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Visualizing Personal Relations in Online Communities

Andrew Webster, Julita Vassileva

Computer Science Department, University of Saskatchewan, Canada.
asw292@mail.usask.ca, jiv@cs.usask.ca.

Abstract. A hard challenge facing developers of online communities is attaining a critical mass of members and subsequently sustaining their participation. We propose a new mechanism for motivating participation in interest-based online communities, which engages non-contributing members (lurkers) by modeling and visualizing the asymmetrical relations formed when reading, evaluating, or commenting other community member's contributions. The mechanism is based on ideas from open user modeling, a new concept of "community energy," with a mechanism of rating contributions and visualizing the rank of contributions in the community interface.

1 Introduction

An online community is a virtual social space where people can meet and interact [1]. The purposes of such interactions are diverse and may include exchanging information or social support [2], fostering social ties [3], supporting learning [4], extending real-world relationships/communities [5], or a combination of these. The crux of building successful online communities is on managing to entangle people together around a common purpose that is usually reflected in the developer's agenda.

It is a well-known dilemma that a certain amount of interaction/contribution must occur in an online community before members start perceiving the benefits of the system and become active participants themselves. This problem is especially acute and frustrating for developers who must reconcile that the majority of their membership (45-90%) never participates [6] within systems understood to be gift economies [7;8]. In a gift economy, information is exchanged for the benefit of the whole community with the generalized understanding that the contributing individuals will receive some benefit from others later on. Hidden, non-participating members (lurkers) do not reciprocate the benefits they have received and have been generally seen as destructive to the health of online communities [8]. However, more recent research [9;10] has shown that this is not the case. Lurkers were interviewed [9] and reported feeling a sense of belonging to the community even though they had lower satisfaction with the community than participating members. The interviewed participating members viewed lurkers as legitimate members of the community (akin to the importance of having an audience in theater performances). It was suggested that "lurking should be recognized as a bona fide activity and supported more effectively" [9] (p 216).

However, in the early stages of a developing an online community, participation is needed and motivating lurkers (and the membership at large) to become active contributors is crucial. We propose a mechanism to motivate participation through making explicit and visible the process of developing networks of interpersonal relationships among the community members (both active participants and lurkers) aiming to "weave" in lurkers with participant members. The resulting visualizations of relationships should be applicable in a wide range of online communities.

2 Related research

The question of what motivates or triggers individuals to join and participate in online communities and how to design the technical features of the community software accordingly rests on the particular rationale from a wide range of perspectives. Preece et al. [11] identifies research in social psychology, sociology, communication studies, computer-supported cooperative work (CSCW) and human-computer interaction as main areas which can help inform designers about how and why people interact in online communities. Consequently, there are many guiding directions on which interactions to support and how to support them. The variety of online communities with their own specific sets of interactions (e.g. a mailing list for cancer-sufferers vs. an interactive, educational website for teens) and specific purposes makes it very hard to choose appropriate guidelines for interaction design.

An area dealing with social issues in interaction design is CSCW and its application of theories from social psychology to the problems of group work [12]. Collective effort, social identity, and social categorization [13] are all theories which have provided direction in the design and evaluation of technical features to support the work of groups [14]. These theories have also been used in the design and study of online communities [15;16]. For example, earlier research from our lab [17] suggested awarding or revoking social status based on contribution levels would motivate higher levels of contribution because people would be motivated by social comparison (i.e. their status in the community) and would fear losing their current standing within the community if they did not continue participating.

However, there is no unified theory in social psychology and most theories are "mid-level," i.e. only the behaviour of individuals within groups is explained. Also, online groups have only recently received attention from social psychologists, and it is not completely clear what similarities and differences exist between face-to-face and online groups [13]. Finally, the CSCW agenda is one of supporting groups that primarily exist to achieve specific work-related goals (typically relatively short term, requiring close collaboration by the group members). Therefore, not all online communities can take straightforward advantage of these fields of knowledge, especially those that are interest-driven rather than goal-driven. For example, in investigating whether the theory of collective effort could potentially aid in increasing participation (the number of movie ratings) in the interest-based MovieLens community, Beenen et al. [7] did observe increase in the number of contributed ratings but failed to attribute it directly to the implementation of the theory. The authors offer several reasons for this including "a deeper mismatch of goals and values of HCI and CSCW research with those of social psychology" (p 220).

