ConnectDots: Visualizing Social Network Interaction for Improved Social Decision Making

Deidra Morrison and Bruce Gooch

Northwestern University
2133 N. Sheridan Rd. Suite 3-209
Evanston, IL 60208 USA
d-morrison2@northwestern.edu
University of Victoria
EECS Bldg. Rm 504
P.O. Box 3055 STNCSC
Victoria, B.C Canada V8W3P6
bgooch@cs.northwestern.edu

Abstract. There has been a fairly large body of research surrounding decision making theory and ways in which choice framing and judgment are major contributing factors to decision outcome and future practice. The purpose of this study is to use abstract visual stimulus as an application for information organization and display, in order to aid in decision making practices. In this paper, we will introduce ConnectDots, a visualization tool that will allow users to be able to view this large data set of interaction information and more easily perceive the patterns of interaction therein. With this information, a person can also become more aware of their current decision making practices for their social network, and observe how their relationships are affected.

1 Introduction

Decision making involves evaluating information related to choices and finding a selection that will satisfy the purposes of the decision task. As people in today's society, there is so much to decide on that we hardly realize that we go through our day making decisions about what we wear in the morning or which restaurant to go to for lunch. Inherent in all of these decisions is a notion of "goal-importance" [5] – understanding how much of a life impact that this decision will have for an individual – and the potential risk associated with choosing between different options in a decision task. There has been a history of investigation of decision making theory of individuals [1][9] This research has been done extensively with choice problems involving probability and statistical average as presentations in the domains of marketing, finance, politics, economics and other fields. When investigated in social contexts, the everyday choices revolving around social interactions for an individual are made based on the exorbitant amount of information that is available through the many media sources used for communication and their pre-existing sociality models [4]. When evaluating the outcomes of interaction choice in social situations, the social

model in which an individual views their relationship with another plays a large role in the perception of satisfaction or success of the social decisions.

The increasing use of technology for information collection and organization has made the amount of information that we can apply to our decision process seem unmanageable. In addition, the advent of new communication technologies such as email, instant messaging, handheld computers, and cell phones which also provide text messaging opportunities, give those who previously would have only communicated face to face or through written correspondence an abundance of options for interaction with their social and business circles. We seek to find a correlation between the quantitative information surrounding personal social interaction through email and instant messaging and the sociality models in which a person attributes to those within their social network.

This paper will continue on to discuss related work in the domain of information visualization for social spaces. There will then be an introduction to sociality theory and its importance in understanding relationship interactions. It will then continue into an explanation of the ConnectDots architecture, and the visual metaphor implemented. There will then be a discussion of planned long term user study and evaluation, and finally the conclusion and future work.

2   Related Works

The use of information visualization techniques to help in the understanding of complex and diverse types of large information collections has been done for many different disciplines. Information analysts that work for government agencies have deployed visualization tools that enable 3D visualization of query results of related intelligence information. Climatologists use visualizations as predictive tools for natural weather phenomena and understanding regional and global climate trends and how different events relate and affect others. Even in the social information domain, there have been graph theory, node network, and abstract representational visualization techniques used to show social networks, online group activity history, and user-centric data portraits. These visual displays allow for the layering of information using symbol and textual mapping to help a person better view the different dimensions in which data can be viewed [7].

2.1   Social Visualization Tools

When creating tools for visualization of social information, there has been a large body of work focused on understanding group interactions and social spaces. Prominent work with network applications such as newsgroups, web logs, and online communities, focused on visualizing group dynamics. The interest in understanding the patterns of communication and interaction practices between the many members of a community were motivated by the desire to understand the "personality" or "identity" of the community, so that newcomers would be able to better establish a place there. Additional motivation came from the desire to understand the online identity of potential new contacts.

One of the most studied and well established online community used as a foundation for these visualizations, is Usenet. Visualization projects such as Treemaps [6], Loom [3], and PeopleGarden [10] take different approaches to the visualization of newsgroup posting and commenting activities within Usenet. These different visualization techniques seek to create a "data portrait" of the individuals and other group members based on interaction data. Treemaps applies a nested box based layout of groups and subgroups to the individual groups and child groups. The size and color and location of the box represent number of posts, age and popularity of particular groups. This visualization has been tailored to many other data problems that have a specific hierarchy that can be applied to them as well as chronological sequencing. Loom, is a networked display that shows connections between individual messages, and there are color codes to indicate subject and suffix differences in message postings. There is also a way to track message thread progression over time. PeopleGarden uses an intuitive nature based visual metaphor of petals, flowers, and gardens to show the posting and commenting history of users within groups in Usenet. Color, size, grouping, and height represent parts of the data such as age, popularity, response amount, and time spent in group.

