

Assessing the Structural Correlates between Friendship Networks and Conversational Agency in Facebook Groups

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Abstract

To what extent do friendship ties influence the conversation structure in open groups? Openly accessible Facebook groups offer the opportunity to examine how individuals leverage their existing friendship relations when speaking to a large and often heterogeneous audience. For example, those with many friends in the group may receive more positive signals from others and also may have their content validated more easily. Thus, while the group is ostensibly open to all, existing relationships may impede such openness on a practical level. We employ a stratified sample of 30 Facebook groups from UK Russell Group universities. Using multilevel regression, we examine the effects of several structural metrics at both the actor and group level on the magnitude of three conversational metrics: likelihood of initiating a conversation, responding to a conversation and receiving responses for content. We find that aspects of individual network positions, e.g. degree-centrality and eigenvector-centrality, as well as qualities of the group e.g. group-density and modularity, have a consistent and highly significant effect on conversational metrics, while the strength of these relationships clearly varies by group type. We contextualise our findings via Gibson's notion of "conversational agency", and point to future directions for designing and managing online communities.

Introduction

The Internet is often touted for its ability to enable interaction among otherwise disconnected actors. On Twitter, disparate users can coalesce over a topic using hashtags. On Reddit, users employ subreddits to discuss everything from crochet to conspiracy theories. Facebook has similarly embedded a feature to allow collective discussions beyond one's friendship circle: the Facebook group. Community associations, student unions and all manner of subcultures host Facebook groups for discussions. Yet, while these groups can be accessible to all (or say all members of

a student union), it is unclear how much the underlying friendship structure plays a role in social feedback.

In this paper, we assess the extent to which the underlying friendship structure of university discussion groups influences the turn-taking and social feedback behaviours of group members. We are interested in assessing whether groups function as inclusive spaces, or whether such groups reproduce existing social hierarchies. We frame the process of engaging with others as "conversational agency" (Gibson 2000). Insofar as latent friendship structure is reproduced in the social feedback and conversational initiation practices within an open group, we can assert that some group members have more agency than others. We present findings from an analysis of 30 student groups drawn from a stratified sample of UK universities. Our conclusions suggest that friendship structure pervades group conversation structure. This suggests a need to consider new features to make ostensibly "open" groups more inclusive to new members and more deliberate strategies to manage feedback within groups.

Related work

Conversational dynamics have been extensively studied in sociology, linguistics and computer science. Examples for this research include studies on individual-group interactions in online communities (Arguello et al. 2006), shared information spaces (Hanks 1996), conversational turn-taking behaviours (Goodwin 1989) and online community building (Kim 2000). More recent work on online conversations has identified salient social roles and archetypes of conversation spaces (Welser et al. 2007).

While the majority of these scholars emphasise the constraining dynamics that arise from the conversation itself, little attention has been paid to the underlying social structure giving rise to these contexts for conversation. We believe this is partially due to a lack opportunity to measure

the underlying social structure. Neither message boards, usenet groups, nor subreddits expose friendship relations. Instead, conversations are taken to stand-in for this underlying network (Gruzd & Haythornthwaite 2013). By examining the shared friendship structure of group members on Facebook, we have a novel opportunity to disentangle conversational networks and social networks. This enables us to explore conversational agency, or the extent to which certain group members feel more or less constrained in their capacity to submit content and receive feedback.

Methods

To test the effects of relational structure on conversational agency, we employ a stratified sample of Facebook groups from UK Russell-Group universities – a large association of 24 British universities with a student base of 549,460. First, using an ordered list of Russell Group universities, we have randomly selected one university from each bin of approximately 110,000 students. Second, for each of the five sampled institutions, we have collected an exhaustive list of all open Facebook groups associated with these universities, and filtered it by membership numbers to retain only groups with $50 < m < 1,000$ members.¹ Third, since some of these groups had few active members, we have randomly sampled six groups per university from the list, generating a total sample of 30 Facebook groups, which differ in their sizes, social contexts, topics and the types of individuals they attract.

For each of the groups we downloaded the social graph of the group. Prior to the introduction of Facebook’s OpenGraph 2.0 protocol, a group member could access the friendship structure shared between group members, but not the friends of group members outside of that group. To comply with our University’s ethical review board and good practice, the researchers joined groups with the explicit permission of the group owner and announced the project to the group. All identifying data about the group members has been scrubbed from the dataset. Group conversational and friendship data was downloaded using the Facebook API-based Netvizz application (Rieder 2013).

Our sample resulted in 30 groups with a total of 10,820 group members and 67,555 friendship ties between them. While friendship relationships form undirected networks, conversational activity in Facebook groups (i.e. wall-posts, likes and comments) can be captured in weighted directed networks where an arc represents an interaction between two users with a weight equal to the number of replies from one user to another. We calculate network statistics for the entire friend network structure, and then filter the

cases for analysis to those group members who have been active at least once (i.e. made at least one post, comment or “like” within the group). Our final sample size thus consists of 2,148 Facebook users from 30 Facebook groups.

