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How Deep Runs the Karma? Structural Holes and Social Capital in an Online Community

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ABSTRACT

Social capital is important as both a mechanism for governing online communities and a product of the interaction in those communities. How networks of relationships in online communities are structured has important implications for how social capital may be generated. We examine a popular website, Slashdot, that uses a system by which users can declare relationships with other users, and also has an embedded reputation system, which they call user Karma. The role between user reputation levels and social network structures may indicate the types of social capital that can form. Using the concept of structural holes, we find that Slashdot users develop broad networks at lower levels of participation, and deep networks at higher levels of reputation.

Keywords

Online communities, social capital, structural holes, reputation systems

INTRODUCTION

Social networks play a critical role in the value and management of online communities. This role can be more profound than in traditional organizations, even those with similar purpose and profit goals. The opportunities and limitations of a purely virtual environment lead to a heightened dependence on social networks to add value to the online community for both the owners and the participants of a given site. Social networks can be used to build loyalty despite a lack of tangible rewards, establish credibility in an anonymous environment, and provide structure to the problem of balancing thousands of cooks in a single kitchen. If deployed and utilized to the benefit of both participants and owners, a social network can be critical to the smooth and optimal design and management of a virtual organization.

The power in social networks manifests to participants as social capital, one metric of which is status ranking. High status rankings in online communities often align with increased privileges to the user or with a higher assumption by other participants of veracity and authority in the user's contributions. The power from a social network to the organization includes the indirect benefits from having participants with more buy-in to the site, and also the direct benefits of being released from the need to vet participant contributions and having implied paths connecting participants for the purpose of control and information dissemination.

The question of what is the optimal structure of a powerful social network to both participants and managers of online communities is still open. Research into the preferred structure of interpersonal networks in business organizations has shown the importance of the concept of *structural holes* being an important correlate of the benefits of high social capital. A structural hole is a bridging relationship between otherwise disconnected network elements. In online communities, the presence of more structural holes may indicate the presence of sub-groups using similar features, rather than a cohesive community of users. The brokerage principle provides the argument that, in a business setting, an individual with a personal network high in structural holes can reap the benefits of high social capital by providing the indirect connection that resources need to flow around an organization. Previous work has indicated that business managers with high social capital from interpersonal networks rich in structural holes receive more positive evaluations, earlier promotions and higher compensation (Burt, Hogarth & Michaud, 2000). We believe that the brokerage principle may also apply to virtual organizations despite an environment where the main resources that need to cross structural holes, such as awareness and the opportunity for exposure to the contributions of others, are primarily intangible. If these resources are critical to the functioning of the site, then structural holes will be an important element of powerful social networks to both participants and the community.

In this paper we examine whether the social capital benefits of networks rich in structural holes are also relevant to participants in virtual organizations. We address a specific, for-profit online community (http://slashdot.org) in which the role of social networks is critical to the efficient running of the site and provides important returns to both participants and the site operators.

Slashdot

Slashdot is a news and commentary site founded in 1997 which is dedicated to technology issues, especially those focused on open source software. It attracts over 600,000 unique visitors a day, as measured by unique IP addresses requesting pages from the site. Paid editors select about two dozen news stories each day to appear on the site, providing a one paragraph summary for each and a link to an external site where the story originated. Each story becomes the topic for a threaded discussion among the site's users. Most of the commentary occurs in the first few hours after a story is posted, in part because the story loses its prominence on the front page of the site as other stories are posted. Around 75,000 comments are posted each day to the site.

To organize conversation and provide feedback, Slashdot has implemented a recommender and reputation system by which users rate comments on the site, which affects the reputation of those who wrote the comments. Slashdot calls their comment rating system "moderation" and their user reputation system "Karma." (Lampe and Resnick, 2004) Comments are eligible for moderation for two weeks, though most moderation happens in the first 4 hours of a story's life. A comment may receive any number of individual moderations, but will only display a score between -1 and +5. Registered Slashdot users have Karma ranging from -50 to +50 based on their posting behavior, and to a lesser extent on their reading activity on the site. A user with high reputation will be able to post comments at a higher starting score than other users, and will be eligible for moderation more often.

In 2002 Slashdot incorporated an online social network by which registered users could explicitly list "friends" and "foes". When a user examines the profile of another, they have the option to select a tab called "Relation" by which they can set the status of that user if they so desire.