We draw from previous social visualization techniques in ConnectDots, by incorporating visual metaphors to create a data portrait that is specific to an individual's social personality based not only on the data retrieved from their interactions. What is different about our approach, however, is that we also apply information and data gained through surveying users on their perceptions of relationship status and health with the individuals whom we've collected interaction data about. ConnectDots correlates social information gained from survey with the frequency of interaction and modes of media used, to give users a more detailed and individual visual representation of the communication practices that they use.

3   Relationships and Sociality Models

Social decision making is tied to the sociality models that individuals associate with others in their social circles. A.P. Fisk created a paradigm of human social life that argues that people construct their social environments based on relationships with others, and that four models of relationships are applied to all social interactions with people. These four models are *communal sharing, authority ranking, equality matching,* and *market pricing*. These models are used to interpret behaviors of interaction partners and make decisions about appropriate ways in which to interact with others.

The *communal sharing* relationships are denoted by a concept of affiliation with a group where the status of all members is equivalent. Persons who fit within this model would be those an individual felt a close bond with and expected equality in treatment and social initiations. In *authority ranking* relationships there is a distinct understanding of hierarchy and the social responsibilities assigned to each level at which a person is considered. There are clear ideas about whether an individual is higher or lower in standing than the individual and interactions and behaviors are expected to be deferential with those of higher rank, and preferential behavior is expected of those of lower rank. The *equality matching* relationship is one where egalitarian, even balanced interaction is expected. The order or frequency, of interactions, is not as

important as the need to keep all interactions equal and fair. A person who an individual shares an equality matching relationship with would expect the same amount of action or attention as has been given to them. Finally, the *market pricing* relationship is based on cost-benefit and monetary or value-relevant features of the interactions in the relationship. There is an expectation of personal value being calculated and compared to the person with whom the relationship has been formed, and typically there is a desire to increase individual value relative to the value of the other member of the relationship.

Although these models are not typically applied alone to relationships, there is generally one model that can describe the overall structure of interactions.

4 ConnectDots Visualization Tool

4.1 Architecture

The ConnectDots visualization tool collects information on the frequency of interaction with members of one's social network and the frequency of use of different media types. The visualization tool was created in Macromedia Flash MX and information is gathered from the user with forms that pass the user information and email and instant messenger logs to web based scripts written in Perl and PHP. These scripts dissect the interaction data and store this and the user information in the database (Figure 1).
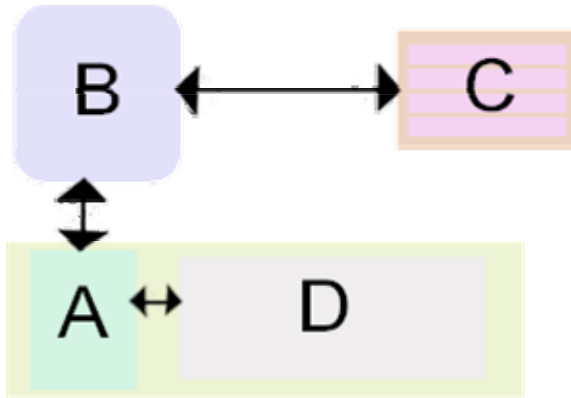

Fig. 1. The architecture of the ConnectDots system. (A) Flash ActionScript that passes information between scripts that interface with database and generates visualization of information. (B) Perl and PHP scripts that take in information from the user and store and retrieve data from database for visualization in flash. (C) MySQL database system that stores user information and network data. (D) Visualization pane where visualization is viewed and explored.

Once this information is collected the user is queried with surveys to acquire their perceived relationship with all of the individuals within their network. Using questions drawn from scales used to measure affiliation and dominance rating within

social relationships, along with expected interaction patterns of relationships of different sociality models this information is correlated with the quantitative information and stored in the database as well. Once the organization and storage of data is completed, a user can immediately return to the visualization and explore the patterns of interaction throughout their social network.

4.2 Organic Visual Metaphor

The visual metaphor that is used is a tree based metaphor, with indicators of relationship status, health, and age indicated by naturally occurring visual cues. The visualization is a user-centric view of their social network, with branches representing the connections that the user has with those within their network.

Each branch of the tree represents one individual with the user's social network. The frequency of interaction that the user has with this person is represented by the length of the branch. The type of sociality model that is widely representative of the type of relationship that the user has with this person is represented by the height at which you would find the branch positioned in the tree. Also the health of the relationship would be represented by width of the branch. Branches that are thinner, would be representative of fragile relationships and less healthy, where as thicker branches would indicate stronger healthier relationships.

