

Community Organizer: Supporting the Formation of Network Communities through Spatial Representation

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Abstract

In this paper, we introduce Community Organizer, a system designed to support network communities by providing spatial representations of community members and communication exchanged among these members. This spatial representation reflects the closeness of interests and concerns among them. We conducted an experiment with two different versions of the software. One version offered meaningful spatial representation while the other version did not. Experiment results indicate the effectiveness of the proposed spatial representation. The subjects who used the software providing the spatial representations felt a greater sense of “community,” enjoyed using the software more, and actively used it longer than subjects in the control condition.

1 Introduction

With the advancement in computer networks, people are getting connected more than ever. New types of communities (“network communities,” and “virtual communities”) are beginning to emerge, and a multitude of projects are being devoted to develop systems supporting community activities over networks [4] [5] [6]. Unlike traditional communities where geographical and institutional properties define the boundary of the community, a network community consists of peo-

ple who share common interests. It is also called a *community of interests*.

Many network communities are based on services such as online discussions, electronic chat rooms, and bulletin board systems. They often adopt the ‘room’ metaphor, that is, the communication occurs only within a pre-existing virtual ‘room,’ such as a chat room and a discussion room. People have to enter the ‘room’ to join the activities inside. Network communities using this metaphor are characterized by common interests or concerns of people in a given room, such as rooms for discussions on ‘food,’ ‘travel’ and others. Therefore, in order to find people who share one’s interests, a person has to find an appropriate ‘room’ first. However, if no appropriate and interesting room can be found, such a person may be at a loss in the virtual space.

In this paper, we introduce *Community Organizer*, which is software aimed at helping users find other users with similar interests on the network in order to form a new community. Community Organizer is designed to support the early stages of community formation by 1) helping a user find other people who share their interests, and 2) encouraging communication among them to establish a new community. This process of ‘finding people’ and ‘establishing a new community’ occupies only a small fraction of the entire life cycle of a community. However, this early stage is not fully supported by conventional software, and we believe that providing a user interface that lets a user

feel comfortable and enjoy the interaction is an important step towards realizing open and adaptable network communities.

This paper is structured as follows. First, we will discuss existing community support software and its required functions. We will focus on the importance of spatiality. Then, we will explain Community Organizer in detail. Next, we will describe the results of our experiment testing the effectiveness of the spatial representation used in Community Organizer.

2 Community Support Software

2.1 Supporting Community Formation

When designing community support software, an important question is how to represent people's interests and present them to users in a meaningful way.

The Yenta system [3] provides clusters of users who are interested in similar topics. These clusters can serve as the first step in meeting new people with similar interests before forming a new community. In this system, the clusters are generated automatically from a user's e-mail messages, news articles, and files he/she reads and composes. This system, however, does not visualize the generated clusters. Thus, it is difficult for a novice user to intuitively recognize a potential community.

In contrast, Visual Who [2] visualizes the relationship between a user's interests (that is, it shows who has similar and related interests) in a two-dimensional plane. The user's interests are calculated from mailing lists a user subscribes to. This system uses the spring model [1] to determine the position of a user on the display plane so that users who share similar interests appear as a cluster in the display. By looking at the clusters of users on the display plane, a user can recognize a potential community on the network. In this system, however, messages exchanged between users do not appear on the display plane. This system only reflects the status of a user's subscription to mailing lists, which does not change so frequently. Therefore, it is difficult to see how a cluster of people develops into a potential community.

In the C-MAP of Sumi *et al.* [13], a social network consisting of visitors at an exhibition, exhibits and exhibitors, is visualized in the graphical view. People's interests are described according to the relationships between him/her and the exhibits. This kind of relationship is also used in Nishida's CoMeMo-Community [8] [9].

Nishimura's Community Viewer visualizes the ongoing interaction between users [7] [10]. For instance,

when a user accesses the personal profile of another user, the number of interactions between them increases. As the degree of interaction increases, the corresponding icons start to congregate in the view.

All of these areas have been addressed in the design of Community Organizer.

2.2 Community Organizer

In order to develop Community Organizer, we defined the early stage of community formation in four phases: "Browse," "Find," "Approach," and "Talk" (Figure 1). Community Organizer provides an interface that prompts the user to act following these phases. The user interface has two major components: 1) visualization, and 2) a communication assistant integrated into the visualization.

