2008

Facilitating Sensemaking in Organizations Through Social Navigation Systems

Jing Wu
McGill University, jing.wu3@mail.mcgill.ca

Alain Pinsonneault
McGill University, alain.pinsonneault@mcgill.ca

Facilitating Sensemaking in Organizations through Social Navigation Systems

Jing Wu
McGill University
Jing.wu3@mail.mcgill.ca

Alain Pinsonneault
McGill University
Alain.pinsonneault@mcgill.ca

ABSTRACT

In the dynamic and uncertain contemporary business environment, sensemaking in organizations is critical to their success and survival. While Internet-based systems are believed to play a key role in providing external information for this process, there is scare knowledge concerning how it can be achieved. This paper provides a theoretical model that examines why and how the application of social navigation systems (SNS) facilitates sensemaking in organizations. It is hypothesized that SNS contributes to sensemaking by facilitating each of its sub processes: it enhances information quality, facilitates the interpretation of the information, and contributes to information and meaning sharing among managers. This paper contributes to existing literature by expanding our understanding of sensemaking process in organizations and how information technology can support it.

Keywords

Social navigation, sensemaking, environmental scanning

INTRODUCTION

The contemporary business environment is dynamic and uncertain. A key role of top managers is to notice and construct meaning about environmental changes so that they can act (Weick, 1979; Kiesler and Sproull 1982). They achieve this through organizational sensemaking, which is the "reciprocal interaction of information seeking, meaning ascription and action" by organizational members (Thomas, Clark, and Gioia, 1993, p. 240). It is critical to the success and survival of organizations (Dutton and Duncan, 1987). It is the key information processing mechanism capable of detecting organization-relevant trends, events, competitors, markets, and technological developments. While existing research focuses on different modes and levels of sensemaking activities based on various situational factors such as environmental uncertainty and strategic objectives, there is a lack of understanding concerning how collaborative IT can facilitate the sensemaking process.

Researchers have suggested that the Internet could play a key role in providing external information for strategic decisions (Pawar and Sharda, 1997). However, while it has a potential for meeting a managers' information requirements with ease of locating and retrieving information, it could also be a waste of time if used unsystematically. Given this, and the distinctive capabilities of the various Internet utilities, it is important to find out how Internet-based systems can be used to acquire and interpret environmental information. In recent years, web-based social navigation systems (SNS) have emerged as a potentially more effective search engine than traditional methods (Kipp and Campbell, 2006). SNS are systems that exploit social navigation practices to help users navigate and explore an information space (Chalmers et al. 2004). The purpose of this study hence is to examine how SNS can be utilized to facilitate sensemaking in organizations. It is hypothesized that SNS, as a collaborative IT, can facilitate sensemaking by enhancing information collection effectiveness during the scanning process and facilitating the interpretation of the scanned information.

The rest of this paper is structured as follows: The first part examines the existing literature to build an integrative sensemaking model; the second part introduces SNS and analyzes their technical features; the third part presents the research model and hypotheses; the contribution of this paper and implications for future research are discussed in conclusion.

THEORETICAL BACKGROUND

Sensemaking in organizations

Sensemaking in organizations is the reciprocal process of information seeking, meaning ascription and action by organizational members, usually a relatively small group of strategic-level managers (Weick, 1995). The purpose is for

managers to understand the external forces of change so that they may develop effective responses which secure or improve their organization's position in the market. Thus effective sensemaking is the capacity to collect important data that covers sufficient environmental sectors from varieties of sources, and to translate them into strategic options/ threats/opportunities for organizational actions (Costa, 1995). Considerable empirical work has found positive relationships between the level of sensemaking efforts in organizations and firm performance in various environments: Intensive sensemaking activity was found to strongly relate to organization's financial performance, and speed of interpreting and adapting to environmental changes (Thomas, Clark, and Gioia, 1993; Garg, Walters, and Priem, 2003; Schmidt and Haines, 2005); firms using systems to monitor external events showed higher growth and profitability than those that did not (Subramanian, Fernandes, and Harper, 1993).

