

VISUALIZING RECIPROCITY IN AN ONLINE COMMUNITY TO MOTIVATE  
PARTICIPATION

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## ABSTRACT

Online communities thrive on their members' participation and contributions. Continuous encouragement of participation of these members is vital for an online community. Social visualizations are one of the methods to make members explicitly aware of their connections and relationships. There are numerous ways to visually represent information, current-status, power, and acceptance of members in an online community. In this thesis I present a design of a visualization representing the evolving reciprocity of relationships among users based on the comments they give to each other's posts. The purpose of the visualization is to emphasize and hopefully trigger a common bond in the community and thereby increase their participation. We developed and deployed the visualization in an online community called "WISETales" where women in science and engineering share personal stories. We also deployed modified and improved versions of the visualization in two other communities, I-Help class discussion forums and the Vegatopia discussion forum for vegetarians. In this thesis we present the results of the evaluation in these three communities. The results unfortunately, were negative. Even though separate explanations for the lack of motivational effect can be found in each of the experiments, it seems that the chosen motivational approach was too gentle to encourage participation. It seems for reciprocation to take place, the users need to be committed to the community and already have some other underlying motivation to participate actively. The visualization also should provide some new information that they weren't aware of previously. This was not the case with the users in the three chosen communities. WISETales was too new and can barely be called a community. I-Help was not a community, but a place for student to post questions for

the teacher to answer. Vegatopia, in contrast, is well established, active community, where people know each other, and engage in conversations with each other. The visualization did not provide any new information for them that they didn't know and only served as a brief attraction for a day (novelty effect). We are still optimistic, however, that the visualization may be useful for active and too dynamic communities where people are unaware of their social relationships because they are too many, for example, social network sites like Twitter.

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## LIST OF ABBREVIATIONS

|        |   |
|--------|---|
| MADMUC | Multi Agent Distributed Mobile and Ubiquitous Computing |
| XML    | eXtensible Markup Language                              |
| MySQL  | My Structured Query Language                            |
| MXML   | Macromedia eXtensible Markup Language                   |
| PHP    | Hypertext Preprocessor                                  |
| SWF    | Shockwave Flash   |

## CHAPTER 1

### INTRODUCTION

#### **1.1 Online Communities**

Online communities, also known as virtual communities are becoming more and more popular in our day-to-day life. Almost every individual with Internet access has come across or has access to at least one community. So far there is no proper definition of an online community but one definition, suggested by Jenny Preece, is “a group of people interacting via the internet over a period of time on a similar subject or interest” (Preece, 2000). During this period the community members become attached to the community as a whole and also to the members in the community, and have a strong bond between them which leads to the development of interpersonal relationships. An online community can sustain itself and grow only when members interact with one another often by posting content and comments.

Web 2.0 has created vastly popular and active online communities like Flickr, Facebook, Twitter, Orkut and Del.icio.us. These communities are evolving quickly and very successful. They are not only used by common people, but also by companies to create awareness about their products and to attract customers. The PR firm Burson-Marsteller (2010), studied the 100 largest companies in the Fortune 500 list and found that 79% of them use Twitter, Facebook, YouTube or corporate blogs to communicate with customers and other stakeholders. They have also found out that customers in fact like to engage with companies through social media. Social networks have become an easy way to spread information and connect people. They bridge the gap between space and time. Social media have replaced traditional news sources in the age of Web 2.0 (The Hindu, 2010).

Online communities differ a lot with respect to multiple dimensions. Probably the most important of them is the purpose of the community. With respect to this dimension, there are

work-related, task-related, topic-related, interest-related and relationship-based communities. People interact differently in these communities. Interest-based communities tend to be mostly discussion forums, blogs and sharing communities. Work-related communities are collaborative spaces, discussion forums and chat rooms. Relationship-based communities are the currently popular social networks, where people connect with real-world friends.

Another dimension is the life-span of the community. Some communities are short-lived while others mature and exist for a long time. There are different phases in the life-span of a community: early phase of accumulating a critical mass, growth, stability, and late phase of decline (Amy Jo Kim, 2000).

## **1.2 The Problem of Ensuring Participation**

Designers of online communities face a problem of attracting and retaining user participation. Online communities demonstrate network effects in their evolution: the successful ones become even more successful, but small communities tend to dwindle. Different design strategies for social web design have been suggested aiming to attract and sustain user participation (Porter, 2008).

The problem of ensuring participation has emerged as one of the most important issues in Social Computing (Shneiderman, 2009). Approaches involving both the design of the community infrastructure, and interventions in the community by the owner or moderators, (e.g. through personalized messages Chen et al., 2007) have been proposed. Some of these approaches are ad-hoc, but others have been inspired by theories from the areas of Social and Behavioural



Sciences, such as Social Psychology, and Organizational Behaviour (Ren, Kraut and Kiesler, 2007).

Approaches inspired by theories from the area of Social Psychology, for example, (Butler et al., 2002), (Sahib & Vassileva, 2009) emphasize visually representing the community's mission, which according to the common identity theory, should trigger intrinsic motivation in the user to contribute towards the common goal. Several motivational approaches have been based on the social comparison theory, which states that people tend to compare with other people whom they perceive as their peers, and this comparison could be a motivation to change one's behaviour. Previous graduate students in the MADMUC Lab (Bretzke.H & Vessileva, 2003), (Cheng& Vassileva, 2005), and (Sun & Vassileva, 2006) have designed motivational strategies for participation in online communities based on the theory of social comparison. In the previous research done by Sun and Vassileva ( 2006) social comparison has been triggered by a visualization of the contributions made by each community member specially designed so that it can facilitate comparison and competition. There has also been research on the design of incentive mechanisms which explicitly reward desirable user actions (typically with virtual credits, points or karma) and which allow users to build their online status and reputation (Cheng & Vassileva, 2006), or gain power by acquiring a role of a moderator in the community (Lampe et al., 2004).

Designing social visualizations or visualizations of online communities is a sub-area of information visualization that focuses on displaying particular features of the group. "Social visualizations are one way to "describe" our online environments and make interaction patterns and connections salient" (Karahalios, 2006). Creating a general awareness of a group is an important goal in the design of systems supporting computer mediated communities, since users

typically never meet face to face in them (Bretzke & Vassileva, 2003), (Erickson & Kellogg, 2000). Most online communities (e.g. file- or bookmark sharing systems, social network sites, and multi-player games) support users in creating avatars and browsing the community “person by person”. There are many possible purposes for creating a social visualization:

(1) Creating a general awareness of the activities of other members; facilitating the location of information or people who have it; or triggering particular behaviours in the group.

(2) For information navigation. During its existence, an online community produces a large amount of content and it becomes difficult for the user to navigate and find the information that they are looking for. A social visualization can help users navigate the content and the social network woven by the evolving interpersonal relationships. The social visualization in this case is embedded in the interface design providing community views, or browsing friends or friends of friends.

(3) Social visualizations can also have an evocative quality (Boyd et al, 2002), emphasizing social norms, fostering reputation building, and stimulating desirable behaviours, so they can serve as a design vehicle for enhancing the effect of motivational strategies or incentive mechanisms described earlier in this section. Visualizations with this purpose or “motivational visualizations” are the focus of this research.

### **1.3 Social Awareness and Visualization in Online Communities**

Successful online communities create vast amounts of information and connections among the people involved in them. These informations and connections makes it difficult for users to understand the overall community structure and activity inside the community. Online

communities and Social Network Sites, such as Facebook, Twitter, and Orkut are used for information- sharing not only between people who meet on the web, but also between friends in the real world and family members. It has become a routine activity for people to use social networking sites to communicate with each other by writing on each other's walls, sending messages, chatting, commenting on posts, sharing photos, tagging, posting links and videos, creating applications for the community, interacting with each other and also sending online gifts to each other using these applications. Many users of these communities are not even aware of how many connections they have, who are in touch with them and who are not, and who needs attention. Social visualizations hold a promise to create such awareness and may become necessary parts of each online community.

In this proposal I describe the design of a social visualization with the purpose of stimulating participation in an online community. The motivational approach proposed is inspired by three theories, the Common Bond Theory from the area of organization studies, social comparison from Social Psychology, and the Reciprocation Theory from the area of Behavioural Economics. The proposed visualization design can be used in any community that supports peer-to-peer interactions, e.g. comments, or responses, among its members, for example discussion forums, blogs, file-sharing P2P communities, as well as chat environments like Yahoo messenger, Skype, social networking sites like Facebook, etc. I describe an implementation of the visualization and its evaluation using a small pilot study and a case study of the proposed visualization in WISETales – an online community for Women in Science and Engineering which allows them to share personal stories, similar to a collective blog system.

This thesis has seven chapters that are organized in the following way:  
Chapter 2 discusses the related literature and the gaps in current work.

Chapter 3 focuses on the proposed visualization design, its meaning and theoretical background, its significance and the technology used to implement it.

Chapters 4, 5 and 6 describe the studies conducted to evaluate the motivational effect of the he visualization in three different communities.

Chapter 7 provides a conclusion and discussion about the positive and negative aspects of the proposed design, and its potential improvements.

## CHAPTER 2

### LITERATURE SURVEY

This survey covers a wide range of related literature and topics from different areas, including an overview of motivational theories in psychology and more specifically the theory of social comparison, two organizational theories – the common identity and the common bond theories; the reciprocation theory from behavioural economics. The chapter also provides an overview of the field of social visualization.

#### **2.1 Theories of Motivation in Psychology**

Members' participation in an online community is vital. A community could become successful only if it grows in member participation. Participation in an online community depends upon the types of people in it (Bishop, 2006). It is not easy to find out what drives some members of community to participate or contribute more when compared to other members of the community.

##### *2.1.1 The Hierarchical Needs Theory*

The Hierarchical Needs Theory (Maslow, 1943) is one of the first theories of motivation in psychology. It postulates that there is a hierarchy of needs that each person tries to satisfy (physiological, safety, social, esteem and finally, self-actualization needs), and the lower level needs (e.g. physiological) have higher priority than the higher level needs (e.g. esteem or self-actualization). According to this theory, lurkers possibly do not participate community because their safety needs are not met, which prevents them from pursuing their higher level needs (social and esteem) (Bishop, 2006).

However, the hierarchical needs theory has been criticized. For example (Mook, 1987) points out that individuals who have not met their security needs can be sociable with those in a similar situation to themselves, exhibiting altruistic behaviours. According to Bishop (2006), needs can play an important part for participation of members in an online community, but it cannot be said that they are the driving force behind an individual's action. Instead, (Bishop, 2006) proposes an ecological cognition framework. The main difference between this framework and needs-based theories is the concept that individuals are not needs driven, but driven by their desires to carry out actions (Bishop, 2006).

### *2.1.2 Cognitive Evaluation Theory*

According to Cognitive Evaluation Theory there are two motivation systems - intrinsic and extrinsic - that correspond to two kinds of motivators. Intrinsic motivators are said to be achievement, responsibility and competence, motivators that come from the actual performance of the task or job and the intrinsic interest of the work. Intrinsically motivated individuals perform for their own achievement and satisfaction. Extrinsic motivators come from pay, promotion, status, power, better working conditions, feedback that comes from a person's environment, and are often controlled by others (Deci and Ryan, 1985).

### *2.1.3 Social Comparison Theory*

One of the theories from social psychology that is used to explain human motivation is the *Social Comparison Theory* (Festinger, 1954). Social comparison consists of comparing oneself with others in order to evaluate or to enhance some aspects of the self. Upward comparison involves comparison with a person who functions better in some relevant ways,

motivating the comparing person to improve his or her performance. Social comparison can have strong motivational effects in an educational context (Schunk, D H., 1984). It has been argued and shown experimentally that high self-efficacy in interaction with upward comparison motivates researchers to be highly productive (Vrugt A & Koenis S., 2002). Sun and Vassileva (2007) examined the effect of making individual reputation visible in an online system for sharing research papers and found out that displaying reputation increased contributions, but some users contributed low quality content simply to achieve higher reputation. However, introducing social comparison into a community might be risky. It could work and increase member participation, or it might not work and reduce member's contributions. Competitive and gaming members like to be compared with other members, but others may find it discouraging and de-motivating. People who are by nature more competitive are more likely to be motivated by the upward social comparison condition.

#### *2.1.4 Self-Efficacy Theory*

*Self-efficacy* is "belief in one's capabilities to organize and execute the sources of action necessary to manage prospective situations" (Bandura, 1986). In other words "Self-efficacy is the judgment that an individual makes about his or her ability to execute a particular behavior"(Bandura, 1977). Self-efficacy judgments are relatively task specific (Locke, 1991). Self-efficacy theory suggests that there are four major sources of information used by individuals when forming self-efficacy judgments (Figure 2.1).

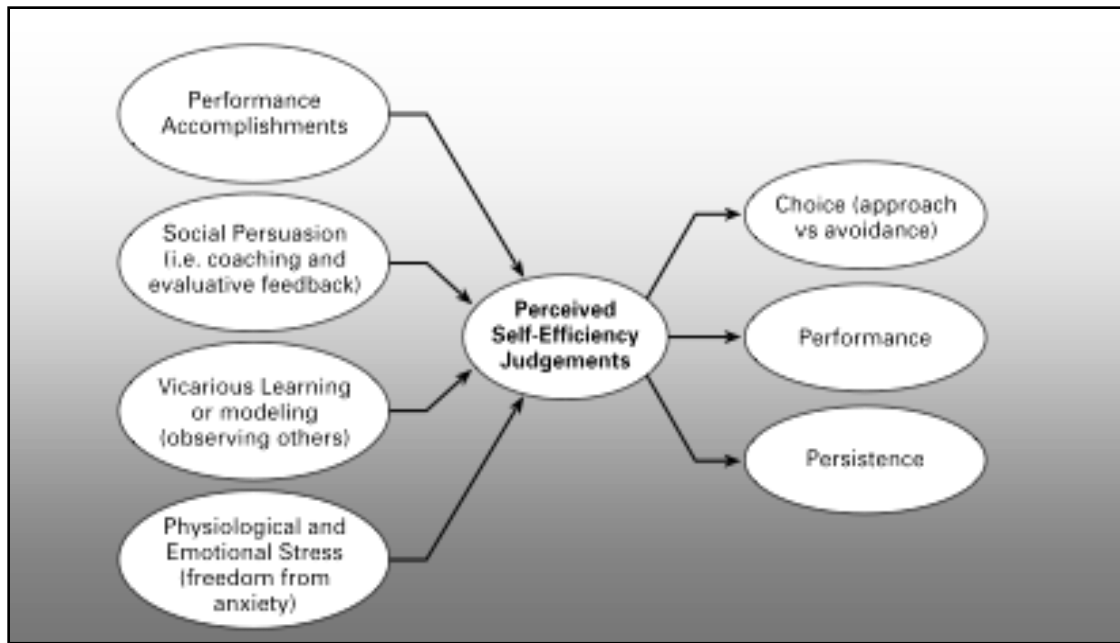


Figure 2.1: Source of Self-Efficacy (Shull & Weiner, 2001)

1) Performance accomplishments, 2) social persuasion, 3) vicarious learning and 4) physiological and emotional stress.

Shull and Weiner (2001) state that:

*“In order of strength, the most influential source of these beliefs is performance accomplishments, where individuals gauge the effects of their actions and their interpretations of these effects help create their efficacy beliefs”*

*“The second source which is vicarious experience, often referred to as modeling, which is gained by observing others perform activities successfully. Part of one’s vicarious experience also involves the social comparison made with other individuals”.*

*“Individuals also develop self-efficacy beliefs as a result of social persuasion, involving exposure to verbal judgments that others provide”.*



*“People often gauge their confidence by the emotional state they experience as they contemplate an action. Emotional reactions to a task (e.g. anxiety) can lead to negative judgment of one’s ability to complete the tasks” (Bandura.A.,1986).*

## **2.2 Theories from Organizational Science**

### *2.2.1 Common Identity Theory and Common Bond Theory*

Community design affects how people can interact, the information they receive about one another and the community, and how they can participate in community activities. There are two theories of group attachments that have been linked to design decisions on online communities (Ren et al., 2007). They are the *common identity theory* and the *common bond theory*. The common identity theory makes predictions about the causes and consequences of people’s attachment to the group as a whole while the common bond theory makes predictions about the causes and consequences of people’s attachments to individual group members (Ren et al., 2007).

The factors leading to a sense of common identity are as follows:

*Social categorization:* Social categorization happens when one creates a group identity by defining a collection of people as members of the same social category (Turner, 1985) (Turner et al., 1987).

*Interdependence:* Groups whose members are cooperatively interdependent tend to become committed to the group (Ren et al., 2007).

*Intergroup comparison:* People who define and categorize themselves as members of a group compare themselves with other groups (Tu & Terry, 2000), and raising the salience of out-groups intensifies people's commitment to their in-groups.

The factors leading to a sense of *common bond* are as follows:

*Social interaction:* Social interaction provides opportunities for people to get acquainted, to become familiar with one another, and to build trust. As the frequency of interaction increases, their liking for one another also increases (Cartwright & Zander, 1953).

*Personal Information:* Opportunities for self-disclosure when members exchange personal revealing information about the self becomes a cause or consequence of interpersonal bonds (Collins & Miller, 1994).

*Personal attraction through similarity:* People like others who are similar to them in preferences, attitudes and values, and they are likely to work or interact with similar others. Similarity can create common identity as well as interpersonal bonds (Ren et al., 2007).

Some identity-based communities shift eventually toward supporting and promoting interpersonal connections among members. For example, Flickr.com was established as an online application for photo management and sharing but it later evolved into a community where people not only share, tag, and comment on photos, but also join groups and interact in its public and private forums (Ren et al., 2007 ).

Bond-based communities help newcomers to connect with existing members, to join group interactions, and to form lasting relationships with a subset of community members. Bond-based communities care more about people-finding than information finding, making it easy to find and meet specific members through directory or personal profile search page (Ren et al, 2007). These communities encourage personal relationships, and their introductory material

often encourages participants to post on a wider range of topics (Ren et al, 2007). As compared to common identity, newcomers feel isolated and become confused in common bond-based communities when they see off-topic discussions among members.

## **2.3 Theories from Behavioural Economics**

### *2.3.1 Theory of Reciprocation*

In a common bond-based community people develop relationships with other members, and that is what ties them to the community. People often help others with the expectation that their help would be compensated or reciprocated, either by those they have helped or by the group as a whole (Blau, 1964), (Emerson, 1972). Thus, reciprocation can happen either at a dyadic or at a community level. In the case of common bond there is direct reciprocity, and in the case of a common identity there is general reciprocity. Social psychologists have found that the urge to reciprocate is deeply ingrained (Cialdini, 2001). Sellers and buyers on eBay usually reciprocate in their ratings of each other (Resnick & Zeckhauser, 2002). Voting on web sites is sometimes done in the context of reciprocity (Dellaroca et al, 2004): i.e., if you rate my story highly, I will rate yours highly. Networks of reciprocity are highly motivating, and encourage participants to maintain an awareness of the community that surrounds it (Sadlon et al, 2008). A community designed on the basis of common identity is said to be more stable when compared to a community designed on the basis of a common bond (Ren et al., 2007). The stability issue is because, in a common bond-based community, if a member leaves the group, many of the friends associated with that member would also likely leave the group or become passive. A member leaving the community does not occur in a community designed on the basis of common identity. Representing relationships in a common identity based community encourages common bond.

As very little research has been done on the coexistence of identity-based and bond-based attachment, this encourages us to explore combining cues that stimulate both kinds of attachment. According to Milgram (Milgram, 1997) and Zajonc (Zajonc, 1986), visually representing people in an online group help people form personal attachment to each other even without communicating with each other. Visualization of actual communication flow among community members can create bonds between friends of friends by helping people fill in gaps (Ren et al, 2007). Making contributions visible in a community as a whole leads to some extent of recognition of the member's contributions. So visualizing reciprocal and non reciprocal relationships might help members to recognize their current position in the community.

## **2.4 Summary of the Reviewed Theories of Motivation**

The previous three sections reviewed theories about what motivates people from different areas. Most of the research has been done by social psychologists, e.g. the theory of cognitive evaluation, social comparison, self-actualization, and they concern the individual situated in a world. More recently, theories in the relatively new area of organizational studies, like the common identity and common bond theories focus on the individual situated in a group. On the other side, the new interdisciplinary area of behavioural economics which seeks to explain why people behave often irrationally looks into economical mechanisms that underlie human relationships based on repeated interactions, e.g. in the reciprocation theory. While these theories seem quite different from each other, there are certain similarities in the motivational mechanisms that they describe. For example, the theory of common bond and the theory of reciprocation seem to describe the same motivational mechanism of acting cooperatively and

investing in relationships to receive a possible payoff later. Self actualization includes social comparison as one of its sources. Therefore particular behaviours can be explained from a motivational perspective using several theories in combination.

All the motivational theories discussed in the previous three sections apply to people in real communities. It is not obvious that the predictions of these theories will hold also in online communities. Researchers (Erickson and Kellogg, 2000, Bretzke & Vassileva, 2003) have argued that in order for people to follow social norms in online communities, they have to be aware of the community. Social visualizations have been proposed as a way of creating such awareness. A community produces a lot of information that could be potentially visualized. However, the design of social visualization should be not too complex, intuitive, easy to understand, to naturally create awareness of particular aspects of the people and their interactions in the community, according to the purpose for which awareness is sought. The next section presents an overview of previous work in the area of social visualization that highlights how different designs present different information in different way for different purposes.

## **2.5 Social Visualization**

Visually representing information enables users to see data in context, observe patterns and make comparisons (Heer et al, 2009). Visualization techniques are important aids in helping users and researchers understand social and conversation patterns in online interactions (Viegas et al, 2004). A data portrait of an online community can give overall information about each other and the overall social environment (Xiong & Donath, 1999). “Social visualization is defined as the visualization of social data for social purposes” (Karahalios & Viegas, 2006).

Social visualization is a sub category of information visualization and focuses on people, groups, conversational patterns, interactions with each other and relationships with each other and with their community. Social networks are said to be a form of social visualization because they have two types of organization patterns namely social groups and social positions (Freeman, 2000). There are various techniques to represent a group of people in an online community. Most approaches use nodes to represent individuals and lines between the nodes to represent connections between them. Real social networks have dense interconnections between people.

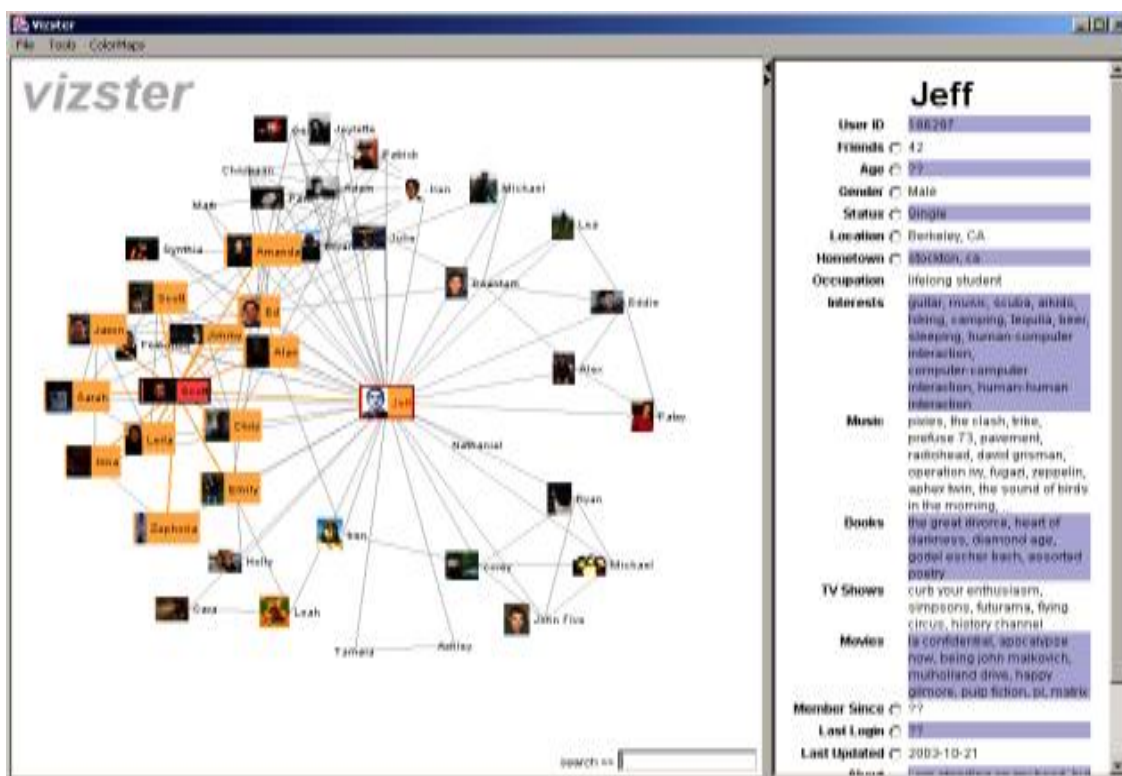


Figure 2.2: Vizster visualization system (Heer et al, 2009).

