Research Article

Who Stays, Who Goes? Predicting Continuance for Bloggers

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Abstract: The purpose of this study was to explore continuance in a group of bloggers. Previous studies demonstrated that continuance decisions depend upon previous use of the software system. For social networking software, previous research revealed that the social relationships an individual had with others through the software influences whether or not the individual planned to continue using the software. While previous continuance studies used survey methodology and self-reports to measure social relationships and previous use, this study used behavioral data to measure these constructs. Data were collected at two time points from a network of 154 interlinked blogs. Data included hyperlinks between blogs and posts made by the bloggers. The study used logistic regression to determine what behaviors and types of social relationships were predictive of continuance for the bloggers in the sample. The results of this study indicated that the number of posts a blogger made, the longest time between any two points, and the number of links pointing to the blog were predictive of continuance.

Keywords: Social network analysis, blogging, continuance

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1. Introduction

Continuance of technology platforms has been studied by a number of researchers. Bhattacherjee (2001) developed a model to explain why individuals continue to use information systems. The factors in the model included the satisfaction that a user has with the system, how useful the individual perceives the system to be, and whether or not the system works the way the individual expected it to work. Some researchers (Kwon & Wen, 2010) have theorized that the purpose of social networking technologies is very different from the task oriented technologies studied by Bhattacherjee (2001). Since social networking technologies are designed to help users develop and sustain social relationships, social pressures may influence both adoption and continuance. Ekdale, Namkoong, Fung, and Perlmutter (2010) examined the motivations of 66 bloggers at two time points. The authors found that intrinsic motivations such as keeping track of thoughts or developing ideas were higher than extrinsic motivations at the time of the original data collection. At the second data collection, however, the extrinsic motivations had increased significantly. In interview questions, the bloggers indicated that the audience they had developed drove some of their decision to keep blogging.

In most adoption and continuance studies, researchers have used survey methodology to test the hypothesized models. The drawback of this methodology in studies of technologies is that response rates for survey studies online are typically low and there is often a selection bias evident in those that respond to the survey (Wright, 2005). The purpose of this study was to determine what behavioral indicators predicted blogging continuance. This study focused on two specific predictors, previous use and social connections. Since both factors can be measured in multiple ways, the purpose of this study was to determine which measures are predictive of continuance behavior for a particular group of bloggers.
Previous Use and Continuance

Cheung and Limayem (2005) studied use of a course management system by students over a 14 week time period. The results of the study indicated that users with a higher initial use of the system were more likely to continue using the system over the entire study time period. Previous use was related to the time investment by the user which has been shown to influence continuance decisions (Lee & Huang, 2014; Zhang, Cheung, & Lee, 2012). Zhao, Stylianou, and Zheng (2013) studied the impact of time investment on intention to continue participating in a virtual community. The authors quantified time investment using two different measures. The first measure, tenure, measured the length of time that a user had been a member of the community. However, being a member of the community for a long time does not necessarily mean that a user has invested a lot of time in the community. A user that visits the community site only once a month for two years has actually invested less time in the community than a user that visits every day but has only been a member for a single month. Thus, the authors introduced a second variable called extent of usage to account for the difference in visit frequency. Extent of usage is quantified by the amount of time each week the user spent on the virtual community site. Together these two variables measured the total time investment in the community. Both variables were significantly positively related to continuance intentions. These variables also interacted with the perceived benefits of participation, weakening the impact of perceived benefits on the continuance intentions of the user.

Previous use has been shown to predict a habit of blog use that was related to continuance. In a study of World Wide Web use, Limayem, Hirt, and Cheung (2007) found that habit was significantly predictive of whether an individual continued to use an information system. The more habitual an individual’s reported use of the system, the more likely the individual was to continue using the system. The frequency of previous use was in turn significantly related to habit. The more frequently the individual had used the system in the past, the higher their reports of habitual use of the system. Liu, Cheung, and Lee (2011) found similar results with users of the microblogging service Twitter. The more an individual had used Twitter in the previous month, the more they reported that use of the system had become habitual.

