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HOMOPHILY AND AGENCY: CREATING EFFECTIVE SUSTAINABLE DEVELOPMENT NETWORKS

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Abstract. Community networks are self-organized groupings that form for many different reasons. Some networks, connected mainly through bonding ties, are based on personal interests and relationships; others, based mainly on bridging ties, centre around broader interests. These networks form to create collective agency for engaging with social, environmental, and other issues through the concentration of social capital. The multi-scaled and evolutionary nature of sustainable development issues requires that community groups dedicated to engaging with such issues be particularly diverse, resilient, and flexible. As such, they must build a large number of bridging ties leading to external resources and limit the potential for bonding ties to impose constraining norms upon the group.

Over time, however, volunteer groups tend towards a state of homophily, the tendency of groups to form from similar actors and then become more similar with time. This tendency leads to a decrease in the number of the bridging ties that help to provide group agency. Homophily must be actively recognized within community sustainable development groups if they are to remain effective over the long term. This paper suggests methods to prevent and control group homophily drawn from experience in forming small, time-limited sustainable development networks.

Key words: agency, bonding ties, bridging ties, community activism, homophily, networks, social capital, sustainable development.

1. Introduction

The concept of sustainable development has evolved significantly since it was first introduced into common use by the Brundtland commission's 1987 report "Our Common Future". Defined in that report as "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland, 1987), sustainable development continues to play an increasing role in planning at all levels of social organization. Sustainable development initiatives have been particularly robust at the community level. This is a very promising process, as sustainable development will be best facilitated when governments have local partnerships (Dale, 2001). Caught on the front lines of the tension between

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ecological values and economic expansion, communities are attempting to resolve conflicting and competing uses of land and resources.

In contrast to the structured hierarchical responses of national and international bodies, community sustainable development initiatives tend to be self-organizing as groups of concerned citizens and local governments mobilize around specific issues and try to resolve competing resource conflicts. However, the volunteer nature of community sustainable development initiatives can lead to difficulties when communities find their scarce human resources stretched over a myriad of issues, many of which are complex and over-lapping. Given the complexity of sustainable development issues, communities often find it a struggle to adequately engage the issues at hand. Often issues have roots that spread far beyond individual communities; they are local manifestations of global concerns. Though these problems can be addressed at the local level in the short term, long-term remediation requires active engagement with and cooperation with outside agencies. As this can involve exhaustive and long term commitments, local sustainable development groups enjoy an advantage if they have a diverse membership with diverse capitals able to address a variety of social and environmental issues without needing to continually reform specific response groups.

Though in the information age the term ''community'' refers both to communities of place and communities of choice or practice (Lesser and Prusak, 2000), voluntary group formation in either setting creates roughly the same result: the formation of networks. As will be discussed below, network formation leads to the creation of group social capital, and under the right circumstances leads to the creation of group agency (Newman and Dale, forthcoming). Networks are a powerful means of distributing knowledge and can lead to the reconciliation of previously competing information, interests and agendas (Dale and Onyx, 2005). Networks consist of individuals connected by ties, and different mixtures of ties create different networks (Borgatti and Foster, 2003). The specific mixture of each group's network ties will ultimately contribute to the success or failure of the group to achieve its sustainable development goals. Equally, homophily, the tendency of groups to form from similar actors, and then become more similar with time, may limit the success of networks. Members of a network are bound together by ties. Research distinguishes between ''bonding'' and ''bridging'' ties, also known as ''strong'' and ''weak'' ties (Narayan, 1999; Onyx and Bullen 2000; Putnam, 2000; Woolcock 2001). Bonding ties refer to relations among family members, close friends and neighbours in closed networks. These networks often lack diversity. Bonding ties create dense network clusters and strong but localized trust. Meanwhile, bridging ties facilitate access to resources and opportunities that exist in one network to a member of another (Granovetter, 1973). A diverse set of bridging ties within a group increases a group's agency (Newman and Dale, forthcoming), and so one might assume that diverse group membership will be an important element of how successful and long-lived a community sustainable development group is. A more diverse group will have the resources needed to address the complex nature of ecological and social problems without exhausting itself.

Unfortunately, as will be discussed below, volunteer groups such as community sustainable development groups tend to become more homogenous over time, leading to a loss of bridging ties and thus a loss of agency, one result of the group tendency towards homophily. This paper is devoted to the discussion of this effect, and potential methods to counter it. Given the extreme expenditure of energy and social capital needed to create a community sustainable development group, it is desirable to keep such groups diverse and robust; otherwise communities must go through continual processes of group dissolution and formation.