2.2.1 Visualization of communities

The central part of Community Organizer's graphical interface features a display window visualizing the relationships among users in real-time [14]. A User's interest is represented as an icon in the display window. Its placement in relation to others reflects the closeness of users' interests. A user's interest is represented as a feature vector of the degree of her/his interest regarding each keyword. A set of keywords such as 'travel,' 'food,' etc. is pre-defined in the system. Icons with similar feature vectors are placed closer to each other in the display plane. By observing how icons are distributed, a user can envision a potential community of interests (*Browse* phase).

The center of the display plane (in other words, a user's point of view) can be adjusted. A user determines the feature vector corresponding to the center of the display plane by adjusting slide bars next to the display. The placement of the icons will change according to the user's point of view, and he/she can find people who have similar interests by adjusting his/her point of view (*Find* phase) (Figure 2).

2.2.2 Communication in communities

Users can express their interests easily to other users. This is done by placing personalized icon of the user in the center of the display (*Approach* phase) (Figure 3). The icon placed by one user will appear on all other users' displays. A user can place plural icons in the display to participate in (potential) multiple communities.

Furthermore, a user can attach her/his message to an icon (called a public message). Other users can read the message by clicking the icon, and attach a reply to



Figure 1: Behavior model of users

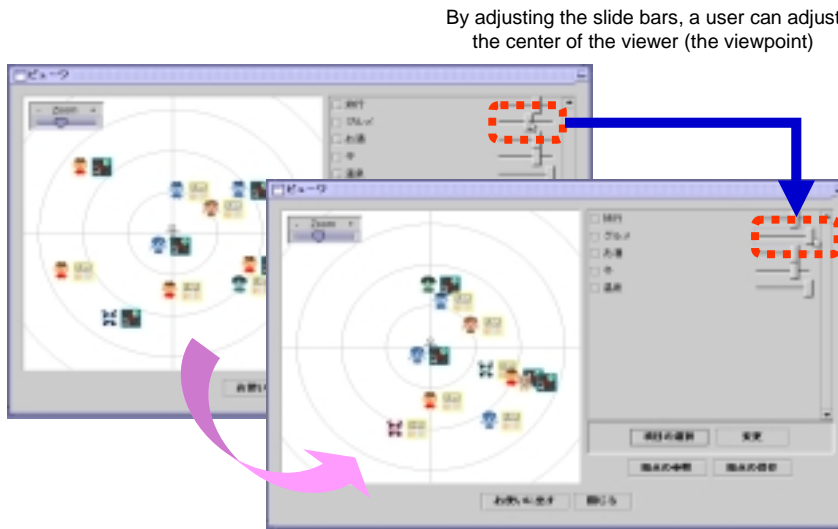


Figure 2: Changing a viewpoint

An icon will appear at the center of the view.

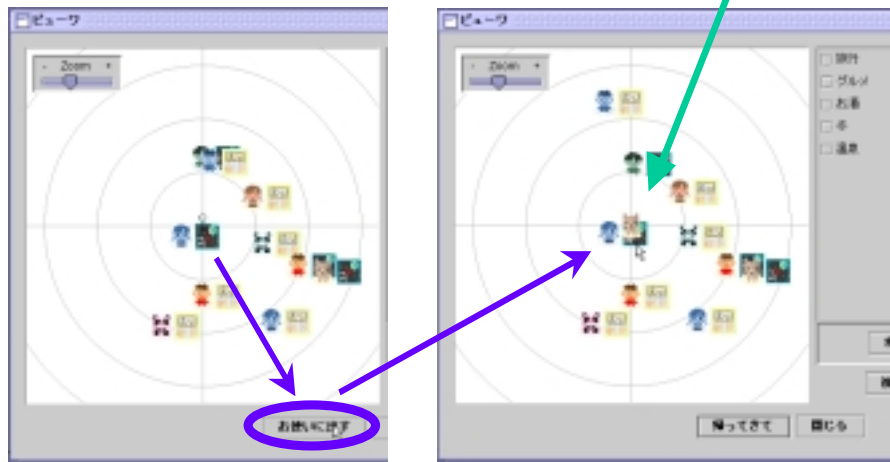


Figure 3: Placing a new icon

the same icon (*Talk* phase). A user can also attach a chat room and URL information to an icon.

Each of these two phases can be interpreted as a declaration of a new relationship between existing icons and a user's interests, messages, and URLs.