We suggest that the failure to apply the theory may also be due to the tendency to link non-participation with free-riding. This is a connection which is hard to avoid within a collaborative work context where individuals must work on their tasks to be of value to the group or community. Therefore, from the perspective of CSCW, nonparticipants are treated as a problem to be fixed. However, in a community where people share common interest but not a task or goal, lurking is acceptable.

It is often difficult for new members to join a new or preexisting community. It takes time to uncover the structure, norms, and history of the community before making one's presence known. It would be useful to present the rudimentary relationship that lurkers form with others, even when they are simply reading or browsing information. Our hypothesis is that by making the structure of these relations explicit new communities will develop quicker by rapidly integrating newcomers, increasing the probability that they will become active contributors rather than remaining on the sidelines as lurkers. In the next section we describe a mechanism for modeling such relations.

3 Mechanism: Energy and Relations

We place value on the *act* of contributing in online communities and not just necessarily on *what* is contributed: information valuable today may be worthless tomorrow. It is important to have people who are invested in each other enough to share information, exchange support, etc.

3.1 Energy: The Building Block

First, we introduce the concept of *energy* in an online community which is a measure of the current level of contributions in the community. When an item (e.g. discussion post, movie review, blog entry, etc.) is contributed, it brings in a default number of new *energy units* into the system. For example, a new post in a discussion thread may produce 5 units.

Only a certain number of energy units are allowed to stay attached to the new contribution (e.g. by default a post may keep 3 of the 5 units). The number of these units determines the contribution's *visibility* in the community. Different levels of visibility are achieved through the scaled use of colour and font size. If a contribution possesses many units, then it will be rendered with hot colours (e.g. orange, yellow) and large fonts, advancing towards the viewer. Conversely, if an item has few or no units, then it will be rendered with cold colours (e.g. blue, purple), and small fonts, receding from the viewer (see Fig. 1).

Units kept by an item are considered to be in the *@work state* (i.e. the energy units work to make the item more visible) while units not kept are considered to be in the *stored state* (i.e. units available to be put into the @work state). Energy units can freely move between the stored and @work states; this movement is mainly dependent on the actions of the community's members. If a member positively evaluates an item (and stored energy is available) then she may decide to "heat it up" by moving a stored energy unit into that item (equivalent to rating the contribution). As a result, the item becomes a little more visible to all other members. Conversely, other members may negatively evaluate the same item and "cool it down" by moving energy units back into storage, one at a time. There are 4 simple rules governing how energy may be distributed:

1. A member cannot add or remove energy from items she has contributed

2. A member can only heat up and cool down an item once
3. Items can only be heated up if stored energy is available
4. There is a set upper limit on the number of energy units an item may hold

Community members should not be able to add energy to their own contributions as their judgment is biased (rule 1). It should not be possible for one member to have too much influence over the visibility of a particular contribution, i.e. each member has one vote per item (rule 2). Energy can be added to contributions only if there is stored energy in the community, i.e. the community must manage the shared, limited resource of what is and is not visible at any point in time (rule 3).

The concept of community energy provides a novel metaphor and system for rating content with a number of advantages:

- Energy is finite and depends on the number of contributions to the community, keeping the ratings always in proportion with the contributions (i.e. prevents inflation in the ratings).
- Using community energy units for evaluation encourages the user to reflect on the usefulness of the item to the community and not just to herself (i.e. "I want others to notice this item" or "I want others to ignore this item").
- Evaluation is cognitively less demanding than determining if an item deserves 1, 2, 3, 4, or 5 stars, for instance.
- Emphasis is placed on the act of contributing (i.e. each contribution brings in new energy—a useful resource to the community).

In combination, these features allow members to easily determine where activity in the community is occurring and what particular activities are relevant to the whole membership (see Fig. 4). This should be of particular benefit to new members who are trying to decide what the community presently values in order to best introduce their contributions, opinions, values, etc.