1.2. Social Relationships And Continuance

For technologies that allow users to build relationships with other users, the social relationships an individual forms were significantly related to their continuance decision (Chen, 2007; Lin, Fan & Chau, 2014; Lin & Lu, 2011). Yet, not all relationships were created equal. Social capital refers to the knowledge and information an individual can access via their connections. Different types of networks have been shown to give individuals access to different types of information. Densely connected networks give individuals bonding social capital. This type of social capital is important for transmitting tacit knowledge and providing social support. Networks that are sparsely connected and where there are weak ties between individuals provide bridging social capital. This type of social capital is helpful in providing diverse information.

Chang and Zhu (2012) examined the relationship between both types of social capital and continuance intentions for a social network site. The results indicated that bridging social capital was a significant predictor of continuance intention. Bonding social capital, on the other hand, was not a significant predictor of continuance intention. The authors theorized that social networking technologies make maintaining weak ties less time intensive. The technologies did not make maintaining strong ties less time intensive. So, individuals perceived a growth in their bridging social capital as a result of the use of the social networking service but not a growth in their bonding social capital. The individuals that perceived growth in bonding capital were more likely to intend to continue using the social networking service. The influence of bridging and bonding social capital on continuance may depend on the technology. Kim, Kim, and Oh (2014) found that bonding social capital significantly predicted continuance for an online game while bridging social capital did not predict continuance.

Some researchers have used tie strength to measure social capital. Strong relationships create bonding social capital while weak relationships create bridging social capital. Sun, Liu, Peng, Dong, and Barnes (2014) found that tie strength was a significant predictor of intention to continue using a social networking site. The stronger the ties to other users, the more likely the individual planned to continue using the social network site. Tie strength has been operationalized in a face-to-face network as the frequency of interactions between two people (Petróczy, Nepusz,
and Bazsó, 2007). Researchers have applied this metric to online communities as well (Jones, et al., 2013).

Because ties between individuals online are often not reciprocal, social network theorists have visualized relationships using directed graphs. Figure 1 shows a directed graph where with a link from Node 1 to Node 2.

![Figure 1: Example of a directed graph](image)

The link is an inlink for Node 2 and an outlink for Node 1. Since the arrow appears only on one end of the line, the relationship is not reciprocal. For a blog network, the figure represents a hyperlink on the blog of Node 1 that points to the blog of Node 2. In social network analysis, the number of links pointing to a node is called the indegree of the node while the number of links pointing out from the node is called the outdegree. Hofer and Aubert (2013) found that outdegree was significantly positively related to perceptions of bridging social capital and that indegree was significantly positively related to perceptions of bonding social capital on Twitter. The more people an individual followed, the more likely the individual would perceive that they had diverse connections. The more people that followed an individual, the more the individual perceived that their network provided social support. In a study of Twitter users, Huberman, Romero, and Wu (2008) found that 98.8% of users have a higher indegree than outdegree. The authors computed the ratio of outdegree to indegree for each user. The majority of users had a ratio close to zero, suggesting that most people have many more followers than friends. Reciprocal ties are therefore an indicator of strong ties to others in the network. Reciprocity has also been used as an indicator of tie strength (Petrócz, et. al., 2007). A large number of reciprocal ties indicate the presence of bonding social capital. A small number of reciprocal ties indicate the presence of bridging social capital.