Maintaining diverse and active networks is especially critical in the engagement of sustainable development issues for several reasons, for the issues involved:

- are multiscaled and thus even a local network must have connections to broader levels of society to grasp the issue;
- are constantly evolving, and require a flexible and open engagement process, and
- require deliberately designed transdisciplinary processes, involving experts, government, and local stakeholders.

Managing homophily is thus especially critical to community sustainable development networks if they are to maintain critical agency and the necessary diversity so essential to transdisciplinarity problem-solving.

2. Social capital and agency

The combination of bonding and bridging ties found in a network of actors is often referred to as ''social capital''. Social capital has been defined differently by various scholars, sometimes as a function of different scales or an emphasis on actors. For example, Coleman (1990) and Portes (1998) explicitly conceptualized social capital as an asset held by individuals, whereas Putnam has explored the ways in which it operates on the collective level. Putnam (2000) defines social capital as ''social networks and the norms of reciprocity and trustworthiness that arise from them'', and Portes (1998) describes social capital as ''The ability of actors to secure benefits by virtue of membership in social networks or other structures.'' Bourdieu (1980) defines the concept as ''the aggregate of the actual or potential resources which are linked to possession of a durable network of more of less institutionalized relationships of mutual acquaintance or recognition''. Social capital, in this sense, is seen as the connections that a group can use to achieve its objectives and this is the focus of this paper, since the implementation of sustainable development issues is clearly a social imperative, demanding changes in the way we do business, the structure of our socio-political institutions and governance (Dale, 2001).

This ability to turn social capital into action can be described as a group's agency. Agency is the key indicator of a group's ability to respond and identify cohesive solutions to sustainable development challenges. There are several definitions of agency. These include ''the capacity of persons to transform existing states of affairs''

(Harvey, 2002), ''the capacity to plan and initiate action'' (Onyx and Bullen, 2000), and the ability to respond to events outside of one's immediate sphere of influence to produce a desired effect (Bhaskar, 1994). A group must have agency if it is to successfully engage with sustainable development issues.

Though this paper focuses on the former, actor agency is affected by both the nature of the links within a social network, and the overall network topology or structure. These factors can either facilitate or constrain the ability of the group to gather information and innovate. Social ties, for example, are not automatically good; they can imprison actors in maladaptive situations or facilitate undesirable behaviour (Borgatti and Foster, 2003). The diversity of one's network ties affects one's ability to adapt to a significant change in environment. In short, social structure is both enabling and constraining (Reuf, 2002a).

We believe that the two different types of network ties create very different types of social capital within a network (Newman and Dale, forthcoming). Bonding ties have the potential to hinder innovation by (1) cutting off actors from needed information and (2) imposing social norms that discourage innovation. In short, networks connected mainly through bonding ties can be too closely knit; dissenting opinions will be discouraged and diversity will fall. Bridging ties, on the other hand, allows actors to access outside information and overcome local social norms with support from outside the local network. Given these two differing forms of network tie, the sheer amount of ties within a network is not likely to be a good indicator of how well a community will be able to engage with sustainable development issues; rather it may well be a question of how diverse these ties are. A healthy mixture of bonding and bridging ties will create a resilient blend of local support and dedication and links to external resources.

Empirical study supports the hypothesis that large amounts of social capital do not automatically increase agency. In Krishna's experiments involving Indian villages, it was noted that the amount of social capital present had little to do with the results of development projects. Social capital did not lead to the achievement of high development performance; agency was also needed (Krishna, 2001). Villages with little social capital still achieved good results if their agency was strong. Furthermore, he found little correlation between social capital and agency levels (Krishna, 2001). What he did note was that villages with bridging ties to officials and external networks often had agency even if their bonding ties were not as strong.

Data from the former East Germany supports the argument that bridging ties are needed to create agency and thus mobilize social capital into political action. As it was dangerous to speak out during communist times, people avoided interacting with those they did not know well. Bridging ties were avoided, and extremely tightly connected networks of strong ties formed (Volker and Flap, 2001). This structure left communities with what appeared to be plentiful social capital; communities were densely nucleated with bonding ties. It was believed that these dense networks would allow eastern communities to adapt well to the changes posed by unification with the west. However these communities had very poor abilities to solve complex social problems that spanned across jurisdictions. After East Germany opened itself to the

West, these very closed social networks proved inadequate to address the vast changes that occurred, and East German communities proved much less adaptive that those in the West, and much less adaptive then was expected (Volker and Flap, 2001).