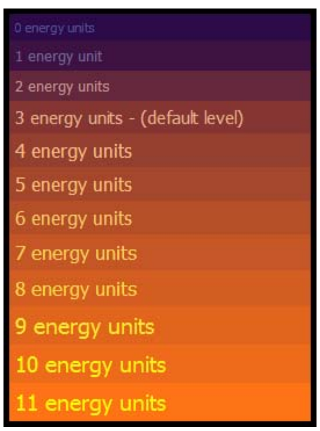

Fig. 1. The visual appearance of contributions at different levels of energy.

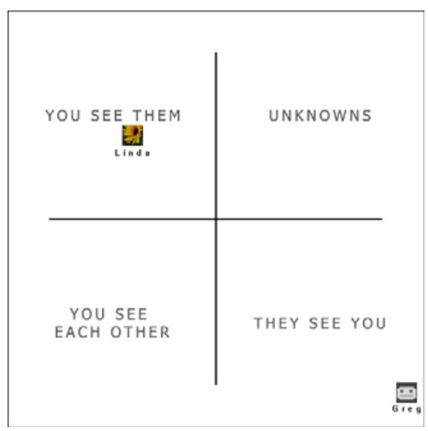

Fig. 2. Example relation visualization (Relavis) from Ralph's viewpoint.

3.2 Modeling Interpersonal Relations

Modeling and visualization for interpersonal relations aims at three goals: 1) connect lurkers and contributors, 2) give the viewer opportunity for reflection which can be beneficial, as suggested by open user modeling approaches [18], 3) influence the viewer to modify her behaviour in a desired way (to participate more). The visualization should also be dynamic to reflect that individual actions constantly modify relationships and in this way confirm and reward the user’s actions.

The most common relationship found in online communities is the weakest (making it difficult to capture): the lurker-contributor relationship. The importance of weak ties has long been recognized [19] so defining a tenable connection between lurkers and contributors is a desirable feature of the visualization but also a challenge.

A relationship between two members A and B always has two sides: from A→B and from B→A, which are not necessarily symmetrical. We define the notion of *member visibility* to capture the inherent asymmetry in interpersonal relationships. The *member visibility* has a value ranging from 1 (invisible / unknown / opaque) to 0 (completely visible / transparent). For example, when a new member enters the community, she does not know or “see” any other member. Thus, from this member’s perspective, visibility values of 1 are assigned to all other members, i.e. her relationships with all other members of the community have value 1. Conversely, as she is a new member, all other community members will assign a value of 1 to their relationships with this new member.

The visibility value at one end of the relation pair is dependent on actions performed by the member on the other end (see Section 3.4). For example, if a lurker reads several messages in a discussion forum, then the authors of these messages will become slightly more visible to the lurker (i.e. the value of the lurker’s relationships with the authors of the posts will decrease), yet the lurker’s visibility for the other members still remains unaffected (i.e. their relationships with the lurker will still have value 1).

3.3 Relation Visualization (Relavis)

The relation between two individual members can be visualized in a two-dimensional space which we call a Relaviz (Fig. 2). The horizontal axis (0 to 1) indicates the visibility of other members to the visualization’s viewer (in this example, Ralph) while the vertical axis (0 to 1) indicates the visibility of the viewer to the other members. For example, in Fig. 2, the position of Linda’s avatar icon (~0.3, ~0.7) describes the relation between Linda and Ralph.

To assist reading, the space is characterized by four relation quadrants: “you see them,” “unknown,” “you see each other,” and “they see you.” Insignificant relations (i.e. unknowns) are located in the top-right corner with coordinates (1, 1) while more significant relations (i.e. mutual awareness) are located in the bottom-left corner with coordinates (0, 0).

Let us return to the scenario where a lurker reads posts in a discussion forum. Let Ralph be an active contributor, checking his Relaviz once in a while to see how things stand. This time he notices “Greg” in the “they see you” quadrant (who did not appear the last time Ralph checked). Ralph can guess that Greg has read and rated positively most, if not all, of Ralph's contributions since the relation is so strongly asymmetric. Depending on the size of the community, Ralph may guess that Greg is new in the community or a chronic lurker who has recently discovered Ralph's contributions. This discovery gives an opportunity for Ralph, who has already received some benefit (i.e. Greg adding energy units to Ralph's contributions), to directly communicate with Greg, to search for Greg's contributions and perhaps evaluate them.