Vizster (Figure 2.2) is a visualization system for playful end-user exploration, navigation of large-scale online social networks to increase awareness of the community. It uses node highlighting; the user's node is coloured red and its neighbors are highlighted in orange, facilitating exploration of communities of friends (See Figure 2). By observing through Vizster visualization, Heer et al. (2009) found out that groups of users, spurred by storytelling of shared

memory spent more time in exploring stories and asked deeper analysis questions than other members. Further, Vizster's visual community analysis provided help to users who could construct and explore higher-level structures of their online communities.



Figure 2.3: A Coterie display (Donath, 2002).

Coterie (Figure 2.3), a visualization tool for Internet Relay Chat (IRC), shows the activity of the participants and the structure of conversation. Coterie highlights active participants and conveys the vitality of discussion (Donath, 2002). The Coterie display (shown in Figure 3) shows three simultaneous conversational threads: one related to aircraft, one about screens, and one with a comment about a previous statement's usage. Six users are currently active, but many more are listening. (Donath, 2002).

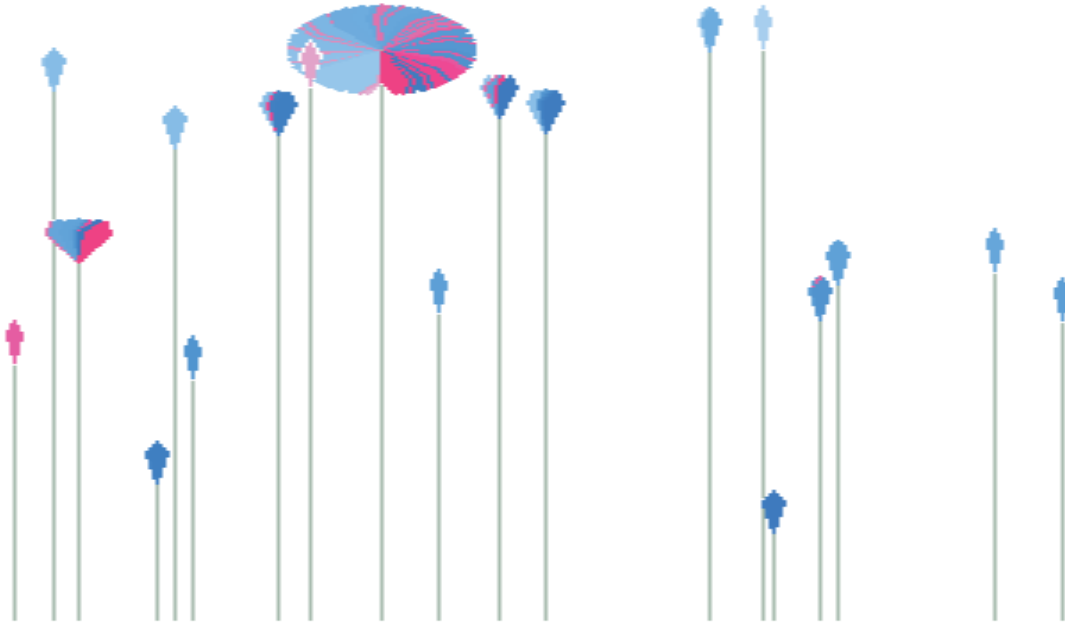


Figure 2.4: People Garden: a group with a single dominant member (Donath, 2002)..

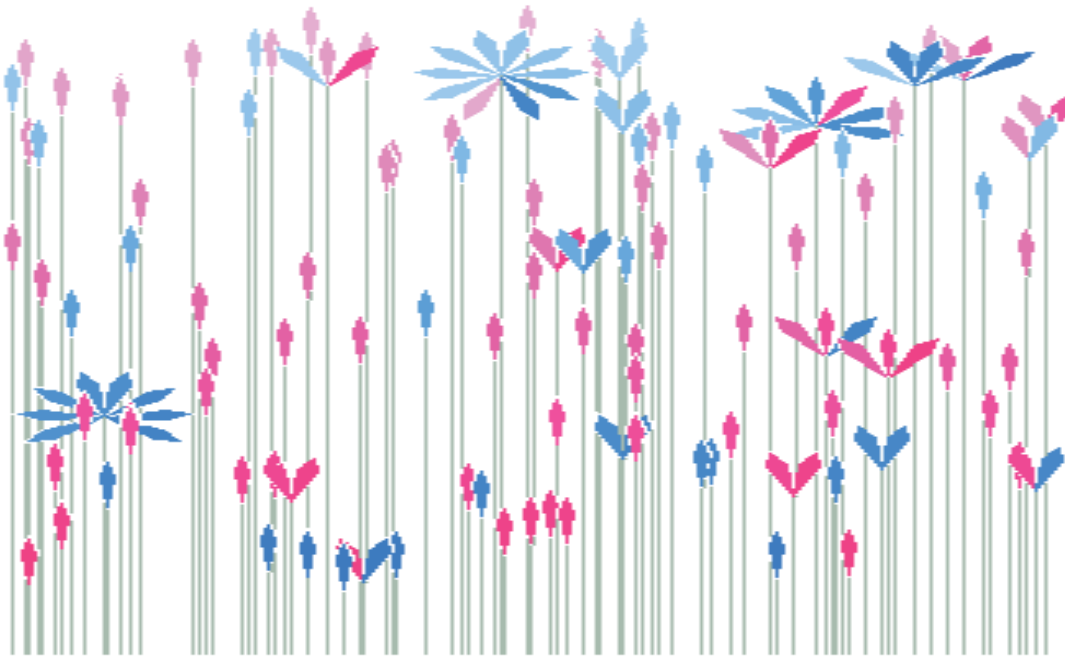


Figure 2.5: People Garden: a group with many members at different levels of participation (Donath, 2002).



PeopleGarden (Figures 4 and 5) is a visualization tool for representing member's participation on a message board. It uses flower and garden metaphor. From this anyone can easily perceive if an individual is active contributor or longtime lurker (Donath, 2002).

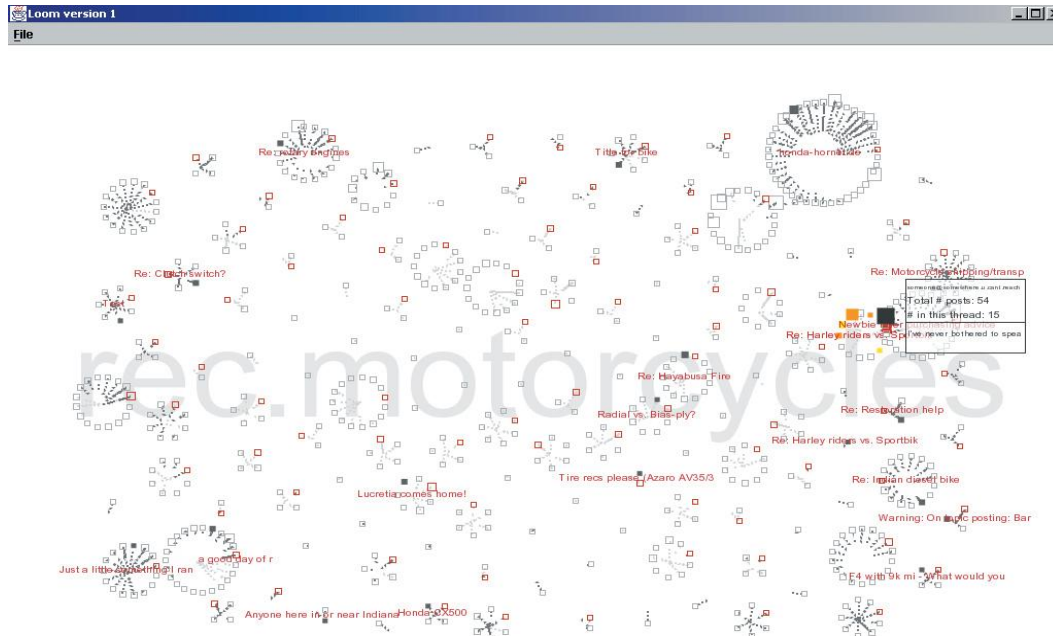


Figure 2.6: Loom: A group with dense threads. (Donath, 2002).

The Loom Project is an evocative semantic visualization for Usenet newsgroups, shown in Figure 6. It is used to depict the leaders and provocateurs. There are people who post frequently and are often replied to in a positive way. This visualization distinguishes them from other frequent posters such as trolls (deliberate troublemakers), automatic newsfeeds, and the excessively verbose. Numerous and dense circles suggest a vibrant conversational arena (Donath, 2002).

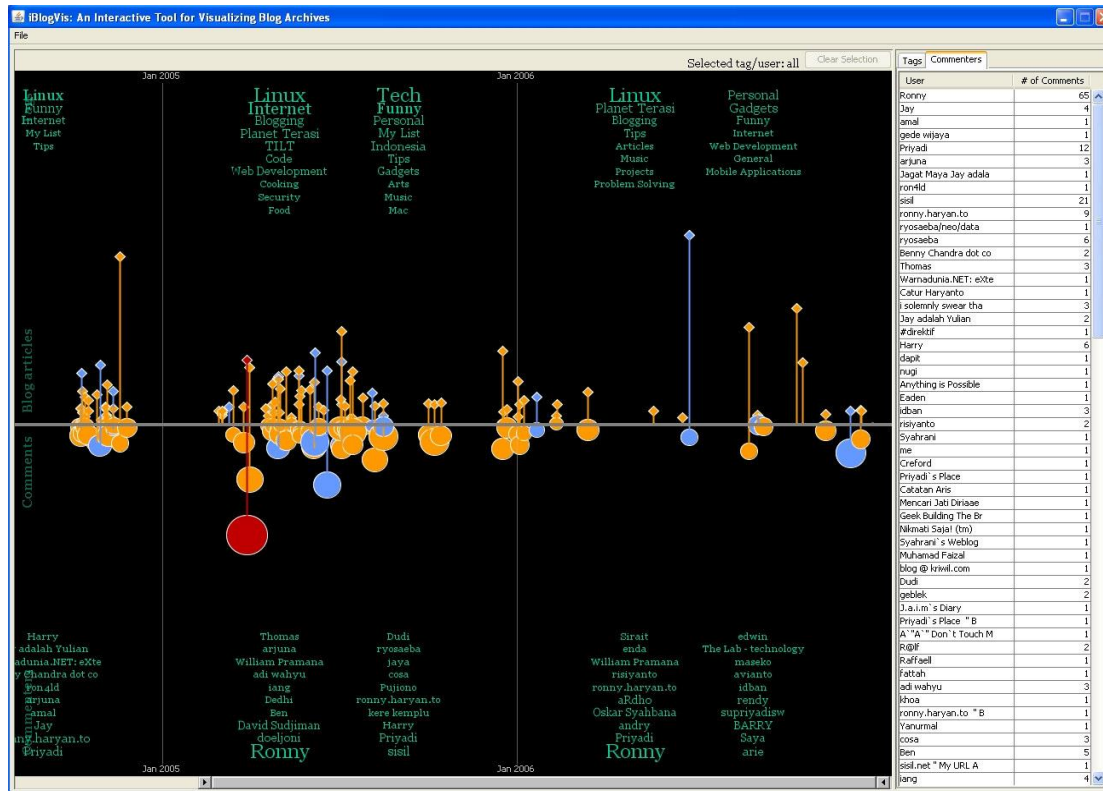


Figure 2.7: iBlogVis visualizing a collection of blog entries along a timeline (Indratmo et al, 2008).

iBlogVis (Indratmo et al, 2008) is a visualization tool for browsing blog archives. As shown in Figure 7, it provides a summary of posted blog articles over time with their length and number of comments received to help users to find the interesting articles in the blog at a glance and to ease exploration and navigation. Social network visualization for blogspace revealed that topic oriented blogs had more interconnections and reciprocation than most popular blogs (Herring et al, 2005).



Figure 2.8: Example relation visualization (Relavis) Webster & Vassileva (2006).

In the context of a discussion forum Webster & Vassileva (2006) explored (Figure 2.8) if a visualization of the reciprocity of a user's relationships with other users would motivate the user to engage in more reciprocal relationships. The evaluation of the visualization (shown in Figure 2.8) showed that it indeed does so for active members, although it doesn't increase the level of participation in general.

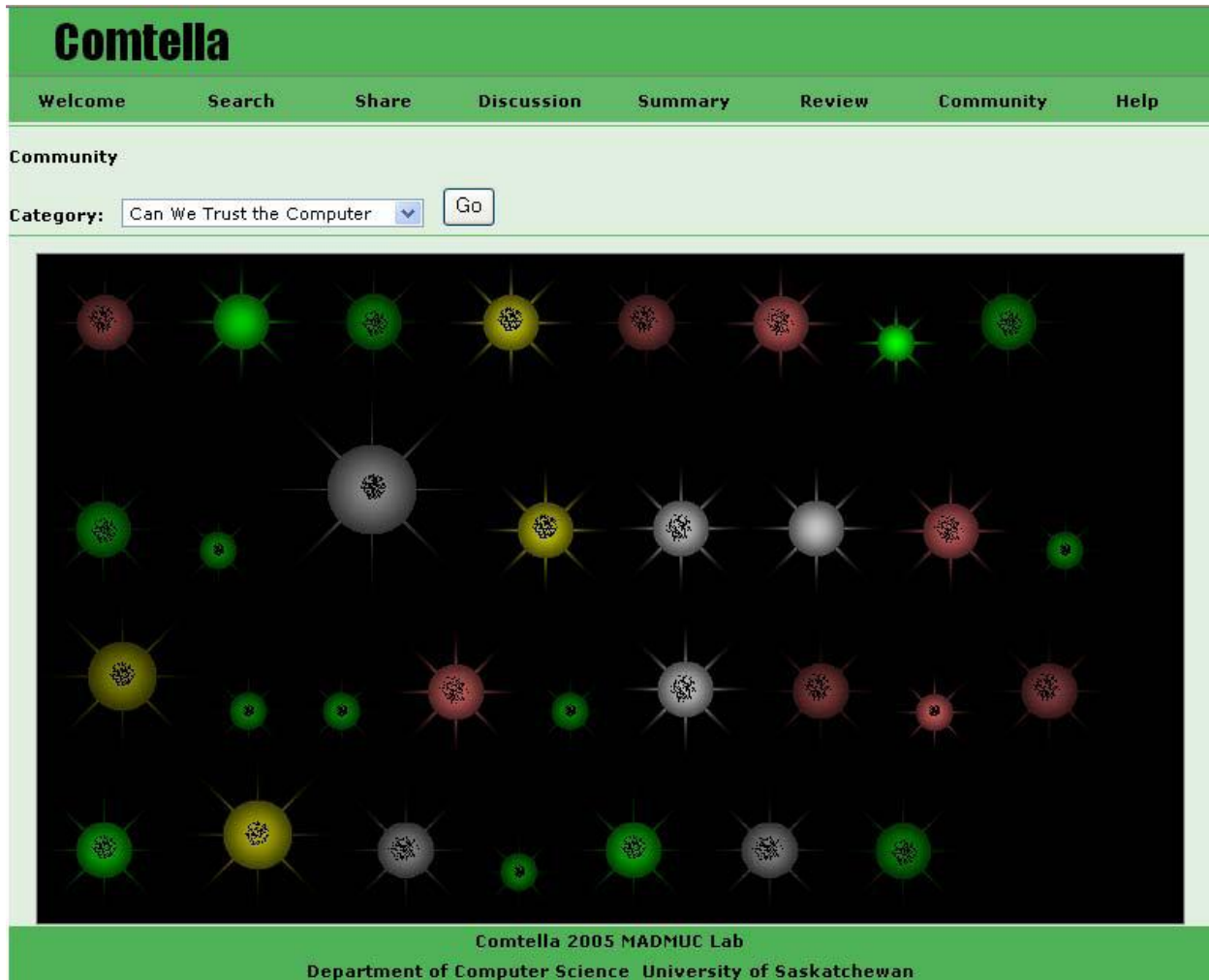


Figure 2.9: Motivational Visualization (Vassileva and Sun, 2007)

Social visualization is expected to activate social norms of behavior, encourage social comparison and reciprocity. Vassileva and Sun, (2007), designed a motivational visualization (Figure 2.9) that effectively increased awareness of community and encouraged social comparison and as a result contribution to the community increased.

I propose to incorporate a motivational visualization to increase participation by stimulating personal bond among members and evoking reciprocity between pairs of users, as well as a gentle social comparison in terms of number of reciprocated relationships.

## 2.6 Summary

From the literature review we find that there is an interesting and underexplored area of designing social visualizations to represent interpersonal relationships and using these visualizations as tools to influence peoples' behavior and motivate them to contribute to their communities. Particularly, the theories of common bond and reciprocation suggest that visualizing the relationships between people and their features (e.g. reciprocity) may trigger reciprocal behavior, and bonding to the community. Most of the social visualizations that visualize relationships are actually socio-graphs depicting relationships as lines. Using lines is difficult to represent the bi-directional nature of relationships. Using arrows doesn't help much since they complicate the picture and may add confusion in the interpretation of what the direction of the arrow means. Finding a way to represent relationships and their reciprocity visually, so that the picture is intuitive and understandable is a challenging task that is addressed in this thesis.

Since social visualizations are frequently used as awareness tools, they can be designed to allow identifying the active members, lurkers and social loafers at a glance. Social visualization could then be used as a stage for social comparison among community members. According to the social comparison and previous research on design of social visualizations promoting social comparison (Sun & Vassileva, 2006), providing a stage for social comparison can be a very effective tool for motivating participation. If users have a chance to build their own representation on the stage, reflecting a reputation in the community, social visualization would also possibly induce self-efficacy, which according to the self-efficacy theory can be a strong intrinsic motivator for action.

Lurkers who have the opportunity to see very active members represented in very attractive way in the social visualization may compare themselves with them, and try to compete with them by contributing. Once they start contributing, they might develop common bonds by becoming attached to particular members in the community. This attachment can trigger norms of reciprocity among them, measured in terms of comments and replies to each other's posts. By increasing their participation, the lurkers will see their representation in the visualization become more attractive, which will bring feelings of achievement, pride and self-efficacy, and further motivate them to contribute. In the next Chapter, a proposed design along these lines is described.

## CHAPTER 3

### PROPOSED APPROACH

This chapter discusses about the motivation, hypothesis, the theoretical basis of the proposed approach and its implementation.

Designing a visualization that could easily represent reciprocal and non-reciprocal relationships among members in an online community is not trivial. Visualizing connections or relationships through lines could be complex and very hard to understand for users, as can be seen in the example social network diagram in Figure 3.1. In this figure the green lines are used to represent reciprocal and red lines represent non-reciprocal relationships among members. From this visualization it is hard to see who is giving and who owes and the lines overlap each other. The visualization is crowded, tangled, and not pleasing to view. A visualization that is not pleasing is unlikely to be viewed by users and less likely to have a motivational effect.

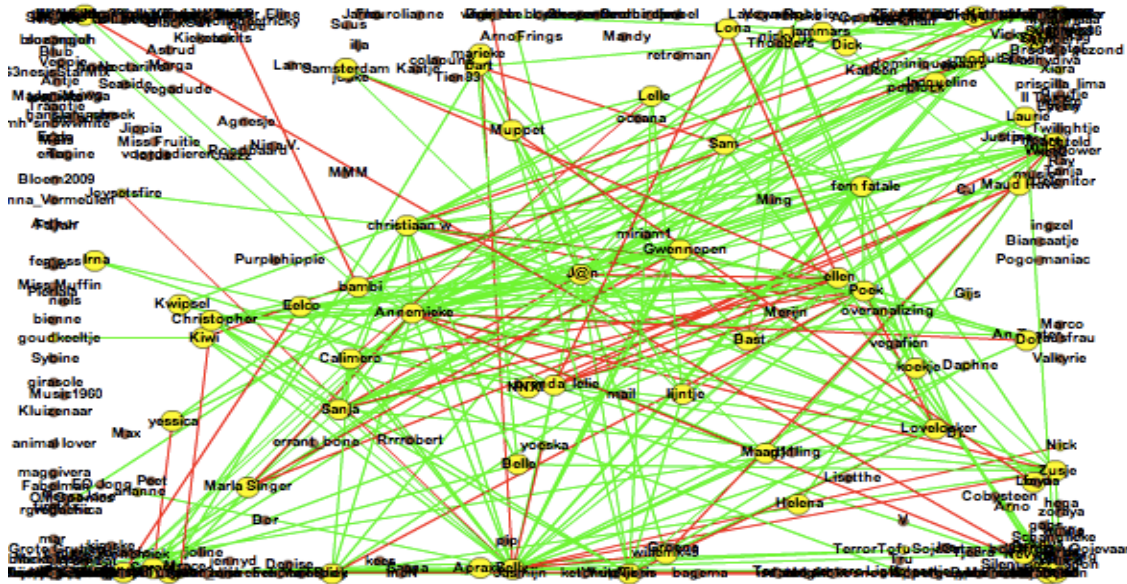


Figure 3.1: Showing reciprocal and non-reciprocal relationships among members in an online community.

To achieve the goal of increasing active participation, I propose designing a system which incorporates visualization techniques to motivate user participation by evolving their relationships with other members in the online community and also make the visualization more attractive and appealing for the users.

### **3.1 Motivation**

The hypothesis is that an appropriately designed visualization can stimulate motivational mechanisms (reciprocation, social bonding, social comparison and self-efficacy) that might lead to more active contributions by the users to their community. The objective of this research is to build a model of each user's relationships based on data from user interactions, for example, giving comments, responding to posts, or rating items posted by others, and to design a visualization of these relationships which the user can view and reflect on. Further, it is hypothesized that this reflection will lead users to change their behavior in a desirable way, aiming towards balanced relationships.

The WISETales community was chosen as a testbed for the proposed approach, because in this community people can get engaged in direct reciprocity by commenting on each other's stories. Therefore the visualization has to reveal the reciprocal and non-reciprocal relationships among the members. According to the reciprocation theory, people help others with the expectation of having their help returned by that individual or the group as a whole (Blau, 1964) (Emerson, 1972). Returning favors are acts of reciprocation. However, it is not clear if being aware of the level of reciprocity of their relationships, and the direction of the non-reciprocal relationships (i.e. who "owes" favors to whom) in an online community, will motivate users to reciprocate. Making the members aware through a social visualization of their reciprocal and



non-reciprocal relationships will it motivate them to contribute towards each other and carrying out experiments in different communities would allow answering this question.

### 3.2 Visualization Design

The visualization design was first set forth with an idea inspired from PeopleGarden (Donath, 2002) as mentioned in the Section 2.5 of the previous chapter. A low-fidelity prototype (Figure 3.2) of the visualization was developed using Flash to substantiate the idea of a flower garden metaphor. A user study was also done on the low fidelity prototype design. After receiving very encouraging feedback from both the users and two workshop presentations, the actual implementation of the design was ventured.

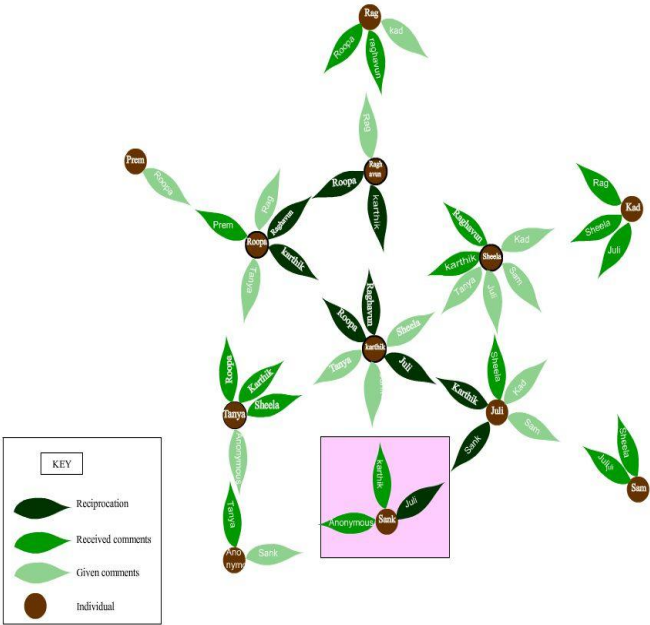


Figure 3.2: Low Fidelity Prototype of the Visualization

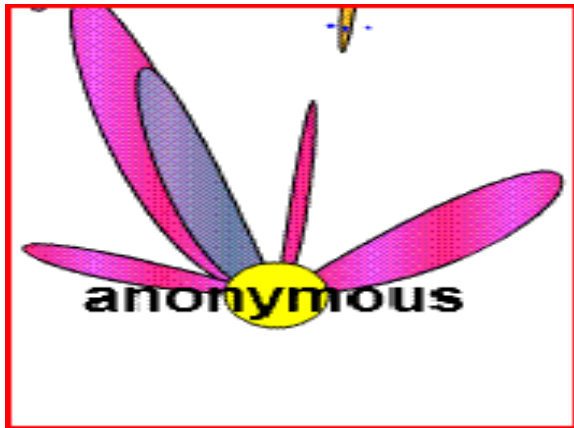


Figure 3.3 Anatomy of a Flower in the Visualization

To make the visualization more attractive, a flower garden metaphor is proposed (see Figures 3.3 and 3.4). Each user is represented by a circular node with his/her name written in it. The size of the node corresponds to the between-ness centrality algorithm. The nodes of users who have interacted with each other are connected by arcs corresponding to their relationships with other users (based on the interactions between the users, e.g. replies, ratings, comments). The arcs are invisible, but petals are drawn out of each node pointing in the direction of each arc, connecting two nodes. The petals can have three different colours to indicate reciprocal and non-reciprocal relationships (with a tendency of giving or taking). In this way users who are engaged in interactions appear as flowers, while lurkers appear as simple nodes with no petals. This design allows the users to find out at a glance which users are active, which tend to be “givers” and which are “receivers”, as well as which users are involved in reciprocal (balanced) relationships.

