological literature on networks, and explain how it is operationalized in the context of two-mode networks. We then describe some specific hypotheses to be tested in our example of water policy institutions. The results section tests these hypotheses by means of descriptive statistics, Exponential Random Graph Models (hereafter ERGM or ERG model), and simulations from the ERG model.

1.1. Brokerage in one-mode networks

Mardsen defines brokerage as a process "by which intermediary actors [*brokers*] facilitate transactions between other actors lacking access to or trust in one another" (Marsden, 1982, p202). Interest in studying brokerage exploded after Burt's claim that "social capital is created by a network in which people can broker connections between otherwise disconnected segments" (Burt, 2001). In the organizations literature, this same role is referred to with a variety of terms from boundary spanners (Aldrich and Herker, 1977; Friedman and Podolny, 1992), bridging organizations (Brown, 1998; Hahn et al., 2006), broker organization (Chaskin, 2001), and many others (Collins-Dogrul, 2012). These brokers can profit from increased exposure to different ideas, knowledge, or resources (Burt, 2001), boosted reputations and influence (Heaney, 2006), and monopolizing communication pathways (Chaskin, 2001). However, these roles are not without costs and potential pitfalls; brokers are often taking the highest risks when working with disconnected parties that can be suspicious of others or even hostile (Stovel and Shaw, 2012).

Gould and Fernandez added a group identity component to Marsden's definition, arguing that frequently in social systems, actors are organized along different criteria – institution type, membership, issue focus, etc. – and therefore have different goals. They were interested in why organizations crossed these group boundaries to work together and whether this structural position was related to perceived influence over policy negotiations (as determined by other organizations in the network).

Fig. 1 shows Gould and Fernandez's classifications of the five types of brokerage possible when group identity (as determined by a categorical attribute) is considered. The shading of the node, specifically black, gray, or white, indicates to which grouping the node belongs. The brokering organization is always the middle node in this "chain" – the one that both sends and receives a tie. The brokerage chain on the far left displays the Coordinator scenario in which brokerage is occurring within one defined group or type of actors (indicated by the fact that all of the nodes are shaded black). In this condition, the broker is coordinating the activities of group members who have similar interests, aims, and goals. For the Representative structure, the broker represents his or her group to a member of a different group. This is indicated by the fact that the broker and the top node are both shaded the same, and the recipient of the broker's information (the node on the bottom) is shaded differently. In the Gatekeeper scenario, the flow of information is reversed – the broker receives information from a node in a different group (the white node at the top) and transmits the information to a node in the same group as the broker. The Itinerant structure occurs when the two alters (top and bottom) are from the same set of nodes (both shaded black) but the broker is from a different group. Finally, in the Liaison structure, is a case where all three nodes in the brokerage chain are from different groups.

One of Fernandez and Gould's main findings is that the benefits of brokerage are mediated both by the type of organization (the node sets) and the type of brokerage chain (the classification in Fig. 1). The first distinction Fernandez and Gould make is between the individuals playing roles in the coordinator scenario and the other brokerage structures; because the coordinators broker only within their own type this is referred to as a 'null' form of brokerage (Fernandez and Gould, 1994, p1459). The second distinction they make is to distinguish coordinator, representative, and gatekeeper brokerage roles from itinerant and liaison roles. They called the first three "insider" roles because at least one other actor in the chain is from the same subgroup as the broker, whereas the itinerant and liaison chains are "outsider" since the broker is the only representative of its type in the chain. In their health policy example, Fernandez and Gould use this insider/outsider division with the classification of organizations as government/non-government to posit a differentiated relationship between brokerage roles and influence. Although non-governmental organizations were found to have more influence when they held any type of brokerage position (Table 3, p1471), governmental organizations gained influence only when they held "outsider" brokerage roles in itinerant and liaison chains (Table 4, p1472). Gould and Fernandez (1989) argued that this results from the constraint that governmental organizations must be perceived as impartial in order to benefit from a brokerage position, but that is not the case for non-governmental organizations.

1.2. Extending brokerage to two-mode networks

A two-mode network has two sets of vertices, referred to here as M and N, and each edge has two endpoints, $\{v_1,v_2\}$, such that $v_1 \in M$ and $v_2 \in N$. In the standard definition of two-mode networks, a vertex is never directly linked to another vertex from the same subset (although some work in multilevel networks uses an alternative; see Wang, Robins et al., 2013). Researchers have been studying two-mode network structures for almost as long as they have studied networks themselves (see Freeman's 2004 description of Hobson's 1884 study). Recently, there has been increased attention on the analysis tools used for two-mode networks (see a special issue in the Journal of Social Networks: Agneessens and Everett, 2013). Many approaches to analyzing two mode networks consist of converting the data to a one-mode network (either MxM or NxN) that is a projection of the original data. However, previous studies