Figure 1: The Slashdot interface for declaring relationships with other users.

Figure 1 above shows the interface for setting relations on Slashdot. The default setting is neutral, with the option to declare either a "Friend" or a "Foe". The user setting the relationship has their ties listed publicly in their profile, as shown in Figure 2.

Figure 2: An example of the list of relationships that a user sees in their profile.

Besides tabs for "Friends" and "Foes" shown in Figure 2, there are also options for "Fans" and "Freaks". Fans are other users who have set you as a friend, and Freaks are users who have set you as a foe. One effect of the social network is the aggregation of other users in personal profiles, which helps provide social awareness in a system in which there are nearly a million registered users. The other effect is that the scores of comments can be personalized based on the social network, such that comments written by friends display higher scores, and comments written by foes display lower scores.

Social Capital in an Online Community

Social capital is both an outcome from interactions in an online community, as well as a tool for facilitating the governance of such spaces. Online communities have characteristics that not only help form traditional ties between participants, but may form new types of relationships as well (Resnick, 2001, Wellman et al., 2001). However, the basic mechanisms that create social capital are also important for organizing online communities. The development of social capital depends on the ability to form relationships with others in a network. This in turn necessitates a history of interactions with others and a path to explore the boundaries of one's immediate experience. If a history of interactions is unavailable or if the pool of participants is too overwhelming, social capital is difficult to create.

Large-scale, pseudonymous participation is typical of many online communities, making them difficult to govern for designers, to make sense of for participants, and to form social capital in for all stakeholders (Jones et al., 2004). Two commonly used methods to respond to the need to create interaction histories and network boundaries are reputation systems and social networking tools. Recommender and reputation systems help create a history of interactions by providing explicit feedback about users based on the experiences and opinions of others (Terveen and Hill, 2002). Reputation systems can be used anytime when the past is predictive of the future (Dellarocas, 2003), and help provide social cues, or signals, that are lost due to the high volume, text-mediated, pseudonymous environment of most online communities. Social networking tools allow participants to make immediate statements about their connections with others. This implicitly draws the boundaries of the social network of each individual, and allows those seeking to expand their network to explore the areas where the pool of contacts is narrowed down to an accessible level.

Structural holes are a type of social network structure in which it is possible for sub-networks in a group like a virtual community to be connected by a few actors. This type of network can create "bridges" or "brokerages" between sub-communities that can facilitate information flow in the larger network. The constraint index (CI), described in technical detail below, shows the extent to which these structural holes exist in a network.

RESEARCH DESIGN AND DATA

In this paper we examine the hypothesis that status is higher for participants with a network higher in structural holes. In the context of Slashdot, status is evaluated as the Karma ranking (-50 – 50) of each individual on the site, and the structure of each network is assessed by a constraint index CI (0 – 1)[1] representing an inverse relationship with structural holes. The relationship between these two variables is moderated by the intensity of their participation on the site, represented by the number of comments, the number of immediate connections they have with other users, and the nature of their immediate network relationships, indicated by their ratio of friends and foes to total contacts.

We have gathered information on the social network of Slashdot consisting of almost 6000 current active users[2] with over 200,000 relationships. Several extremely connected participants, like users 1 and 666, were omitted from the final analysis to focus the results on the more typical participant. The final data set included 5591 individuals, all with at least 2 relationship connections, encompassing 150,912 network ties in total. Table 1 indicates some summary statistics of the data series used in this analysis.

	Mean	Std. Dev	Max	Min
Karma	36.2	16.8	50	-138
CI	.0349	.1104	.9931	0
Comments (#)	360.8	700.1	9009	1
Connections	26.9	55.1	900	2
Friends (#)	9.9	25.7	401	0
Foes (#)	3.2	14.4	201	0