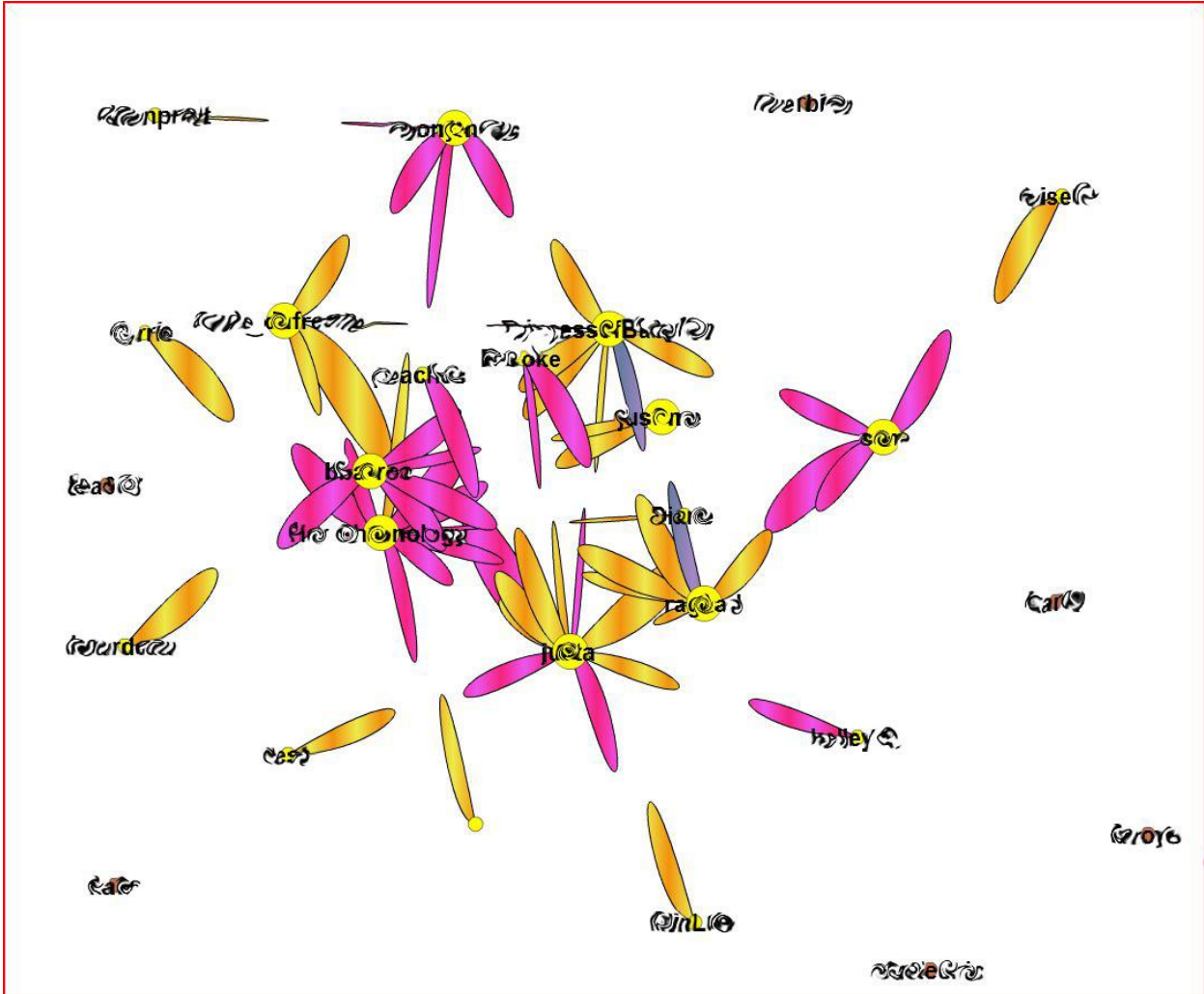


Figure 3.4: Visualization of reciprocal and non-reciprocal relationships in WISETAles.

The design of the visualization is to serve for both a navigational and motivational purpose. The navigational purpose is pursued by creating an overall idea in the viewer at a glance about who the active members are (by the size of the node, the number of outgoing or incoming petals), and which users have written posts that have attracted the most comments (the most “receiving” petals), and which users are the most active commentators (nodes with the most “giving” petals).

The motivational purpose is pursued by:

1) Setting the stage of a gentle social comparison among users in gaining petals, between those having a larger and better connected node and those who did not; users with high self-efficacy may be motivated to build up their flowers to have more petals by contributing more interesting posts to attract comments and giving more comments to others' posts.

2) Emphasizing the relationships among the users, and the direction of reciprocity, can encourage a common bond. If a user has received a lot of comments from a particular user and has not been aware of that before, the visualization will make him/her realize that he/she "owes" that user some attention, and that he/she needs to contribute something to the other user. The realization that other users are viewing the same visualization and will be aware of the lack of reciprocation from the user to others, will add social pressure to behave according to community norms.

Thus, this visualization design is consistent with several theories of motivation: the self-efficacy theory, the social comparison theory, the social bond and the reciprocation theories. In addition, various guidelines for visualization design from the literature were used, as explained below. To emphasize the relationships between users in the visualization, there was some enhancement to the visualization with additional effects. If a user hovers the mouse over any flower, it becomes highlighted. Hovering the mouse over a particular petal highlights this petal, and the corresponding petal of the other node, along the arc between the two nodes, so that the user gets a clear view of the relationship between the two users represented by the nodes. The visualization is dynamic – it grows by adding new nodes when new members sign in, the nodes grow when users create new posts, stories, and contributions, and new petals grow off the their nodes when a user give comments to contents contributed by other users. To ensure

scalability, users can pan the visualization (move it around to bring particular cluster of nodes to the center of the screen), zoom in and out. Users can also search for certain nodes (users) using the search box, which blows out the searched node bigger in the visualization (if it exists).

The active members are clustered in the center while the inactive members are scattered around them.

“Varying shapes of nodes is used to denote different characteristics of members in the graph; the location of the node is used to denote the valuable marker for understanding the structure in the network. Centrality in a group is a useful indicator that the participant plays a key role in the group” (Wasserman.S and Faust.K, 1994).

The nodes which have more petals are slightly bigger than the other nodes with fewer connections. The petals always point towards related other nodes. The reason is to give an easy navigation and sense of direction for the users to find their relationship partners in the visualization. We could have represented the relationship between two nodes as an arc between them, which is the typical approach in visualizing social networks. However, according to (Moreno, J.L., 1953):

“...the fewer the number of lines crossing, the better the sociogram”

The lines between nodes increase complexity and decrease the beauty of the visualization. In addition, a straight line does not allow representing the two directions of a relationship from the individual point of view of the two nodes participating in the relationship. Two separate petals from each node, aligned along the (invisible) relationship arc allow representing more information – the giving and taking aspects, or the balance of these aspects in reciprocal relationships. The balance of a relationship between two users is calculated as a summative function of the number of interactions (views, ratings, responses and comments) that

each user has provided to the other user's contributions. Different formulas for calculating the balance of a relationship are possible, as well as different thresholds for considering a relationship with a given balance as reciprocal.

Colour is used in the visualization to distinguish active from inactive members, and different types of relationships among users (giving, receiving, or balanced/reciprocal). Viewers perceive colours differently, but experimental evidence shows that relationships between colours are universal, and are free from individual and cultural differences (Jacobson, N and Bender, W., 1996). According to Jacobson, N and Bender, W., (1996).

“People can make consistent evaluation of the magnitude of any given experience of colours based on the type of interaction among colours. People respond to the relationship among colours”.

Yellow colour is used for nodes of active members and brown colour is for inactive members. Active members are those would have at least one petal attached to their respective node; i.e. have given or received at least one comment, response, rating, or view. The visualization uses three different colours to represent reciprocal and non-reciprocal relationships among members. A petal with purple colour represents reciprocation among users; a pink petal shows that the user has received interactions from another user, and a golden petal shows that the user has given comments to another user. For the purpose of the visualization, any set of three clearly distinguishable colours (e.g. black, white and grey) should be sufficient to represent the different kinds of relationships. These particular colours were chosen (pink, gold and purple) purely for aesthetic reasons, making sure that they are clearly distinguishable also by most types

of colour blind people<sup>1</sup>. Only two types of colour blindness may affect the distinction of the chosen colours - Blue-Blind/Tritanopia (which would see only reciprocal / purple petals, but the rest will be indistinguishable), and Monochromacy/ Achromatopsia (for which the colours of the petals would be indistinguishable). However, both of these types of colour blindness are extremely rare.

To make the visualization more engaging and ensure better visibility of relationships, the visualization is interactive. Besides panning, zoom-in and zoom-out and highlighting nodes, the user can drag nodes around and see the rest of the nodes follow and adjust their position. The above mentioned feature creates an aesthetically pleasing “action” effect that can engage the user to play and explore the effect of his/her actions. Moreover, it allows the user to rearrange the nodes to ensure better visibility of a node that she/he is interested. Since it is impossible to avoid intersection between the edges and petals, dragging of nodes allows the user to see different views in quick succession and in this way “explore” the visualization more effectively.

### **3.3 Implementation**

The visualization is generated using a Force Directed Layout algorithm<sup>2</sup>. These types of algorithms produce good layouts for medium sized graphs (50- 100 nodes). In particular, they are good at achieving the following criteria: uniform edge length, uniform vertex distribution, and showing symmetry. The algorithm places nodes based on a physics simulation of interacting forces. Each node in the layout is mapped to a particle instance and each edge to a spring

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<sup>1</sup> An online test of how an image looks for colour-blind people is available at:<http://www.colblindor.com/>

<sup>2</sup> Wikipedia article on this topic: [http://en.wikipedia.org/wiki/Force-based\\_algorithms](http://en.wikipedia.org/wiki/Force-based_algorithms)

instance in the simulation. The nodes repel each other as electrically charged particles; edges act as springs, and drag forces which are similar to air resistance<sup>3</sup>. An advantage of the algorithm is that it is interactive; by drawing the intermediate stages of the graph, the user can follow how the graph evolves, seeing it unfold from a tangled mess into a good-looking configuration. The algorithm can be run for multiple iterations for a run one time layout computation, or can repeatedly run in an animated fashion for a dynamic and interactive layout. Force-directed algorithms produce a graph with minimal energy, in particular one whose total energy is only a local minimum. The edges of the nodes overlap because so far, Flare's physics engine has not implemented any collision resolution methods yet. The overlapping of nodes was avoided by exploring the space of different combinations of parameters of the ForceDirectedLayout like spring length, particle mass, and spring tension. One shortcoming of this algorithm is that it is time-consuming (its complexity is a cubic function of the number of nodes in the graph) and that it can settle in relatively poor local minima. The visualization is implemented using ActionScript 3.0, Flare, MySQL, Groovy, GraphML. Flare<sup>4</sup> is a web content visualization toolkit and an open source framework built on ActionScript 3 programming language<sup>5</sup>. Using Flash platform, Flare gives a rich and reliable way to develop and share information visually. Flare also provides utilities for loading external datasets. The visualization is available online at

<http://homepage.usask.ca/~kas411/vis3.swf> .

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<sup>3</sup> Flare API Documentation, <http://flare.prefuse.org/api/>

<sup>4</sup> Heer, J. Flare: Visualization Tools with Adobe Flash. Adobe Developer Connection [http://www.adobe.com/devnet/edu/articles/jeffrey\\_heer.html](http://www.adobe.com/devnet/edu/articles/jeffrey_heer.html).

<sup>5</sup> Moock, C. 2007. Essential ActionScript 3.0.



## CHAPTER 4

### PILOT STUDY AND VISUALIZATION EVALUATION IN WISETALES

This chapter presents the evaluation of the motivational social visualization proposed in the previous chapter in an online community for Women in Science and Engineering, developed in the MADMUC lab, which faces the problem of ensuring participation. An overview of the community is presented first; then a pilot study to test the methodology is described; and then a user study involving the community is presented.

#### 4.1 Target Community: Wisetales



Figure 4.1: WISETales community website

WISETales (Figure 4.1) is an online community for Women in Science and Engineering. This community has been developed by Zina Sahib, former M.Sc. Student at MADMUC Lab, as one of the projects of the NSERC/Cameco Chair for Women in Science and Engineering for the Prairies, Dr. Julita Vassileva. This community is specially designed to allow women who are underrepresented in the sciences to share their personal stories. The goal of this community is to provide a virtual channel to share emotion, experience and provide support to other women. WISETales helps women to overcome the generation gap and isolation. Generally women in these fields are very busy and achieving active participation in an online community is a great challenge. Though they have the desire to post stories and comments, they hesitate to do so. The reason could be time limitations or it could reflect worries about expressing themselves. So to motivate their participation is vital for the community to survive. In order to overcome this problem, I propose to use a visualization of user relationships that may motivate users to contribute and reach a critical mass of active users.

I implemented the motivational visualization discussed in Chapter 3 in WISETales ([www.ourwisetales.com](http://www.ourwisetales.com)), which had been active since January 2008 and had 51 registered users who had shared 33 stories by the time of the launch of the study. Previous research on this community (Sahib & Vassileva, 2009) has focused on the design of the community site and functionality, and has attempted to encourage participation (in terms of increased number of new stories contributed by users) using a motivational visualization based on the Common Identity Theory. In that approach the common goal was visualized as a ladder towards the top, and the contributed stories became building blocks for the steps of the ladder. This approach has had a limited success, as the users did not find the visualization particularly motivating, even though

they were able to grasp that the visualization represented the current needs of the community in terms of types of stories needed.

WISETales community was chosen as a benchmark to evaluate the motivational effect of the relationships visualization on encouraging the users to give comments to each other's stories because it certainly needed an increase in participation. Also it was a fairly small community, which avoids scalability problems for the visualization (both computational and visual). As a first stage, we evaluated the usability and clarity of the visualization in a pilot study to make sure that the users understood the message that the visualization is communicating, that they found it readable and attractive, that the tool for evaluation (questionnaire) was usable; and able to collect the data needed. As a second stage, I attempted to evaluate the motivational effect of the visualization directly in the WISETALES community.

#### **4.2 A Pilot Study of the Visualization**

The pilot study involved six subjects, none of whom were members of the WISETALES community. Out of the six, four members were MS students (female) in the Veterinary Medicine department. The other two members were from the University of Saskatchewan, Computer Science Department. One was a Post Doctoral student working in the area of Graph Theory, and the other was a Ph.D student from the HCI (Human Computer Interaction) lab. To evaluate the visualization a questionnaire was used with 57 questions along with space for open suggestions and comments. Some important questions had required answers, and most of the questions had multiple choice answers.

Since the users were not familiar with the WISETALES community, they were given a general introduction about the community and its purpose, and were presented with the

visualization. After that they were given a few minutes to observe its elements and explore it. If they were not able to understand its significance, then the users were given a brief description of the visualization. I gave such an explanation only if users demanded it. The six people, who did not belong to the department, demanded an explanation. Though they were amazed to see the visualization for a moment they demanded an explanation after a few minutes. The demand for an explanation by them could be because of the influence of my presence as a computer graduate. The other two people from our department silently studied the visualization and filled in the questionnaire. They never demanded an explanation. Then they were asked to interact with it for some time and were given the questionnaire. The questions aimed to evaluate the clarity of the visualization, usefulness of its features, whether the visualization conveyed the correct information to the user, and whether they were able to understand and interpret the visualization clearly and to find drawbacks. The questionnaire had 6 subsections with heading as follows.

- Clarity of visualization
- Utility of the features
- Visualization design
- About the meaning of visualization
- About the usefulness of visualization
- Cognizance and motivational power.

The following tables summarize the results obtained from the pilot study. The tables consists of questions, sum and average as row heading and each of the multiple choice answers as column heading under which the number of users who gave the respective answer are entered.

Table 4.1: Questions about Visualization Clarity

| Clarity of visualization | Very bad | Bad         | Neutral     | Good        | Very good |
|--------------------------|----------|-------------|-------------|-------------|-----------|
| Colour of background     |          |             |             | 3           | 3         |
| Nodes colour             |          |             | 2           | 4           |           |
| Petals colour            |          |             |             | 3           | 3         |
| Text colour              |          | 1           |             | 3           | 2         |
| Search box colour        |          | 2           |             | 4           |           |
| Legend colour            |          | 1           | 1           | 3           | 2         |
| “+”, “-” button colour   |          |             |             | 4           | 2         |
| Size of font             |          | 2           | 4           |             |           |
| Search box size          |          | 2           | 2           | 2           |           |
| Legend size              |          | 2           | 4           |             |           |
| “+”, “-” button size     |          |             | 1           | 3           |           |
| SUM                      |          | 10          | 14          | 29          | 12        |
| AVERAGE                  |          | 1.666666667 | 2.333333333 | 3.222222222 | 2.4       |

From Table 4.1 it can be seen that the majority of the users said the clarity of the visualization was good. However, there were minor issues - some of the users did not like the search box, the text and legend colour and also they did not like the size of the font, search box and legend, which was small and hard to see clearly.

Table 4.2: Questions about Visualization Design

| Visualization design                                       | Not at all | Not that much | Neutral | Definitely | Very much |
|--|------------|---------------|---------|------------|-----------|
| Is the visualization attractive and appealing?             | -          | 1             | 2       | 3          | -         |
| Will you be happy to see your flower in the visualization? | -          | -             | 2       | 3          | 1         |
| SUM  | -          | 1             | 4       | 6          | 1         |
| AVERAGE  | -          | 1             | 2       | 3          | 1         |

Table 4.2 consists of questions about the visualization design. There seems to be a tie between the answers “neutral” and “definitely”. However the results could be taken for positive feedback about the attractiveness and appearance of users flower in the visualization. The

majority of users felt that the dancing of nodes were annoying to them, as can be seen in Table 4-3.

Table 4.3: Questions about the nodes of the Visualization

| <b>Visualization design</b>       | <b>Not at all</b> | <b>Not that much</b> | <b>Neutral</b> | <b>Definitely</b> | <b>Very much</b> |
|-----------------------------------|-------------------|----------------------|----------------|-------------------|------------------|
| Is the dancing of nodes annoying? | 2                 | -                    | -              | 4                 | -                |
| SUM                               | 2                 | -                    | -              | 4                 | -                |
| AVERAGE                           | 2                 | -                    | -              | 4                 | -                |

Table 4.4: Questions about the meaning of the Visualization

| <b>About the meaning of visualization</b>   | <b>Yes</b> | <b>No</b> |
|---|------------|-----------|
| On seeing the visualization do you infer any meaning associated with the position and size of nodes and petals? | 6          | -         |
| SUM   | 6          | 0         |
| AVERAGE   | 6          | 0         |

From Table 4-4 it can be seen that the participants were able to infer some meaning associated with the size of nodes and petals. But some had difficulty in understanding that the size of petals was associated with the distance of nodes. They interpreted it differently - that the larger the petal sizes the more the person has given/received comments to/from other person, which is an intuitive explanation. We considered this likely interpretation of the petal size during the design phase, but did not find any way to implement it. Another misunderstanding the users developed was related to the size of nodes. The users took the size of nodes as related to the number of connections a node had. The more the connections a node, the bigger was the node. However, according to the visualization algorithm, the size of the nodes depends upon the

betweenness centrality of a node (that is the node which connects two subgroups of nodes), which is not an intuitive explanation. The size of the node, as well as the size of the petal, were built to the algorithm and could not be controlled in a desirable way in the visualization, so even after providing personal explanations during the pilot study; we could not avoid misinterpretation by the users.

Table 4.5: Questions about the Visualization Usefulness

| <b>About the usefulness of visualization</b>                                  | <b>Yes</b> | <b>Not sure</b> | <b>No</b> |
|---|------------|-----------------|-----------|
| If the visualization was implemented in your community will you use it often? | -          | 5               | 1         |
| Do you think this visualization would motivate you to contribute more?        | 1          | 4               | 1         |
| SUM   | 1          | 9               | 2         |
| AVERAGE   | 1          | 4.5             | 1         |

Table 4.5 consists of questions that are related to the usefulness of the visualization in a community. It is clear that the majority of the participants were unsure about using the visualization as a motivational tool for enhancing contribution.

Table 4.6: Understandability and Motivational Power of the Visualization

| <b>Understandability and motivational power</b>                           | <b>Yes</b>  | <b>No</b> |
|---|-------------|-----------|
| Do you understand the meaning of different elements of the visualization? | 6           | -         |
| Were you interested to find your flower in the visualization?             | 3           | 3         |
| Do you like the way your flower appears in the visualization?             | 4           | -         |
| Do you want to change the appearance of your flower?                      | -           | 5         |
| SUM   | 13          | 8         |
| AVERAGE   | 4.333333333 | 4         |

Table 4.6 presents the results obtained for the questions about the understandability and motivational power of the visualization, to which the majority of the participants gave positive answers. Though the participants did not have their own personal flower in the visualization as they were not WISETales members, they were asked to imagine they had a flower in the visualization and asked about their opinions regarding their flower. They were able to understand the meaning of different elements of the visualization, but half of them said they would not be interested to find their flower in the visualization, and a majority of them said that they did not want to do anything that would change the appearance of the flower. These results do not suggest that the visualization had a motivational effect for these participants. However didn't expect that the answers would indicate strong motivational effect for users who were not members of the WISETales community anyway. Moreover, the participants in the study were not very active participants in online communities in general. Even though they all had accounts on Facebook, they rarely accessed the community. But the majority of the participants felt that it would be interesting to implement this visualization on Facebook or in the community that they were actively involved in.

From this pilot study learned that the visualization showed clearly the reciprocal and non reciprocal relationships among the members and the participants understood its meaning and found it attractive. Two main problems were the size of the nodes and the size of the petals – which were misinterpreted by users. The size of the nodes in reality corresponds to the betweenness centrality (a parameter used by the graph generation algorithm) and therefore doesn't have the meaning that the visualization was trying to convey. However, the participants mistook the size of the node to represent the contributions (number of posts) by the respective user.



Similarly, the size of petals was controlled by the graph generating algorithm (ForceDirectedLayout). It depended on the distance between the nodes, which was automatically generated and was not controllable. Instead the participants interpreted that the larger petals as indicators of a stronger relationship between nodes. I tried different ways to control the size of nodes according to number of posts submitted by each user and the petal according to the number of replies to each other. In the beginning controlling the size of the petal was totally unattainable due to the fact that Flare was a new tool and there was no guide or examples except for the API. Currently, after the two studies, I found a way to control these factors by exploring deeply the features of Flare.

### **4.3 Case Study in WISETales**

Using the feedback from the pilot study, modifications to size of font, legend, and the speed of bouncing (or dancing) of nodes in the visualization were made. The questionnaire was extended with several questions aimed at testing the understandability and the motivational effect of the visualization.

To evaluate the motivational effect of the visualization, we needed real users in the community as participants, who can see themselves represented in the social visualization and are affected by it. Therefore, we launched a study in the WISETales community, inviting all registered users (around 50 of them) to participate.

#### *4.3.1 Tool, Participants, and Procedure*

We used a questionnaire and collected participation data, hoping to see an increase in contributions (comments) by the end of the study. We provided an icon linking to the visualization in the WISETales main page. Upon clicking on the icon, the visualization opened in

a new window. We realized that having to click and open a new window is an obstacle to seamlessly accessing the visualization, but it was impossible to embed the visualization in the current design of the WISETales main page.

