Designing Adaptive Engagement Approaches for Audience-bounded Online Communities

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ABSTRACT
Audience-bounded online communities require innovative user engagement techniques. Without special efforts focusing on engagement, the contribution volume will likely to be insufficient to maintain a sustainable community-driven system. This paper presents an adaptive approach for user engagement that aims to apply alternative engagement strategies to users with different behavior in the online community. We report the results of the first experiments testing the feasibility of such approach. We discuss further design options that can be explored and the implications of the approach.

Author Keywords
Audience-bounded Online Communities; Adaptive User Engagements;Design;Engagement Messages.

INTRODUCTION
Audience-bounded online communities refers to online social systems that aims to support online interaction among few hundreds of people. For example, online communities that support collaboration among people in a geographical community (e.g. a neighborhood), an organization or an event-related social systems (e.g. conferences). This kind of online communities resembles to some degree offline social relationships or information dependencies among users. This specific context is interesting for this research project because audience-based online communities have fewer potential users, then engagement strategies are specially important to achieve critical mass and become a self-sustainable online community

Previous work in encouraging contributions has generally drawn from social psychology, Sociology and Economics [1, 9, 7, 4, 3, 10]. The encouraging mechanisms embed the principles of specific theories. The experimental designs test hypotheses about the effectiveness of the proposed mechanism compared to a control group. Some experiments also try to find interaction between mechanisms. A limited number of them have also tried to discover differences of effectiveness among users with different psychological characteristics [3].

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This paper presents an innovative adaptive engagement approach which aims to adapt the engagement strategies to the prior user behavior in the system. The approach is based on a network of possible actions in the system that are gradually introduced to the users in order to engage them in new and more sophisticated tasks. We report the results of a feasibility study on adaptive engagement run in an social conference-support system. Based on the promising results, we discuss further design option within the context of adaptation of engagement strategies and the implications of such approach.

RELATED WORK
In addition to well-known online communities such as Facebook and Wikipedia, there are many other social systems that have not been successful at engaging enough users to be self-sustainable[5]. Current research in the area of online social systems has proposed a number of mechanisms to increase contributions in online communities.

The main goal is to create large amount of content (e.g. videos in Youtube or pages in Wikipedia) to provide enough benefits to the whole online community, including casual visitors. Several ways to engage users have been reported:

- broadcasting a request for specific contributions [1]
- emphasizing uniqueness of the user's contributions [1, 8],
- providing social information and feedback [9, 3],
- assigning people to competing groups [1]
- reducing the effort required to identify tasks that are likely to be done by a user (i.e. recommend possible tasks that match the user's interests) [4].

A limited number of research projects have also tried to discover differences in the impact of an engagement strategy among users with different characteristics. Experiments that tested the effect of displaying social information [3] showed that below-median contributors in a community increased their contribution at a higher rate than median and above-median contributors when exposed to social information. Furthermore, this effect was more significant for those users who present a more competitive psychological profile. Some other studies have reported the effect of mentioning the benefits of contributing as a motivator, however the results in different studies have been contradictory. Mentioning the value of contributions increased the level of contributions in one study [9], but it decreased the contribution rate in another one [1] .

The results presented above hint that the impact of an engagement mechanism may be dependent upon some user's characteristics. These observations inspired us to explore an adaptive approach to engage users in audience-bounded online communities. This approach provides different engagement strategies to users with different characteristics. Our overall goal is to evaluate several mechanisms of adaptation such as adapting to the user's prior levels of contribution, motivations and navigation patterns.

DESIGN OF AN ADAPTIVE ENGAGEMENT MECHANISM

The kind of actions a user already performed in the system and the kind of contributions made so far define the bounds of realistic user engagement in the near future. We believe that user should be introduced incrementally to both system features and different levels of engagement. For example, we will likely to be most successful when soliciting the simplest contributory actions (such as bookmarking or liking) from a user who has been just a passive reader in the past. At the same time, a user with a past history of simple contributions might be encouraged to contribute on the next level, especially if the new kind of contribution is a natural expansion of contributions performed so far (such as progression from bookmarking to tagging).