If Greg looks at his Relaviz, logically, he will see Ralph appear in the "you see them" quadrant. The important consideration is that both members now have some awareness of each other and can take actions to further define the relation. In order to encourage the use of the Relavis, whenever possible, a light-weight version is displayed alongside the contribution to give specific relation information (see Fig. 3).

3.4 Calculating Visibility Values

The calculation of visibility values is largely dependent on the features of the online community. Actions which are deemed to affect the visibility between members are assigned constant values which will either increase or decrease the overall visibility value (recall it ranges from 0, visible, to 1, invisible). In our implementation, accessing discussion thread subtracts a little (-0.005) from the opaqueness of each reader-author relationship regardless whether the reader actually looks at every post. Explicit actions that indicate preference (e.g. "heating" (-0.05) or "cooling" (+0.05) posts) have the most impact on visibility. For example, if a member comments on another's post (-0.08) and then cools down that post, the resulting decreased visibility is much greater (+0.15) had there been no comment. Also, energy units come into play to provide bonuses: "hot" items have stronger effect on changing visibility than "colder" ones.

The determination of these constants is an open question. Some initial intuition is required to say certain actions affect visibility between two community members more than others. The analysis of the results the evaluation (described in the next section) should provide direction into how these values should be best determined.

4 The Study: Comtella Discussions

Comtella Discussions (CD) is an online community for discussing the social, ethical, legal and managerial issues associated with information technology and biotechnology, available online at http://fire.usask.ca. The primary aim is to share and circulate information related to these topics through a discussion forum. Access to content is restricted to registered members, but anyone may create an account after consenting to the conditions of the study. A nickname (alias), e-mail address, and password are all that are required to create an account, so members are free to be relatively anonymous and create multiple identities, if they desire.

4.1 Participant Groups

CD is being used by students in two university courses at the University of Saskatchewan: Computer Science 408 and Philosophy 236, from January to April 2006. Both courses study the ethics of technology except the former emphasizes information technology while the latter emphasizes ethical theory and biotechnology.

Table 1. Subject groups in Comtella Discussions

Identifier	N	Description
Cα	10	Core members (computer science students required to participate) with test interface
Cβ	9	Core members who see a control (standard discussion forum) interface
Pα	15	Peripheral members (philosophy students and others not required to participate) with test interface
Pβ	17	Peripheral members who see a control interface

The computer science students, as part of their coursework, are required to submit five posts to the forum every week. Thus, they represent the core membership of the community. Conversely, philosophy students are not required to participate and are peripheral members: their instructor just recommended CD as an additional class resource. We denote the core members with C and peripheral members with P. Next, we divide the users (by the order in which accounts are created) into two orthogonal subgroups: a test group who receive the new (hot-cold) interface and Relaviz visualizations (α) and a control group who receive a standard discussion forum interface with no relation visualization (β). A summary of the groups is shown in Table 1. All groups use the same concept of community energy to evaluate postings, but the representation of the act of rating is different between groups (see Fig. 3). The model of relations for each participant computes visibility values towards the other participants as described in section 3.4; however, only the α-group participants receive visualizations displaying their relations. To the β-group participants, CD has the appearance and functionality typical of online discussion forums.

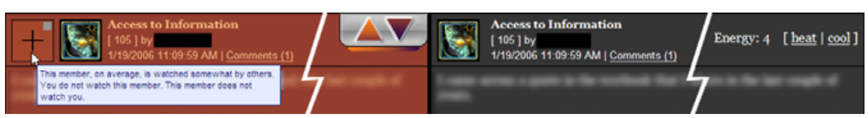

Fig. 3. A post header as seen by an α-group participant (left) and β-group participant (right).