We sent around email invitations to all registered users of WISETales to visit and explore the visualization and fill in the modified questionnaire. We continuously invited the registered users in WISEtales for over 6 weeks to visit the community, play with the visualization and fill the questionnaire. However, we had a very low response rate (only 4 users). We sent additional invitations to 46 women in science and engineering (personal acquaintances of Dr. Vassileva, faculty and staff members, graduate students and mentors in the “ourWISE mentor” program), some of whom are registered users of WISETales. Six more people responded to the additional email invitations, but 2 did not accept the consent form, so we had to exclude the data provided by them. Finally, we managed to get 8 filled questionnaires, which was disappointing. Of these, half were from registered users in WISETales (i.e. they had a node in the visualization representing them); the other half were from people who responded to the invitation to participate in the evaluation, but they had no accounts on WISETales and correspondingly, no node in the visualization.

#### *4.3.2 Results*

The study began on December 21<sup>st</sup>, 2009 and ended on February 17<sup>th</sup>, 2010 since WISETales had to be forced to shut down due to some spam issues. There was no noticeable increase in participation in terms of new stories and / or comments during the period of the study. After the visualization was launched, there were 3 new stories submitted by the members of WISETales in the month of January 2010 with 7 comments to the stories. The previous activity was in September 2009 with one story and 3 comments. During this time an additional

reciprocation emerged between the members of WISETAles, which can be seen by comparing the visualization states in the beginning and in the end of the study (Figures 4.2 and 4.3). In the beginning there was only two petals pointing toward each other and representing reciprocity (purple colour), between the member *PrincessofBabylon* and *ragkad*. As the days went by, one additional reciprocal relationship emerged between *Brooke* and *anonymous*.

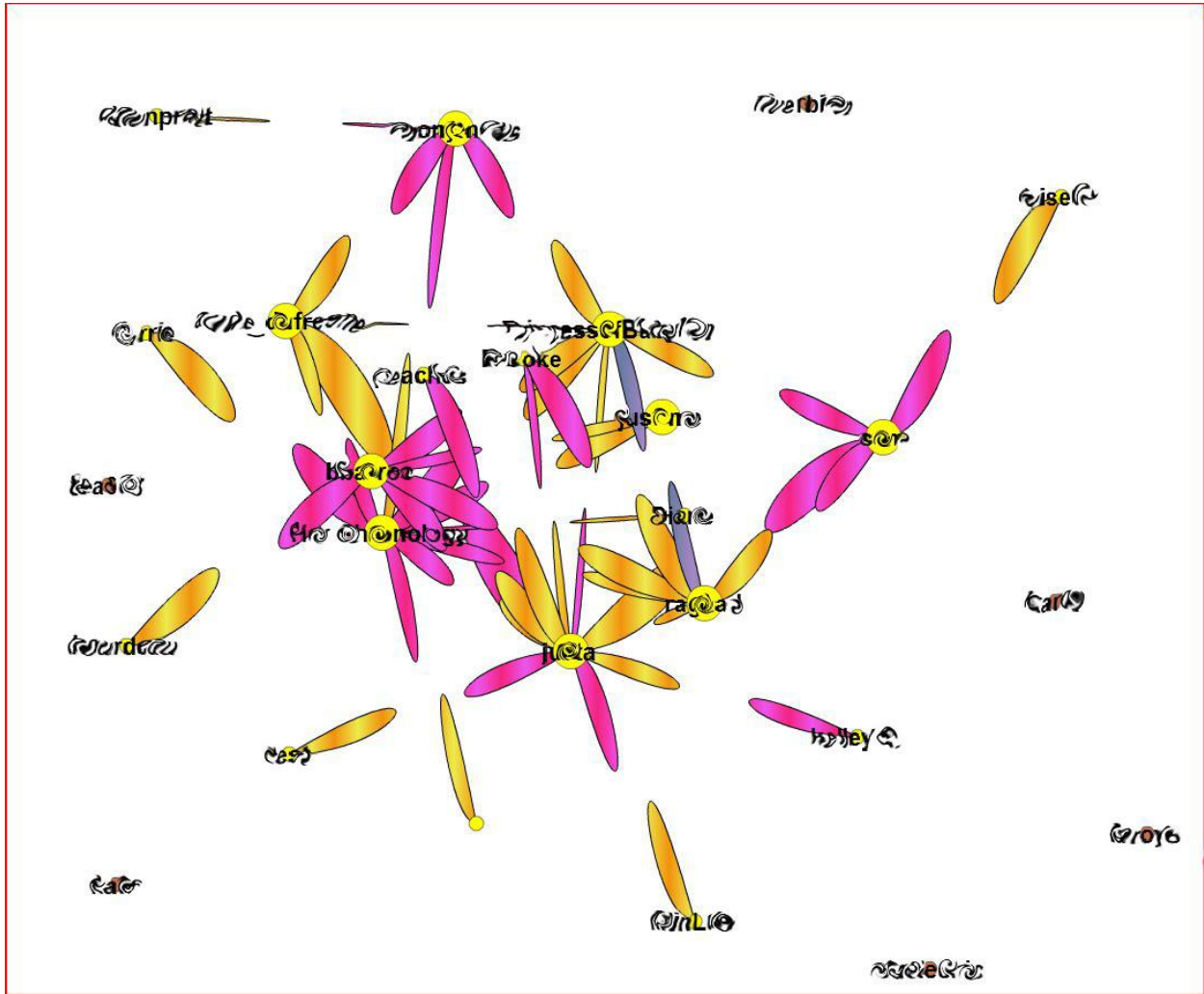


Figure 4.2: WISETAles visualization at the beginning of the study

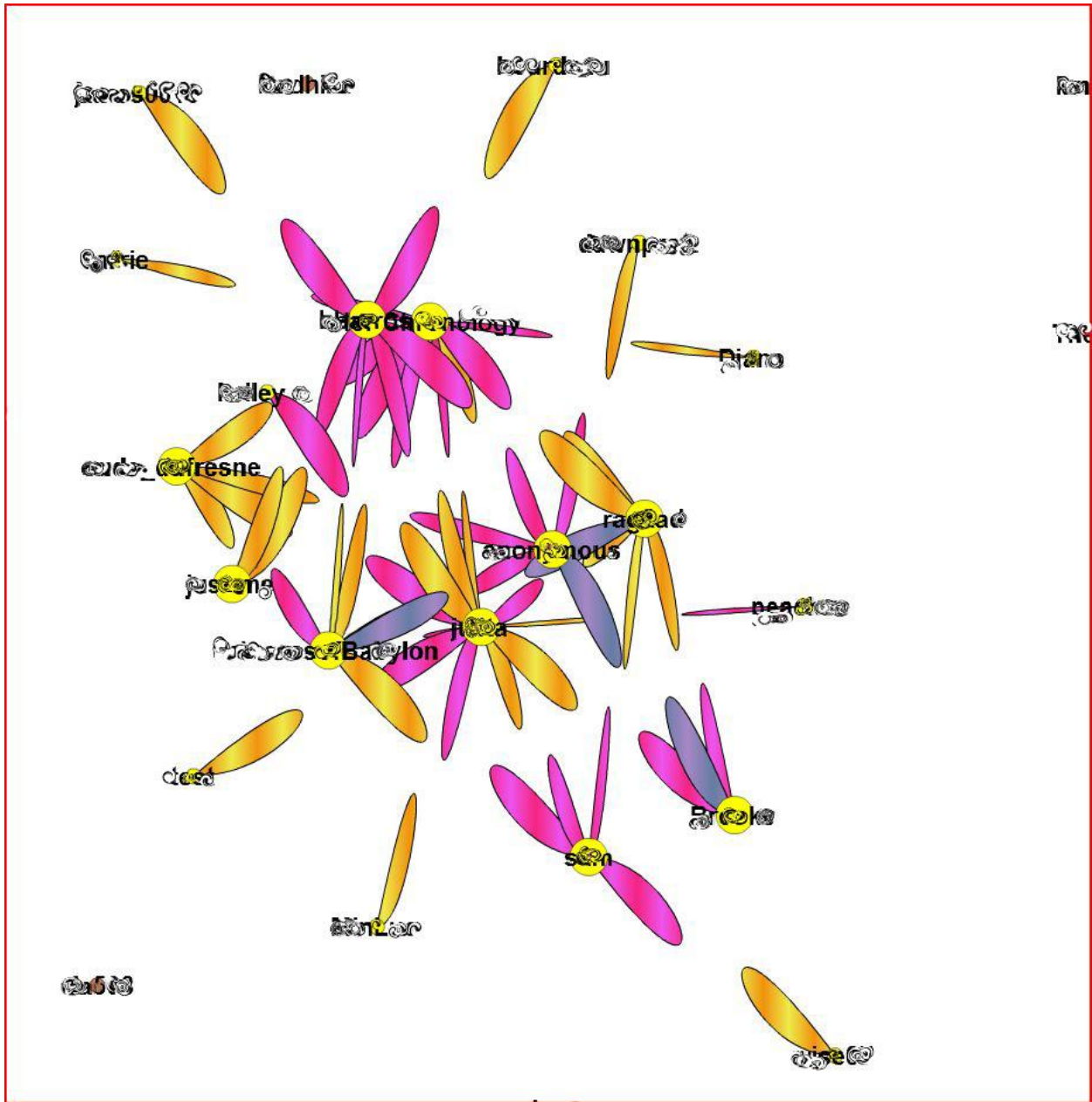


Figure 4.3: WISETales visualization at the end of the study

A group of questions in the questionnaire aimed to find out if the users understood the meaning of the visualization and if they could guess correctly its purpose. All users with accounts responded positively to the question “Do you understand the meaning of different elements of the visualization?” Of the other users (without accounts on WISETales), only one

responded negatively to this question. Here are some comments the users gave to the question inviting them to explain their interpretation of the elements:

*“The colour of the center of the flower indicates if you are active in the community, and the colour of the petals indicates if you have commented on someone else's story or if you have received comments on your story.”*

*“Node means users, orange for their comments and pink if they have received comments. Yellow for active users and brown for inactive users.”*

*“Nodes: members, petals: relationship with others”*

*“The only thing that I don't understand is because there is a member in pink, because according what I understood it should be yellow or red. I don't like that a petal has yellow and orange colour at the same time I would prefer to see just a colour. So if I see a flower (a member), I can say if it is active or not, and the comments that it has done or has received.” (sic)*

*“Petals = users who have left a comment, Node = users who have no left a comment” (sic)*

*“Active members are centralized. Petals represent relation activities like giving or receiving comments.”*

From these comments it is clear that the users interpreted the visualization correctly and understood what the flowers, the petals and their colours represent.

Regarding the size of the nodes and petals, the same misconception emerged as in the pilot study. Of the 8 users, only 2 answered “No” to the question if they infer any meaning associated with the position and size of flowers – one of these users had account on WISETAles and the other one didn’t have account. There were differences between the answers of the two groups (those of users who had accounts or those of users who didn’t have accounts). Here are some of the comments that the users gave to the question to specify how they interpreted the position and size of flowers.

*“I think that the size has to do with the contribution amount.”*

*“I presume the number of petals is equal to the number of other users one has commented on, and the size is proportional to the number of comments to the particular users' posts. The orientation of the petals tries to convey who those other users are.”*

“I can infer the active members and if they have a lot of comments or have given a lot of comments.”

We asked the users to comment on what they thought the purpose of the visualization was. The answers are summarized in Table 4.7.

Table 4.7: Answers to the question regarding the purpose of the visualization (original spelling and grammar is preserved).

What do you think the purpose of the visualization is?

| <b>MEMBER ACCOUNTS</b>                     | <b>User 1</b>   | <b>User 2</b>   | <b>User 3</b>   | <b>User 4</b>   |
|--|---|---|---|---|
| <b>Users with accounts on WISETales</b>    | <i>To encourage community involvement in the sense of increasing story postings and comments</i>              | <i>It's good and impressive. Using visualization we can find out who are active and inactive users and who actively participate in posting stories and comments</i> | <i>Make it more obvious?</i>  | <i>Recognizing contributors; revealing relationships between users.</i> |
|  | <b>User 5</b>   | <b>User 6</b>   | <b>User 7</b>   | <b>User 8</b>   |
| <b>Users with no accounts on WISETales</b> | <i>To see at a glance which are the more active members of the community and the relationships among them</i> | <i>To show the different interactions between members. And to see at first glance which are or not active</i>   | <i>To motivate people to get involved in their community - online or real life.</i> | <i>Entice me to participate and be active</i>                           |

While there were no big differences between the answers of the users who had and those who didn't have account on WISETales for the questions related to understanding the

visualization, there were obvious differences between the answers of the two groups related to the questions about the motivational effect of the visualization.

All of the users who had accounts on WISETales said that they were happy to see their flower and that they were interested to see their flower (these were separate questions to verify the consistency of answers given by the subjects). Two of these users liked how their flower looked, and two didn't like their flowers. But only two (USERS 3 and 4) replied “yes” to the question if they would be willing to do something to change the way their flower looks. One of the users (USER 1 whose answers are shown in Table 4.8) who replied “no” to the question if she would be willing to do something to change the way her flower looks, also answered “no” to the question if she liked her flower. The fact that she didn't want to do anything about it shows that the visualization was not motivating for this user. The answers of this individual to the further questions probing into the motivational effect of the visualization supported this conclusion. This user responded that she doesn't feel attached to the community since she didn't know the members; that she didn't care how her flower appeared in the visualization; that she would not use this visualization if it was available in one of her communities, and that the visualization would not motivate her to contribute more.

The other three users were more positive in their responses. USER 4 stated that she felt attached to the community as a whole, USER 3 –to particular individuals, and USER 2 - to both. USER 2 stated that she would use the visualization if it was applied in her community, and that it would motivate her to contribute more. The other two users were split in their answers to these two questions.



Table 4.8: Answers to the questions related to the motivational function of the visualization by the users who had accounts in WISETales community

| <b>QUESTIONS</b>  | <b>User 1</b>                      | <b>User 2</b>      | <b>User 3</b>                   | <b>User 4</b>                      |
|---|------------------------------------|--------------------|---------------------------------|------------------------------------|
| Were you interested to find your flower in the visualization                            | <i>Yes</i>                         | <i>Yes</i>         | <i>Yes</i>                      | <i>Yes</i>                         |
| Do you like the way your flower appears in the visualization?                           | <i>Yes</i>                         | <i>No</i>          | <i>Yes</i>                      | <i>No</i>                          |
| Do you want to do something to the community to change the appearance of your flower?   | <i>No</i>                          | <i>No</i>          | <i>Yes</i>                      | <i>Yes</i>                         |
| How would you like yourself to appear in community visualization?                       | <i>That's not a concern to me.</i> | <i>As a flower</i> | <i>Don't know</i>               | <i>Neutral</i>                     |
| In this community do you feel attached to particular individuals or to the community as | <i>Neither of the two</i>          | <i>Both</i>        | <i>To particular individual</i> | <i>To the community as a whole</i> |
| If the visualization was implemented in your community, would you use it often?         | <i>No</i>                          | <i>Yes</i>         | <i>Don't Know</i>               | <i>Don't Know</i>                  |
| Do you think this visualization would motivate you to contribute more?                  | <i>No</i>                          | <i>Yes</i>         | <i>Yes</i>                      | <i>Don't Know</i>                  |

Table 4-9 shows the answers to the same questions by the users who didn't have accounts on WISETales, and therefore had no flowers representing them in the visualization. Not surprisingly, most of the users of this group (3 out of 4) were not interested to find their flowers, didn't want to do anything to change their flower, didn't understand some of the questions, and didn't feel attached to the community. Yet their answers to the last two questions were similarly split like those of the users who had accounts, between Yes, No and Don't know.

Table 4-9: Answers to the questions related to the motivational function of the visualization by the users who did not have accounts in WISETales community

| <b>QUESTIONS</b>  | <b>User 5</b>                           | <b>User 6</b>               | <b>User 7</b>             | <b>User 8</b>             |
|---|---|-----------------------------|---------------------------|---------------------------|
| Were you interested to find your flower in the visualization                            | <i>Yes</i>                              | <i>No</i>                   | <i>No</i>                 | <i>No</i>                 |
| Do you like the way your flower appears in the visualization?                           | <i>Yes</i>                              | <i>Yes</i>                  | <i>No</i>                 | <i>No</i>                 |
| Do you want to do something to the community to change the appearance of your flower?   | <i>No</i>                               | <i>No</i>                   | <i>No</i>                 | <i>No</i>                 |
| How would you like yourself to appear in community visualization?                       | <i>I do not understand the question</i> | <i>With a lot of petals</i> | <i>Active</i>             | <i>No</i>                 |
| In this community do you feel attached to particular individuals or to the community as | <i>Both</i>                             | <i>Neither of the two</i>   | <i>Neither of the two</i> | <i>Neither of the two</i> |
| If the visualization was implemented in your community would you use it often?          | <i>Yes</i>                              | <i>Don't Know</i>           | <i>Yes</i>                | <i>Don't Know</i>         |
| Do you think this visualization would motivate you to contribute more?                  | <i>Yes</i>                              | <i>No</i>                   | <i>Yes</i>                | <i>Don't Know</i>         |

#### 4.4 Discussion

From the results of the WISETales study, it seems that the users can understand correctly the meaning of the elements and the purpose of the visualization. Users who were native to the community and feel attached to the community cared more about how they appear in the visualization and they were more likely to do something to change the appearance of their image in a positive way. Like native users, users who weren't native to the community liked the visualization; similarly non native users may use such visualization in their own community, and that visualization may motivate non-native users to participate. These results are encouraging. But the visualization should have been directly integrated into WISETales webpage because

users need not have to take an effort to click on a link or a button to view the visualization. As soon as the users visit the WISETales webpage the visualization will always be readily viewable to them and may have influenced them to greater degree. I could also have implemented an algorithm to control the size of the petal according to the number of messages exchanged or according to the user relationship but I was unable to do so due to time constraints.

## CHAPTER 5 EVALUATION IN IHELP

IHelp is a system hosting multiple discussion forums used by Computer Science students at the University of Saskatchewan. It has been used by thousands of students over the last 10 years to ask questions about assignments, deadlines, exams, and receive prompt responses by the instructor, teaching assistants and their own peers. The use of each class forum depends on the course instructor. In some classes it was used very actively by the students, as the instructor and the teaching assistant use it as the primary way to answer student's questions. The pattern of activity usually revolves around assignment deadlines. In other classes the level of activity is lower, mostly driven by the students to communicate about the class coursework. This chapter describes the design changes applied to the visualization following the lessons learned from the WISEtales study. This chapter describes the specific software supporting the community, the participants, method and tools, the results and a discussion.

### **5.1 Design Changes**

When implementing the social visualization in IHelp, modifications and enhancements in the design were based on the results from the WISEtales experiment.

In the new version, the petal sizes pointing to each other of two flowers depend on the number of messages exchanged between the two respective users. If only few messages are exchanged, the size of the petal between the two users is smaller. The number of messages exchanged between the two users is displayed in a text box that appears when hovering over each petal. When a user hovers over a node all the related nodes and connections are highlighted.

Another visible change was that different colours were used from those in the WISEtales visualization. The colors were chosen following recommendations by the instructors who

thought that the previous colours were too bright and not attractive. The relationships were categorized into three different levels: balanced, medium balanced and unbalanced. The balanced relationships were represented with green colour petals. The medium balanced relationship (receiving more than giving) was shown with bright orange petals and medium balanced (giving more than receiving) was shown with bright blue petals. The unbalanced relationships were represented by light brown (receiving more than giving) and light blue (giving more than receiving). The thresholds for the three levels were defined empirically depending on the average numbers of exchanged messages between actively engaged pairs of users in the community.

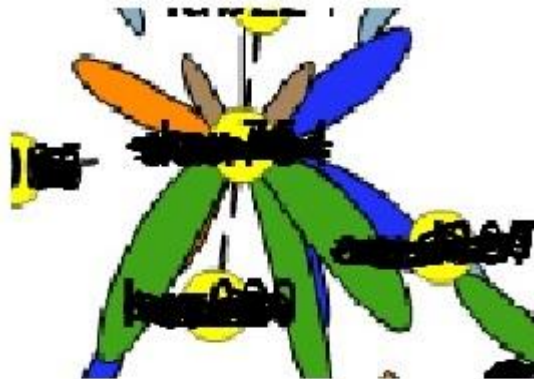


Figure 5.1: IHelp visualization colours

The Figure 5.1 shows the relationship between three users: user1, user2 and user 3. User1 and user2 have green colour petals pointing towards each other as they have a strong reciprocal relationship (i.e have exchanged many messages and have responded to each other almost equally). User1 and user3 have a medium balanced relationship, where user1 has given more comments to user3. User3 and user2 have a strongly unbalanced relationship where user2 has

given comments to user3 but the number of messages exchanged is very small (therefore the petals pointing to each other are very small).

To reduce the cognitive load on and distraction of the students, and based on previous positive observations made about the comprehensiveness of the visualization in the WISETales study, no explanation to the visualization was provided. In this way we could also check if the users would be able to understand the meaning of the visualization and interpret the meaning of the different elements (size, colour of petals, etc.) without any help.

Since there was no direct access to the IHelp database, unfortunately, it was not feasible to update the visualization in real time, which would have allowed students to see how their petal grows and changes as they exchanged messages. So the visualization was updated on daily basis. We knew that this would be a disadvantage in terms of the motivational function of the visualization, since students were unable to notice the results of their actions immediately, if they ever decided to reciprocate under the influence of the visualization.

The visualization was incorporated in one of the frames of the IHelp interface. There are several frames in the interface, but we could only choose to place the visualization between two, the upper, larger frame or the lower, narrower frame. The narrow frame was sufficient to display only a very small part the visualization, scrolling would have been necessary. So we chose the larger upper frame, occupying approximately half of the screen. Both the visualization and Ihelp interface was incorporated in the same page so that the users could simultaneously access the IHelp forums and view the visualization. Based on previous experiences from WISETales study, having the visualization in the same page with Ihelp was considered a better way to guarantee that the users are exposed to the visualization and have a chance to be influenced by it. In comparison the visualization integrated in WISETales required the user to click on a small

flower image in the community interface to access the visualization in a separate browser tab.

One of the lessons learned from the WISETales evaluation was that there was no way of knowing if the users click to view the visualization frequently enough to be influenced by it.

