

Community Organizer: Supporting 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 them. This spatial representation reflects closeness of interests and concerns among community members. We conducted an experiment with two different versions of the software. One version offered this 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.

Keywords

Network community, online community, virtual community, community support, community formation, Socialware, Community Organizer, empirical study, experiment, interpersonal distance, social psychology.

INTRODUCTION

With the advancement of computer networks, people are getting connected more than ever. A new type of community (“network community,” “virtual community”) is beginning to emerge on the networks. A multitude of projects is devoted to develop systems to support community activities over networks [10]. Unlike traditional communities where geographical and institutional properties define the boundary of the community, a network community consists of people who share common 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 in 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 a room for discussion 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, a person may be at a loss in the virtual space.

In this paper, we introduce *Community Organizer*, software aimed to help users find other users with similar interests on the network 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 makes 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 results of an experiment we conducted to test the effectiveness of the spatial representation used in *Community Organizer*.

COMMUNITY SUPPORT SOFTWARE

Supporting Community Formation

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

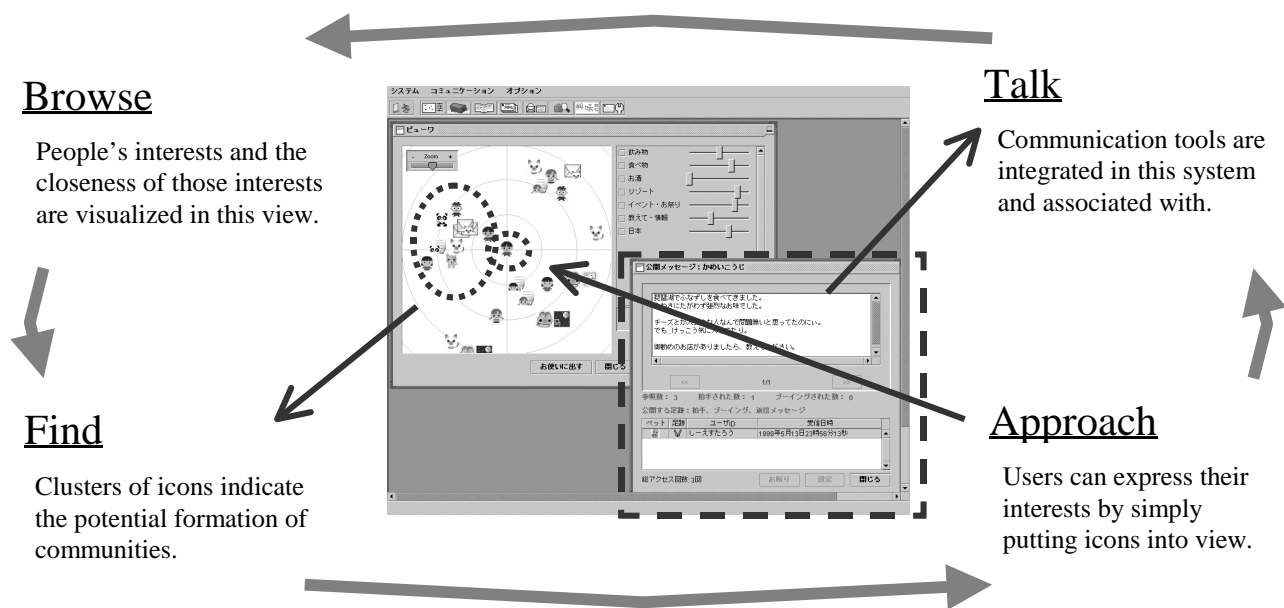


Figure 1. Four Phases in the Community Formation.

The Yenta system [7] provides clusters of users who are interested in similar topics. These clusters can serve as the first step to meet new people with similar interests and to form a new community. In this system, the clusters are generated automatically from a user's e-mail messages, news articles, and files a user read and composed. This system, however, does not visualize the generated clusters. Thus, it is difficult for a novice user to recognize a potential community intuitively.

In contrast, Visual Who [4] 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. This system, however, does not have a communication tool integrated. Thus, even when a user finds a person who has similar interests, contact has to be initiated through *another* communication medium. Messages exchanged between users do not appear on the display plane. Therefore, it is difficult to see how a cluster of people is developing into a potential community.