Past studies have focused on factors that determine the patterns of scanning behaviors (i.e. proactive/reactive scanning, frequencies/breadth of scanning, amount of personnel involved, etc.), such as environmental turbulence, resource dependency, nature of the business and the strategy, scanner's knowledge and cognitive style, availability and quality of information, etc. (Yunggar, 2005; Choo, 2001; Daft and Weick, 1984). However, little is known about how IT could be utilized to facilitate the sensemaking process, particularly the collection of information and removal of cognitive barriers for scanners.

The Process of Sensemaking

As depicted in Figure 1, the sensemaking process in organizations involves reciprocal scanning, interpreting, and responding, which occur at both individual and group levels (Daft and Weick, 1984). *Scanning* is concerned with data collection. At the individual level, it is the process of monitoring the environment and obtaining environmental data by managers, either through formal data collection systems or informal personal contacts. This information is then *shared* among top managers as a way of *interpreting* the scanned information. It the process of individual level noticing and bracketing of information clues, as well as translating events and developing shared understanding and conceptual schemes among top managers (Daft and Weich, 1984). Such understanding then guides the third stage where strategic decisions and organizational *actions are taken*. Additionally, actions may provide new collective insights for top managers, thus forming a feedback loop (Daft and Weich, 1984).

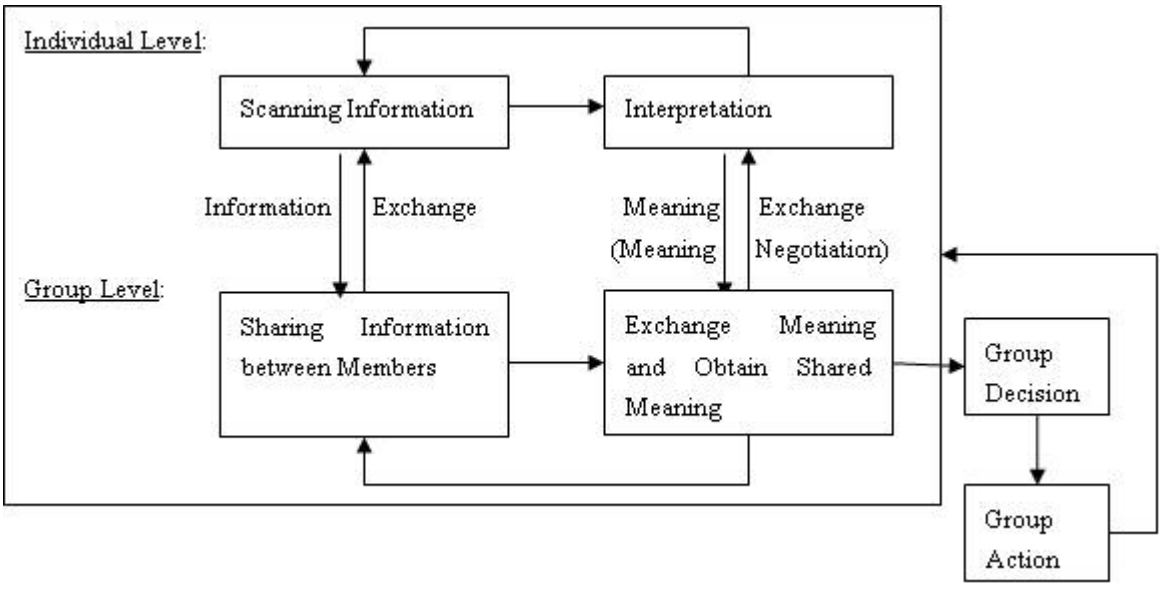

Figure 1. The Process of Sensemaking in organizations

Social Navigation Systems

Since the key role of sensemaking is to provide information for the company's strategic decision making (Costa, 1995), it is an intriguing question for IS researchers to understand how information systems can facilitate the information scanning and interpretation process. Social navigation systems (SNS) are information systems that exploit social navigation practices to help users navigate and explore (Chalmers et al. 2004). Examples are del.icio.us, flickr, etc. The concept of social navigation

utilizes the fact that most information navigation in the real world is performed by interaction with other people rather than by the individual alone. In the Internet context, it means navigation towards a cluster of people or navigation because other people have looked at something (Dourish and Chalmers, 1994). With the emergence of bookmark techniques and popularity of personal websites, the practice of social navigation evolved to include all behaviors that assist others to more easily navigate and explore a shared information space (Chalmers, Dieberger, Höök, and Rudström, 2004). Examples are direct recommendations of web sites and bookmark collections on homepages where people build a list of pointers to interesting people and places, in effect inviting others to view that person's network of friends, colleagues, and concerns (Dieberger, 1997; Chalmers et al. 2004).