Social capital is not the only way an individual’s relationships influence continuance. An individual’s relative position within the network may also influence continuance decisions. Hsiao and Chiou (2012a) examined position within a Massive Multiplayer Online Game (MMOG). The results indicated that position of an individual within the network was significantly related to continuance intentions. The more prominent the individual in the social hierarchy, the more likely it was that the individual intended to continue participating in the game. Social Network Analysis allows the position of a user to be quantified using betweenness centrality and closeness centrality. Hsiao and Chiou (2012b) found that centrality was significantly correlated with an intention to continue playing an online game. Betweenness centrality measures whether the member lies on paths connecting other members of the network. Members of the network with a high score for betweenness centrality have the potential to control flow of information within the network. Lento, Welser, Gu and Smith (2006) found that betweenness centrality was predictive of whether or not a blogger continued using the Wallop social networking service. The higher the betweenness centrality of the individual, the more likely it was that the individual continued to use the system. Closeness centrality measures the distance from an individual from every other member of the network. The smaller the closeness centrality of an individual, the more easily that individual can disseminate information to the rest of the network. Kayes, Zuo, Wang, and Chakareski (2014) examined the relationship between various measures of social position and continued participation on the Blogster platform. The results indicated that continued participation was significantly correlated with degree, betweenness and closeness.

2. Methods

Data were collected from teacher blogs that were interlinked. This is a follow up to a study in 2011 where we used a network detection algorithm to identify science and mathematics teacher blogs...
and the links between these blogs (Smith Risser & Bottoms, 2014). The purpose of the earlier study was to examine how practicing teachers were using blogs to talk about their content and their classroom practices with other science and mathematics teachers. In the previous study we focused on the networks and the interactions or links within these networks. In this study we wanted to explicate the factors that might encourage or discourage continuance in blogging. The group of interlinked blogs was discovered using a network detection algorithm. Data collected from the 161 blogs in the original study include posts, comments, and hyperlinks to other blogs. In 2013, we conducted a follow up examination of these 161 blogs. In the follow up, post, comment, and hyperlink data were again collected. There were seven bloggers that did not have follow up data available. One had marked his/her blog as private. The remaining six blogs were restarted. Since it was not possible to determine in these cases whether or not the original blogger and the one currently using the blog URL were the same, we removed these blogs from the sample. For the remaining 154 blogs, we determined whether or not the blogger was still actively posting. A blogger was considered to be actively posting if the blog had not been deleted and the blogger made at least one blog post between July 1st and December 31st of 2013.

Two types of hyperlinks were recorded in the original study: comment links and blogroll links. Blogroll links are used to recommend certain blogs to readers while comment links are used to interact with other bloggers. Since both types of links are unidirectional, both the link and the direction were recorded.

2.1. Variables

All independent variables were computed using data collected during the original study time period. The independent variables fell into two categories, variables computed from the individual blog and variables computed using the hyperlinks between the blogs. One of the challenges of studying blogs is the “bursty” nature of blog activity (Goetz, Leskovec, McGlohon, & Faloutsos, 2009). A topic or current event can create a flurry of posts. After that short burst, the number of posts may recede. To reduce the impact of these bursts on our measurements, we chose to record behavior during the original data collection for a six month period. Three variables were used to measure previous blog use: the number of posts, the number of months blogging, and the longest time between two posts. The number of posts was computed by counting the number of posts made by the individual blogger during the original study. The number of months was computed using the date of the first post on the blog. The months were counted between the month when the first post was made on the blog and the end of the original study in December 2011. The time, in days, between every pair of sequential posts in 2011 was measured. The longest time between posts was computed by finding the largest of these values.

The network variables were computed using hyperlinks between blogs. Tie strength was measured in two ways. The number of reciprocal ties between an individual and other members of the network was computed by counting the number of bidirectional links between an individual blogger and another blogger in the network. The strongest tie was computed by counting the number of links between any two blogs. The strongest tie was the largest number of links (either pointing to the blog or out from the blog) between a blogger and any other blogger in the network. Position in the network was measured using indegree, outdegree, betweenness centrality and closeness centrality. All variables were computed using Mathematica and the standard Social Network Analysis functions (Mathematica, 2014).