Table 1: Summary statistics Slashdot user characteristics

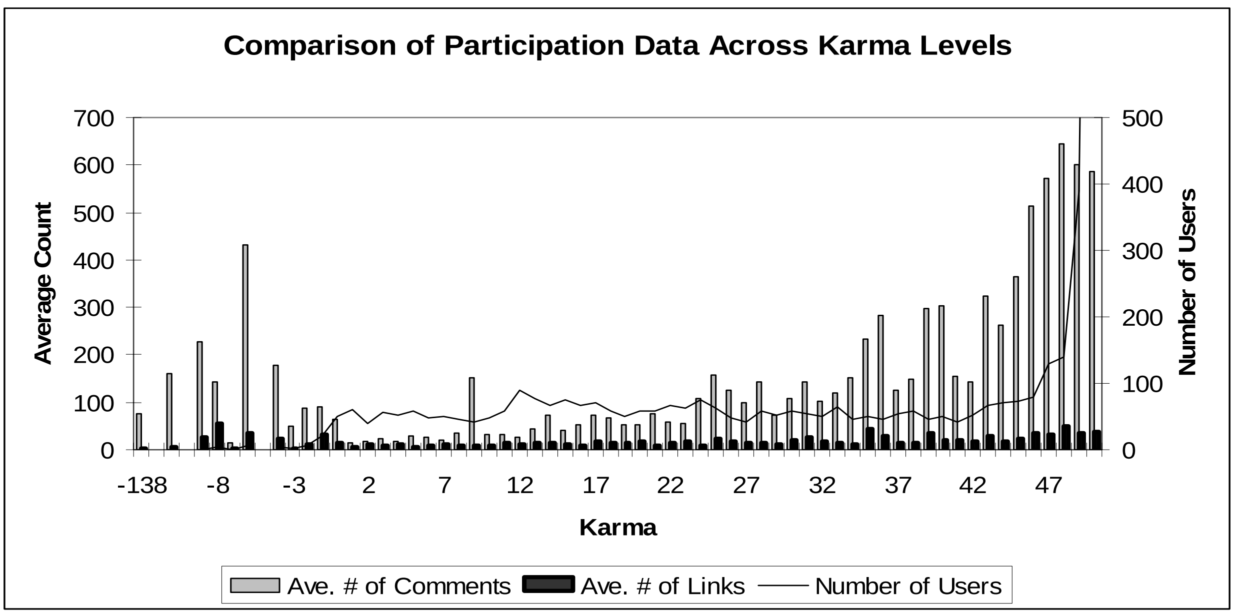

Figure 3: Graphical representation of Slashdot user characteristics.

To assess the relationship we first conduct a standard regression analysis of the dependent variables, CI, Comments, Friend Ratio and Foe Ratio, on the independent variable, Karma. Karma is standardized to compensate for the upper and lower limits of the values, and the Comment variable is logged to correct for the exponential growth pattern. The standard

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[1] The constraint index (CI) measures the extent to which the contacts of an individual i are directly or indirectly connected to a contact j, corrected for the size of the network: $\Sigma_i(p_{ij} + \Sigma_q p_{iq} p_{qj})^2$, for q≠I,j, where p_{ij} if the proportion of i's relations invested in contact j (Burt et al. 2000).

[2] This is defined as users posting at least one comment within the last year, receiving at least one feedback rating and participating in the social network.

regressions were tested for multi-colinearity (all values below .5) and have been corrected for heteroskedasticity using White's heteroskedasticity-consistent error terms. Then we follow with a quantile regression technique (see (Koenker and Hallock, 2000)) at various intermediate quantiles of Karma levels. This allows us to assess the impacts of the dependent variables as the Karma levels increase, thus allowing comparison of the potentially different network dynamics at different stages of Karma accumulation.

RESULTS

In Table 2 we present the results of the regressions. The coefficient value between CI and Karma is negative, which supports the hypothesis that as structural holes increase (i.e. constraints decrease) the benefits of social capital increase. Further, this relationship exists beyond the significance of the moderating variables. The number of connections also has a positive and significant relationship with Karma, which indicates that there is a complementary relationship between Karma building and network participation. We note that the Friend and Foe Ratios exhibit the same behavior as CI to Karma, which supports the interpretation of these values as representing the intensity of network reducing social capital.