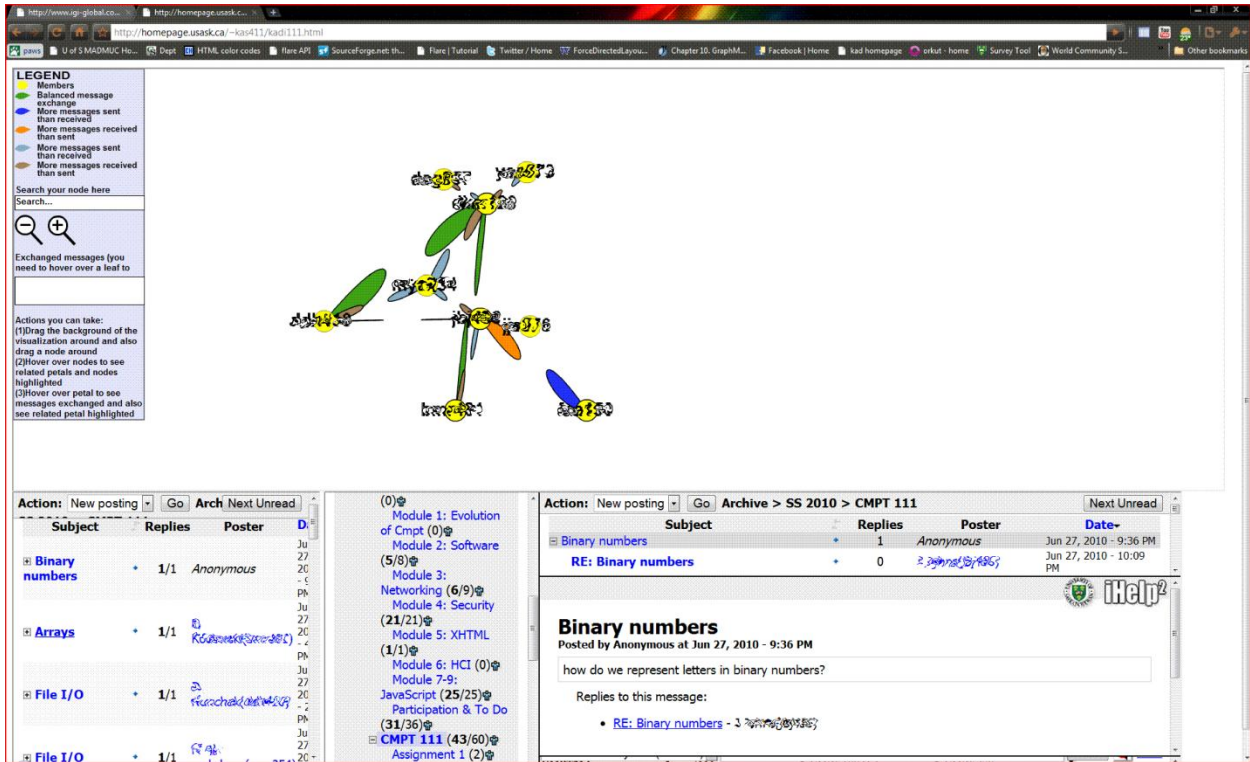


Figure 5.2: CMPT 111: iHelp visualization

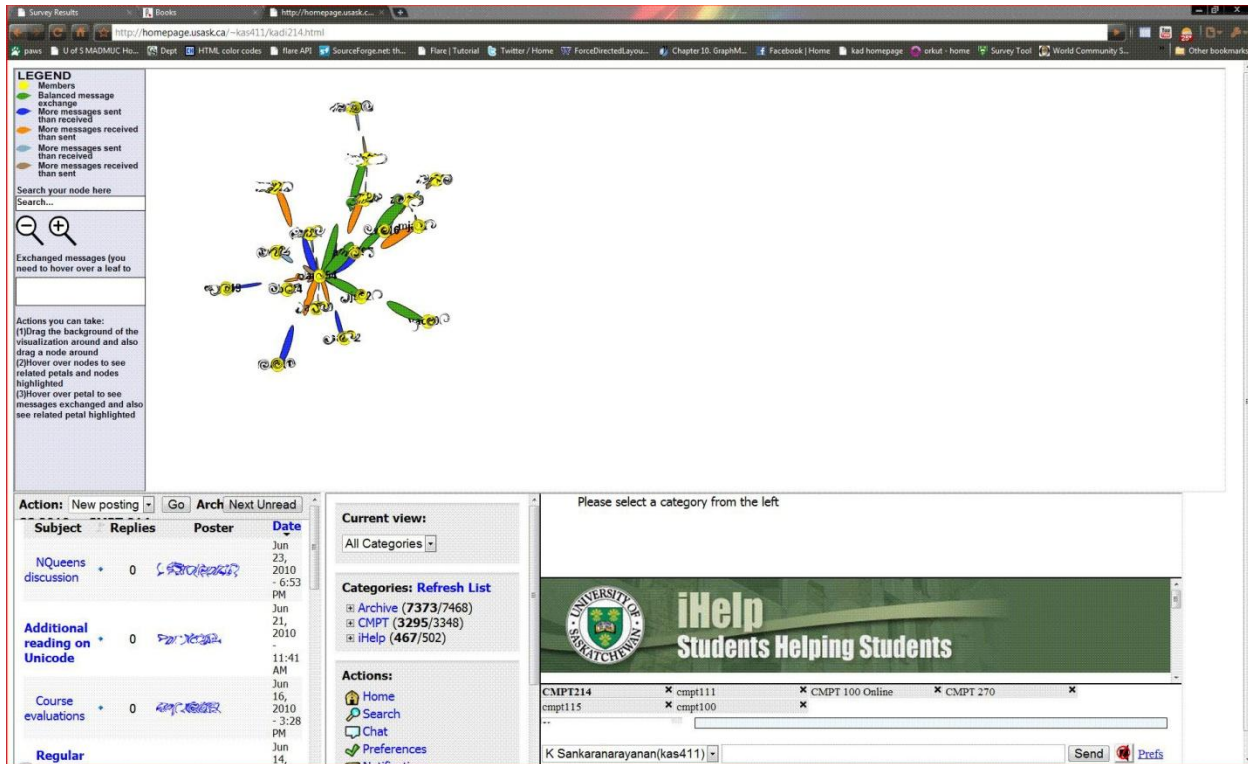


Figure 5.3: CMPT 214: iHelp Visualization

## 5.2 Participants, Method and Tools

We evaluated the visualization in two classes, CMPT 111 (introductory programming) and CMPT 214 (a summer term class in 2010). CMPT 111 had 23 registered students and CMPT 214 had 20 registered students, so in total, there were 43 students. These two classes are both 6-week long and intensive classes, which compress the material taught during the 13 weeks of the regular term. Needless to say the students have very little time for exploration and discussion, but use iHelp mostly driven by pressing questions arising when working on assignments or project. Thus these two communities were somewhat similar to WISETales in the aspect that the users had very little time to engage actively in the community. The students were made aware of the experiment with the visualization by an email from the course instructor. The students could choose to access the iHelp system as usual (without visualization) or to access (through a special



link on the course website) a special version of IHelp with the same functionality but including the visualization. To encourage participation an incentive (draw to win an iPad computer worth around \$600) was introduced. Fourteen (14) students filled the consent form across the two classes. We started the experiment on June 3<sup>rd</sup> and ended it on June 28<sup>th</sup>. The messages exchanged between students were recorded on a weekly basis.

After the class was over we invited the users to answer an online questionnaire with 20 questions (see Appendix G) nearly identical to those asked to the WISETale users, to check about the user's understanding of visualization and its motivational effect.

### **5.3 Results**

We collected data of posts and responses. For each post or response we had the data about the author, the recipient (if it was a response) and the time-stamp.

In CMPT 111 there were 9 students who participated in IHelp discussions (approx. 40%). Two users sent the majority of responses (the first – 18 and the second – 22 responses). The rest of the students posted occasionally, with the next highest number of responses given by a user who gave 7 responses.

In CMPT 214 there were 17 students who initiated a post in IHelp discussions. The posts made by them were almost exclusively replied to by the course instructor rather than by peers.

From the collected postings data we could not find any evidence of reciprocation happening between the users in any of the classes. There were occasional messages, but nearly no messages were exchanged between the same pair of users after the introduction of the visualization.

Despite the chance to win an iPad, which we thought was a very attractive reward, only 8 subjects filled in the questionnaire of the 14 who consented to participate in the study. Tables 5.1 to 5.4 summarize the responses received by these students.

Table 5.1: Responses regarding the users' frequency of use of the visualization, attachment to the community, and to the questions related to the visualization's attractiveness and usefulness as awareness tool

| <b>Users</b> | <b>Approximately what % of time did you access iHelp with visualization compared to standard iHelp?</b> | <b>In this community do you feel attached to particular individuals or to the community as a whole</b> | <b>Is the visualization attractive and appealing</b> | <b>Did you feel that the visualization is useful to create awareness of the community?</b>  |
|--------------|---|--|--|---|
| User 1       | Approx 60% with visualization   | <i>Neither attached to the individuals nor to the community</i>  | <i>No</i>  | <i>Not really no, i think if someone really wants to talk to other individuals they will use the chat line or send them an email.</i>   |
| User 2       | Approx 20% with visualization   | <i>Neither attached to the individuals nor to the community</i>  | <i>No</i>  | <i>Not really.</i>  |
| User 3       | Approx 40% with visualization   | <i>Neither attached to the individuals nor to the community</i>  | <i>No</i>  | <i>No! I think it was more of a bother than a help. It took up half the window and made it less functional just to show who is using it the most.</i>   |
| User 4       | Approx 20% with visualization   | <i>Neither attached to the individuals nor to the community</i>  | <i>No</i>  | <i>Not really. I accessed the community via my laptop and the flower took up a lot of room. Maybe it would seem more useful if it could be customized to a smaller screen. And also, I post under a</i> |

|        |                                 |   |            |  |
|--------|---------------------------------|---|------------|--|
|        |                                 |   |            | <i>screen name, not my NSID, I prefer that my identity didn't appear as my NSID in the flower.</i>   |
| User 5 | Approx 40% with visualization   | <i>To the community as a whole</i>                              | <i>Yes</i> | <i>Maybe, though the box it occupied took up all the space of monitor</i>  |
| User 6 | All the time with visualization | <i>Neither attached to the individuals nor to the community</i> | <i>Yes</i> | <i>I don't know what you mean by this question. I was made aware of the community by my prof.</i>  |
| User 7 | Approx 60% with visualization   | <i>To the individuals in the community</i>                      | <i>No</i>  | <i>Not especially. I found it to be too abstract.</i>  |
| User 8 | All the time with visualization | <i>Neither attached to the individuals nor to the community</i> | <i>No</i>  | <i>The visualization is interesting but not extremely useful. It is not a large problem in a small summer class but if there was a class of 200 people and even if 20% of the students commented to one other person about that 20% 10% of them commented to two other people there would be so many connections it would be so many connection that it would be very difficult to keep track of them all. Also I what I would really want to know is the subject of the communication so that if someone has already answered a question I may have I would be able to find it.</i> |

Table 5.2: Responses regarding the users' understanding of the meaning and purpose of the visualization

| Users  | On seeing the visualization do you infer any meaning associated with the position and size of flowers? | If yes, please specify below   | Do you understand the meaning of different elements of the visualization? | If yes please specify below   | What do you think the purpose of the visualization is?                             |
|--------|--|--|---|---|--|
| User 1 | No   |  | No  |   | <i>I didn't really understand the point of it.</i>                                 |
| User 2 | No   |  | No  |   | <i>To motivate one to participate.</i>   |
| User3  | No   |  | Yes   | <i>The colours indicated how many times they had posted/been replied to</i> | <i>It appeared to be a way to view how frequently someone posts/is replied to.</i> |
| User4  | Yes  | <i>The nodes were individual users, the petals and their colours represented the activity level of the user -- depending on the type and frequency of usage.</i> | No  |   | <i>To encourage users to more fully participate in the community.</i>              |
| User5  | Yes  | <i>Petals are</i>  | No  |   | <i>Something like</i>  |

|        |     |  |     |  |   |
|--------|-----|--|-----|--|---|
|        |     | <i>students lesser importance, colour maybe active inactive, closer to centre more importance.</i>   |     |  | <i>human interface interaction. more interactive</i>  |
| User6  | No  |  | Yes | <i>CMPT meant the department and 111 meant the the class that I was in. I assume that's what you mean be "elements".</i>   | <i>To allow students an avenue by which questions could be asked and answered regarding assignments and the course in general.</i>  |
| User 7 | Yes | <i>The different nodes are different users right? I assume the bigger nodes are users with a high number of comments/replie.</i>   | No  |  | <i>I think the purpose of the visualization is to show graphically how the different users of iHelp are linked to one another. However, I'm not 100% sure this was the purpose.</i>                   |
| User 8 | No  | <i>I said no because when I move the "flowers" around they appear to change and stretch according to how the different nodes are connected. At first I also found it strange how the whole group</i> | Yes | <i>There were coloured circles labled with different student's IDs. Connecting the IDs where "petals" (ovals) that represented communication between people on iHelp</i> | <i>To represent the different connections made between all the people involved in the class on iHelp. I believe it is a good way to show all the communication that you can read to help you with</i> |

|  |  |   |  |  |                   |
|--|--|---|--|--|-------------------|
|  |  | <i>floated around, but after I got used to it I liked the random bobbing.</i> |  |  | <i>the class.</i> |
|--|--|---|--|--|-------------------|

Table 5.3: Responses to the questions probing the motivational effect of the visualization

| <b>Users</b> | <b>Will you be happy to see your flower in the visualization?</b> | <b>Were you interested to find your flower in the visualization?</b> | <b>Do you like the way your flower appears in the visualization?</b> | <b>Do you want to do something to the community to change the appearance of your flower?</b> | <b>If yes, please specify below<sup>2</sup></b>  |
|--------------|---|--|--|--|--|
| User1        | <i>Yes</i>  | <i>Yes</i>   | <i>Yes</i>   | <i>No</i>  |  |
| User2        | <i>No</i>   | <i>No</i>  | <i>No</i>  | <i>No</i>  |  |
| User3        | <i>No</i>   | <i>No</i>  | <i>No</i>  | <i>No</i>  |  |
| User4        | <i>No</i>   | <i>No</i>  | <i>Yes</i>   | <i>No</i>  |  |
| User5        | <i>Yes</i>  | <i>Yes</i>   | <i>Yes</i>   | <i>Yes</i>   | <i>It doesn't take up so much of my space,</i>   |
| User6        | <i>Don't Know</i>   | <i>No</i>  | <i>No</i>  | <i>Yes</i>   | <i>I don't know what you are talking about. I didn't see any flowers, so my above answers were blindly made.</i> |
| User7        | <i>Yes</i>  | <i>Yes</i>   | <i>No</i>  | <i>No</i>  |  |
| User8        | <i>No</i>   | <i>No</i>  | <i>No</i>  | <i>No</i>  | <i>I really don't care much about how my flower looks. I can more about how I</i>                                |

|  |  |  |  |  |  |
|--|--|--|--|--|--|
|  |  |  |  |  | <i>had to login more than once in one window. Also I found it frustrating how much space the "plant" (flower and petals) takes on my computer screen. I have a 15" laptop and the white space around the plant is very large compared to the space taken up by the discussion that you can read.</i> |
|--|--|--|--|--|--|

Table 5.4: Responses to the questions gauging the users opinion of the visualization's motivational effect

| <b>users</b> | <b>Do you think this visualization would motivate you to contribute more?</b> | <b>If you answered 'yes' to the above question, could you specify what you would be motivate to do</b> |
|--------------|---|--|
| Users 1      | <i>No</i>   |  |
| User2        | <i>No</i>   |  |
| User3        | <i>No</i>   |  |
| User4        | <i>No</i>   |  |
| User5        | <i>Yes</i>  | <i>Chat with them, I guess not really too sure</i>   |
| User6        | <i>Yes</i>  | <i>I don't know about more. I contributed a lot while in the class.</i>                                |
| User7        | <i>Don't Know</i>   |  |
| User8        | <i>No</i>   |  |

## 5.4 Discussion

The results of the questionnaire indicate that for this group of users the visualization made little sense and wasn't attractive. Also less than 40% (3) assigned some meaning to the

elements of the visualization and of the position and size of the flowers. Less than 40% (3 users) were happy to see their flower. Only 3 subjects liked the way their flower appeared in the visualization, and only 2 said that they would like to do something to change the appearance of their flower. The reasons stated by the two people who said “Yes” to this question had nothing to do with the motivational purpose of building up one’s flower through engaging in exchange of messages with others. Rather user 5 was annoyed by the large space occupied by the visualization user 6 didn’t comprehend. While two of the users (users 2 and 4) understood that the general purpose of the visualization was to encourage participation (as this was stated in the consent form which they had to accept to fill in the questionnaire online), there were three (users 1, 5 and 6) who apparently didn’t see the purpose in the visualization. Most of the subjects (6 out of 8) did not find it motivational. The two users who answered “yes” specifically indicated by their actions that they didn’t show understanding what to do. Some users commented that if they wanted to communicate with their classmates, they would use the chat tool of IHelp.

Most of the users did not feel attached to the community or to the individual due to the short-term and goal-directed use of the discussion forum. Only one user felt attached to the individuals in the IHelp community because s/he had some replies to his/her posted questions and felt good about it. These communities were centered round the course instructor and the motivation for posting was to get answers to pressing questions related to the assignments. Most of the member’s questions were answered by the course instructor.

Many comments criticized the integration of the visualization in IHelp, complaining that it took too much space away from the actually useful interface that allows reading and posting messages. The IHelp interface which provided the main functionality of the forum was cramped in the lower part of the screen, and it became inconvenient to use, especially when viewed on a



laptop computer. Shrinking the visualization further was not an option as the text font in the visualization became unclear. It would have been much better if the IHelp interface itself could have supported the visualization, but integration of the visualization was not possible in IHelp as IHelp is a legacy system which has to run securely, and the technical staff that supports it was not willing or able to take the risk involved in re-organizing the frames of the interface. The subjects found that the visualization was a hindrance to their main purpose, which led to overly negative responses, instead of increasing motivation to reciprocate with their peers.

Based on these results, it could be said that the visualization did not increase the IHelp users' motivation to reciprocate or participate in general. There can be four possible reasons for that:

- 1) It seems that we chose an inappropriate community to apply this approach of motivation. The community was too goal-focused, too time-pressured, and driven by other goals than socialization. Moreover, the students shared classes nearly every day, so they could engage freely in face-to-face discussion, if they needed, rather than reciprocating through responding to comments on a discussion forum.
- 2) The reason for the failure can be in the approach itself. It is possible that the design of the visualization was not able to clearly represent reciprocation and engage the users in reciprocal acts. The inability to update the visualization in real time, showing immediately the change in petal's size and colour when users reply or send messages to others lead to the users' inability to see immediate results of their actions, and hampered their understanding of the purpose of the visualization as a motivational tool. The lack of explanation or legend didn't help.

The implementation suffered also from two specific limitations related to the I-Help system implementation:

- The visualization occupied too much space on the screen which made it inconvenient to pursue the main goal of using IHelp, initiating and following online discussions, and
  - It did not provide any functionality by itself, e.g. supporting users in posting messages, the main function expected from a discussion forum.
- 3) It could also be that discussion forums in general are more topic driven, than, for example, group blog systems like WISETales. Maybe in discussion forums it is not appropriate to respond to someone just in order to reciprocate. Instead one would respond if one has something essential to say. Possibly, communities in which users comment on each other's activities in a more casual way are a better fit for this approach. Examples of such communities are chat rooms, or social networks like Facebook or Twitter. These communities could possibly benefit more than discussion forums from such visualization.
- 4) There is also the possibility that common bond and reciprocation are weaker motivation mechanisms that cannot yield the motivational effects those cruder but stronger mechanisms, such as social comparison and competition can.

The next chapter describes one more experiment that was carried out in a different discussion forum community. It ran immediately after the I-Help experiment, but was in preparation for several months in collaboration with colleagues from Germany. The community this time is a well-established, interest/hobby-based discussion forum for vegetarians called Vegatopia. a. The goal was to see if fixing limitations 1) and 2) listed above, and changing the

community to an interest-based, leisure community, which exists only virtually (most of the members have never met in real life), might lead to the expected effect of the visualization – increased reciprocation and participation. There was much better control of the implementation in this community, real time updating, more natural integration in the community interface, and meaningful functionality within the visualization (sending messages to users by clicking on their flowers).

## CHAPTER 6

### EVALUATION IN VEGATOPIA

Vegatopia is a Dutch website “for anyone who is interested in tasty vegetarian food”. It is owned by Eelco Herder, a researcher from L3S Lab at the University of Hannover, Germany.

The evaluation study described below was done in collaboration with Eelco Herder and Daniel Krause from the same lab. The Vegatopia site consists of three parts:

- An editorial blog with news items, product reviews and recipes.
- An interactive restaurant guide with reviews of vegetarian and vegetarian-friendly restaurants in the Netherlands and in Belgium.
- An active Web forum in which the registered members (currently 561) post an average of 160 messages per day.

#### 6.1 Design Changes and Implementation

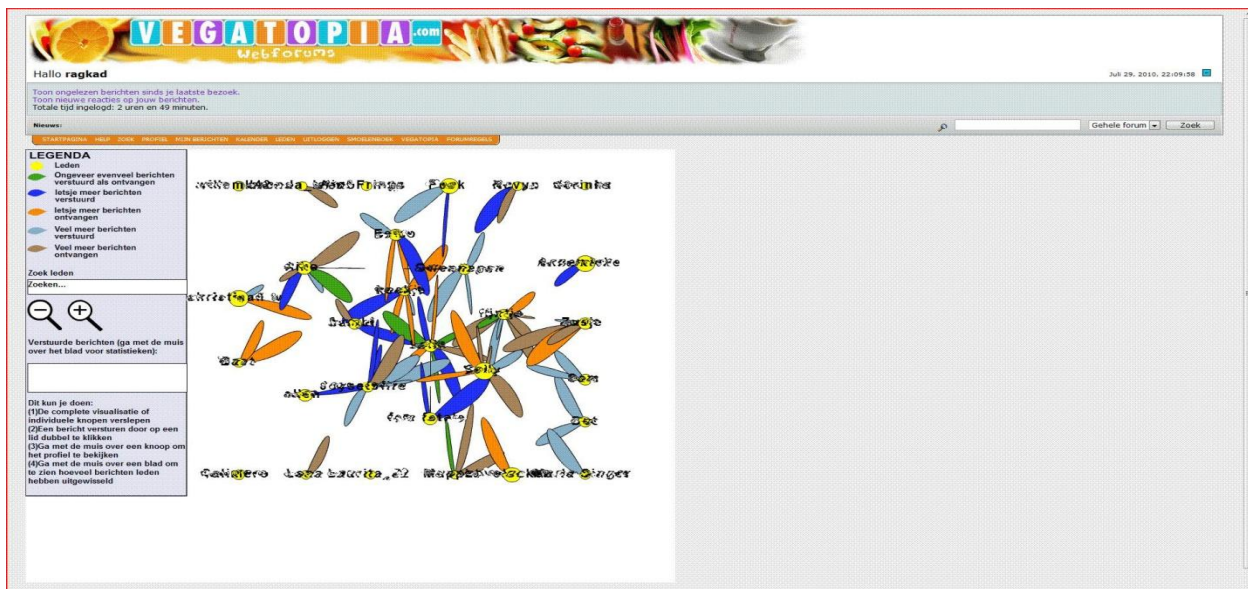


Figure 6.1: The visualization incorporated in Vegatopia

In the Vegatopia experimental system, the size of the petals corresponded to the strength of relationship (the total number of exchanged messages between the users). The same colours used for the IHelp visualization were also used for the Vegatopia visualization (in fact, these colours were chosen in consultation with our German colleague and probably reflect more masculine / European taste in colours). Once the decision to use these colours in Vegatopia was made, the same colours in IHelp were applied as there was no indication of what the gender and cultural background of the users in the IHelp study would be.

Unlike in IHelp where the visualization was running separately on our server and displayed in a pre-fixed frame, here the visualization was tightly coupled with the Vegatopia functional interface and running on the Vegatopia server. As the visualization was tightly coupled with Vegatopia interface, this allowed integrating the Vegatopia functionality in the visualization; so the users used the visualization as their interface to the forum in this way increasing its usefulness for the users. For example, one could double click on a particular node to send private messages to another user (in order to grow their petals).

As the visualization was integrated into the Vegatopia system, it became possible to reflect the users' actions immediately in the visualization, without any delay.

Since Vegatopia is a Dutch forum, the visualization legend and buttons had to be translated into Dutch, along with the questionnaire and the invitation for participation in the study. After the study, the results of the questionnaire had to be translated back to English. All of this was done by Eelco Herder.

## **6.2 Participants, Method and Procedure**

The data collection and analysis were handled carefully to make sure that all the data was stored at the Dutch server hosting Vegatopia; that no user-identifying information was collected at the University of Saskatchewan; and that all the data was anonymized before the beginning of analysis. Only a subset of users was chosen from all the users in Vegatopia to participate in the study since the visualization could not scale to over 50 users. A core of active users was sought, who exchanged private messages.

Unlike IHelp, this forum didn't consider posts made in response to another post as replies, so it wasn't possible to compute reciprocity by analyzing the thread of posts. Rather the private messages exchanged by users had to be considered as acts of reciprocity. This consideration however, added a limitation since private messages are not the normal way of interacting on discussion forums (these messages are invisible for the community), and they are used as a private channel for communication between users, who know each other personally and have already an established relationship. Based on historical data for several years, it was possible to find a cluster of users who have engaged actively in private communications. The following filtering mechanism was used to select the sub-group.

The members were sorted from very active members to inactive members (by number of posts). Then all members with less than 100 posts to the forum were excluded (the non-active members or very new members were excluded in this way). Then all members with less than 50 private messages (sent or received) were excluded, followed by all team members (moderators, board ...). Then the forum owner manually excluded people who had not been active in the very

recent past or who were known to be rather special. In total, this procedure yielded 29 candidates eligible for the study.

### 6.3 Classifying relationships into balanced, medium and unbalanced

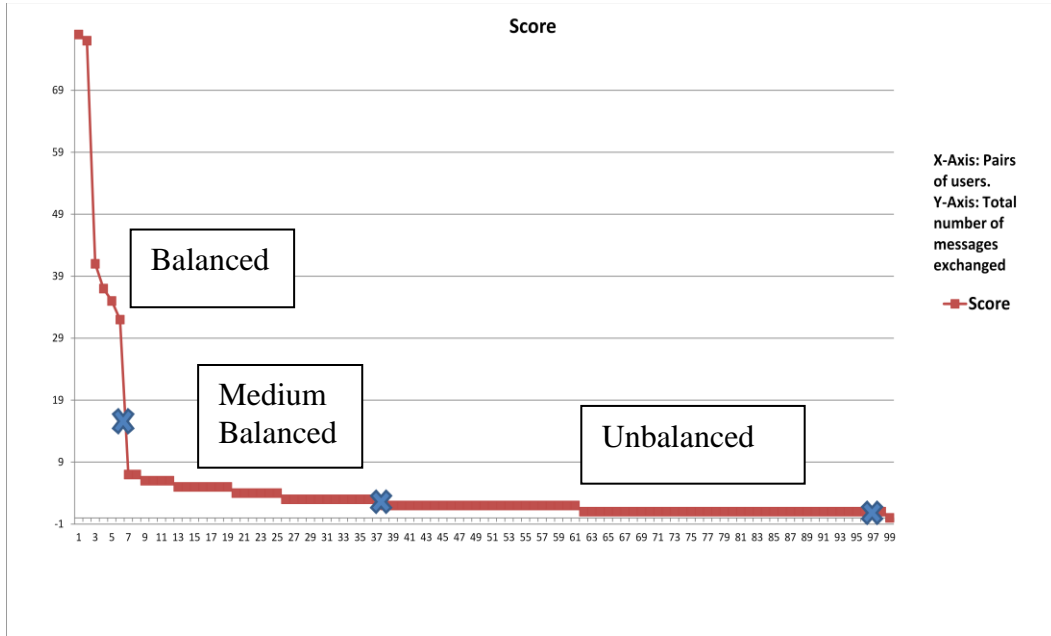


Figure 6.2: Thresholds for classifying relationships into three categories

Since the users selected for the study by this procedure were all active participants in the forum, they formed a social network with 49 edges (98 unidirectional relationships) in total between them (Figure 6.2). Thresholds had to be applied accordingly to categorize these relationships into balanced, medium balanced and unbalanced relationships, and to decide which colour to use for each relationship (petal).