It is not just a lack of bridging ties that can inhibit agency; too many strong ties can have the same effect. The ease of using old strong ties can keep us from making new ones, (Gargiulo an Benassi, 2000), preventing change. A lack of indirect ties encapsulates a person (Granovetter, 1973), cutting off the flow of information. And in terms of overly restrictive social mores, bonding ties can resist change and inhibit bridging ties (Rydin and Holman, 2004). This can be seen as a lack of social variety. If we always associate with the same people our ideas are not likely to be challenged, but are instead likely to become more entrenched.

It was suggested above that it would be advantageous for community sustainable development groups to be resilient, have some elements of self-organization, and be generalist and diverse enough to approach a changing and complex issue from many different angles and perspectives. Social capital is something we have to build (Wilson, 1997), and nurture, it is not an endless stock of supply, and successful outcomes are critical to sustaining long-term activity. The experience of addressing a sustainable development issue and failing to create the desired outcome both exhausts and jades a community to future efforts. As it has been found that team diversity raises team performance (Reuf et al., 2003) and that group diversity raises group adaptability, and the ability to adapt is key to maintaining social capital (Gargiulo and Benassi, 2000), we should encourage the formation of diverse groups if we are to encourage the successful use of social capital to create needed change. Diversity also encourages resilience; a large group without functional diversity will engage in internal turf battles (Reuf et al., 2003), which tend to be very destructive and threaten long-term group success.

Unfortunately, encouraging diverse groups with a large number of weak ties is difficult. There is a limit to how many weak ties a group has, as actors know each other, which leads to redundancy (Reuf, 2002b). People tend to network and contact who they know and in the case of personal networks, who they trust. As well, previous network ties influence group formation (Reuf et al., 2003), which increases group cohesion, but sometimes at the expense of more impersonal, looser ties (Newman and Dale, forthcoming). We thus find it is difficult to foster diverse groups, and it appears that networks can tend towards a state of homophily.

3. Homophily

If group agency were directly related to the ratio of bridging ties to bonding ties, it would follow that a beneficial strategy of group formation would be to encourage the formation of groups of diverse actors connected though bridging ties. Unfortunately, groups tend to form from similar actors, and then become more similar with time. This property is called homophily.

The principle of homophily states that people who are similar in socio-demographic characteristics are more likely to interact with each other than with people who are dissimilar (Mark, 2003). Some experts maintain that we form homophilic networks, (Kiesner et al., 2003), and that homophily occurs even though it is not optimal (Reuf et al., 2003). Homophily occurs as cultural similarities and differences provide a basis for cohesion and exclusion (Mark, 2003). We feel more comfortable with those like ourselves, even in virtual communities; online groups have been rated by participants as more satisfying if the participants are similar (Wright, 2000). This preference for the company of similar actors is a barrier to the pursuit of diversity.

Reuf describes different varieties of homophily; ascriptive homophily (which has to do with personal characteristics) and functional and structural homophily (which has to do with credentials and location) (Reuf, 2002a). The latter form of homophily is a natural result of the defining characteristics of the group. For example, everyone in a group might live in one city, or have a certain needed credential. However Reuf's study shows ascriptive homophily is surprisingly strong (Reuf, 2002a), though it has nothing to do with the stated properties of the group. Functional and structural homophily may also be dysfunctional to the interdisciplinary and transdisciplinary research and decision-making so critical to sustainable development (Dale, 2001), but that is outside the scope of this paper.

Though some constant level of structural homophily will exist in every group due to group membership requirements, ascriptive homophily seems to increase over time; groups become more homogenous with time without new members (Carley, 1991). There are several theories as to why this perverse effect occurs. Mark (2003) argues that we lose cultural tastes that we don't involve, and thus association with a group will reinforce shared tastes and discourage divergent tastes. Others argue that membership in a group creates "relational inertia". The ease of having a network of bonding ties tends to encourage us to deepen those ties, and dissuades us from forming new bridging ties (Gargiulo and Benassi, 2000) As the density of relationships within a network increases, homophily increases (Louch, 2000).