For each branch there is a flower that represents the interaction history that the user has with the person represented over the different media types (i.e. email, IM, etc.). There is a color distinction for the flowers based on the type of media it represents. The petals of the flower are representative of the individual instances of communication that have been made through the media. The color hue indicates the age of the message, where a lighter hue represents more recent messages than darker hues.

The layout of the petals of the flower is based on the naturally occurring phenomena of interlocking spirals found in plants such as sunflowers. The older messages would be found toward the outside of the flower and as you spiraled inward you would be able to find the more recent messages for that media type.

5 Future Work

Currently the ConnectDots visualization tool has the capability of visualizing email and instant message interaction information, however, the ability to show the effectiveness of navigating this information for the purposes of decision support needs to be studied with long range user studies and use evaluation. Also, being able to incorporate more communication media types into the visualization is a priority.

Although the current visualization is useful in gaining an insight into social decision habits, a more complete view would be gained by incorporating interaction information relative to cellular phone interactions and text messaging behavior. The ability to access and download logs of this type of information requires development of information extraction and sharing for mobile devices. A proposed plan is to work on implementations of possible web-based logging and transfer software for mobile device communication records.

Another relevant issue is the inability for ConnectDots to currently do automatic updates of data to the system. The proposed use of the system would be administrative and used to keep a person updated on the status of their social decision making behaviors. With the ability for the system to automatically upload information from communication media, would allow for a more regular use of the tool and a less time intensive operation of the visualization.

Measuring the effectiveness of this tool for decision support for social interaction practices will require a study of not only usability factors and issues with the interface, but an extended study of the task of social decision making and the tools currently used to perform these tasks. We propose conducting user studies that observe the affects of the decision tasks with the aid of visual stimulation and of those without to see differences in the resulting impacts that these decisions have made.

To conduct this test, a study of the current decision task performance methods will be evaluated by methods of observation and interviews or surveys. The study participants will then be asked to complete decision tasks using their current methods. Quantitative information about the time it takes to complete decision tasks and the quantity and frequency that information sources are access will be recorded and a survey about attitudes toward the process will be given to the participants. The participants will then be given the visual tools to use in the same type of decision task and the process of data recordings and survey collection will be repeated.

6   Conclusion

Through the presentation of this information, users will be able to view this large data set of interaction information and more easily perceive the patterns of interaction therein. With this information, a person can also become more aware of their current decision making practices for their social network, and observe how their relationships are affected. This will allow for the opportunity to engage in interventions to prevent relationship dissolution, as well as give better indicators to users of their methods for establishing and maintaining what they perceive as successful relationships. Through the use of tools that will allow for faster exploration of information and quicker development of choice options a decision maker would make more satisfying and well rounded decisions. This work will also contribute to current efforts to find means of evaluating information visualization systems for their effectiveness in comparison to currently used tools or decision making processes.

References

1. Abelson, R.P., Levi, A.: Decision making and decision theory. In: The Handbook of Social Psychology, 3rd edn., pp. 231–309. Random House, New York (1995)
2. Beisswanger, A.: Risk Taking in Relationships: Differences in Deciding for Oneself versus for a Friend. Basic & Applied Social Psychology 25(2), 121 (2003)
3. Boyd, D., Lee, H.-Y., Ramage, D., Donath, J.: Developing legible visualizations for online social spaces. In: Proceedings of the Hawaii International Conference on System Sciences. (Janaury 7–10, 2002, Big Island, Hawaii) (2002)

4. Fiske, A.P.: The four elementary forms of sociality: Framework for a unified theory of social relations. Psychology Review 99, 689–723 (1992)
5. Schwartz, B. (ed.): The Paradox of Choice: Why More is Less. HarperCollins Publisher, New York, NY (2004)
6. Shneiderman, B.: Tree visualization with treemaps: a 2-d space-filling approach. ACM Transactions on Graphics 11(1), 92–99 (1992)
7. Sutton, S.A.: The role of attorney mental models of law in case relevance determinations: An exploratory analysis. Journal of the American Society for Information Science 45(3), 186–200 (1994)
8. Tufte, E.: Envisioning Information. Graphics Press, Cheshire, CT (1990)
9. Tversky, A., Kahneman, D.: Rational Choice and the Framing of Decisions. The Journal of Business, vol. 59 (1986)
10. Xiong, R., Donath, J.: PeopleGarden: Creating Data Portraits for Users. UIST 1999, Asheville, NC. CHI Letters, vol. 1(1) (1999)