2.2.3 Integration of visualization and communication tools

As explained above, Community Organizer has the following main functions: 1) visualization of people and related information according to a user's own interest, and 2) mechanisms for easily expressing a user's preference and messages.

Even though there are tools that provide these functions individually, to our knowledge there is currently no tool that integrates these functions. Combining visualization and communication in one tool is important for the process of leading a user along the four phases mentioned above. In this way, Community Organizer helps users meet other people and encourages them to form new communities.

3 Implementation

3.1 Query based on user's interests

Data in Community Organizer include users' interests and dislikes. This kind of data is represented as a feature vector whose element is the value for each keyword ('travel', 'food', etc.) defined by the system. A user is

not required to define her/his degree of interest for every keyword in the system. Instead, a user can specify vectors which contain information on only some of the pre-defined keywords. Community Organizer will handle the presence of a user as well as messages, chat rooms and URLs. These entities are associated with feature vectors and represented in the same two-dimensional plane.

The client software of Community Organizer has slide bars with which a user can input his/her current interests. The user's interests are then also represented as a feature vector. The client software sends this feature vector to the server and requests similar data from the server. The server will then find data (from the same user or other users) that have similar feature vectors. Similarity is defined here as the cosine measure of feature vectors in a multi-dimensional space.

3.2 Calculating icon placement based on the spring model

Query processing on the server side is done by calculating the relationship between the user specified feature vector (set by the slide bars) and other data (other users' interests, messages, chat rooms, URLs). A client will send the feature vector and the server will respond with icons that are close in value to the client-supplied feature vector. The client then displays icons returned from the server based on the spring model.

The spring model provides heuristics which can be used to distribute various elements with a certain dis-

tance between them on a two dimensional plane [1] [12]. In the spring model, a hypothetical spring is attached between elements, and the natural length of this hypothetical spring corresponds to the closeness between elements. When elements do not move (that is, equilibrium is reached), the placement of elements reflects the semantic similarity.

There are other statistical methods for visualizing elements between which distance (similarity) is defined. For example, the dual-scaling method [11] is commonly used. These statistical methods are useful in the classification and analysis of static data. In Community Organizer, however, new data (icons, in this case) are added in on-going communication and the distribution of icons should reflect changes in real time. When using the spring model, icons can move to their new positions gradually, so users are not confused by sudden reorganizations of the view. Thus, an intuitive spring model is adopted instead of these statistical methods.

The calculation based on the spring model requires $O(n^2)$ time for n elements. On the other hand, it is difficult to understand the relationship between hundreds of icons on the display. Due to these two reasons, it is appropriate to limit the number of icons to be displayed, that is, the spring-model-based calculation is only performed on icons close to the user's point of view (icons returned from the server in response to the user's query). In current implementation, the icons that have lower similarity (less than 0.40, in the cosine measure) are not displayed. Moreover, the number of icons on a view is limited not to exceed 50. By doing so, we have achieved good responses and a less crowded display.

3.3 Expressing interests and concern

As mentioned above, a user can specify his/her interests by adjusting slide bars, and look at other people's interests from her/his own viewpoint. If a user is satisfied with a current setting, he/she can save it for later use. This user information is also collected at the server and is distributed to other clients to inform them of the current interest.

In Community Organizer, expressing one's interest is directly linked to placing an associated icon at the center of the view. Changing slide bars corresponds to adjusting this view (that is, viewpoint). By placing an icon (its associated feature vector corresponds to the user's interest), other people become able to learn a user's interest.

Icons appearing on a client display are associated with each user's interests. A user can register as many icons as he/she wishes.

4 Current Experiment

4.1 Hypotheses

These assumptions on the way Community Organizer facilitates the formation of communities and information flow within them lead us to formulate the following hypotheses.

1. With "Community Organizer," users will feel a greater sense of community than users who use software without a meaningful graphical representation of the community.
2. Community Organizer users will get to know more people within a group of a certain size than those users using software without such a representation.
3. With "Community Organizer," users will report greater enjoyment using the communication features of the software than those using software without this representation.
4. With "Community Organizer," users will find the software easier to use than users of software with the same functionality that lacks this representation.
5. Community Organizer users will choose to actively use "Community Organizer" longer than those using software without meaningful spatial relations.