Other effects are also at work. Voluntary organizations have remarkable homogenuity (Popielarz and McPherson, 1995) and unfortunately they become more homogenous over time. We are more likely to drop non-homogenous ties (McPherson et al., 2001), and atypical members tend to stay in the organization a shorter time than typical members, a phenomenon known as the niche edge hypothesis (Popielarz and McPherson, 1995). Though the actors with the most bridging ties are often the most instrumental in creating group agency, they are also the most likely to feel excluded from the group. The edge actors are also pulled by other groups who also need their bridging ties. Individuals in demand by multiple groups leave quickly, an effect called niche overlap (Popielarz and McPherson, 1995). These particular actors are known as connectors (Gladwell, 2000) or hubs, and play a critical role in cross-network communication. Describing Stanley Milgram's work on "six degrees of separation", he comments that Milgram's result does not mean that everyone is linked to everyone else in six steps. The results mean that a very small number of people are linked to everyone

else in a few steps, and the rest of us are linked to the world through these special few (Gladwell, 2000).

If a group loses its connectors, it loses its bridges into the wider community and thus loses agency. A group without connectors also has a hard time evolving; losing edge inhibits a group's ability to spread through society. (Popielarz and McPherson, 1995). The core members connected with bonding ties know only each other, and have no larger pool to recruit from. Homophily limits peoples' life in ways that effects the information they receive, the attitudes they form, and the interactions they experience (McPherson et al., 2001). Without the bridging ties needed to access different kinds of resources and spheres of influence, a group's agency will decrease over time and the group runs the risk of failure and/or collapse.

As mentioned, network topology also plays a role in actor agency. Network topology can be defined by several parameters, one of which is the average path length between agents in the network (Amaral and Ottino, 2004). The longer this path length, the more difficult it is for local clusters to access outside information and assistance. Fortunately, it takes a relatively small amount of bridging ties to lower average path length and create what is called a "small world" network (Watts, 2003) such as that described by Milgram. One such network topology is the "scale free" network, in which a few central hubs are very well connected (Areanas et al, 2004), Scale-free networks can spread a concept very quickly, and can incubate an idea or innovation even if the rate of penetration of that idea is very slow (Omerod and Roach, 2004). Scale-free networks are also very robust in their response to random stressors (Albert et al., 2000).

Though there is much yet to learn about the scale-free structure of social networks, it is likely that they help provide agency to local networks. The hubs in such a network allow us to find paths by seeking out a hub as a messenger; the hubs often are connectors. Though a network without such hubs can still be a "small world" network, there is a big difference between knowing a path exists and being able to find it (Watts, 2003). Homophily lowers the number of hubs within a network cluster by limiting the diversity of connections. As Watts remarks, "The more your friends know each other, the less use they are to you in getting a message to someone you don't know" (2003, 41).

4. Managing Homophily: a case study

Several expert moderated time-limited asynchronous electronic dialogues focusing on sustainable development issues have been led by the second author of this paper, as part of a 5-year ongoing research project. Preparation for each of these dialogues involves the construction of a small simple network of expert practitioners, as well as communicating the event itself to larger networks of each of the experts, the principal researchers and partner groups. These small networks provide an opportunity to observe the process of social capital building and the impediments to agency observed in larger scale social networks. This repeated formation of small networks

has given the authors a chance to observe and attempt to manage group homophily. Six e-dialogues have been led to date and for the purposes of this paper, we will discuss one in particular, focusing on the critical public policy issue of the management of nuclear waste.

On October 26th, 2004 we began running a series of synchronous electronic dialogues for the Nuclear Waste Management Organization (NWMO) of Canada, whose mandate is to conduct scientific and public opinion study and then recommend a method of nuclear waste disposal to the Canadian government (NWMO, 2005). Our first task was to assemble a panel of experts in the field who would then conduct a synchronous on-line dialogue with each other with the public looking on and presenting questions to the panel. A transcript of the first e-dialogue is available at www.e-dialogues.ca.

Due to the contentious and somewhat polarized opinions surrounding the issue at hand, we wished to avoid homophily on the expert panel, as we wanted majority viewpoints to be included in an open discussion. The panel was to consist of five experts moderated by the second author of this article. To ensure diversity, five experts with diverse opinions were chosen from both the natural and social sciences; a mix of technical and process expertise; geographically three were local to Ontario, Canada, one was from the US, and one from the UK. Four were from academia, and one was from a nongovernmental organization, although one of the academics had a long history of consulting in this area to the private sector. Their position on nuclear waste and nuclear energy in general ranged from strongly against nuclear energy to strongly for nuclear energy.

What we found during the dialogue was that the primary objective to hold a broad conversation was met. Many different topics were touched upon and the audience was engaged at several levels. However we did find that we paid a price for this diversity; it took significant time for trust to emerge between the panelists, and some polarization of views occurred for many reasons. We also could not maintain the panel for future dialogues; in a demonstration of the niche edge effect, one of the panelists refused to take part in further dialogues because he felt that the audience questions had not been given sufficient time and respect by the expert panelists.