Community Organizer has been designed in order to overcome these problems.

The Importance of Spatiality in Interpersonal Interaction
What kind of environment is needed to support "community"? In her analysis of requirements for virtual

communities, Donath [5] suggests that to understand virtual communities, looking at how social cues are communicated in the real world can yield valuable information.

Literature shows that "spatiality" is an important factor for the formation and maintenance of real-world communities. A sense of space is an important means for humans to intuitively find "their place" in a community and to orient themselves in a group of others.

The importance of spatiality in interpersonal interaction has been pointed out by a number of authors (e.g., [2]). Interpersonal closeness and distance provide important nonverbal proximity cues about the state of a relationship [1].

In fact, research suggests that people's mental model of "community" might be spatial. Humans use closeness and distance as geographical metaphors [11]. Edney [6] suggests that spatial organizational dimensions help humans reduce complexity, define group identity and structure interpersonal events in group interaction. A sense of space has been shown to reduce randomness and add order in human group interaction.

The influence of spatial distance on small group structure has been documented by Patterson [14]. Spatiality in the form of human territoriality has even been demonstrated to directly benefit the organization of real-life communities [6].

In his discourse on how groups benefit from the use of space, Minami [12] defines "group space" as collectively "inhabited" and socioculturally controlled spatial settings.

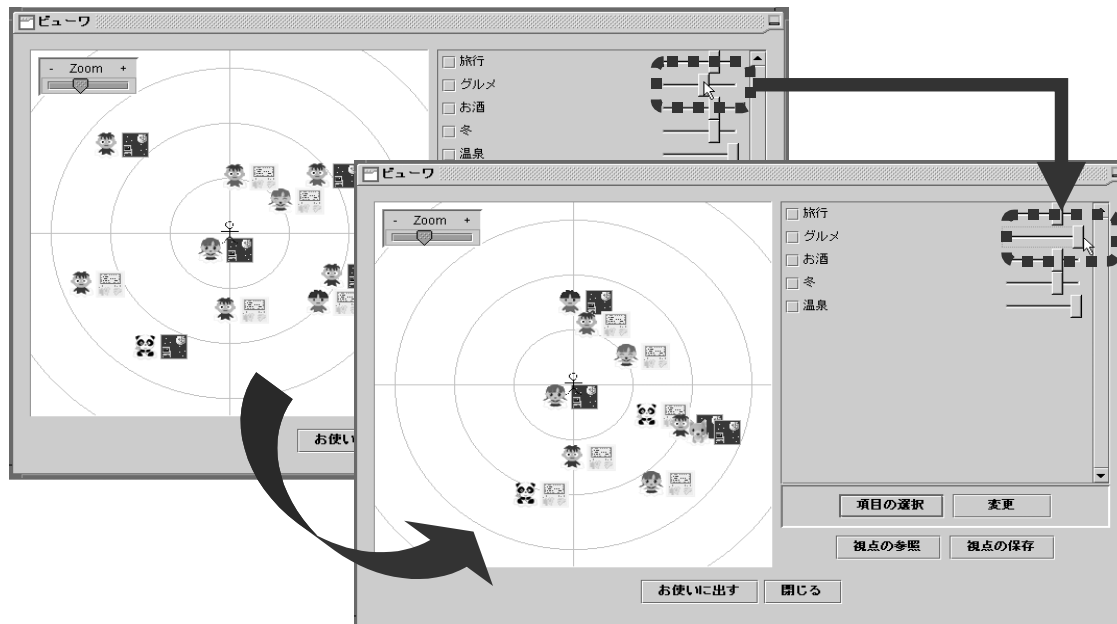


Figure 2. Changing viewpoint.

By adjusting the slide bars, a user can change the center of the viewer (that is, viewpoint).

This space is socially organized and affects social-dynamic processes such as the formation of group identity and socialization of group members [12].

Finally, spatiality has even been identified as a factor which directly influences group participation, and spatial distribution of community members which allows for group monitoring as well as direct interactions with other members has been found to facilitate group participation [8].