A social navigation system usually involves a community of information seekers navigating in a shared information space enabled by a set of technologies including, but not limited to, search engines, information visualization techniques, bookmarking, real simple syndication (RSS), and more recently folksonomy. While bookmaking is a mechanism that enables participants to store and classify digital information using keywords (often referred to as tags), the non-hierarchical and inclusive process of a group of people cooperating ad hoc to classify and share information using reader-created tags is called a folksonomy (Wikipedia).

A typical social navigation process would involve: (1) a serendipitous browsing where users come across an information of interest with a certain tag; which triggers (2) an intentional search where users cross-reference that tag to find information; which may be followed by (3) personalized search where users add personalized tags to the retrieved information and bookmark it for their own use in future searches; and finally (4) users can subscribe to the RSS feed from the information source to be informed of future updates.

SNS have unique possibilities of aiding users to find their way through vast information space (Chalmers et al. 2004). The following section examines how they can improve sensemaking in organizations by facilitating individual scanning and interpretation as well as sharing of information and interpretation between scanners in a sensemaking team.

RESEARCH MODEL

The research model is shown in Figure 2. While some scholars suggest that response is included in the process of sensemaking in organizations (Weick, 1995), others insist that sensemaking may simply result in members of the organization having more and different information about the ambiguous issue and does not necessarily involve action (Feldman,1989). While information systems are capable of facilitating scanning and interpretation, it is much less likely to influence an organizational action by itself. Thus this paper adopts the later perspective, and examines sensemaking in organizations on its four underlying processes of scanning, interpretation, information sharing and meaning sharing as drawn from figure 1. Based on literature review, five factors that mediate between the use of SNS and sensemaking in organizations are identified (i.e., relevance of information, freshness of information, breadth of information, information space complexity and time spent scanning and monitoring information space). SNS are expected to facilitate sensemaking, both directly and indirectly through the above factors, with a variety of technical features as depicted in Table 1.

Individual Level									
Sensemaking Activity		**Facilitators**		**SNS Figures**					
				Access to Internet	Search Engine	Folksonomy	Bookmark	RSS	Visualization
Scanning	H1b	Relevance	H1a			x			x
	H2b	Freshness	H2a			x		x	
	H3b	Breadth	H3a	x	x	x			
		Barriers							
Scanning &	H4b	Complexity	H4a			x			x
Interpretation	H5b	Time	H5a	x	x	x	x	x	x
Group Level									
Sensemaking Activity				**SNS Figures**					
Information Sharing		H6				x	x	x	
Meaning Sharing		H7				x			