	CI	Comments	Connections	Friend Ratio	Foe Ratio	
Karma	-0.0577*** (.0153)	0.0367*** (.0020)	0.1804*** (.0191)	-0.2705*** (.0133)	-0.1143*** (.0141)	5591 records F=.0000 R^2 = 0.1647
Karma (negative)	0.2101 (.1392)	-0.5455*** (.0347)	0.1553 (.1266)	-0.0378 (.1589)	-0.2852 (.2394)	59 records F=.0000 R^2 = 0.7795
Karma (positive)	-0.0488*** (.0144)	0.0428*** (.0018)	0.1823*** (.0172)	-0.2687*** (.0127)	-0.1058*** (.0127)	5483 records F=.0000 R^2 = 0.1987
Quantile Regressions (positive Karma only)					5483 records	
Karma (15^{th})	-0.0723*** (.0274)	1.0215*** (.0243)	0.2534*** (.0375)	-0.3093*** (.0269)	-0.1127*** (.0269)	Pseudo R^2 0.0742
Karma (35^{th})	-0.0911*** (.0253)	0.0807*** (.0240)	0.2281*** (.0293)	-0.5561*** (.0254)	-0.2177*** (.0257)	Pseudo R^2 0.1529
Karma (50^{th})	-0.0745*** (.0063)	-0.3129*** (.0061)	0.1645*** (.0063)	-0.4145*** (.0061)	-0.1376*** (.0061)	Pseudo R^2 0.0996
Karma (65^{th})	-0.0034*** (.0007)	-0.7167*** (.0006)	0.0356*** (.0006)	-0.0991*** (.0006)	-0.0182*** (.0006)	Pseudo R^2 0.0131
Karma (70^{th})	-0.0023*** (.0002)	-0.7836*** (.0002)	0.0134*** (.0001)	-0.0321*** (.0001)	-0.0077*** (.0001)	Pseudo R^2 0.0021

Constant terms are omitted; standard error in parentheses

*** significant at the 1% level (p<0.01)

** significant at the 5% level (p<0.05)

* significant at the 10% level (p<0.1)

Table 2: Regression of Constraint Index (CI)

However, these results are not consistent across the range of values for Karma. As the quantile regressions show, while the signs of the coefficients remain the same for most of the equations, the scale of the CI coefficient varies as the value for Karma increases. The CI coefficient begins in the 15th quantile as significant and negative, grows in scale in the 35th quantile, and then reduces steadily until becoming very small by the 65th quantile. Thus, structural holes are strongly related to the status of participants in the beginning and middle part of their Karma-building experience, but less so at the end. Further, the values for the number of comments and the number of connection begin as positive and large in the 15th quantile and decline in impact sharply by the 70th quantile, where the number of connections actually has a negative impact by the 70th quantile. This strongly implies that a network that spans many unconnected items is more strongly correlated with the early stages of a Karma rating, and a network still containing many unconnected items but overall fewer structural holes is more strongly correlated with the later stages of a Karma rating.

DISCUSSION

Our results show that there is an important role for structural holes in forming a powerful social network, just as previous studies in business organizations have demonstrated. More specifically, we reveal a higher correlation between structural holes and a large number of contacts, what can be termed a *broad network*, in the early levels of Karma building and a lower but still relevant correlation between structural holes and number of contacts, a *deep network*, at later levels. Our test of the relationship between the structure of a participant's social network and the power of social capital as indicated by their status in the organization has revealed interesting patterns in the functioning of networking on this online community.

We can speculate on the network dynamics of these patterns that these results are reflecting, even though we cannot use these results to definitively comment on causality. If we assume that network participants are acting rationally within the bounds of their goals and information, it follows that the benefits to individuals at lower Karma levels of establishing a broad network are higher than for a deep network, and that these benefits are less important at higher Karma levels. This suggests a pattern of users expanding their network of contacts early on in an effort to make connections and establish a reputation and a group of supporters for mutual benefit. Later, with the breadth and foundation of a social network established, network participants may indulge more in nurturing a tighter group of contact with similar interests and assessments of other participants. In an analogy with a business environment, first the emphasis is on expanding the Rolodex and later it's on joining networking clubs.

This dynamic may have negative implications for the management of the site however. An overly deep network by too many participants is indicative of network power becoming concentrated in sub-groups of privileged participants instead of being dispersed throughout the membership. This can lead to clique behavior which reduces the egalitarian spirit valued by many of these sites and increases the potential for abusive peer pressure. It can also lead to a power struggle between the site participants and the leadership that can seriously disrupt the management and future of the organization. Since many of these sites have become for-profit organizations, as is the case with Slashdot, these negative forces need to be guarded against in order to maintain business viability. A policy response that may be considered is an expiration-date on relationships that would need to be renewed periodically for the connection to remain active. This might more effectively mimic the reality of social networking in the off-line world where connections are not open indefinitely, and better support a network structure in which connections truly reflect active and valued interpersonal relationships.

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