Conversational agency manifests itself when actors speak up, respond to fellow members, or articulate their opinions and ideas to the group (Gibson 2000). Thus, we measured conversational agency in three ways: initiating posts, sending comments and likes to existing posts (conversational out-degree) and receiving likes and comments (conversational in-degree). On average, group members initiated 2.47 wall-posts, contributed 2.41 comments and “likes” (conversational out-degree) and received 2.64 responses (conversational in-degree) as reported in Table 1.

Analysis

The 30 sampled Facebook groups span a variety of interests and social contexts from music societies to sport clubs and LGBT groups. Groups vary notably in participation, with a minimum of 9.4% of members participating to a max of 64.5%. We provide further descriptive statistics in Table 1. In addition to gender and membership age, we present a number of statistics on the network structure of the group’s friendship network. One group was highly fragmented with 462 distinct components, while most have a smaller number of distinct components. We assessed the modularity of partitions found using the Louvain method for community detection (Blondel et al. 2008). Other statistics are calculated in Gephi. On average, groups were substantially clustered with an average modularity of 0.43. As a general rule, modularity ought to be greater than 0.3 to suggest that the separate clusters represent truly distinct subgroups. The average degree across all actors is 8.55, whereas the average degree for active group members is much higher at 23.47 (min 0, max 397). The average clustering coefficient for active group members is 0.33, which implies that one third of potential triads are closed.

Table 1: Descriptive Statistics

Variable	Mean	S.D.	Min	Max
Number of posts	2.47	7.26	0	111
Conv. in-degree	2.64	7.21	0	134
Conv. out-degree	2.41	3.23	0	34
Gender (male)	0.57	0.50	0	1
Membership age	9.82	3.74	0	20
Degree-centrality	23.47	33.58	0	397
Eigenvector-centr.	0.21	0.23	0	1
Clustering coeff.	0.33	0.25	0	1
Components	60.33	97.40	1	462
Group modularity	0.43	0.11	0.18	0.79
Group density	0.06	0.05	0.01	0.23
Group size	405.69	267.84	63	997
% active members	0.33	0.18	0.09	0.64

¹ Preliminary analysis suggested that groups with less than 50 members tend to be informal or unstable. When groups are larger than 1000, we cannot reliably retrieve network data from Facebook.

Investigating the bivariate correlations, we see that the 3 conversational measures are moderately related among one another with correlation coefficients ranging from 0.43 to 0.55 (see Table 2). One explanation for these correlations is that actors, who are actively posting links on the group wall, are also more likely to receive a response, and engage with the group using comments and “likes”. Furthermore, the correlations between degree-centrality and the conversational measures, in-degree (0.41), out-degree (0.37) and the number of posts (0.56) are strong and significant.

The correlations among group-level variables show expected patterns of cohesiveness (see Table 2): dense groups are less modular ($r=-0.64$) and have fewer components (when including isolates as components; $r=-0.46$). Furthermore, denser groups have proportionately more active members ($r=0.61$), and larger groups tend to have a more components and isolates ($r=0.52$).

Table 2: Bivariate Correlations

Variable	1.	2.	3.	4.	5.	6.	7.
1. Numb. posts							
2. Conv. in-d	0.55						
3. Conv. out-d	0.43	0.52					
4. Gender-m	0.03	0.05	0.02				
5. Membership	0.13	0.13	0.13	0.01			
6. Degree-cent	0.56	0.41	0.37	0.05	0.19		
7. Eigenvector	0.48	0.41	0.45	0.05	0.32	0.67	
8. Clustering c.	-0.03	-0.01	0.06	0.01	0.18	0.11	0.13
Variable	9.	10.	11.	12.	13.		
9. Components							
10. Modularity	0.51						
11. Gr. density	-0.46	-0.64					
12. Group size	0.52	0.18	-0.43				
13. % active m	-0.45	-0.54	0.61	-0.56			

Note: **Bolded** items show significant correlations ($p<0.01$)

Since groups vary significantly in size and shape, we cannot simply include all cases from the 30 groups in three OLS regressions predicting to our 3 measures of conversational agency. In order to account for within-group effects, we use a multilevel model. A preliminary variance components analysis shows that there is significant unexplained variation at the group level, thereby validating our choice to model cases within groups (Van Duijn et al. 1999).

Results

We find that conversation structure is partially conditioned upon friendship structure in a Facebook group – and this is supported by the multilevel regression results, which show consistent effects of the relational metrics on conversational measures. In particular, the aspects of individual network positions (degree-centrality, eigenvector-centrality) and qualities of the group (group-density, modularity) have a highly significant effect on conversational measures. Table 3 demonstrates that χ^2 statistics for all models are sig-

nificant at $p<0.001$. Because of the way error terms are distributed in multilevel models, PRE statistics such as R^2 are not available.