This work on incremental engagement techniques expand the ideas of adaptive and incremental interfaces, which have been explored in the past [2]. To support these techniques, a conceptual network of various information-access and contributory actions is required. Directed links in this network indicate natural progress from basic actions to more involved activities, which are considered as the next step in a specific direction to achieve better information access or higher participation levels. For example, using advanced search function is a natural next step for someone who already has reasonable experience with basic search. Tagging is a next step for someone already familiar with simple bookmarking. A subset of such links indicating most natural advancement paths can be provided at design time, however, the majority of links should be elicited by processing the logs of successful system users. This network is used to model the current level of system experience for individual users and drive user gradual exposure to more complex system features with higher levels of user engagement.

THE STUDY

To prove the feasibility of the adaptive engagement approach, we apply the conceptual design to a conference support system. Conference Navigator [6] is a community-based system designed to help conference attendees make decisions about which sessions to attend. Conference Navigator allows users to browse the conference schedule, to bookmark and tag their favorite papers and create social connections with other conference attendees. The system tracks browsing, scheduling, tagging and networking activities of the community members, using these data to provide social navigation support and recommendations to the community. We create a conceptual network of actions for Conference Navigator in design time, as shown in Figure 2. This network was also validated later through the analysis of the log records.

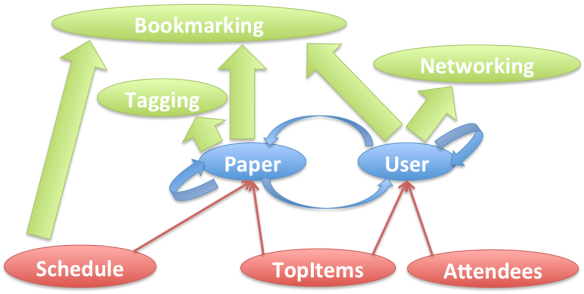

Figure 1. Network of Actions in Conference Navigator

There are three main entry points to information in the Conference Navigator: Schedule, Top Items and Attendees list. These pages enable the user to access more detailed information such as the paper details and user pages. Schedule shows all the papers of the conference. The Attendees page displays the list of people attending to the conference. Top Items include links to the most bookmarked papers in the conference and the most active attendees in the system. The paper page and the schedule view enable the user to bookmark a paper. The paper page also allows the user to add tags to the paper. The user page provides the user's contact information along with her bookmarked papers. When a user visit other user's page, she can create a social connection and bookmark papers that were included in the other user schedule. Bookmarking is by far the most common activity in the system. On the other side, few people tag papers and create network relationships with others.

Conference Navigator provided support for the Conference UMAP [1] 2011. The number of registered attendees in the conference is 140. Furthermore, we invite attendees of recent UMAP conferences and accepted papers authors to visit the system, so our potential audience is 294. We run an study to test an adaptive engagement mechanism one week before the conference begins. Our research question is: Will an engagement technique adapted to user past experience with the system be more effective than a technique that treat equally the users with different experience?

To answer our research question, we design an study to compare the effectiveness of an email-based adaptive engagement strategy and a control (same for all users) engagement strategy. One week before the beginning of the conference, we analyze users' past behavior data to verify the validity of designed network of actions (see Figure 2). We confirm that bookmarking was the most popular action. 798 bookmarking actions had been undertaken by 72 users of the system before the study. On the other side, tagging and networking were much less used as shown in the second column of Table 1.

Based in these data, we categorize users in three groups: Non-bookmarkers, low-level bookmarkers and high-high level bookmarkers. We first distinguish between people who have bookmarked and those who haven't. Given that the other actions are barely used, we prefer to discriminate between users who have broadly used bookmarks and those who have done

[1] User Modeling, Adaptation and Personalization

Table 1. General Statistics Before the Study

Description	Count
Number of Contributors	72
Browsing Actions	4818
Bookmarking Actions	798
Tagging Actions	30
Networking Actions	12

it at a lower rate. The threshold between these two categories was defined as five bookmarks. This number was chosen due to a prior engagement email that have suggested that five bookmarks were required to get recommendations. This previous email was sent to all the users.

Users in each category were randomly assigned to one of two possible condition: control or adaptive engagement. The control engagement condition was implemented as single email that explained the benefits of the system and all the possible actions that can be done in the system: bookmarking, tagging and networking. On the other side, the adaptive condition was implemented by different emails for different user categories. Three emails were designed:

Non-Bookmarkers Email: that suggests the user to bookmark their favorite papers to get content-based recommendations.