The dependent variable was a dichotomous variable computed using data from the follow up study. If a blogger made at least one post during the follow up study period, then the blogger was considered to be actively blogging. The dependent variable was assigned the value of 0 in this case. If a blogger made no posts during the follow up or the blog had been deleted at the time of the follow up, then the blogger was considered to have quit blogging. The dependent variable was assigned the value of 1 in this case.

3. Results

All statistical tests were computed using the statistical package R (R, 2013). In order to determine which independent variables should be included in the regression model, a Mann-Whitney test was performed. Significant differences in means were detected between active bloggers and
bloggers that were no longer blogging for eight of the nine independent variables. The only variable where no significant differences were detected was the number of months blogging (see Table 1).

Table 1. Mean (standard deviation) for bloggers that quit and those still actively blogging

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Quit blogging (N=37)</th>
<th>Actively blogging (N=117)</th>
<th>U</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of posts</td>
<td>7.08 (4.08)</td>
<td>19.37 (21.40)</td>
<td>3252***</td>
</tr>
<tr>
<td>Number of months blogging</td>
<td>21.78 (20.76)</td>
<td>23.85 (19.10)</td>
<td>2408</td>
</tr>
<tr>
<td>Longest time between posts</td>
<td>91.00 (24.28)</td>
<td>56.86 (29.10)</td>
<td>896***</td>
</tr>
<tr>
<td>Number of reciprocal ties</td>
<td>0.86 (1.51)</td>
<td>3.91 (6.06)</td>
<td>3108**</td>
</tr>
<tr>
<td>Strongest tie</td>
<td>1.05 (0.85)</td>
<td>2.35 (2.33)</td>
<td>2992***</td>
</tr>
<tr>
<td>Indegree</td>
<td>2.35 (2.63)</td>
<td>9.67 (13.16)</td>
<td>3261***</td>
</tr>
<tr>
<td>Outdegree</td>
<td>4.65 (6.21)</td>
<td>8.94 (10.19)</td>
<td>2808**</td>
</tr>
<tr>
<td>Betweenness Centrality</td>
<td>39.00 (116.15)</td>
<td>285.24 (682.09)</td>
<td>3108***</td>
</tr>
<tr>
<td>Closeness Centrality</td>
<td>0.32 (0.17)</td>
<td>0.34 (0.13)</td>
<td>2685*</td>
</tr>
</tbody>
</table>

Note: *p< .05, ***p< .001

A backward stepwise logistic regression was performed. The first model included all variables in Table 1 except the number of months blogging as predictors of continuance. This variable was excluded from the first model because there were no significant differences were detected between the means of the two groups. In the final model the number of posts made during the original study, the indegree, and the longest time between posts were all predictors of blogging continuance.

Table 2. Logistic Regression Analysis of Blogging Persistence (N = 154)

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>B</th>
<th>se</th>
<th>Wald’s χ²</th>
</tr>
</thead>
<tbody>
<tr>
<td>β₀ = Intercept</td>
<td>-0.87</td>
<td>0.91</td>
<td>0.93</td>
</tr>
<tr>
<td>β₀ = Indegree</td>
<td>-0.22**</td>
<td>0.07</td>
<td>9.22</td>
</tr>
<tr>
<td>β₀ = Number of posts</td>
<td>-0.06</td>
<td>0.04</td>
<td>2.56</td>
</tr>
<tr>
<td>β₀ = Longest time between posts</td>
<td>0.02*</td>
<td>0.01</td>
<td>4.67</td>
</tr>
</tbody>
</table>

Note: The dependent variable in this analysis is blogger persistence coded so that 0 indicated that the blogger was still actively blogging in 2014 and 1 indicated that the blogger was no longer actively blogging in 2014; *p<.05, ** p<.01