Donath [5] identifies three main areas to be important for the design of software to support successful virtual communities: visual representations of social phenomena, the role of information spaces as contexts for communication, and the presentation of the user in the virtual world.

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

COMMUNITY ORGANIZER

Behavioral Model of Community Formation

For the purpose of developing Community Organizer, we defined the early stage of community formation as comprised of four phases: “Browse,” “Find,” “Approach,” and “Talk” (Figure 1). Community Organizer provides an interface that prompts the user to act along these phases. The user interface has two major components: 1) visualization and 2) a communication assistant which is integrated with the visualization.

Visualizing Communities

The central part of Community Organizer’s graphical interface features a display window visualizing the relationships among users in real-time [9, 16]. A user 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 potential community of interests (“Browse” phase).

The center of the display plane (in other words, a user’s point of view) can be set by the user. 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 a user can find people who have similar interests by adjusting her/his point of view (“Find” phase) (Figure 2).

Communication in Communities

In addition, a user can express her/his interest easily to other users. This is done by placing an icon associated with 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 multiple icons in the display. Thus, it is easy to participate in (potential) multiple communities.

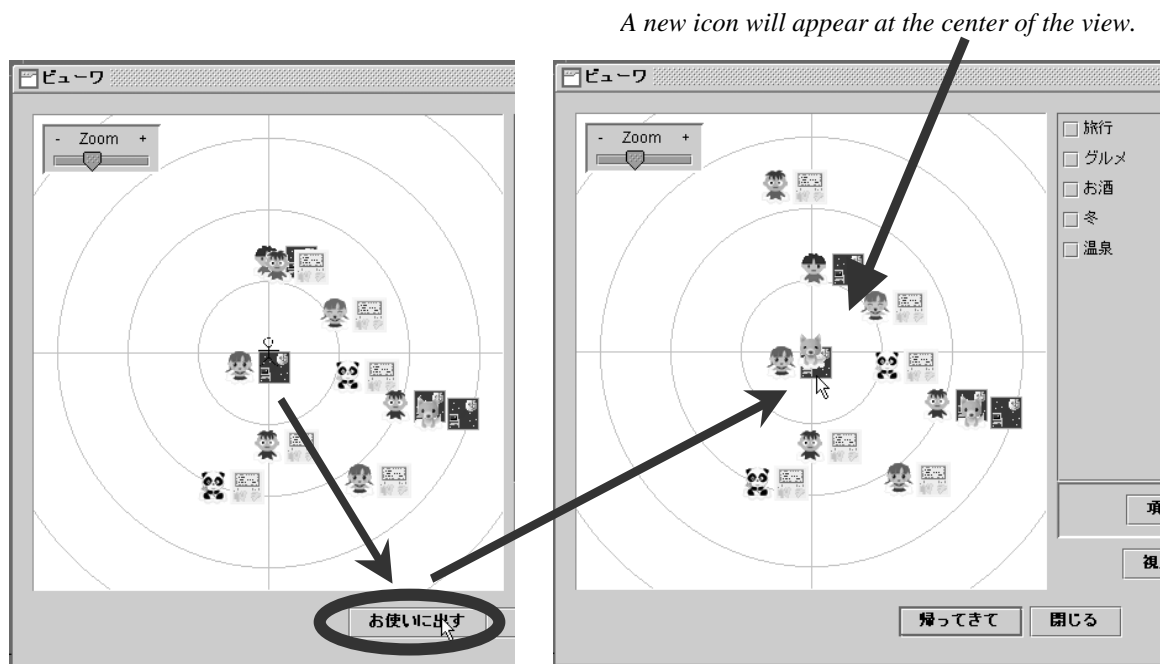


Figure 3. Placing a new icon.

Furthermore, a user can attach her/his message to an icon (called *public message*). Other user can read the message by clicking the icon, and attach one's reply to the same icon ("Talk" phase). A user can also attach URL information and a chat room to an icon besides public messages.

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) mechanism for expressing a user's preference and messages easily.

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 in order to lead a user to act along the four phases mentioned above. In this way, Community Organizer helps a user meet other people and encourages them to form a new community.

IMPLEMENTATION

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 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 can not only handle the presence of a user but also messages, URLs, and chat rooms. These entities are also associated

A new icon will appear at the center of the view.

with feature vectors and represented in the same 2 dimensional plane.