4.1 Hypothesis

The hypothesis is that the subgroups using the α-interface, i.e. the test-subgroup, in both the core and peripheral user groups will show higher participation, will have less lurkers (or the number of non-actively participating members of the Pα group will be less than the corresponding number in the Pβ group) and will show increased satisfaction with the community. In order for the hypothesis to hold, participation rates *p* of each group should be ranked in the following order:

$$p(C\alpha) > p(C\beta) > p(P\alpha) > p(P\beta). \quad (1)$$

As a consequence, if the hypothesis holds, we expect the average interaction levels (and, of course, the corresponding mutual visibility values) between pairs of members of the four groups will be partially ordered so that the mutual visibility of members of the α-subgroup in both the core and the peripheral group is highest. Also we expect that the members of the β-subgroups will be more visible for the members of the α-subgroups than the reverse in both the core and peripheral groups. The lowest visibility and interaction levels will be between members of the β-subgroups in each of the core and peripheral groups.

Fig. 4. The distribution of energy units when displaying forums in the α interface.

5 Results

As shown in Table 2, for most participation metrics, the expected order (1) between the groups holds. However, the only observed significance was that Pα subjects logged into the system more than Pβ subjects did ($p < 0.02$).

Table 2. Subject Group Participation Data

	Contribution Counts				Average Access / Views		
Group	Threads	Posts	Comments	Evaluations	Logins	Threads	Relavis
Cα	72	326	17	55	66.3	233.6	4
Cβ	60	299	5	11	48.6	180.2	n/a
Pα	6	10	0	6	15.9	28.1	1.1
Pβ	1	6	1	4	7.9	19.2	n/a

Table 3 shows the relative ordering of average visibility of the participants from each subgroup. For an idea of the level of interaction these average visibility values capture, consider if all incoming relations to a particular participant averaged a visibility value of 0.75, then this participant can expect that *each* user connected with an incoming relation to her has viewed at least one of her posts approximately 50 times (ignoring other actions such as heating and cooling).

The results generally confirm our expectations. In particular, the Pα subjects interacted with the core group C more than Pβ subjects did ($p < 0.01$) which was our basic objective. Within the core group, the members of the α-subgroup engaged in more symmetrical relationships. Eight (8) relations of mutual recognition (i.e. 'you see each other') were made within the Cα group, compared to 3 such relations formed within the Cβ group. The interactions and visibility among the members of the peripheral group however do not confirm our predictions. Even though the differences are very small, the relationships of the Pβ group members among themselves and with members of the Pα group show that these users engaged in more interactions than the users of the Pα group. We still need to do more thorough analysis and interpretation of the results. We are currently administrating a questionnaire which will help qualify the subjects' attitudes towards the visualizations. Specifically, we are trying to determine if members changed their behavior in any significant way as a result of considering the visualization. A larger study, with more similar core and peripheral group will be done in the future.

Table 3. Interaction between Subject Groups

Grouping	Interaction (from → to)	Number of relations	Avg. Visibility
Core-to-Core	Cα → Cα	89	0.5988
	Cα → Cβ	90	0.5763
	Cβ → Cα	88	0.6125
	Cβ → Cβ	72	0.6573
Core-to-Periphery	Cα → Pα	11	0.9784
	Cα → Pβ	7	0.9860
	Cβ → Pα	11	0.9894
	Cβ → Pβ	3	0.9820
Periphery-to-Core	Pα → Cα	82	0.9624
	Pα → Cβ	87	0.9674
	Pβ → Cα	70	0.9711
	Pβ → Cβ	79	0.9742
Periphery-to-Periphery	Pα → Pα	42	**0.9713**
	Pα → Pβ	28	**0.9678**
	Pβ → Pα	40	**0.9688**
	Pβ → Pβ	33	**0.9667**

6 Summary

We propose a new mechanism for motivating participation in interest-based online communities which engages lurkers through modeling and visualizing the relations they build with other community members through reading, evaluating, commenting or replying to their contributions. The mechanism is based on ideas from open user modeling, a concept of community energy, and a new mechanism of rating contributions and visualizing the rank of contributions in the community interface. The results indicate that the new approach can draw increased participation for both active and non-active members.

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