The final model represented a significant improvement over the null model (χ²=48.10, df=3, p<.001). The indegree was a significant predictor for the final model. For every additional inlink pointing to a blog the odds that the blogger will quit decreased by approximately 20%. The longest time between posts was also a significant predictor. For each one day increase in the longest time between posts the odds that the blogger will quit increased by 2%. The number of posts was included in the final model, but was not significant. For each additional post made by the blogger, the odds that they would quit blogging decreased by 6%.
The predicted probability that a given blogger will quit blogging was given by
\[ \hat{p} = \frac{\exp(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3)}{1 + \exp(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3)} \]

This predicted probability was compared with the actual outcomes for all of the bloggers in the sample. Bloggers with a predicted probability \( \hat{p} < 0.50 \) were predicted to still be actively blogging. Those with a predicted probability \( \hat{p} \geq 0.50 \) were predicted to have quit blogging. These predictions were correct in 79.22% of the cases (see Table 3).

Table 3. Observed and predicted frequencies for blogging persistence with a cutoff of 0.50

<table>
<thead>
<tr>
<th>Observed</th>
<th>Predicted</th>
<th>% Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quit blogging</td>
<td>15</td>
<td>22</td>
</tr>
<tr>
<td>Actively blogging</td>
<td>10</td>
<td>107</td>
</tr>
<tr>
<td>Overall % Correct</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Thus, the model predicted more cases correctly than chance.

4. Discussion

This study revealed indicators related to previous behavior and social interactions that are predictive of blogging continuance. One important result was that group means were significantly different for all variables except the number of months blogging. This result contradicted theories that posited a relationship between the time an individual spends creating content on a technological platform and continued usage of the platform. Nov, Naaman, and Ye (2009) found that users of a photo sharing community contributed fewer photos to the community as time passed. The authors theorized that the motivation an individual had for posting photos changed as time passed. This change in motivation to blog over time was demonstrated by Ekdale, Namkoong, Fung, and Perlmutter (2010). However, this result can also be explained by the fact that some bloggers of long standing produced content very infrequently. Infrequent content creation means that despite a long standing tenure, a blogger has invested very little time and effort in blogging. The significant differences between the groups for both the number of posts and the time between posts supported the theory that tenure is not an effective way to measure an individual’s investment in blogging.

The final model used both previous behavior (the number of posts and the time between posts) and social relationships (indegree) to predict continuance decisions. Hsu and Lin (2008) found that bloggers who identified with others in the blogging community were more likely to continue blogging. In our results the only social position indicator included in the final model was indegree. This suggests that having a strong readership (signified by a high indegree) is more likely to create identification with a community of bloggers than being a central player (signified by betweenness or closeness centrality scores). Previous research has indicated that positive feedback from readers is related to both feelings of acceptance and blogging continuance (Miura & Yamashita, 2007). It may be that those with a high indegree are having more positive interactions with other bloggers that in turn create motivation to continue blogging.

Examining the cases where the model did not correctly predict continuance revealed an interesting pattern. The average time between posts for the correct predictions was 59.98 days while the average time between posts for the incorrect predictions was 84.47 days. This suggests that the model may not be accurate for bloggers that are infrequently making posts. This result revealed the primary weakness of this study. Some bloggers may have long periods of dormancy followed by short bursts of posts. The methodology we used captures continuance over a six month period. Just because a blogger did not post during that time period does not mean that they will never post again. In fact, after the analysis for our data was complete, one of the bloggers that had gone almost a year without making a post began posting again. Continuance may be
harder to measure for individuals that already tend to go long periods of time without posting.

Previous studies showed that continuance decisions for blogger are related to social relationships (Chang & Yang, 2013) and behaviors (Liu et. al., 2011). However, the survey methodology used in these previous studies made it impossible to determine what specific types of relationships and behaviors are predictive of continuance. The strength of this particular study was the use of observable behavior to determine which specific behaviors and relationships were important for predicting continuance. This study focused on a group of bloggers with a particular shared interest. While the model predicted persistence for this group, it is not clear whether the same variables would predict persistence for other types of groups. Consequently, this study should be repeated for other groups of bloggers with a different interest.

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References