Low-Level Bookmarkers Email: that invites the user to tag their favorite papers to get tag-based recommendations.

High-Level Bookmarkers Email: that advise the user to connect to other users to be able to improve the social navigation support.

The study is run with 133 subjects. We analyzed the contribution rates during the week immediately after the emails were sent. The results are detailed in the following section.

Results

A 2x3 analysis of variance analysis was performed on the number of contributions as a function of the prior level of bookmarking (non-bookmarkers, low-level bookmarkers and high-level bookmarkers) and the engagement strategy condition (control and adaptive). The assumptions of normality and homogeneity of variance were not met. ANOVA results and non-parametric tests found significant differences. ANOVA results are reported here.

Users who were assigned to the adaptive engagement strategy contributed significantly more (M= 4.636, SE= 1.036) than user who were in the control group (M=1.344, SE=1.095) averaged across prior level of contribution categories, F (1, 127) = 4.773, p = .027, η^2 = .055. There was a significant difference on the number of contribution among different categories of users averaged across the kind of engagement strategy that was applied, F (2, 127) = 3.726, p = .031, η^2 = .036 [2]. Marginal comparisons were performed on the categories of users. There was a significant difference on number of contributions between non-contributors (M=5.750, SE=1.018) and low-level contributors (.667, SE=1.661). The interaction effect turned out to be not significant. Figure 2 shows the patterns of contribution rates for the adaptive condition (label 1) and the control condition (label 0). Table 2 details the mean number of contribution during the observation period (i.e. 1-week after the emails were sent).

[2]Kruskal-Wallis: p=.044

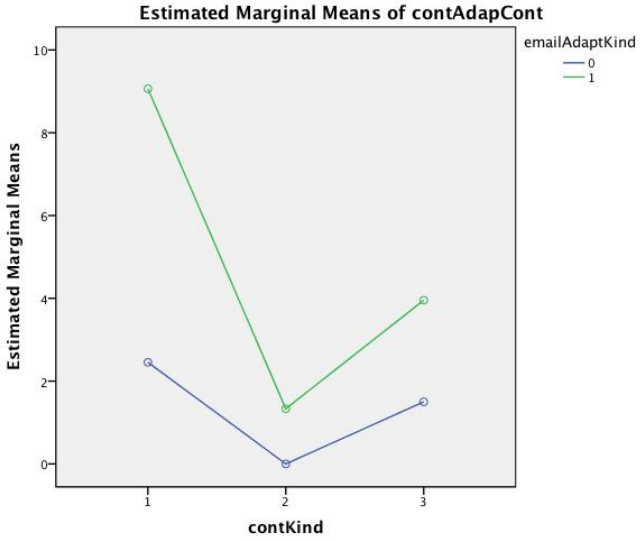

Figure 2. Number of Contribution after the Adaptive Engagement Message

Table 2. Descriptive Statistics of the Study Results

Engagement	User Category	N	Mean	SE
Adaptive	Non-bookm.	29	9.065	1.462
	Low-level bookm.	15	1.333	2.101
	High-level bookm.	22	3.955	1.753
Control	Non-bookm.	32	2.455	1.417
	Low-level bookm.	11	$-.66^{-16}$	2.573
	High-Level bookm.	24	1.5	1.661

ADAPTING ENGAGEMENT STRATEGIES TO MOTIVATIONS

The following step in this research effort will be to identify reliable indirect indicators of users' motivations to participate in audience-bounded online communities. This knowledge can be used to adapt the users' engagement strategies to different users' expectations to better support the users' needs. For example, if a user contributes to a system because of altruistic motives, then the engagement strategy would be displaying social feedback about community achievements and the effect of each user's contribution. Another strategy could be suggesting contributions that would help the community work better such as discussion moderation or socializing newcomers. On the other side, if a user's motivation is increasing her professional reputation, then the engagement mechanisms would choose to show who other community members are and explain how to enhance visibility in the community.

Adaptive engagement features in the user interface would require an automatic way to recognize motivations instead of

asking the users about it. Directly surveying users about their motivations may lead to increase drop out rates because it requires them to spend time in something that is not the ultimate goal of the system. Furthermore, users might try to hide the real motivations and choose those motivations that seems more socially acceptable. Additionally, users' motivation may change over time and be circumstantial. Therefore, an automatic approach to predict motivations would be more desirable as a basis for adaptive interfaces.