Table 1. SNS Figures Supporting Sensemaking in organizations

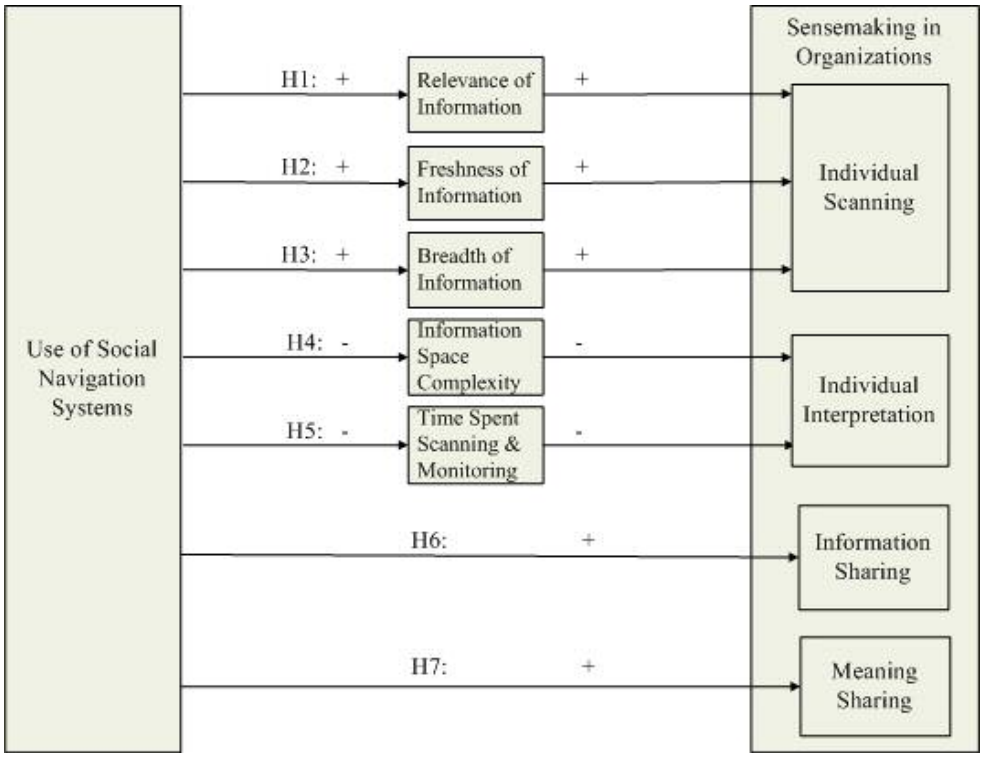

Figure 2. Research Model

Facilitating Individual Scanning

Relevance of Information

Research shows that the first and foremost requirement for the information required for sensemaking is its relevance with the organizational context, i.e. its strategic objectives, customers, competitors and suppliers (Costa, 1995; Morrison and Wilson, 1996; Tallon and Kraemer, 2007). However, as top managers are trying to identify potential trends that they do not know ahead of time, interpretation of relevance is a major difficulty in analysis of the collected data (Albright, 2004).

To study how relevance can be obtained the cognitive process of human information processing for sensemaking needs to be understood. Sensemaking starts with noticing and bracketing which are guided by mental models managers have acquired during their previous work, training, and experience (Weick et al. 2005). Those mental models are abstract structures called schemas or scripts, which are the knowledge structures against which new information is tested for relevance. They cause certain materials to be more salient than others (Kiesler and Sproull, 1982). However, conforming to mental models alone does not initiate sensemaking. Given the limited capacity of human beings to deal with large amount of information, managers tend to attend to salient cues, i.e. those that are deviant, intense, and unusual, such as unanticipated drains on cash flow, new taxes and regulations, disruptions of routine and emergencies, etc. (Kiesler and Sproull, 1982). It is the combination of mental models and salient cues that calls managers' attention to specific environmental stimuli (Weick et al. 2005). Thus decision makers will most likely notice information that is discrepant enough to capture attention but not so discrepant as to seem irrelevant (Kiesler and Sproull, 1982).

SNS facilitate the above noticing and bracketing process through the use of folksonomy, which is the result of the practice and method of personal free tagging of information objects (anything with a URL) for one's own retrieval (Vander Wal, 2007). Importantly, tagging is done in a social environment, i.e. a shared and open information space. On a collective level, it creates a powerful pool of tags linking a wide range of objects, so that if one knows an information object and its tag, he can find other individuals who use the same tag on that object (Vander Wal, 2007). In effect, a tag establishes a relation between an online object and a concept in the user's mind. Assigning a specific (set of) tag(s) to a piece of information represents the scanner's mental schema of interpreting that information. Thus, tagging the same way very likely indicates sharing similar

cultural, educational, or professional background therefore having similar schemas of interpretation (Golder and Huberman, 2006). It is such shared schemas of interpretation that facilitate scanners to easily identify the relevance of the information (Vander Wal, 2007). Enabled by visualization mechanisms, folksonomy can also help managers identify salient cues, such as environmental changes/trends. For example, tag clouds visualize tags in a way that users can easily identify the frequency of a tag for a specific information or for an information space as a whole, effectively providing scanners a structure to navigate through the information space, notifying them of the salient cues in the environment.

In conclusion, SNS allow scanners to identify salient clues in environment, and refine their navigation to the information tagged by people with similar mental models. Hence we propose:

Hypothesis 1a: Usage of social navigation systems is positively associated with relevance of source information.

Hypothesis 1b: Relevance of source information is positively associated with effectiveness of scanning.

Freshness of Information

Thomas (1980) found that successful sensemaking depends on continuous scanning with proactive and structured data collection. Such a continuous process aims to assemble sufficient data to discern the past and future direction of trends or to enable managers to estimate the strength of indicators of potential events (Morrison and Wilson, 1996). The continuality of the process ensures that the most recent data are noticed and those no longer relevant are discarded.