The client software of Community Organizer has slide bars with which a user can input his/her interests. A user can specify his/her interests by adjusting slide bars, and look at other people's interests from his/her own viewpoint. If a user is satisfied with a current setting, s/he can save it for later use.

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 icons from the server. The server will then find data (from the same user or from other users) which have similar feature vectors. Here, similarity is defined as the cosine measure of feature vectors in a multi-dimensional space.

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 icons. A client will send the feature vector and the server will respond with icons which are close in value to the client supplied feature vector. Then, the client 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 distance between them on a two dimensional plane [3, 15]. 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



(a) Full version



(b) Listing version

Figure 4. The two visualization methods used in the experiment.

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 [13] is commonly used. These statistical methods are useful in classification and analysis of static data. In Community Organizer, however, data (icons, in this case) are added as communication between users occurs, and the distribution of icons should reflect changes in real time. 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. In order to shorten the update time, we limit the number of icons to be displayed. The spring model based calculation is only performed on icons which are close to the user's point of view (icons returned from the server in response to the user's query). By doing so, we have achieved good response and a less crowded display.

Expressing interests and concern

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 the center of the view (that is, viewpoint). By placing a new icon, a user's interest can be known by other people. The new icon's associated feature vector corresponds to the user's current viewpoint. A user can register as many icons as s/he wishes.

CURRENT EXPERIMENT

Hypotheses

These assumptions about the way Community Organizer facilitates the formation of and information flow within communities, lead us to formulate the following hypotheses:

1. Users who use "Community Organizer" will feel a greater sense of community than users who use

software without meaningful graphical representation of the community.

2. Community Organizer users will get to know more people within a group of a certain size than users using software without meaningful graphical representation.
3. Users who use "Community Organizer" will report greater enjoyment using the communication features of the software than users using software without meaningful graphical representation.
4. Users who use "Community Organizer" will find the software easier to use than users of software with the same functionality, but without meaningful graphical representation of users.
5. Community Organizer users will choose to actively use "Community Organizer" longer than users using software without meaningful spatial relations.

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

Method

Two versions of the software were used: The "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). While the "full" version was Community Organizer as described above, 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 "space" in which user icons were distributed in meaningful ways, with more similar users closer to the "self" and others farther away,

the listing version simply provided a rank-ordered listing of users and messages with match percentages, similar to a listing of WWW search results.

A 1x2 (presence or absence of meaningful spatial representation) between-subjects experiment was conducted.

Measures

To test our hypotheses, we had to measure 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.

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.

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*.

Subjects

42 subjects, aged between 23 and 59 years, participated in the experiment. Subjects were randomly assigned to conditions; however, conditions were balanced for gender, age, and online experience, based on data gathered from a pretest questionnaire.

Procedure

Subjects were asked to use "Community Organizer" for one week at their workplace. Two "communities" of 21 users each were established; each community 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 never met face-to-face. At the end of the experiment, users were asked to complete the online questionnaire.

RESULTS

Consistent 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

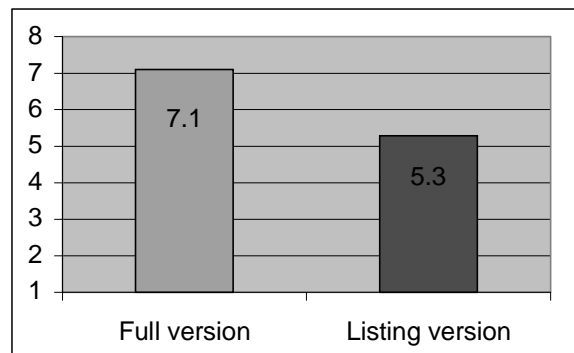


Figure 5. Feelings of Community (8-point scale)

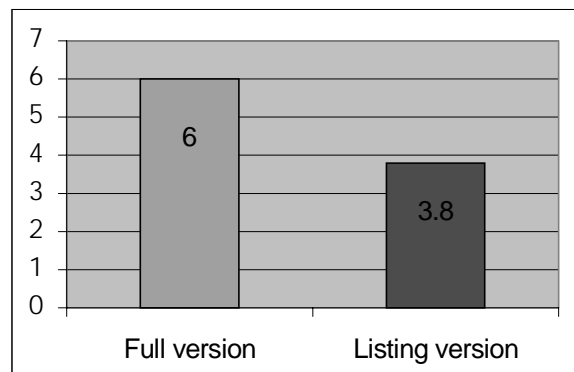


Figure 6. Number of people met in the community.

condition ($t=2.4$, $p<.01$) (Figure 6). Thus, hypothesis 2 was confirmed.