The strength of the relationship between users was calculated based on the number of messages exchanged between them. The greater the number of messages exchanged between

two users, then stronger the relationship is and the larger the size of the petals between the two users.

To ensure motivational effect, I wanted to have a “fat middle class” (Cheng and Vassileva, 2005): a small exclusive part (e.g.10%) of the relationships to be considered as balanced which users can strive to achieve: also a relatively small part (30%) of the relationships to be considered as unbalanced so that there aren’t too many people that have nothing to lose from not participating. The goal was to have the majority of relationships (60%) as medium unbalanced, so that the users can strive to achieve a balanced status and fear that through inaction, their relationship may deteriorate to strong unbalance. To make this classification, an ad-hoc approach was used tailored to the strongly skewed data of messages exchanged between the users. Figure 6.2 shows that just 6 pairs of users exchanged most of the messages in the system (the Score graph shows the total number of exchanged messages between a pair of users). As in many complex and self-organizing systems, the number of messages sent between users (in each direction) was distributed unevenly, with a narrow peak and with a long tail. The two pairs of users who exchanged the most messages had larger absolute disbalance in their relationships (disbalance is the absolute value of the difference between the numbers of messages from one user to the other). However, I decided that such strong relationships should be considered more reciprocal than weaker relationships, consisting of very few occasional interactions, where the disbalance may be very small, but this disbalance is more likely due to chance. For example, if a pair of users has exchanged 65 messages, where one user sent 30 and the other 35, the disbalance of this relationship is 5. Another pair of users, that has exchanged only 1 message, has a smaller disbalance (1). However, I consider the first stronger relationship more reciprocal than the weaker relationship. So the reciprocity of the relationships was classified in 3 categories based



on their strength, i.e. the sum of the messages exchanged between the two users. This was done manually, based on the ranked distribution of the relationships strengths considering the desired size of the clusters.

Fortunately, in this implementation, the users' access to the visualization and their actions could be tracked. This allowed seeing how frequently the users visit the site with the visualization and how many messages they exchange. While in the IHelp and WiseTales studies it was possible to track the posted comments, it wasn't possible to keep track of the user views, which provide important information for the evaluation.

The study was launched on June 21<sup>st</sup>, 2010 and lasted more than a month, until July 29<sup>th</sup>, 2010. At the end of this period, the users' reactions to the visualization were evaluated using the same questionnaire that was used in IHelp. As an incentive an online gift certificate from a Dutch bookstore worth 10 Euro was to the members who completed the questionnaire. The questionnaire consisted of 17 multiple choice questions where each offered room for users comments and suggestions.

## 6.4 Results

### 6.4.1 Visualization Access Log Analysis

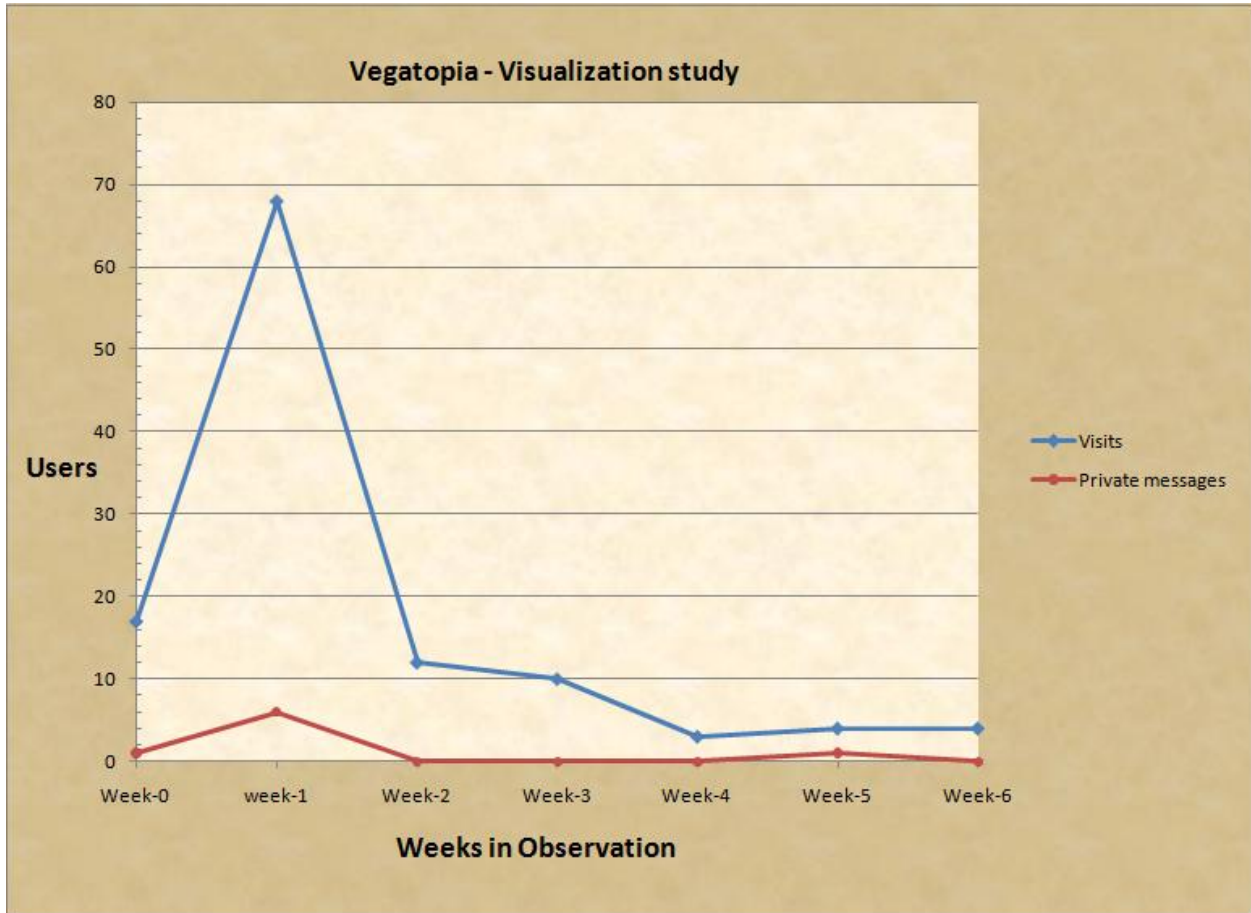


Figure 6.3: User activity for the 6 weeks period

Figure 6.3 shows the users activity in terms of number of visits to the community and number of exchanged of private messages each week. Week 0 is the week before the launch of the study, which is used here for historical comparison. There were 16 visits to the community and 1 private messages exchanged between the selected community members during the week 0. From week 1 as soon as the visualization was launched, the number of visits of the site with the visualization increased to 68 and 6 private messages were exchanged. As the weeks went by the

number of visits and private messages dropped drastically and remained an average of 1 per day, at an even lower level than in the historical week before the launch of the study.

Tables 6.1, 6.2 and 6.3 (Appendix K) show the logs of user access to the visualization and the private messages they sent for a period of 6 weeks, from June 14<sup>th</sup>, 2010 until July 29<sup>th</sup>, 2010. The uses are shown with code ids, and the actions are of two types: “vis” means that the user (“fromUser”) listed in the corresponding line of the table has accessed the Vegatopia forum (which during the first week did not include the visualization, but for the remaining weeks did include it); “pm” means that the user listed in the column “fromUser” has sent a private message to the user listed in the column “toUser”.

Table 6.1(Appendix K) shows the log of activities during the week preceding the introduction of the visualization, for comparison purposes. Table 6.2 (Appendix K) shows the log of activities during the first week of introducing the visualization. It can be seen that the level of activities has drastically increased, mostly with users viewing the visualization. Table 6.3 (Appendix K) shows the log of activities starting from the second week after introducing the visualization until the end of the study.

From Table 6.1(Appendix K) we can observe that 18 user actions of accessing the forum and one private message was sent during the 7 day interval before the introduction of the visualization, averaging to 2.5 actions per day.

Introducing the visualization spurred a lot of activities on Vegatopia. As can be seen from Figure 6.2, during the week following the introduction of the visualization, there were 68 actions (9.71 per day), of which 6 were direct messages. Most of the activity (45 actions, or 66%) happened on the first day of introducing the visualization, June 21<sup>st</sup>, 2010. Thus, we observed a classical novelty effect, with the users exploring the visualization and exchanging private

messages (possibly about the visualization, or testing the effect of the pm exchange on the visualization). Unfortunately, afterwards, the activity level dropped down, as can be seen from Table 6.3. For the month following June 29, 1 week after introducing the visualization, there were only 34 actions (1.1 actions per day on average) and of these only one was a private message. It can be seen that most of the activity happened as soon as the visualization was launched (first two days). Several members made repeated visits of the visualization which shows that they were curious and exploring. Five members sent messages to other members using the visualization. However, after the second day June 22<sup>nd</sup>, 2010 the number of accesses to the visualization dropped to half and kept decreasing as the days went by.

Triggered by some informal comments by users to the forum's owner, we did two small changes in the visualization at the end of June. First, we reduced the speed of dancing of the nodes. Second, we increased the distance between the nodes giving a clearer view of user names and connections than the previous one, since there were fewer overlapping petals. However, it caused some disadvantage. As the distance between nodes increased, the sizes of the petals also increased. This feature is embedded in the algorithm for forced graph layout and beyond our control. This countered the new feature in the visualization to present the size of petals proportional to the number of messages exchanged. The only aspect in the visualization where the users could see a change resulting from their actions remained the sizes of the nodes, which were dependent on the number of posts submitted by the users.

Until June 28<sup>th</sup> the visualization was accessed by at least by one user each day; afterwards the visits dropped down close to zero.

Although the visualization had an impact only on the users' activity in the beginning when it was a novelty and the users were exploring it, we could see a few patterns in the way the

visualization changed reflecting activities by the members. One user sent a personal message to a user who had no connections at all. Another member who was in an unbalanced relationship, sent several private messages and attained a medium balanced category of relationship.

#### *6.4.2 Questionnaire Results*

Out of twenty nine (29) members, sixteen (16) agreed to the consent form but only ten (10) completed the questionnaire. When asked the question if the members were attached to the Vegatopia community or to the members in the community, five of them (5/10) said they were attached to the whole community. Only two (2/10) said that the visualization was attractive. Very few, three (3/10) of them understood its meaning. Half of the users (5/10) said they were curious to see their flower in the visualization. The majority of the users (7/10) said that they were satisfied about how their flower appeared in the visualization. None of the users indicated they were willing to do something to change their flower. To the question about the purpose of the visualization, majority of them (7/10) answered correctly. Some of their answers are as follows

*“At first it seems so far to be a nice "gadget" but I can imagine that the intention is a fun way to see the statistics?”*

*“Visual insight into who "many" who sends messages to”.*

*“To facilitate communication”, “to understand traffic flow and to contact member through private messages easily”.*

Only one (1/10) user answered positively to the question of whether the visualization drives a member to communicate with other members or to answer forum messages. Most of them answered negatively to the question if the visualization could be used as an awareness tool for the Vegatopia community but (3/10) felt it was useful to see other people's connections. One of the members indicated that he would not have anything to say to the other member who sent him a private message, and so the visualization might not be useful. One member was concerned about their exchange of private messages being displayed in the visualization. They said that the private messages were meant to be private and that is something that others should not see. As a general comment some of them found that the visualization was confusing and that the flowers moved too fast; and some said if there was a clear explanation for the visualization they would have understood much better.

Below are the answers that the users gave to the questions in the questionnaire, translated from Dutch.

Table 6.1: About visualization attractiveness

| <b>Question</b>        | Is the visualization attractive and appealing to you? |                   |           |
|------------------------|---|-------------------|-----------|
| <b>Answer</b>          | <b>Yes</b>  | <b>No opinion</b> | <b>No</b> |
| <b>Number of users</b> | 2   | 1                 | 6         |

Table 6.2: About the size and position of nodes

| <b>Question</b>        | Is it clear to you what the position and size of the nodes and petals mean? |           |
|------------------------|---|-----------|
| <b>Answer</b>          | <b>Yes</b>  | <b>No</b> |
| <b>Number of users</b> | 3   | 6         |

Table 6.3: About users interest to see their flower

|                        |   |           |
|------------------------|---|-----------|
| <b>Question</b>        | Were you interested to find your flower in the visualization? |           |
| <b>Answer</b>          | <b>Yes</b>  | <b>No</b> |
| <b>Number of users</b> | 5   | 4         |

Table 6.4: About users fondness of their flower

|                        |   |           |
|------------------------|---|-----------|
| <b>Questions</b>       | Do you like the way your flower appears in the visualization? |           |
| <b>Answer</b>          | <b>Yes</b>  | <b>No</b> |
| <b>Number of users</b> | 7   | 2         |

Table 6.5: Responses regarding the users' frequency of use of the visualization, attachment to the community, and to the questions related to the visualization's attractiveness and usefulness as awareness tool

| <b>Users</b> | <b>In this community do you feel attached to particular individuals or to the community as a whole</b>                 | <b>Is the visualization attractive and appealing</b> | <b>Did you feel that the visualization is useful to create awareness of the community?</b> |
|--------------|--|--|--|
| User 1       | <i>If there would be a lot of change in the way the community is built, it would have a (possibly negative) impact</i> | <i>No opinion</i>                                    | <i>No</i>  |
| User 2       | <i>There are always people with whom you feel more</i>   | <i>No</i>  | <i>One can see who exchanges personal messages with whom,</i>                              |

|        |   |                   |  |
|--------|---|-------------------|--|
|        | <p><i>connected than with others. I think the forum very diverse and one can find information about anything. I learedn a lot from it.</i></p>  |                   | <p><i>but not what they are talking about; so, in end effect, there's no real difference</i></p>   |
| User 3 | <p><i>The longer I am a member, the more I feel connected to other members. Interesting to see that in certain cases an 'online' friendship translates to an offline friendship as well</i></p>                                 | <p><i>Yes</i></p> | <p><i>Not for me. When I log in, I see who replied to me anyway and what messages have been posted. Sometimes I send a reply and sometimes not, depending on whether you have something useful to say.</i></p> |
| User 4 | <p><i>There are some people whom I have met via Vegatopia and with whom I feel particularly connected. But in general, it is the community feeling of Vegatopia and all information exchanged within the community that</i></p> | <p><i>Yes</i></p> | <p><i>Yes, one can see which people communicate with one another behind the scenes.</i></p>  |



|        |  |           |  |
|--------|--|-----------|--|
|        | <i>appeals to me. After all, that's our common denominator.</i>  |           |  |
| User 5 | <i>To particular members. People who I have known via the Internet or in real life: it's interesting to follow their ideas and activities.</i> | <i>No</i> | <i>I really don't see why it should be useful</i>  |
| User 6 | <i>Of course one has some preferences for certain members, but I feel connected with Vegatopia as a whole as well.</i>                         | <i>No</i> | <i>I have an issue regarding privacy: personal messages are meant to be personal - other people should not know with whom one exchanges personal messages. It's not a big deal to me, I kinda like it, but others might think consider this to be a problem.</i> |
| User 7 | <i>It feels good to be member of a community with certain shared values.</i>   | <i>No</i> | <i>No.</i>   |
| User 8 | <i>In general; I don't think there are many people</i>   | <i>No</i> | <i>No</i>  |

|         |   |           |                |
|---------|---|-----------|----------------|
|         | <i>who specifically value my contributions.</i> |           |                |
| User 9  | <i>No</i>                                       | <i>No</i> | <i>No</i>      |
| User 10 | <i>After all, it's still a part of my life.</i> | -         | <i>No Idea</i> |

Table 6.6: Responses regarding the users' understanding of the meaning and purpose of the visualization

| <b>Users</b> | <b>On seeing the visualization do you infer any meaning associated with the position and size of nodes and petals?</b> | <b>If yes please specify below</b>   | <b>What do you think the purpose of the visualization is?</b>   |
|--------------|--|--|---|
| User1        | <i>No</i>  | <i>(I answered no)</i>   | <i>To indicate the connections in a network</i>   |
| User2        | <i>yes</i>   | <i>Position: how more private messages you send, the more to the middle you will be. I don't really understand the size.</i> | <i>To show which private messages are sent between members</i>  |
| User3        | <i>Yes</i>   | <i>The number of sent/received messages, the members, the number of messages</i>   | <i>At first sight it just looks like a nice gimmick, but I can imagine that it's a more attractive way of visualizing statistics of the forum</i> |
| User4        | <i>No</i>  |  | <i>To depict graphically who sends how many</i>   |

|         |            |   |   |
|---------|------------|---|---|
|         |            |   | <i>messages to whom</i>   |
| User5   | <i>No</i>  |   | <i>I really have no clue</i>  |
| User6   | <i>No</i>  | <i>Not everything is clear to me.</i>   | <i>Insight in personal message exchange; easier to get into touch with one another via pms</i>  |
| User 7  | <i>Yes</i> | <i>Knots are a person, leaves are a representation of messages to another person; leaves touch one another if people exchange messages.</i> | <i>No Idea.</i>   |
| User 8  |            |   | <i>To foster communication between members.</i>   |
| User 9  |            |   | <i>No idea. I think it is meant to depict information graphically and I guess it will do so if one would take the time to get to understand the visualization, but for now I think it's just a 'visual thingie'</i> |
| User 10 |            |   | <i>I discussed it with other members, but sorry, I don't understand it.</i>   |

Table 6.7: Responses to the questions probing the motivational effect of the visualization

| Users | How would you like yourself to appear in the visualization?                         | Do you want to do something to the community to change the appearance of your flower? | If yes, please specify below <sup>2</sup>     |
|-------|---|---|---|
| User1 | <i>Readable, but I guess that's not the answer you were looking for</i>             | <i>No</i>   | <i>I answered No</i>                          |
| User2 | <i>No idea</i>  | <i>No</i>   |   |
| User3 | <i>No specific opinion</i>  | <i>No</i>   |   |
| User4 | <i>It's ok the way it is</i>  | <i>No</i>   |   |
| User5 | <i>No idea what the visualization means, so no opinion about my position either</i> | <i>No</i>   |   |
| User6 | <i>As it appears now</i>  | <i>No</i>   | <i>It looks pretty appealing, doesn't it?</i> |
| User7 | <i>Not</i>  | <i>No</i>   |   |

|        |             |  |           |
|--------|-------------|--|-----------|
| User 8 | <i>Not.</i> |  | <i>No</i> |
|--------|-------------|--|-----------|

Table 6.8: Responses to the questions gauging the users opinion of the visualization’s motivational effect.

| <b>Users</b> | <b>Do you think this visualization would motivate you to contribute more?</b> | <b>If you answered 'yes' to the above question, could you specify what you would be motivate to do</b> |
|--------------|---|--|
| Users 1      | <i>No</i>   | <i>(I answered no)</i>   |
| User2        | <i>No opinion</i>   | -  |
| User3        | <i>No</i>   | <i>N.A.</i>  |
| User4        | <i>No</i>   | <i>N.A.</i>  |
| User5        | <i>No</i>   | <i>N.A.</i>  |
| User6        | <i>Yes</i>  | <i>A nice thing to play with, perhaps it has an impact if one really exchanges messages.</i>           |
| User7        | <i>No</i>   | <i>On the contrary: see Question 15</i>  |

Table 6.9: Responses to the question “Do you have any further comments or suggestions?”

|       |  |
|-------|--|
| User1 | <i>It was the first that I felt I am too old for an internet application. I got a headache because of the continuous movement and I couldn't read the text</i> |
| User2 | <i>I don't know whether I really understand the meaning if the visualization, I only played around with it a couple of times.</i>                              |

|       |   |
|-------|---|
| User3 | <i>No.</i>  |
| User4 | <i>No.</i>  |
| User5 | <i>I am not too digitally savvy to understand it, so I would have appreciated some more explanation</i>   |
| User6 | <i>It's quite messy. A bit unorderly, the flowers move too fast, and the leaves are hard to select</i>  |
| User7 | <i>I think the visualization violates my privacy: private messages are private, not just the contents, but also to whom you send the messages. Privacy is disturbed by the visualization.</i> |
| User8 | <i>No.</i>  |

## 6.5 Discussion

The answers to the questionnaire indicate that most of the users felt a strong attachment either to particular members of the community or to the community as a whole. Four people indicated that they have strong relationships with other members, some of which have even grown into real-life friendships. Also 4 people indicated that they felt connected with the community as a whole. These two groups overlap: there were two users who said they were attached both to particular members and the entire community. So Vegatopia seems to be one of the very few examples reported in literature (Kraut & Kiesler, 2007) of active communities which are both common-bond and common-identity based.

However, despite the availability of a legend and explanation that were visible all the time, it seems that the meaning of visualization and its individual elements was not clearly

understood by the users. While 6 of the 10 people who answered the questionnaire generally understood the meaning of the visualization, a significant proportion of the users (4) stated that didn't understand its meaning at all. One stated that they still had no clue, even after discussing it with other members. It seems that the colour of the petals was not understood as an element of the visual language, i.e. the users did not associate any meaning with it; therefore they could not observe the "balance" or their relationships. The users seemed to be mostly focused on the size of the petals and flowers.

Based on the results obtained both from the user action logs and the questionnaire, we can conclude that while the introduction of the visualization generated temporarily some interest and activities, (including private messages that it was designed to encourage), it did not motivate the users to send more private messages. After the first few days while the visualization was still a novelty, the activity level dropped down to its usual value of 1 access per day and occasional private messages exchanged when necessary. The comments that the users provided in their answers to the questionnaire clearly show that they didn't perceive any motivational effect from the visualization. Only one user perceived that there was some additional value from the visualization seeing that some people interact behind the scenes. Users who understood the meaning and purpose of the visualization stated that they wouldn't send more private messages unless they have something to say, which depends on the topics posted and the discourse of the forum, and not at all on the visualization. One member raised privacy concerns, stating that even though no private messages are shown, visualizing the fact that some people exchange private messages can be considered as a disturbing the privacy of private messages.

So all in all, this visualization did not serve any motivational role in the well-established and active community of Vegatopia, in which users are united both by common bond and

common identity. This study raises questions if there is a community at all, where this approach can successfully motivate reciprocity in term of responses. This study also puts in question the numerous design decisions involved in the creation of the visualization. Finally, it puts in question the theoretical foundation of the approach - whether the combination of emphasizing social bond, reciprocation and at the same time, social comparison can be used for encouraging participation. These questions will be discussed in the final chapter of the thesis.



## CHAPTER 7

### DISCUSSION AND CONCLUSIONS

This thesis proposed to use a social visualization based on several theories of motivation to stimulate responses in an online community. A specific visualization was designed to motivate users in coherence with the theories of social psychology, organizational sciences and behavioural economics.

#### **7.1 Summary**

The proposed motivational social visualization is based on the hypothesis that visualizing reciprocal relationships among users in an online community as petals of flowers pointing to each other will encourage common bond and reciprocity in an online community. The possibility to grow more, larger and more beautiful petals in the visualization by sending comments and messages to other users, will allow them to experience self-efficacy. Through more participation users “grow” their flowers and engage in social comparison with other users. It was expected that all of these psychological and social processes will ultimately lead to increase in participation in terms of responses and comments among users.

A prototypical implementation of the flower-garden visualization was designed with Flex, which runs on a server and uses data about user interactions from a database. The implementation is generic, i.e. it can be used to visualize the various communities where users engage in 1-to-1 interactions – discussion forums, chat rooms, blogs, social networking sites, or even groups connected through email. Data about user interactions is normally kept by all online communities, and it is the only data needed to feed in the visualization.

Four user studies were conducted to evaluate the hypothesis: one pilot study with students in the lab, one real-user study in the WISETales community, another – in a class-support discussion forum called IHelp and a fourth one – in well-established and active forum for vegetarians in the Netherlands. While each study ended up with few users giving consent and answering the questionnaire, in total there were 29 users from the pilot, WISETales, I-Help and Vegatopia, who used the visualization and filled different but overlapping versions the questionnaire. The results across all of the studies for the common, most important questions in the questionnaire are shown in Table 7.1. Please, note that the total number of answers do not always sum up to 32 for each question, since some users skipped some of the questions in some of the studies. For example, question 3) was not answered by 2 users from the pilot study, and 2 users from the Vegatopia study. If not providing an answer to a question is considered “neutral”, one can count the percentage of positive and negative answers to the questions out of the total number of participants across the four studies (32).