Social navigation is inherently a dynamic phenomenon that is of a continuous nature (Chalmers et al. 2004). The emergence of new tags in folksonomy and the evolving size of a tag in a tag cloud indicate the evolving attention of the community members. Thus SNS capture the continuous update of new information generated by shifts in user attentions enabling organizations to collect and analyze the freshest information of the time. With the possibility to subscribe to the RSS feeds from an information source, scanners can be informed of any update from that source in real time. Hence it is proposed that:

Hypothesis 2a: Usage of social navigation systems is positively associated with freshness of source information.

Hypothesis 2b: Freshness of source information is positively associated with effective scanning.

Breadth of Information

Information needs of sensemaking are based on well-defined organizational goals that are broad, detailed, and open-ended (Choo, 2001), thus it is important to scan broadly to ensure decision quality (Hatum and Pettigreww, 2006; Olson, Bao, and Parayitam, 2007). Breadth of information requires an extensive scan of the general environment and coverage of diverse views of the same external events so that it represents the true state of affairs (Morrison and Wilson, 1996; Choo, 2001).

SNS are Internet-based systems with search engines. They can contribute to the breadth of information by widening the breath of information sectors covered and the volume of information obtained. The Internet gives scanners access to vast amount and rich varieties of external information with the ease of locating and retrieving (Pawara and Sharda, 1997). Traditional scanning uses sources from trade shows, expert interviews, personal contacts, and hard copy publications obtained in most instances by means other than online literature search (Gordon and Glenn, 1993). The downside of these sources is that they are slow and costly to obtain and to distribute across geographically dispersed sensemaking teams. Nowadays, a great many of scholarly journals, newspapers, industry magazines and technology periodicals are available online. With powerful search engines embedded in SNS, getting access to them is just a few clicks away, and is way much easier and faster than traditionally obtaining hard copies. What's more, due to the application of folksonomy, there often exist multiple high frequency tags on one online information resource, which reveals multiple dimensions of the content indicating multiple associations between a resource and various concepts (Kipp and Campbell, 2006). Thus scanners can readily take reference of alternative perspectives of the same information and cross-reference between the tags to explore other information sectors that are of high relevance yet afresh to them.

Therefore, SNS contributes to scanning effectiveness through increasing the breadth of the information sectors and diversity of views scanners access to. We propose:

Hypothesis 3a: Usage of social navigation systems is positively associated with the breadth of source information.

Hypothesis 3b: Breadth of source information is positively associated with effective scanning.

Facilitating Individual Interpretation

SNS help managers to scan and obtain relevant, timely updated environmental information encompassing a variety of views. However, quality input alone is not sufficient for comprehensive sensemaking for two reasons: (1) the complexity of the information obtained may overwhelm managers' comprehension capacity, and (2) the limited time span may hinder managers' interpretation of large amount of information. SNS can facilitate the interpretation process mainly through two mechanisms: (1) providing structure to the information space; (2) information visualization.

Complexity of information space

Research found that the structure of information space plays a critical role in managing its complexity (Albright, 2004). Information sources that provide a structural scheme can help scanners undertake analysis, such as a key word classification or information grouped by categories (Costa, 1995), because the cognitive process of interpretation entails the fitting of information into some structure for understanding and action (Gioia, 1986).

SNS provide scanners various meta-data such as tags in an information space, tags for a piece of information, the frequency a content is recommended/bookmarked, the date a content is published, etc., all of which can serve as structures to the online information space. Based on shared understanding of a tag, scanners can easily infer the relevance of a new piece of information by reading the tags associated with it, hence linking it to the mental schemas for interpretation. Other users who have already explored the information space may possess specific domain knowledge and experience, thus the opinions and subjective evaluations of the information content they provide could also facilitate scanners in their initial navigation of the information domain. Using the popular tags as a way of looking to what others see and interpret the information requires much less time and cognitive effort for the scanners to explore the information space and make sense of it particularly when it is not familiar to the navigator (Chi and Mytkowicz, 2007).