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 the software's ease of use. Therefore, hypothesis 4 was refuted.

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 ($t=1.99$, $p<.05$).

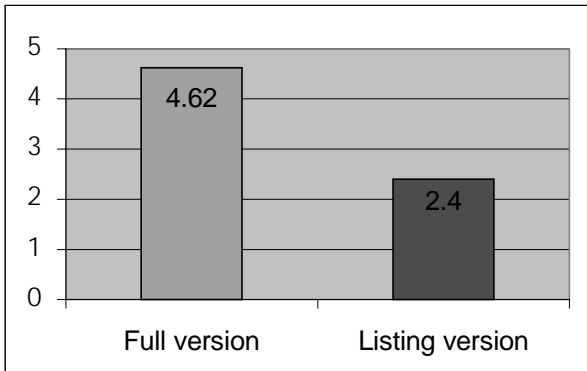


Figure 7. Time of active usage (hours).

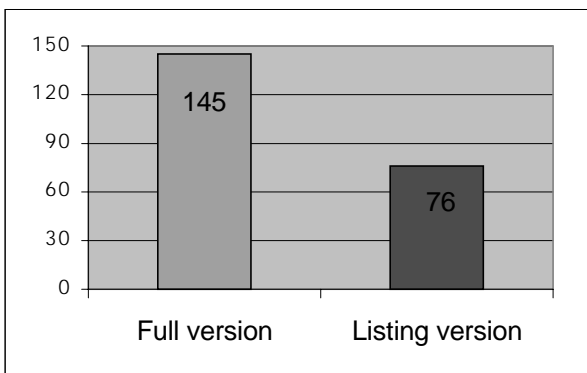


Figure 8. Number of public messages read.

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 ($t=1.81$, $p<.05$).

DISCUSSION

Our study shows that the presence of a “community space” is an important tool for community members not only in real-life communities, but also in online communities.

Study results clearly indicate that users feel more at ease in an online community when meaningful 2-dimensional spatial representation gives them an intuitive look at the network community similar to people’s real-life experience of 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 participating in the community, made them feel as part of a group, and encouraged them to participate more actively.

Our study also shows users’ *interests and hobbies* to be suitable indicators for their spatial placement in the virtual

community to create a visual representation which is useful for other community members.

Spatial representation of community members based on hobbies and interests may allow users to assess the community in intuitive ways, since it may allow them to utilize their experience from real-world communities in the online community. The reason for this might be that in real-world encounters with strangers, among the most important cues people use to assess another person are cues about this person’s attitudes and interests [1]. While in real-world encounters, cues utilized are people’s dress code, manner of speaking, and social group they belong to, our study shows that Community Organizer’s visualization of people’s interests might be a suitable substitute for these cues in virtual communities.

The one area of Community Organizer which our study showed to still require improvements was ease of use of the communication features. Qualitative comments by users showed that users wished for their 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 currently requires several mouse clicks to place a new message or respond to other peoples’ messages; this issue will be addressed in future releases.

CONCLUSION

In this paper, we introduced Community Organizer and examined its effectiveness for the support of communities by means of a field experiment. Since the study was conducted in the users’ natural environment, and subjects can be considered representative of people who might use community support software, we can assume that the spatial representation offered by Community Organizer is effective at encouraging communication between users.

Our study shows that humans’ need for meaningful spatial representations of individuals in communities in real life directly translates to a preference for software which offers comparable visualization of others’ interests.

This area of research is a relatively new field, and it is suggested that future empirical studies focus on comparing various ways of visualizing virtual communities, as well as comparing 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, our planned future work includes support for the seamless transition from community formation to community activities in a single system.

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