In order to test these hypotheses regarding the effectiveness of Community Organizer in facilitating community formation, we conducted the following experiment.

4.2 Method

Two versions of the software were used: a "full" version, providing meaningful spatial representations of proximity based on similarities and differences in subjects' specifications of their interests, and a "listing" version, which was prepared for the experimental control condition (Figure 4). The "full" version was the Community Organizer previously described, but the "listing" version was prepared specifically for this study. Both versions had the same look and feel.

Both versions offered the same functionality and features, including displays of similarity or dissimilarity between the user's specified interests and other people's or messages' specifications. However, while the similarity display in the full version resembled a graphical

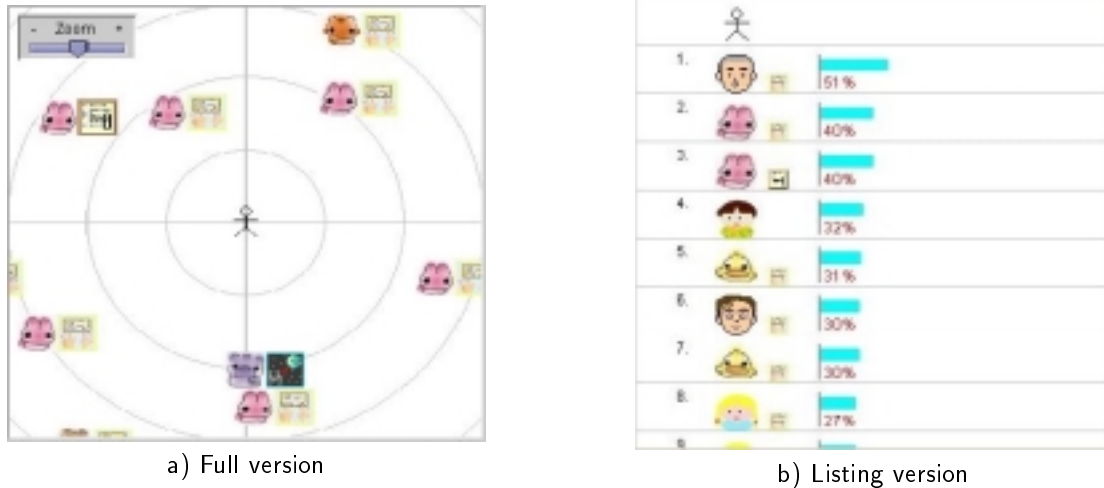


Figure 4: Two visualization methods used in the experiment

“space” in which user icons were distributed in meaningful ways and more similar users were closer together and others farther away, the listing version simply provided a rank-ordered listing of users and messages with match percentages. This version was similar to a listing of WWW search results.

A 1 x 2 (presence or absence of meaningful spatial representation) between-subjects experiment was conducted.

4.3 Measures

To test our hypotheses, we had to measure the users’ “sense of community”, enjoyment of the main communication features (“public messages” and “chat”), perceived ease of use, active usage time, and the number of people met in the online community.

To do this, we prepared a Web-based questionnaire as well as Community Organizer log files. 8-point scales were used on the questionnaire.

The attitudinal measures gathered from the online questionnaire and partially collapsed into new variables were: *Feelings of community* ($\alpha = .91$), *enjoyment of the “public message” feature* ($\alpha = .70$), *enjoyment of the “chat” feature*, *perceived ease of use* ($\alpha = .81$), and *number of people met in the community*. One-tailed t-tests were conducted to analyze the data.

The behavioral measures obtained from the log data were: *total login time*, *duration of active usage* (defined as time when the user was logged in and was actually using features of the software, as opposed to idle time), *number and length of active periods*, *number of public messages posted and read*, and *chat participation*.

4.4 Subjects

42 subjects, from 20 - 60 years old, participated in the experiment. Subjects were randomly assigned to two conditions; however, conditions were balanced for gender, age, and online experience, based on data gathered from a pre-test questionnaire.

4.5 Procedure

Subjects were asked to use “Community Organizer” for one week at their workplace. Two groups of 21 users each were established; each group used one version of “Community Organizer” for the duration of the experiment. An online manual was available to subjects, and subjects were instructed to use “Community Organizer” for as long as they wished during the week of the experiment. In order to provide anonymity, each subject chose a “handle” name and icon. Users were prohibited from talking about the experiment face-to-face. At the end of the experiment, users were asked to complete the online questionnaire.