Different from traditional means of sensemaking, SNS rely on information visualization techniques. Information visualization refers to the use of computer-supported, interactive, visual representations of abstract data to amplify cognition (Card, Mackinlay, and Shneiderman, 1999). Certain visual patterns can be detected without having to go through the cognition process (Tory and Möller, 2004). Some of these pre-attentive features include line, length (width), curvature, color (hue), orientation, intensity, depth, position, direction, texture and artistic properties (Healey, 2007). The meta-data that serve as structure, once effectively visualized, can represent information values as visual features and group features into objects, which in turn allows scanners to visually organize the information and offload the cognitive processing burden to the human perceptual system. Take a tag cloud for instance, it groups tags together and differentiates the tags based on weights such as frequency of being applied, so that a larger tag size represents higher volume of information grouped under this tag. By grouping related information for easy search and access, and representing a large quantity of data in a small condensed space, information visualization can reduce the cognitive load of searching and interpretation.

Based on the capacity of SNS to structure information space and visualize the structure, we propose that:

Hypothesis 4a: Usage of social navigation systems is negatively associated with the complexity of information space.

Hypothesis 4b: The complexity of the information space is negatively associated with effective interpretation.

Time Constraints on Interpretation

One of the biggest barriers towards effective interpretation is difficulty in analysis of collected data due to time limitations (Albright, 2004). Faster pace of change in the environment as well as other heavy organizational engagements limits the time available for executives to understand environmental signals and build shared understanding within the decision making group. With chief executive's time being a scarce resource of the company, a shorter lead time to identify potential change in the market means more free time for interpreting the environment and exchanging ideas within the group. SNS can facilitate sensemaking through reducing the time to perform scanning, monitoring and interoperation on the same amount of information.

Scanning time can be reduced in several ways: first, using the Internet and search engines speeds the process of accessing information sources compared with traditional physical means; second, bookmarks speedup the retrieving of the information; and lastly with the meta-data in folksonomy as an efficient way to structure information space, managers are able to make sense of where to search and what they are searching more promptly. Structure makes comprehension and assimilation of information much easier than if it is presented flatly as a list of retrieved items (Thomas, 1998). In a flat information space, each piece of information is equivalent. Therefore, scanners have to navigate blindly through each piece inevitably wasting

time on irrelevant ones. Folksonomy allows managers to effectively manage the time they spend on each piece of information based on structural aid, such as the number or recommendations, relevance of associated tags, etc.

Monitoring the external environment can account for as much as one quarter of top executives' time (Garg et al. 2003). Traditional ways that require managers to regularly go out and search for the emerging information on a relevant topic/issue is extremely time consuming. SNS can reduce the time to monitor the emerging information with the support of RSS feed. It can automatically inform scanners of updates from relevant information sources such as a news portal, a specialist's blog, etc. With less time spent in seeking for information, and monitoring the updates, a higher proportion of top executives' time can be devoted to building a shared interpretation of the collected information.

SNS also speed interpretation with the help of visualization techniques. As humans, we have the ability to recognize the spatial configuration of elements in a picture and notice the relationships between elements quickly, and such highly developed visual ability allows people to grasp the content of a picture much faster than they can scan and understand text (Ware, 2000). Thus compared with reading hard copied newspapers, trade reviews and journals or listening to vocal interviews, not only can SNS obtain a swifter access to and retrieval of the information, but also the system can facilitate speedier interpretation by providing visual cues for navigating the information domain, such as a tag cloud in del.icio.us, and a recommendation star in Amazon. To sum up, we propose:

Hypothesis 5a: Usage of social navigation systems is negatively associated with time to scan and monitor the information space.

Hypothesis 5b: The time to scan and monitor the information space is negatively associated with effective interpretation.

Facilitating Distributed Sensemaking

For managers to understand their complex, dynamic, competitive environments, there is an obvious question of trust, reliability, and consistency when it comes to relying on the view of a single person (Tallon and Kraemer, 2007). Thus it has been often recommended that a corporate-level environmental scanning unit be established and held responsible to monitor and interpret interacting trends (Fahey, King, and Narayanan, 1981). The idea behind this is striving for a breadth of view and interpretation. Groups with different functional backgrounds are able to provide richer discussions on various perspectives and alternatives to the decision making process, which is of vital importance when the problem domain, such as that faced with sensemaking, is complex and vague (Olson et al. 2007).