It would appear that dialogue involving an issue that is both value-laden and highly contentious technical options, and involves expertise that has a high level of technical ability, has a tendency towards homophily. As previously mentioned, trust became a critical issue in the first e-dialogue of this series, as the experts took more time on-line to build trust in each other's expertise and opinions in the absence of a preceding telephone conversation. In all previous on-line dialogues, a preliminary telephone conference call has been held to allow people to meet at last audibly, but more importantly, to establish social capital between themselves and the moderator, particularly with respect to individual needs for trust and to establish whether or not professional reciprocity exists. The latter is particularly important given the intense interactivity of on-line dialogue (Dale, 2005) and the highly public and immediacy of recorded voice of the medium.

With respect to the lack of attention paid to the questions posed by the audience, the subject of this e-dialogue was very technical, that is, the management of risk and uncertainty, whereas many of the audience questions were political and general in nature. We do not believe that any of the panelists were not committed to responding to the audience, however, the homophilia of the panel was manifested in their tendency to stay at the expert and specific level of discussion, thus, failing to adequately respond tothe more general audience questions. Sheng (2005) touches on this in his discussion of the citing of hazardous-material disposal facilities about the discourse of the parochial and the discourse of big science, a more particular kind of homophily in our opinion. When we are uncertain of outcomes, people tend to revert to the language in which we are more comfortable, to intellectual constructs, myths and paradigms, at the risk of appearing to be exclusionary, Thus, homophily is an important concept for community organizers to be aware of, especially when designing expert panels, interdisciplinary groups and for communicating complex scientific concepts to the general public.

From our experience with this particular dialogue and the construction of other dialogue teams in both a classroom and general environment we can recommend a number of suggestions for building diversity and controlling homophily at both the micro and macro community levels.

1. During network formation groups should encourage as much diversity as possible by defining a wide mandate and avoiding unnecessary membership requirements that might impose structural homophily. This often involves deliberate design and strategies for inclusion of a diversity of perspectives, expertises and experiences.
2. Groups should engage in active and ongoing recruitment programmes to ensure that new members enter the group to replace those who leave. New people destabilize groups, but this effect is balanced by the strength brought through greater heterogeneity (Carley, 1991).
3. Group renewal strategies should involve the deliberative inclusion of people from a wide variety of age groups to bridge age homophily in society and to take advantage of the extensive bridging networks of younger actors new to their social and career roles.
4. Group management and leadership should rotate regularly in order to avoid the formation of cliques and to encourage different viewpoints to shape the direction of the group.
5. Group activity should be conducted in a variety of diverse but interacting formats; for example a group might run physical meetings as well as an internet chat room. Including a virtual component will draw in participants who might not otherwise take part.
6. Lateral decision-making processes, strategic partnerships and alliances and some elements of self-organizing properties may mitigate the natural tendency to homphilly.

7. Time must be allotted for diverse groups to develop trust before serious engagement of issues begins.
8. In order to encourage continued participation within a group, specific incentives should be stressed; these incentives can include advertising the group as an interesting source of social and intellectual capital and as a place to meet other interesting highly skilled participants, in addition to enlarging one's networks (Peer-reviewed contributions such as a special issue of a journal might also be planned as an outcome of the formation and functioning of the network).

5. Conclusion

Sustainable development issues are messy, wicked problems, not easily solved by any one group, or indeed any one community or government. The decisions of one community now affect all communities, and the local is inevitably tied to the global. The problems transcend current disciplines, sectors and thus require novel forms of network formation (Dale, 2005). Local communities and network formation are critical to the implementation of sustainable development imperatives (Dale and Onyx, 2005). Indeed, the ability of community groups to self-organize and mobilize social capital around critical issues affecting their community is key to their resolution (Ibid, 2005), but one of the most critical determinants may be agency (Newman and Dale, forthcoming).

Just as functional diversity is critical to the resiliency of ecosystems, it appears to be equally critical to the development of agency. As networks have a natural tendency to homophily both at formation and over time, groups must constantly work to prevent homophily, as the bridging ties associated with diversity are keys to successfully engaging with sustainable development initiatives. Our experience with putting together a very small network to engage with a very complex social and technical sustainable development issue suggests that groups can manage homophily, but they must also be prepared to deal with the challenges that diversity creates.

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