The main assumption to be tested is that motivations and activity patterns are correlated. For example, in the case of Q&A, one of the best predictors of users lifespan is the tendency to answer more than ask new questions at early stages in the user lifecycle (ratio number of answers and number of questions) [11]. This imply that there are at least two patterns of interaction: tendency to answer and tendency to ask. It is feasible to think that these two patterns are related to the users' perception regarding the community. People who tend to ask might approach the community when they look for answers for some personal benefit (e.g. solve a doubt). On the other side, people who tend to answer might interact with system because they want to help or reciprocate previous help from the community. In this way different users' activity patterns might give clues about the users' motivation to participate in the community.

Analyzing user logs may enable us to create navigation maps in such a way that navigation patterns can be identified. If this is the case, specific engagement strategies which have been proven to persuade people to contribute can be matched to the users' predicted motivations. Thus, the engagement strategy can be adaptive to the user motivation on runtime instead of an offline process as presented in this paper.

CONCLUSION

The contributions of this paper are three fold. First, it proposes an innovative adaptive approach to implement engagement strategies in online communities. Second, it provides evidence of the feasibility and effectiveness of adaptive engagement strategies in audience-bounded online communities. Third, the paper also proposes a new research avenue in using navigation patterns as indicators of motivations, and using these indicators to automatically adapt the engagement strategies.The results of this work can significantly influence the way in which system designers can make decisions about system features aiming to increase contributions in audience-bounded online communities.

REFERENCES

1. Beenen, G., Ling, K., Wang, X., Chang, K., Frankowski, D., Resnick, P., and Kraut, R. E. Using social psychology to motivate contributions to online communities. In *Proceedings of the 2004 ACM conference on Computer supported cooperative work*, CSCW '04, ACM (New York, NY, USA, 2004), 212–221.
2. Brusilovsky, P., and Schwarz, E. User as student: Towards an adaptive interface for advanced Web-based applications. 1997, 177–188.
3. Chen, Y., Harper, F. M., Konstan, J. A., and Li, S. X. Social comparisons and contributions to online communities: A field experiment on movielens. In *Computational Social Systems and the Internet* (2007).
4. Cosley, D., Frankowski, D., Terveen, L., and Riedl, J. Suggestbot: using intelligent task routing to help people find work in wikipedia. In *Proceedings of the 12th international conference on Intelligent user interfaces*, IUI '07, ACM (New York, NY, USA, 2007), 32–41.
5. Cummings, J. N., Butler, B., and Kraut, R. The quality of online social relationships. *Commun. ACM 45* (July 2002), 103–108.
6. Farzan, R., and Brusilovsky, P. Where did the researchers go?: supporting social navigation at a large academic. In *Proceedings of the nineteenth ACM conference on Hypertext and hypermedia*, HT '08, ACM (New York, NY, USA, 2008), 203–212.
7. Harper, F. M., Frankowski, D., Drenner, S., Ren, Y., Kiesler, S., Terveen, L., Kraut, R., and Riedl, J. Talk amongst yourselves: inviting users to participate in online conversations. In *Proceedings of the 12th international conference on Intelligent user interfaces*, IUI '07, ACM (New York, NY, USA, 2007), 62–71.
8. Ludford, P. J., Cosley, D., Frankowski, D., and Terveen, L. Think different: increasing online community participation using uniqueness and group dissimilarity. In *Proceedings of the SIGCHI conference on Human factors in computing systems*, CHI '04, ACM (New York, NY, USA, 2004), 631–638.
9. Rashid, A. M., Ling, K., Tassone, R. D., Resnick, P., Kraut, R., and Riedl, J. Motivating participation by displaying the value of contribution. In *Proceedings of the SIGCHI conference on Human Factors in computing systems*, CHI '06, ACM (New York, NY, USA, 2006), 955–958.
10. Wash, R., and MacKie-Mason, J. Using a minimum threshold to motivate contributions to social computing, 2009.
11. Yang, J., Wei, X., Ackerman, M. S., and Adamic, L. A. Activity lifespan: An analysis of user survival patterns in online knowledge sharing communities. In *ICWSM* (2010).