In term of sensemaking in organizations, the issue facing group work is not about common sense, consensus building, or the assembling and diffusing of preexisting meanings. Rather the focused is more on collective induction of new meanings (Weick et al. 2005). When information is distributed across numerous parties, each with a different impression of what is happening, the cost of reconciling these disparate views is high, and discrepancies and ambiguities in outlook will persist (Weick et al. 2005). Multiple interpretations, while valuable, cannot define a consistent action. Equivocality is reduced through shared observations and discussion until a common grammar and course of action can be agreed on (Weick, 1979). To be able to reconcile for a meaning that can ultimately lead to an action, members have to be able to get access to a common pool of information that allows for collective interpretation of what is happening.

Social navigation systems allow individuals to scan the environment independently and pool the results together through sharing their navigation history, bookmarks, tags and scanned information relevant to organizations. With RSS feeds, each scanner can be informed in real time of any updates on each other's process and the new information linked to the system. In this way, while each is scanning for a specific domain, all are learning from the collaborative system. What's more, global talents can be involved as external brains free of restrictions of time and geographic location. Hence SNS allow the virtual strategic planning team to work together by sharing information beyond functional divisions and organizational boundaries.

Sharing of tags and bookmarks also facilitates exchange of interpretations of the information. Sensemaking is about labeling and categorizing; it's about imposing labels on interdependent events in ways that suggest plausible acts of managing, coordinating, and distributing (Weick et al. 2005). Categories are cognitive classifications that group objects, events, and the like with similar perceived attributes. Strategic issues are often the result of the categories that decision makers use, because when decision makers use particular labels to describe a given issue, the labels initiate a categorization process that affects the subsequent cognitions and motivations of the decision makers (Weick et al. 2005). The act of tagging is the process of labeling the external events/information a decision maker has browsed. By sharing the tags, the decision maker is sharing his/her interpretation of that event/information. SNS enable open access to each other's tags and bookmarks, hence enables sharing of interpretations of external information/events. Managers may not agree fully about their perceptions, but passing a startling observation among members, or discussing a puzzling development, enables managers to converge on an approximate interpretation (Weick, 2001). Thus we propose that:

Hypothesis 6: The use of social navigation systems is positively associated with information sharing among scanning team members.

Hypothesis 7: The use of social navigation systems is positively associated with sharing of meaning among scanning team members.

CONCLUSION

This paper examined why and how a social navigation system and its specific technical feature are likely to affect sensemaking in organizations. It contributes to the present literature with deeper understandings of the sensemaking process and how information technology can be utilized to facilitate it, particularly the collection of external information and removal of cognitive barriers for managers. It is hoped that this framework will help organizations to enhance the efficiency of sensemaking, and to provide a starting point for future research, which may further investigate how IT can be used to facilitate organizational response after scanning and interpretation.