4.6 Results

In accordance with our main hypothesis, subjects using the full version of “Community Organizer” felt a greater sense of community than subjects using the listing version ($t = 2.06$, $p < .05$) (Figure 5). Similarly, subjects in the full condition met more people online than subjects in the listing condition ($t = 2.4$, $p < .01$) (Figure 6). Thus, hypothesis 2 was confirmed.

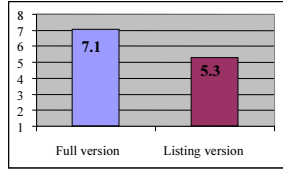


Figure 5: Feelings of Community

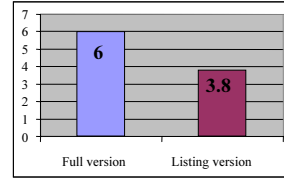


Figure 6: Number of people who met in community

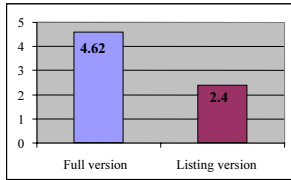


Figure 7: Time of active usage (hours)

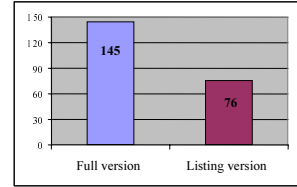


Figure 8: Number of public messages read

Subjects using the full version also reported greater enjoyment of using both the “public message” ($t = 1.96$, $p < .05$) and the “chat” feature ($t = 2.33$, $p < .05$), thus confirming hypothesis 3. However, no significant difference was found regarding subjects’ perceptions of the software’s ease of use. Both groups gave similar assessments of this measure. Therefore, hypothesis 4 was not confirmed.

An analysis of the log data showed that users of the full version chose to actively use “Community Organizer” significantly longer than users of the listing version ($t = 2.65$, $p < .01$) (Figure 7). This greater willingness and drive to use the full version of Community Organizer shows a clear preference for this version; in fact, users of the full version actively participated in the community almost twice as long as users in the control condition.

Our analysis showed that while the average length of the blocks of time when users were actively engaged in the community was roughly equal for both groups at about 11 minutes, participants in the “full” condition checked up on the community significantly more often than users in the control group ($t = 1.99$, $p < .05$).

Finally, the greater active participation of full version-users in their community is also reflected by the much higher number of posted messages each participant chose to read ($t = 2.70$, $p < .005$) (Figure 8), and by the number of chat utterances ($t = 1.81$, $p < .05$).

5 Discussion

Our study shows that the presence of a spatial representation is an important tool for forming online communities.

The experimental results clearly indicate that users feel more at ease in an online community when meaningful two-dimensional spatial representation gives them an intuitive look at the network community that is similar to people’s real-life experiences with communities. While the listing version proved somewhat convenient when looking for specific information, it did not encourage people to explore the community and engage in communication with others.

The full version of Community Organizer, on the other hand, increased people’s interest in community participation, made them feel part of a group, and encouraged them to participate more actively.

One area of Community Organizer that still requires improvement was the ease of use of the communication features. Qualitative comments by users showed that users wanted communication with others to be as easy and intuitive as surveying the community for interesting people or messages by means of the display window. The current version of Community Organizer requires several mouse clicks to place a new message or respond to other peoples’ messages; this issue will be addressed in future releases.

6 CONCLUSION

In this paper, we introduced Community Organizer, and then examined its effectiveness in supporting communities by performing a field experiment.

The study was conducted in the users' natural environment, and the subjects were considered to be representative of people who might use community support software. Therefore, we can safely assume that the spatial representation offered by Community Organizer is effective at encouraging communication between users.

This area of research is a relatively new field, and it is important for future empirical studies to focus on comparing various ways of visualizing virtual communities. Such studies should also compare community formation and maintenance in real-world and network communities.

Finally, while the current version of Community Organizer focuses on the early stages of community formation, in the future, we will include support for the seamless transition from community formation to community activities in a single system.

Acknowledgments

We thank our colleagues at NTT Communication Science Laboratories for participating in the experiment reported in this paper. We also thank Fumio Hattori, Makoto Yokoo, Takeshi Ohguro and Kaname Funakoshi for their contribution to the earlier version of Community Organizer and Advanced Business Works at NTT Communications for the software implementation.

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