Table 7.1 Overall analyses of the results (N=29 users).

| <b>Question</b>  | <b>Yes</b> | <b>No</b> | <b>Neutral</b> |
|--|------------|-----------|----------------|
| 1) Were you interested to find your flower in the visualization? |            |           |                |
| Pilot (6)  | 3          | 3         | 0              |
| Wisetales (8)  | 5          | 3         | 0              |
| I-Help(8)  | 3          | 5         | 0              |
| Vegatopia (10)   | 5          | 4         | 0              |
| Total  | 16         | 15        | 0              |
| % of 32  | 0.5        | 0.47      | 0              |

| <b>Question</b>  | <b>Yes</b> | <b>No</b> | <b>Neutral</b> |
|--|------------|-----------|----------------|
| 2) Do you want to do something to the community to change the appearance of your flower? |            |           |                |
| Pilot (6)  | 0          | 5         | 0              |
| Wisetales (8)  | 2          | 6         | 0              |
| I-Help(8 )   | 2          | 6         | 0              |
| Vegatopia (10)   | 0          | 7         | 2              |
| Total  | 4          | 24        | 2              |
| % of 32  | 0.13       | 0.75      | 0.06           |
| 3) Do you like the way your flower appears in the visualization?                         |            |           |                |
| Pilot (6)  | 4          | 0         | 0              |
| Wisetales (8)  | 4          | 4         | 0              |
| I-Help(8 )   | 3          | 5         | 0              |
| Vegatopia (10)   | 3          | 5         | 0              |
| Total  | 14         | 14        | 0              |
| % of 32  | 0.44       | 0.44      | 0              |
| 4) Do you think this visualization would motivate you to contribute more?                |            |           |                |
| Pilot (6)  | 1          | 1         | 4              |
| Wisetales (8)  | 4          | 2         | 2              |
| I-Help(8 )   | 2          | 5         | 1              |
| Vegatopia (10)   | 1          | 5         | 1              |
| Total  | 8          | 13        | 8              |
| % of 32  | 0.25       | 0.406     | 0.25           |

From the above table 7.1 it is clear that the users across all studies were split on the nearly equally between being and not being interested to see their flower in the visualization. The majority of the users (nearly 75%) did not want to do anything in the community to change or grow their flower. The users were equally split between “yes” and “no” on the question if they liked the way the flower appeared to them in the visualization – 44% liked it and 44% did not. The results for the question about the motivational effect of the visualization were mostly negative. Only 25% thought that the visualization would motivate them to contribute more.

Fourty percent (40%) of the users, users said they would not be motivated, and the remaining users (25%) were 'neutral' (35% if we count the missing answers as "neutral").

## **7.2 Conclusions**

Unfortunately, the hypothesis was not confirmed in any of the three online communities in which the visualization was evaluated. Though the results from the pilot study and the WISETales evaluation were somewhat encouraging, it is possible that they were due to the small sample of users, and the fact that most of the users were personal acquaintances, who didn't want to give discouraging answers.

The expectations that the visualization of the asymmetry of relationships will stimulate social norms or reciprocation, and social bond were not met. While we saw some possible evidence of self-efficacy demonstrated in the occasional answers of users that they liked their flowers and would like to change their flower to look better, it was clear from their answers that the effect of the visualization was not as strong as needed to drive them to action, even in the case when it was very easy to perform these actions (For example, in Vegatopia, the users were able to send private messages by just clicking on the flower of the user they wanted to address it to).

From the experience with the four studies, the conclusion is that the visualization was not motivational in any way, and that the hypothesis was not supported. This finding could be due to three possible principle reasons:

-The communities in which the visualization was evaluated were not appropriately selected.

- The visualization approach was not executed well:
- The metaphor of the visualization was not motivational
- The graphical language was too complex or inappropriate
- A combination of small design decisions that were made in each study of the visualization was inappropriate and this hampered the motivation effect
- The integration of the visualization into the respective community was not done appropriately.
- The theoretical background is faulty.

These four possible reasons will be discussed separately in the next section.

### **7.3 Discussion**

#### *7.3.1 The communities in which the visualization was evaluated were not appropriately selected*

The initially chosen community, WISETales, was expected to be social identity based, therefore it looked like a good candidate to target in motivating social bond, and building relationships between users, based on comments of stories. In addition, there weren't many comments in the community, and motivating users to comment was a real need. Unfortunately, by the time the visualization was developed, the activities in the community nearly seized due to the departure of the community creator and most active user (Zina Sahib, who completed her M.Sc thesis in August 2009). The evaluation was based on a too small number of users (8) and half of them were not members of the community, but viewed the visualization only to take part in the study. All of the users were personally acquainted with Dr. Vassileva, and this influence may have biased their responses in a positive direction. Therefore, based on this data, it was not possible to make any conclusions, but overall the results did not support the hypothesis.

It wasn't easy to find an active community which would allow us to incorporate the visualization. It took quite a lot of negotiation and time, and there was a lot of uncertainty if it would be indeed possible. Therefore two communities were targeted simultaneously: IHelp and Vegatopia. IHelp was the only available active local community. Unfortunately, IHelp turned out to be not suitable, since it wasn't a "real" community, but just a way for students to ask questions of the instructor. The students were not engaged in building any bonds and did not feel any attachment to the group as a whole. They were extremely time-pressured, and their online interactions were strictly utility driven- i.e., to receive answers by the teacher. It is possible that if the visualization was applied in IHelp during the regular term, when students were not under such time pressure and in classes where the instructors encouraged discussion among the students rather than use the system as a broadcast tool to answer student questions, more positive results would have been obtained. However, there is no way to know without trying it out. In addition, the way the visualization was integrated in the interface was flawed (it took too much space). This space occupation by the visualization explains the strong negative response to the visualization received in this study. Therefore based on these results, one can't invalidate the design of the visualization per se, or its theoretical foundations.

Vegatopia, on the other side, was an active, interest-based, long-term community, driven by both social identity and social bond. Our collaborators in Germany ensured access to log data and the implementation integrated the visualization tightly in the forum, so that users could perform direct actions (sending private messages) through the visualization. Nevertheless, the results clearly showed that there was no motivational effect of the visualization on the subjects of the study, both on those who did understand its meaning and purpose and those who didn't. The

user's responses indicated that they would send direct messages if the discussion requires it, or if they have some other reasons, but not to grow petals or change the colours of their petals.

It is possible that the users were already accustomed to sending private messages to each other since they knew each other, had established bonds; therefore the visualization didn't do much to change these relationships but just showed what they knew already. Those few users who had strong bonds had already exchanged a lot of messages; they knew each other well, and responded to each other when appropriate. Even when there was an imbalance of 5-6 messages, it was minor considering that 50 or 60 messages were exchanged between the users. Of the other users, who were mostly driven by attachment to the community (common identity), and who occasionally sent private messages to each other, most of the relationships were in fact balanced too, with an imbalance of just 1. Therefore, in this community the target behaviour that the visualization aimed to encourage was already achieved. People were already reciprocating with each other, only at different levels, depending on their own main motivation for using the community (common bond or common identity).

From the results it seems that all three communities were not the right choices for evaluating the visualization: in WISETales - due to the low level of basic activity it was impossible to show convincingly any effect; in IHelp - due to the nature of the community it would be impossible to achieve the desired behaviour; and Vegatopia – because in this community, the desired goal was already achieved.

It is very hard to generalize from the experience in the three communities and the pilot study what might be the features characterising a community where this approach has a chance to succeed. As stated in the introduction, communities differ along many dimensions. The

communities that were selected for the evaluation of the flower visualization were very different from each other across various dimensions:

WISETales was a leisure community build with the purpose to further a social cause (advancing women in science and engineering) for sharing and discussing experiences. It was intended to be long-lived and was still in an early phase of its lifetime (building its pool of active contributors and lurkers). However, the level of activity in the community was very low.

IHelp is a work-related community (or study-related) for the purpose of providing forum for asking class-related questions and finding answers. While the system has been around for almost 10 years, each class community is short lived (for the duration of the class). The level of activity varies depending on the dynamics established by the students and course-instructor. The experiment covered the entire life-span of the community, but the level of activity was low and the pattern of interaction – very limited.

Vegatopia is a leisure community, build with the purpose of sharing common interest in sharing vegetarian recipes. It is long-lived, and the experiment happened in the maturity phase of its life-span. The levels of activity were long established, the relationships among users - already built.

While the evaluation of the visualization in each of these communities failed to show positive effect on the users' motivation for reciprocation, it seems that the type of community that was originally envisaged as a target for the visualization, WISETales, is still the most suitable community for this approach.

A community that is long-term, leisure, common interest-based, or common-cause based, and that is in an early phase of its life-cycle, but with sufficient level of attraction to its members (they contribute since they feel attached to the purpose of the community, or by common



identity), would be suitable, since the visualization can help to encourage the development of common bond, and personal relationships between users. Ideally, WISETales would have been such a community, if only women in science and engineering were less busy and more willing to contribute personal stories. To find another third party community of this kind that would allow using their access logs, and agree to incorporate the visualization in their interface would hard. Yet, it is worth trying, if the WISETales community lives through a renaissance some day.

A useful lesson that was learned is recruiting participants is a very hard. Though in the first two studies there were no incentives for participation, 7 or 8 participants filled the questionnaire each time. In the last two studies quite significant incentives were provided and yet there was nearly the same number of participants. It seems that incentives don't help really in the recruitment of participants anymore. Possibly users are fatigued with questionnaires.

### *7.3.2 The visualization design was flawed*

The metaphor may have been inappropriate. Another possible reason for the negative results is the choice of the visualization metaphor. This metaphor was chosen first for its visual appeal, second, since it provides users with the stage to “grow” their own flowers and engage in social comparison, and finally since the target community was WISETales, the community of women in Science and Engineering, and our intuition that women are more likely to like gardening. It was also expected that this metaphor will be suitable for the Vegatopia community. From the responses of the users, it seems that the users in both of these communities liked the idea, and found the visualization appealing. Yet, the metaphor was not exploited fully. In fact the visualization looked more like a flower-printed material than like a real garden. To exploit better

the metaphor, the flowers could have been arranged in different sections of the garden based on their relationships to each other, perhaps using proximity to show semantic relationships between the topics discussed. The random positioning of flowers did not really fit a garden metaphor, but more that of a wild meadow, which does not suggest to the user that they need to put work in gardening, or improving the layout of the garden. In fact several users in Vegatopia understood the purpose of the visualization as a pretty way of displaying community statistics, rather than to motivate users to do something.

It is possible that the visualization metaphor also did not communicate clearly what is a desirable state for a user to be in. A flower garden is a complex scene, with many objects, and features. The complexity of the picture makes it hard to comprehend (as seen by the results in all studies) and the motivational effect is lost. The graphical language was too complex.

It included the size of the nodes (representing the number of contributions of users), the size of the petals among the nodes (the number of exchanged messages), the colour of the petals (the balance of the relationship, if the user is on the “owing” or “giving” side). In addition, each node showed the name of the user, and on mouse over, a box showed statistics about the user. Possibly there was too much information that was overwhelming for the users and didn’t send a clear message of what they could do. The visualization could have been simpler representing arrows instead of petals (but then the metaphor of a flower garden wouldn’t have been kept and the visual attractiveness would have been lost).

Another disadvantage of the graphical language is that it did not provide a clear gradient of “goodness”. The design decision to use different colours to represent the balance or imbalance of relationships may have been wrong. Our motivation was to enhance the self-efficacy in building one’s own flower, by trying to achieve petals of beautiful colour. But

people's tastes of beautiful colours differ immensely based on culture, gender, and personal preference. Coming up with a fixed set of colours that every user would find likable or unlikeable is impossible in principle. A lot of time was wasted in choosing the colours according to stereotypical ideas of what women and men might like, until the last two designs basically used an ad hoc palette of 5 colours representing balanced relationships and the two different levels of imbalance in the relationships, with the two signs of imbalance (giving and owing). In retrospect, having only two categories - reciprocal and non reciprocal relationship - visualized with just two contrasting colours, as was done in the pilot study and in WISETales, was probably a better solution than having three colours. It seemed that the users ignored the colours entirely, since there were no comments by users in any of the studies that related to colours.

### *7.3.3 The implementation was not good enough*

The choice of using force layout algorithm as a basis for the visualization lead to many constraints and difficulties especially in the first two versions (the pilot study and WISETales). Being unable of controlling the distance between the flowers or the size of the petals made it very hard to create a stage for social comparison, since the position of flowers was random, and the distance between them (also random) defined the size of the petals. This implementation could have also limited the motivational power of the visualization in all of the studies

The elastic bouncing of the flowers in the visualization was introduced to increase its attractiveness and interestingness, to emphasize the feeling of dynamics of the community. As some users commented, this visualization had a dizzying effect and made it harder to read the visualization and find particular nodes and petals.

Since the visualization was updated only once a day in all studies except Vegatopia, the users could not see their actions resulting immediately into growing petals. According to some theories of motivation (Skinner's reinforcement theory), immediate feedback is essential to encourage certain behaviours.

#### *7.3.4 The theoretical foundation is faulty.*

Finally, the reason for the negative results may be that it is not productive to combine social comparison and self-efficacy, on one side, with reciprocation and social bond, on the other side, in the same motivational tool. While previous research has demonstrated that it is possible to create quite effective social visualizations motivating participation in online communities based on social comparison (Sun & Vassileva, 2007, 2008), (Farzan et al., 2008) and on reciprocation (Webster & Vassileva, 2006), perhaps there is something in the underlying psychological mechanisms that makes them cancel each other in combination. Of course, a lot more research is needed to be able to say this with any certainty.

### **7.4 Lessons Learned for the Future**

Generally, motivating people to behave in particular way is a very difficult task. It involves understanding the underlying psychological mechanisms and the purposes for which the users of particular communities participate in general. It also involves the design of interventions based on the theoretical foundation that are meaningful and useful for the users. Finally, it involves the design of computational systems that truly implement the intention of the chosen

interventions, and are attractive, understandable, usable and able to create feelings of achievement and satisfaction in the users. There are uncountable ways in which one can fail at each of these stages and numerous concurrent design decisions.

One conclusion to draw for future work is to adapt the methodology and include incremental, layered small evaluations at each stage, starting from the intervention design (in our case the visualization metaphor) to make sure one is building on a solid foundation before investing much effort in the next level.

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## APPENDICES

## Appendix A – Pilot Study for the Visualization Materials & Methods

### **i. Evaluation Plan:**

#### **• Goal(s) of evaluation:**

1. Do users find this visualization easy to understand and use?
2. Can the users interact with the visualization easily?
3. Can the users interpret the elements and features of the visualization easily?
3. Do users understand the purpose of the visualization?
4. What do the users think about the visualization?

#### **• Rationale for type of evaluation:**

The evaluation method that is used for this purpose is Questionnaire with multiple choice answers.

#### **• Participant pool**

I had about 5 female and male participants for this study. The target participants' pool includes female graduate students from various departments at the University of Saskatchewan. I directly met them individually and provided them with a questionnaire and the visualization was shown on their respective systems as it ran on a server.

#### **• Brief overview of evaluation protocol**

A. I estimate the study time to be 10-15 minutes as follows:

- Brief introduction and overview of study process (1 minute)
- Participants explore the visualization and interact with it.(5 minutes)
- Participants answer a the questionnaire (15 minutes)

B. The location of the evaluation will be either at the participant's cubicle / office.

C. I was with the participant throughout the time of study, first to observe how they are interacting with the visualization and then to hand in a printed questionnaire once they are familiar with the features of the visualization and then to clarify the doubts raised by the participants about the visualization.

## Appendix B – Case Study for WISETales

### Scenario

1. Visit: [wisetales.usask.ca](http://wisetales.usask.ca) and click on the Social Visualization image
2. Observe and interact with the visualization and its features like clicking on a node or hovering over an edge.
3. Click on help button if you don't understand the visualization clearly.
4. Click on the survey link to take the survey
5. Close the survey and logout.

## Appendix C – Case Study for WISETales-Consent Form



### DEPARTMENT OF COMPUTER SCIENCE UNIVERSITY OF SASKATCHEWAN

You are invited to participate in a study entitled "Evaluation of Motivation Visualization Effect on Participation in WISETales."

Please read this form carefully, and feel free to ask the researchers any questions you might have.

Researchers: Julita Vassileva, Department of Computer Science (966-2073), [jiv@cs.usask.ca](mailto:jiv@cs.usask.ca) Kadhambari Raghavun, Department of Computer Science

The purpose of the study is to evaluate the understandability and motivational effect of a social visualization applied to the WISETales community. The estimate of the total time to participate in this study is 30 minutes. There are no known risks in this study.

You will be invited to visit and use the WISETales community, which allows women in science and engineering to share stories of personal experiences from their study or work. You visit from time to time the motivational visualization (accessible by clicking on a link off the WISETales site), and then you fill a questionnaire about your experience with the visualization.

The research data is stored anonymously by the University of Saskatchewan survey tool and it cannot be linked to your id. It will be stored on a password-protected computer system and will be available only to the researchers. Pseudonyms (alias) will be used to refer to the participants. Any information that could be potentially linked to a specific participant will be removed or altered. The data will be kept by the researchers for a minimum of five years upon the completion of this study in a secure storage. Aggregate results will be used in a M.Sc. thesis and articles published in peer reviewed conferences and scientific journals.

Your participation is voluntary, and you may withdraw from the study for any reason, at any time, without penalty of any sort. You may refuse to answer individual questions. If you withdraw from the study, any data that you have contributed will be destroyed.

If you have any questions concerning the study, please feel free to ask at any point; you are also free to contact the researchers if you have questions at a later time. This study has been approved on ethical grounds by the University of Saskatchewan Behavioural Research Ethics Board on (insert date). Any questions regarding your rights as a participant may be addressed to that committee through the Ethics

Office (966-2084). Out of town participants may call collect. You may find out about the results of the study through the MADMUC website (<http://madmuc.usask.ca>) or by contacting the researchers.

I have read and understood the description provided above; I have been provided with an opportunity to ask questions and my questions have been answered satisfactorily. I consent to participate in the study described above, understanding that I may withdraw this consent at any time. A copy of this consent form has been given to me for my records.

- Agree
- Disagree

Quit - Do not save answers

Next Page >>



**Preview of Survey: Visualizing Reciprocity in an Online Community to Motivate Participation**

Page 2 of 3

2. **[Required]** How do you like the visualization background colour?

- bad
- neutral
- good

3. Any suggestions for background colour?

A text input field with a scroll bar on the right and a scroll bar at the bottom. The field is empty. To the right of the field, the text "(4000 chars max)" is displayed.

4. **[Required]** How do you like the colour of nodes ? (yellow for active members and brown for inactive members)

- bad
- neutral
- good

5. What colour would you suggest for the nodes?

A text input field with a scroll bar on the right and a scroll bar at the bottom. The field is empty. To the right of the field, the text "(4000 chars max)" is displayed.

6. **[Required]** How do you like the colour of petals ? (Purple for reciprocal relationships, pink for receiving comments and orange for giving comments)

- bad
- neutral

- good

7. Do you have any other suggestions for petal colours?



(4000 chars max)

8. **[Required]** How do you like the colour of text?

- bad
- neutral
- good

9. Any suggestions for text colour?



(4000 chars max)

10. **[Required]** How do you like the search box colour?

- bad
- neutral
- good

11. Any suggestions for search box colour?



(4000 chars max)

12. **[Required]** How do you like the Legend colour

- bad
- neutral
- good

13. Any suggestions about Legend colour?



(4000 chars max)

14. **[Required]** How do you like the "+" (Zoom in) and "-" (Zoom out) button colour?

- bad
- neutral
- good

15. Any suggestions for zoom button colour?



(4000 chars max)

16. **[Required]** How do you like the "+" (Zoom in) and "-" (Zoom out) button size?

- bad
- neutral
- good

17. Any suggestions for zoom button size?



(4000 chars max)

18. **[Required]** How do you like the size of font?

- bad
- neutral
- good

19. Any suggestions for font size?





(4000 chars max)

20. **[Required]** How do you like the search box size?

- bad
- neutral
- good

21. Any suggestions about the search box size?



(4000 chars max)

22. **[Required]** How do you like the size of Legend?

- bad
- neutral
- good

23. Any suggestions about the size of Legend?



(4000 chars max)

24. **[Required]** How do you like the click and drag of nodes?

- bad
- neutral
- good

25. Any suggestions about the dragging of nodes?



(4000 chars max)

26. **[Required]** How do you like the panning of Visualization (moving the visualization around by dragging it)

- bad
- neutral
- good

27. Any suggestions about the panning of visualization?



(4000 chars max)

28. **[Required]** How do you like the effect of zooming in and out the visualization?

- bad
- neutral
- good

29. Any suggestions about the zooming effect of the visualization?



(4000 chars max)

30. **[Required]** How do you like the Keyword search-usability?

- bad
- neutral
- good

31. Any suggestions about the Keyword search - usability?



(4000 chars max)

32. **[Required]** How do you like the Keyword search-usefulness?

- bad
- neutral
- good

33. Any suggestions about the keyword search-usefulness?



(4000 chars max)

34. **[Required]** How do you find a short freezing effect of nodes after dragging or clicking a node?

- bad
- neutral
- good

35. Any suggestions for freezing effect of nodes?



(4000 chars max)

Page 3 of 3

36. **[Required]** Is the visualization attractive and appealing to you?

- Yes
- Don't Know
- No

37. **[Required]** is dancing of nodes annoying

- Yes
- Don't Know
- No


38. **[Required]** Will you be happy to see your flower in the visualization?

- Yes
- Don't Know
- No

39. **[Required]** On seeing the visualization do you infer any meaning associated with the position and size of nodes and petals?

- Yes
- No

40. **[Required]** If yes, please specify what meaning do you infer?



(4000 chars max)

41. **[Required]** Do you understand the meaning of different elements of the visualization

- Yes
- No

42. **[Required]** if yes, please specify the meaning below



(4000 chars max)

43. **[Required]** Were you interested to find your flower in the visualization?

- Yes
- No

44. **[Required]** Do you like the way your flower appears in the visualization?

- Yes
- No

45. **[Required]** Do you want to do something to the community to change the appearance of your flower?

- Yes
- No

46. **[Required]** If yes, please specify what do you want to do to the community to change the appearance of your flower?



(4000 chars max)

47. **[Required]** What do you think the purpose of the visualization is?



(4000 chars max)

48. **[Required]** How would you like yourself to appear in a community visualization?



(4000 chars max)

49. **[Required]** In this community do you feel attached to particular individuals or to the community as a whole?

- to particular individual
- to the community as a whole
- both
- neither of the two

50. Could you explain why?



(4000 chars max)

51. **[Required]** If the visualization was implemented in other communities like Facebook, a discussion forum or a blog, would you view it often?

- Yes
- Don't Know
- No

52. **[Required]** Do you think this visualization would motivate you to contribute more? e.g. "interact more with the community members or content" or "comment/respond"?

- Yes
- Don't Know
- No

53. **[Required]** Do you have any further comments or suggestions about the visualization?



(4000 chars max)

54. **[Required]** Do you have an account in WISETAles?