Model-A concerns the number of wall-posts produced by group members. As expected, one of the strongest predictors for this type of proactive conversational agency is actors’ degree-centrality ($\beta=0.149$, $p<0.001$). Similarly, group members’ eigenvector-centrality is strongly related to the number of initiated wall-posts ($\beta=2.690$, $p<0.004$). The block of group-level network metrics sheds light on the effects of group cohesiveness on proactive conversational agency, and it is exposed that the number of components ($\beta=-1.207$, $p<0.007$) and group modularity ($\beta=-3.657$, $p<0.089$) exhibit a statistically significant negative effect. Conversely, group density is shown to have a significant positive effect on the number of initiated wall-posts ($\beta=23.078$, $p<0.046$). This suggests that actors located in more cohesive Facebook groups are more predisposed to conversing with their fellow group members by posting on the group wall, while facilitating more social feedback.

Table 3: Multilevel Regression Results

Independent variables	Dependent variables		
	(A) Number of wall posts	(B) Conv. out-degree	(C) Conv. in-degree
Intercept	0.717*	1.093***	0.126*
Gender (male)	0.071	-0.019	0.384
Membership time	0.072*	-0.027	0.028**
Degree centrality	0.149***	0.023***	0.082***
Eigenvector centr.	2.690***	4.113***	5.552***
Clustering coeff.	-0.755	0.378	-1.215**
Components	-1.207***	-0.169	-0.054*
Group modularity	-3.657*	-0.003	-0.007**
Group density	23.078**	13.027***	16.161***
Group size	0.209***	0.072***	0.126
Active members	-0.434***	1.641***	1.189**
Likelihood ratio test χ^2	158.93***	284.78***	61.36***

Note: * $p<0.1$; ** $p<0.05$; *** $p<0.01$

Model-B tells a similar story for the significance of relational variables for predicting conversational out-degree i.e. actors’ reactive conversational agency. The centrality measures exhibit the most robust associations with conversational out-degree. Specifically, both degree-centrality ($\beta=0.023$, $p<0.001$) and eigenvector-centrality ($\beta=4.113$, $p<0.001$) have a significant positive effect on conversational out-degree. Membership-age, in comparison, does not appear to have a statistically significant relationship with conversational out-degree ($\beta=-0.027$, $p<0.146$). Yet, the negative coefficient hints that newcomers engage with wall-posts more frequently than “older” group members. At the group-level, this model finds evidence for the positive and significant association between group density and conversational out-degree ($\beta=13.027$, $p<0.005$). Along similar lines, the number of components and modularity are negatively related to conversational out-degree, signi-

ying that higher group fragmentation is associated with fewer instances of reactive conversational agency.

Model-C investigates the relationship between network variables and conversational in-degree. This model is sufficiently significant with a likelihood ratio of $\chi^2=61.36$ ($p<0.001$). As expected, degree-centrality is found to be a significant predictor ($\beta=0.082$, $p<0.001$). Further, conversational in-degree is independently related to actors' eigenvector-centrality ($\beta=5.552$, $p<0.001$) meaning that actors who are well connected receive greater feedback. Membership-age is consistently positively related to conversational in-degree ($\beta=0.028$, $p<0.047$), indicating that longstanding group members are more likely to receive greater uptake for their posts than newcomers. On the group-level, all three measures of group cohesiveness have an independent effect on conversational in-degree, given the significant coefficients reported in Table 3.

Discussion and summary

While social science researchers have long studied conversations in social groups, this paper provides granular insight into one particular aspect of this question: how do group members' network positions and the overall patterning of personal ties in online social groups relate to their prospects of conversational agency?

Degree and eigenvector centrality were both found to be positively associated with conversational in-degree and out-degree, as well as the total number of initiated wall-posts. Following this rationale, actors with more friends in the group may feel empowered and motivated by their presence, kindling a greater sense of agency. On the other hand, group members who react and participate may make themselves attractive as friends to fellow group members. Despite the opportunity to access both friendship and conversation structure, Facebook does not provide programmatic access to the date of friendship creation. As such, we can only hint at the direction of causality.

Being in a position mostly connected to low-degree alters may not contribute to eigenvector-centrality scores, but may render actors more powerful, because their surrounding neighbours depend on them. For instance, peripheral actors may rely on more central alters to access new information and to arrange introductions to distant members.

Finally, the group-level variables from our analysis posit that actors integrated in strongly cohesive Facebook groups face a different set of constraints and resources than those who are not embedded in such networks. Across all social groups, the conversational measures are positively associated with group density, while being negatively related to modularity, and the number of components. Particularly density is found to be substantial for conversational out-degree and in-degree. In view of the results, actors appear

to be particularly receptive to group cohesiveness when initiating new wall-posts. This provides evidence for the hypothesis that more cohesive groups constitute group solidarity, creating more encouraging environments for conversational agency and uptake. From past research we know that a more cohesive network could increase the likelihood of activating social resources. Accordingly, highly cohesive groups are better arranged to generate feedback.

From a practical perspective, our findings indicate that group managers can facilitate activity in online communities by recognising the links between relational structures of the friendship network and conversational agency. For example, by encouraging the formation of social ties and incentivising the invitation of friends from outside, they might cultivate a better climate for conversation. Similarly, by improving the visibility of low-degree members, managers might enhance the agentic prospects of hitherto silent group members. In addition to that, group managers need to recognise the role of influential group members in facilitating dialogue and integrating newcomers into the group. These and other measures can develop greater group cohesiveness and nurture more engaged online communities.

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