- Yes
- No

55. If you answered "yes" to the above question, How many different accounts do you have?

- 1
- 2
- 3
- 4

- 5
- 6

56. (optional) My username(s)

  
(4000 chars max)

57. **[Required]** Email address

  
(255 chars max)

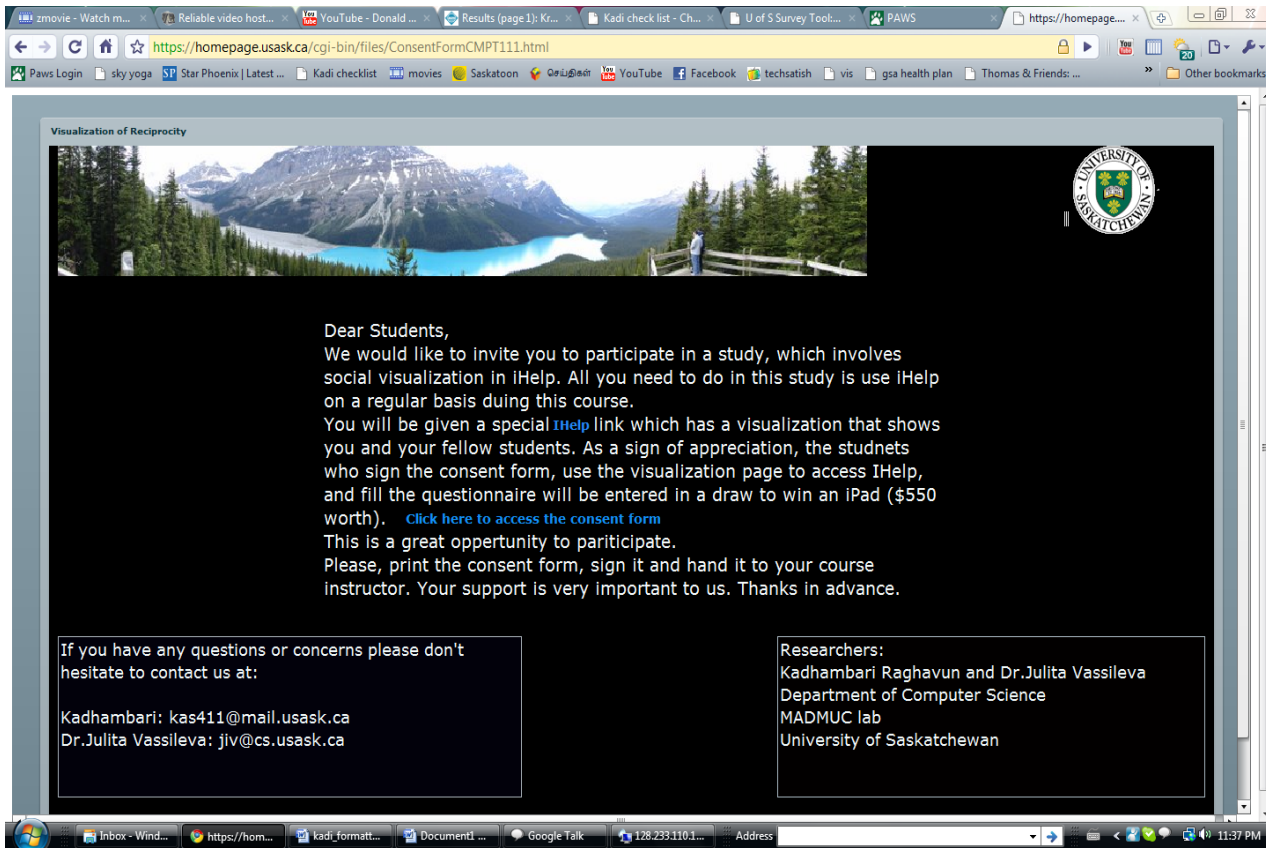
## Appendix E– Evaluation in I-Help CMPT 111 and CMPT 214

### Scenario


1. Visit: <http://homepage.usask.ca/~kas411/kadi111.html> and <http://homepage.usask.ca/~kas411/kadi214.html>
2. Observe and interact with the visualization and its features like clicking or hovering on a node or hovering over an edge.
3. Read IHelp posting related to classes on the lower bottom of the screen.



## Appendix F- I-Help Consent Form



Visualization of Reciprocity



Dear Students,

We would like to invite you to participate in a study, which involves social visualization in iHelp. All you need to do in this study is use iHelp on a regular basis during this course.

You will be given a special [iHelp](#) link which has a visualization that shows you and your fellow students. As a sign of appreciation, the students who sign the consent form, use the visualization page to access iHelp, and fill the questionnaire will be entered in a draw to win an iPad (\$550 worth). [Click here to access the consent form](#)

This is a great opportunity to participate.

Please, print the consent form, sign it and hand it to your course instructor. Your support is very important to us. Thanks in advance.

If you have any questions or concerns please don't hesitate to contact us at:

Kadhambari: kas411@mail.usask.ca  
Dr. Julita Vassileva: jiv@cs.usask.ca

Researchers:  
Kadhambari Raghavun and Dr. Julita Vassileva  
Department of Computer Science  
MADMUC lab  
University of Saskatchewan

You are invited to participate in a study entitled "Evaluation of Motivation visualization Effect on Participation in iHelp". Please read this form carefully, and feel free to ask the researchers any questions you might have. Researchers: Kadhambari Raghavun, Department of Computer Science (9662072) kas411@mail.usask.ca, Julita Vassileva, Department of Computer Science (966-2073), jiv@cs.usask.ca. The purpose of the study is to evaluate the understandability and motivational effect of a social visualization applied to the iHelp discussions. The estimate of the total time to participate in this study is 4 weeks. There are no known risks in this study. You will be invited to use a new starting page for I-Help which includes a community visualization. You will use I-Help as usual to discuss questions related to your class(es). In the end you will be invited to fill a questionnaire about your experience with the visualization.

As a token of appreciation for your time to participate in this study, **you will be entered in a draw to win an iPad (\$550 worth)**. To participate in the draw, you have to:

- 1) Sign and hand the consent form to your instructor,
- 2) Access iHelp through the URL that would be provided to you (that includes the visualization) and
- 3) Answer the online questionnaire with approx. 20 questions about your experience with the visualization in the end.

We will collect data about your activity on I-Help (number of posts) and your access of the visualization. The research data will be anonymized immediately after the draw for the prize at the end of the experiment. It will be available only to the researchers. Pseudonyms (alias) will be used to refer to the participants. Any information that could be potentially linked to a specific participant will be removed or altered. The data will be kept by the researchers for a minimum of five years upon the completion of this study in a secure storage. Aggregate results will be used in a M.Sc. thesis and articles published in peer reviewed conferences and scientific journals. Your participation is voluntary, and you may withdraw from the study for any reason, at any time, without penalty of any sort. You may refuse to answer individual questions. If you have any questions concerning the study, please feel free to contact the researchers at any point during or after the experiment.

This study has been approved on ethical grounds by the University of Saskatchewan Behavioural Research Ethics Board with certificate 08-143 on (July 17 2009). Any questions regarding your rights as a participant may be addressed to that committee through the Ethics Office (966-2084). You may find out about the results of the study through the MADMUC website (<http://madmuc.usask.ca>) or by contacting the researchers.

I have read and understood the description provided above; I have been provided with an opportunity to ask questions and my questions have been answered satisfactorily. I give the consent to participate in the study described above, understanding that I may withdraw this consent at any time. A copy of this consent form has been given to me for my records.

Signed:

Date:

Class:

## Appendix G – IHelp Questionnaire



UNIVERSITY OF  
SASKATCHEWAN

### Preview of Survey: Visualizing Reciprocity in an Online Community to Motivate Participation

Page 1 of 1

1. **[Required]** Is the visualization attractive and appealing to you?

- Yes
- Don't Know
- No

2. **[Required]** Did you feel happy to see your flower in the visualization?

- Yes
- Don't Know
- No

3. **[Required]** On seeing the visualization do you infer any meaning associated with the position and size of nodes and petals?

- Yes
- No

4. If yes, please specify what meaning do you infer?

(4000 chars max)

5. **[Required]** Do you understand the meaning of different elements of the visualization?

- Yes
- No

6. if yes, please specify the meaning below



(4000 chars max)

7. **[Required]** Were you interested to find your flower in the visualization?

- Yes
- No


8. **[Required]** Do you like the way your flower appears in the visualization?

- Yes
- No

9. **[Required]** Do you want to do something to the community to change the appearance of your flower?


- Yes
- No

10. If yes, please specify what do you want to do to the community to change the appearance of your flower?



(4000 chars max)

11. **[Required]** What do you think the purpose of the visualization is?



(4000 chars max)

12. **[Required]** How would you like yourself to appear in a

community visualization?



(4000 chars max)

13. **[Required]** In this community do you feel attached to particular individuals or to the community as a whole?

- to the individuals in the community
- to the community as a whole
- neither attached to the individuals nor to the community

14. Could you explain why?




(4000 chars max)

15. **[Required]** Do you think this visualization would motivate you to contribute more? e.g. "interact more with the community members or content" or "comment/respond"?

- Yes
- Don't Know
- No

16. If you answered 'yes' to the above question, could you specify what you would be motivated to do?



(4000 chars max)

17. **[Required]** Did you feel that the visualization is useful to create awareness of the community?

 (4000 chars max)

18. **[Required]** Approximately what % of time did you access the iHelp with the visualization provided compared to the standard iHelp website?

- All the time with visualization
- Approx 80% with visualization
- Approx 60% with visualization
- Approx 40% with visualization
- Approx 20% with visualization
- Accessed the standard iHelp all the time

19. Do you have any further comments or suggestions?

 (4000 chars max)

20. **[Required]** Please provide your first name and NSID for the draw.

(255 chars max)

Quit - Do not save answers

Finish

## Appendix H- Vegatopia scenario

### Scenario

1. Visit: <http://www.vegatopia.com/smf/vegatopia.swf>
2. Observe and interact with the visualization and its features like clicking or hovering on a node or hovering over an edge.
3. Send private messages to respective members using double click on the node of the visualization.

.

## Appendix I – Vegatopia Consent Form

1. [verplicht] Je bent uitgenodigd om deel te nemen aan een vragenlijst over de effecten van visualisatie op je activiteiten in Vegatopia. Op deze pagina vind je meer informatie over de vragenlijst. Als je vragen hebt, neem dan contact op met de onderzoekers:

- Kadhambari Raghavun (kas411@mail.usask.ca)
- Julita Vassileva (jiv@cs.usask.ca)
- Eelco Herder (herder@l3s.de)

Met deze vragenlijst willen we evalueren hoe begrijpelijk de visualisatie van de Vegatopia community voor jou is en of de visualisatie jouw activiteiten op Vegatopia heeft beïnvloed.

Als blijk van waardering voor de tijd die je met deze vragenlijst bezig bent, krijg je een geschenkbond ter waarde van 10 euro. De vragenlijst bestaat uit 18 vragen; de antwoorden worden geanonimiseerd en zijn alleen beschikbaar voor de onderzoekers.

Alle informatie die mogelijk jouw identiteit kan onthullen wordt verwijderd of veranderd. De antwoorden worden minimaal vijf jaar bewaard op een veilige locatie. De resultaten zullen worden gebruikt voor een Master Thesis en wetenschappelijke artikelen.

Deelname is op vrijwillige basis en je mag op elk moment je deelname beëindigen, zonder verdere consequenties. Je kunt ook besluiten bepaalde vragen niet te beantwoorden. De vragenlijst is goedgekeurd door de Behavioural Research Ethics Board van de University of Saskatchewan (Canada) op 17 juli 2009. De resultaten zullen beschikbaar zijn via de MADMUC website (<http://madmuc.usask.ca>).

Ik heb de bovenstaande informatie gelezen. Ik heb de mogelijkheid gekregen vragen te stellen en deze vragen zijn naar tevredenheid beantwoord. Ik stem toe, deel te nemen aan de studie. Deze toestemming kan ik op elk moment intrekken, indien nodig.

[verplicht] Je bent uitgenodigd om deel te nemen aan een vragenlijst over de effecten van visualisatie op je activiteiten in Vegatopia. Als je vragen hebt, neem dan contact op met de onderzoekers: • Kadhambari Raghavun (kas411@mail.usask.ca) hoe begrijpelijk de visualisatie van de Vegatopia community voor jou is en of de visualisatie jouw activiteiten op Vegatopia heeft beïnvloed. Als blijk van waardering voor de tijd die je met deze vragenlijst bezig bent, krijg je een geschenkbond ter waarde van 10 euro. De vragenlijst bestaat uit 18 vragen; de antwoorden worden geanonimiseerd en zijn alleen beschikbaar voor de onderzoekers. Alle informatie die mogelijk jouw identiteit kan onthullen wordt verwijderd of veranderd. De antwoorden worden minimaal vijf jaar bewaard op een veilige locatie. De resultaten zullen worden gebruikt voor een Master Thesis en wetenschappelijke artikelen. Deelname is op vrijwillige basis en je mag op elk moment je deelname beëindigen, zonder verdere consequenties. Je kunt ook besluiten bepaalde vragen niet te beantwoorden. De vragenlijst is goedgekeurd door de Behavioural Research Ethics Board van de University of Saskatchewan (Canada) op 17 juli 2009. De resultaten zullen beschikbaar zijn via de MADMUC website (<http://madmuc.usask.ca>). Ik heb de bovenstaande informatie gelezen. Ik heb de mogelijkheid gekregen vragen te stellen en deze vragen zijn naar tevredenheid beantwoord. Ik stem toe, deel te nemen aan de studie. Deze toestemming kan ik op elk moment intrekken, indien nodig. Akkoord

Niet akkoord

Volg.



## Appendix J – Vegatopia Questionnaire

**Deze enquête sluiten**

**2. Pagina 2 van 2**

100%

\*

**1. Vind je de visualisatie aantrekkelijk, in het algemeen en voor jou in het bijzonder?**

- Vind je de visualisatie aantrekkelijk, in het algemeen en voor jou in het bijzonder? Ja
- Geen mening
- Nee

\*

**2. Is het voor jou duidelijk wat de positie en de grootte van de knopen en bladeren betekenen?**

- Is het voor jou duidelijk wat de positie en de grootte van de knopen en bladeren betekenen? Ja
- Nee

\*

**3. Indien ja, kun je de betekenis hieronder beschrijven?**

Indien ja, kun je de betekenis hieronder beschrijven?

\*

**4. Was jij nieuwsgierig om jouw bloem in de visualisatie te vinden?**

- Was jij nieuwsgierig om jouw bloem in de visualisatie te vinden? Ja
- Nee

\*

**5. Ben je tevreden met de manier waarop jouw bloem in de visualisatie is afgebeeld?**

- Ben je tevreden met de manier waarop jouw bloem in de visualisatie is afgebeeld? Ja
- Nee

\*

**6. Zou je iets willen doen om de visualisatie van jouw bloem te beïnvloeden?**

- Zou je iets willen doen om de visualisatie van jouw bloem te beïnvloeden? Ja
- Nee

\*

**7. Indien ja, beschrijf wat je dan zou doen?**

Indien ja, beschrijf wat je dan zou doen?

\*

**8. Wat is volgens jouw de bedoeling van de visualisatie?**

Wat is volgens jouw de bedoeling van de visualisatie?

\*

**9. Hoe zou je zelf het liefst in de visualisatie willen verschijnen?**

Hoe zou je zelf het liefst in de visualisatie willen verschijnen?

\*

**10. Voel je je in Vegatopia vooral betrokken bij bepaalde andere leden of bij Vegatopia in het algemeen?**

- Voel je je in Vegatopia vooral betrokken bij bepaalde andere leden of bij Vegatopia in het algemeen
- bij Vegatopia in het algemeen
- geen van beide / kan niet kiezen

\*

**11. Kun je uitleggen waarom?**

Kun je uitleggen waarom?

\*

**12. Geeft de visualisatie jou een impuls om meer met de andere leden te communiceren of op forumberichten te antwoorden?**

- Geeft de visualisatie jou een impuls om meer met de andere leden te communiceren of op forumberichten te antwoorden
- Geen mening
- Nee

\*

**13. Als je hierboven "ja" hebt ingevuld, beschrijf dan hieronder waartoe de visualisatie je heeft geïnspireerd.**

Als je hierboven "ja" hebt ingevuld, beschrijf dan hieronder waartoe de visualisatie je heeft geïnspireerd.

\*

**14. Denk je dat de visualisatie nuttig is om te zien wat in Vegatopia gebeurt?**

Denk je dat de visualisatie nuttig is om te zien wat in Vegatopia gebeurt?

\*

**15. Heb je nog verdere vragen of opmerkingen?**

Heb je nog verdere vragen of opmerkingen?

\*

**16. Wat is je Vegatopia gebruikersnaam?**

Wat is je Vegatopia gebruikersnaam?

\*

**17. Als je de geschenkbond wilt ontvangen, laat dan hier je emailadres achter.**

Als je de geschenkbond wilt ontvangen, laat dan hier je emailadres achter.

Vor.

Gereed

**Appendix K – Vegatopia Visualization: Access log before introducing the visualization  
(June 14-Jun 20, 2010, 7 days)**

| timestamp              | fromUser | toUser | action |
|------------------------|----------|--------|--------|
| 2010-06-19<br>01:47:56 | 3767     | 0      | vis    |
| 2010-06-18<br>19:36:09 | 3767     | 0      | vis    |
| 2010-06-18<br>18:05:47 | 3767     | 0      | vis    |
| 2010-06-18<br>16:44:21 | 3767     | 0      | vis    |
| 2010-06-18<br>15:47:14 | 3767     | 0      | vis    |
| 2010-06-18<br>15:44:23 | 3767     | 0      | vis    |
| 2010-06-18<br>15:44:07 | 0        | 0      | vis    |
| 2010-06-18<br>15:44:06 | 8408     | 0      | vis    |
| 2010-06-18<br>13:04:45 | 8408     | 0      | vis    |

|                        |      |     |     |
|------------------------|------|-----|-----|
| 2010-06-18<br>00:59:10 | 3767 | 0   | vis |
| 2010-06-17<br>22:19:10 | 3767 | 0   | vis |
| 2010-06-17<br>18:08:01 | 3767 | 0   | vis |
| 2010-06-17<br>16:02:36 | 3767 | 0   | vis |
| 2010-06-17<br>15:38:39 | 8408 | 0   | vis |
| 2010-06-17<br>15:30:59 | 3767 | 713 | pm  |
| 2010-06-17<br>15:30:28 | 3767 | 0   | vis |
| 2010-06-14<br>11:03:42 | 3767 | 0   | vis |
| 2010-06-14<br>10:56:17 | 3767 | 0   | vis |

**Appendix L – Vegatopia Visualization: Access log after introducing the visualization (June 21 – June 28, 2010, 7 days)**

| timestamp           | fromUser | toUser | action |
|---------------------|----------|--------|--------|
| 2010-06-27 23:35:51 | 7885     | 0      | vis    |
| 2010-06-27 23:22:15 | 2187     | 0      | vis    |
| 2010-06-27 22:30:11 | 2187     | 0      | vis    |
| 2010-06-27 22:26:01 | 2187     | 0      | vis    |
| 2010-06-23 23:39:34 | 5509     | 0      | vis    |
| 2010-06-23 16:28:58 | 7885     | 0      | vis    |
| 2010-06-23 14:58:38 | 3767     | 0      | vis    |
| 2010-06-23 12:18:12 | 3767     | 622    | pm     |
| 2010-06-23 12:17:50 | 3767     | 0      | vis    |
| 2010-06-23 11:06:59 | 2944     | 0      | vis    |
| 2010-06-23 06:07:44 | 4512     | 0      | vis    |
| 2010-06-22 22:46:54 | 5372     | 0      | vis    |
| 2010-06-22 21:54:50 | 3767     | 0      | vis    |
| 2010-06-22 20:53:45 | 7885     | 0      | vis    |
| 2010-06-22 12:57:20 | 3767     | 0      | vis    |
| 2010-06-22 12:45:04 | 1525     | 0      | vis    |
| 2010-06-22 12:29:38 | 19       | 0      | vis    |
| 2010-06-22 11:48:06 | 242      | 0      | vis    |
| 2010-06-22 10:04:51 | 2944     | 0      | vis    |

|                     |      |      |     |
|---------------------|------|------|-----|
| 2010-06-22 01:42:53 | 6491 | 0    | vis |
| 2010-06-22 01:37:36 | 1434 | 0    | vis |
| 2010-06-22 00:51:20 | 3767 | 0    | vis |
| 2010-06-22 00:45:14 | 3767 | 0    | vis |
| 2010-06-21 23:09:52 | 7885 | 0    | vis |
| 2010-06-21 23:07:23 | 1434 | 0    | vis |
| 2010-06-21 23:06:41 | 1434 | 0    | vis |
| 2010-06-21 22:43:18 | 19   | 0    | vis |
| 2010-06-21 22:24:51 | 1434 | 0    | vis |
| 2010-06-21 22:15:29 | 2187 | 0    | vis |
| 2010-06-21 21:35:59 | 5372 | 0    | vis |
| 2010-06-21 20:43:19 | 2944 | 0    | vis |
| 2010-06-21 20:37:32 | 2402 | 7885 | pm  |
| 2010-06-21 20:36:51 | 2402 | 0    | vis |
| 2010-06-21 20:07:10 | 2563 | 0    | vis |
| 2010-06-21 20:03:23 | 3767 | 0    | vis |
| 2010-06-21 19:53:15 | 622  | 0    | vis |
| 2010-06-21 19:49:36 | 622  | 0    | vis |
| 2010-06-21 18:35:53 | 7885 | 0    | vis |
| 2010-06-21 18:29:33 | 7885 | 0    | vis |
| 2010-06-21 17:24:18 | 554  | 0    | vis |
| 2010-06-21 17:18:00 | 2549 | 0    | vis |

|                     |      |      |     |
|---------------------|------|------|-----|
| 2010-06-21 16:53:35 | 5515 | 0    | vis |
| 2010-06-21 16:48:22 | 443  | 0    | vis |
| 2010-06-21 16:41:37 | 443  | 0    | vis |
| 2010-06-21 16:28:54 | 5509 | 0    | vis |
| 2010-06-21 16:16:18 | 3281 | 0    | vis |
| 2010-06-21 16:15:15 | 3281 | 0    | vis |
| 2010-06-21 16:11:33 | 4512 | 0    | vis |
| 2010-06-21 15:59:57 | 8214 | 0    | vis |
| 2010-06-21 15:56:48 | 6491 | 1525 | pm  |
| 2010-06-21 15:54:04 | 2187 | 0    | vis |
| 2010-06-21 15:48:55 | 3767 | 0    | vis |
| 2010-06-21 15:48:16 | 6491 | 0    | vis |
| 2010-06-21 15:34:16 | 1606 | 0    | vis |
| 2010-06-21 15:33:45 | 1606 | 622  | pm  |
| 2010-06-21 15:32:39 | 1606 | 0    | vis |
| 2010-06-21 15:31:59 | 3767 | 2944 | pm  |
| 2010-06-21 15:29:39 | 2187 | 0    | vis |
| 2010-06-21 15:29:19 | 3767 | 3767 | pm  |
| 2010-06-21 15:29:09 | 3767 | 0    | vis |
| 2010-06-21 15:26:57 | 6151 | 0    | vis |
| 2010-06-21 15:25:48 | 3767 | 0    | vis |
| 2010-06-21 15:25:14 | 3767 | 0    | vis |



|                     |      |   |     |
|---------------------|------|---|-----|
| 2010-06-21 14:52:24 | 3767 | 0 | vis |
| 2010-06-21 12:09:36 | 3767 | 0 | vis |
| 2010-06-21 12:02:57 | 3767 | 0 | vis |
| 2010-06-21 11:32:50 | 8408 | 0 | vis |
| 2010-06-21 11:32:38 | 8408 | 0 | vis |

**Appendix M: Vegatopia Visualization: Access log starting one week after introducing the visualization (Jun 29 – July 29, 2010, 30 days)**

| Timestamp           | fromUser | toUser | action |
|---------------------|----------|--------|--------|
| 2010-07-28 13:36:50 | 3767     | 0      | vis    |
| 2010-07-27 14:47:58 | 5372     | 0      | vis    |
| 2010-07-27 09:07:45 | 6151     | 0      | vis    |
| 2010-07-26 10:14:58 | 5372     | 0      | vis    |
| 2010-07-25 20:29:25 | 1412     | 0      | vis    |
| 2010-07-23 01:32:15 | 1434     | 6491   | pm     |
| 2010-07-23 01:30:33 | 1434     | 0      | vis    |
| 2010-07-20 23:58:56 | 5372     | 0      | vis    |
| 2010-07-19 19:49:38 | 8214     | 0      | vis    |
| 2010-07-16 23:54:40 | 5372     | 0      | vis    |
| 2010-07-15 02:29:53 | 7885     | 0      | vis    |
| 2010-07-14 23:24:09 | 1434     | 0      | vis    |
| 2010-07-10 18:11:38 | 7885     | 0      | vis    |
| 2010-07-08 13:58:25 | 8408     | 0      | vis    |
| 2010-07-08 13:58:24 | 8408     | 0      | vis    |
| 2010-07-08 13:57:45 | 8408     | 0      | vis    |
| 2010-07-08 13:57:41 | 8408     | 0      | vis    |
| 2010-07-08 13:54:53 | 8408     | 0      | vis    |
| 2010-07-08 09:51:50 | 1434     | 0      | vis    |

|                      |      |   |     |
|----------------------|------|---|-----|
| A2010-07-08 01:28:16 | 3767 | 0 | vis |
| 2010-07-06 16:43:37  | 1434 | 0 | vis |
| 2010-07-05 00:43:54  | 2402 | 0 | vis |
| 2010-07-03 19:28:09  | 1525 | 0 | vis |
| 2010-07-02 09:45:56  | 443  | 0 | vis |
| 2010-06-30 12:56:03  | 3767 | 0 | vis |
| 2010-06-30 12:49:25  | 3767 | 0 | vis |
| 2010-06-29 23:21:20  | 8214 | 0 | vis |
| 2010-06-29 10:58:22  | 8408 | 0 | vis |
| 2010-06-29 10:47:12  | 7885 | 0 | vis |
| 2010-06-29 10:41:10  | 3767 | 0 | vis |
| 2010-06-29 10:37:42  | 3767 | 0 | vis |
| 2010-06-29 01:31:43  | 2187 | 0 | vis |
| 2010-06-29 01:30:41  | 2187 | 0 | vis |
| 2010-06-29 00:02:30  | 2187 | 0 | vis |