REFERENCES

1. Albright, K. S. (2004) Environment Scanning: Radar for Success, *Information Management Journal*, May/Jun
2. Chalmers, M., Dieberger, A., Höök, K., and Rudström, Å. (2004) Social Navigation and Seamful Design, Cognitive Studies, 11, 3, 1-11.
3. Card, S.K, Mackinlay, J.D. and Shneiderman B. (1999) Readings in Information Visualization: Using Vision to Think, San Francisco, Morgan Kaufmann Publishers.
4. Chi, E. H. and Mytkowicz, T. (2007) Understanding Navigability of Social Tagging Systems, *Proceedings of the SIGCHI conference on Human factors in computing systems (CHI'07)*, February, 2007.
5. Choo, C. W. (2001) Environmental scanning as information seeking and organizational learning, *Information Research*, 7,1.
6. Costa, J. (1995) An empirically-based review of the concept of environmental Scanning, *International Journal of Contemporary Hospitality Management*, 7, 7, 4-9.
7. Daft, R.L. and Weich, K.E. (1984) Toward a Model of Organizations as Interpretation Systems, *Academy of Management Review*, 9, 2, 284-295.
8. Dieberger, A. (1997) Supporting Social Navigation on the World-Wide Web, *International Journal of Human-Computer Studies*, 46, 6, 805-826.
9. Dourish, P. and Chalmers, M. Running out of Space: Models of Information Navigation, short paper presented at HCI'94, Glasgow, Scotland, 1994
10. Dutton, J.E. and Duncan, R.B. (1987) The creation of momentum for change through the process of strategic issue diagnosis, *Strategic Management Journal*, 8, 279-295.
11. Fahey, L., King, W.R., and Narayanan, V.K. (1981) Environmental scanning and forecasting in strategic planning: The state of the art, *Long Range Planning*, 14, 1, 32-39.
12. Feldman, M.S. (1989) Order without design, Stanford: Stanford University Press.
13. Garg, V. K., Walters, B. A., and Priem, R. L. (2003) Chief executive scanning emphases, environmental dynamism, and manufacturing firm performance, *Strategic Management Journal*, 24, 8, 725.
14. Golder, S. and Huberman, B. A. (2006) Usage Patterns of Collaborative Tagging Systems, *Journal of Information Science*, 32, 2, 198-208.
15. Gordon, T. J., and Glenn, J. C. (1993) Issues in Creating the Millennium Project, UNU.
16. Haeckel, S. (1999) Adaptive Enterprise, Harvard Business School Press, Boston, MA.
17. Healey C. G. (2007) Perception in Visualization, Retrieved at: http://www.csc.ncsu.edu/faculty/healey/PP/index.html
18. Hatum A., and Pettigreww A.M. (2006) Determinants of Organizational Flexibility: A Study in an Emerging Economy, *British Journal of Management*, 17, 115–137.
19. Kipp, M. E. I., and Campbell, D. G. (2006) Patterns and Inconsistencies in Collaborative Tagging Systems : An Examination of Tagging Practices, *Proceedings Annual General Meeting of the American Society for Information Science and Technology*, Austin, Texas, US.

20. Morrison, J. L., and Wilson, I. (1996) The Strategic Management Response to the Challenge of Global Change, re-formatted manuscript in Future Vision, Ideas, Insights, and Strategies, H. Didsbury (eds.), The World Future Society, Bethesda, MD.
21. Olson B.J., Bao Y.J. and Parayitam S. ((2007)) Strategic decision making within Chinese firms: The effects of cognitive diversity and trust on decision outcomes, *Journal of World Business*, 42, 35–46.
22. Pawar B. S. and Sharda R. (1997) Obtaining business intelligence on the Internet, Long Range Planning, 30, 1, 110-121.
23. Schmidt, T., and Haines, S. (2005) Scanning the Changing Environment Scanning the Changing Environment - Taking a Helicopter View of Our Fast-Tempo World, Centre for Strategic Management.
24. Subramanian, R., Fernandes, N., and Harper, E. (1993) Environmental scanning in US companies: their nature and their relationship to performance. *Management International Review,* 33, 3, 271-286.
25. Tallon P. P., and Kraemer K.L. (2007) A Sensemaking Perspective on the Reality Behind Executive's Perceptions of IT Business Value, *Journal of Management Information Systems*, 24, 1, 13–54.
26. Thomas, J. B., Clark S. M., and Gioia D. A. (1993) Strategic Sensemaking and Organizational Performance: Linkages among Scanning, Interpretation, Action, and Outcomes, *The Academy of Management Journal*, 36, 2, 239-270.
27. Thomas, P. (1980) Environmental Scanning - The State of Art, *Long Rang Planning,* 13, 20-28.
28. Thomas, J. B., Clark S. M., and Gioia D. A. (1993) Strategic Sensemaking and Organizational performance: Linkage among Scanning, Interpretation, Action and Outcomes, *Academy of Management Journal*, 36, 2, 239-270
29. Thomas, P. (1998) Visualizing Information: Visualization Systems Data Management, *Database*, 21, 1, 47-49
30. Tory M. and Möller T. (2004) Human Factors in Visualization Research. *IEEE transaction on visualization and computer graphics*, 10, 1.
31. Vander Wal, T. (2007) Folksonomy, retrieved from: http://www.vanderwal.net/, Feb, 2007.
32. Ware C. (2000) Information Visualization: Perception for design, Morgan Kaufmann.
33. Weick K.E. (1979) The Social Psychology of Organizing. Reading. Mass: Addison-Wesley.
34. Weick K. E. (1995) Sensemaking in organizations, Thousand Oaks, CA: Sage.
35. Weick K. E. (2001) Making Sense of the Organization, Blackwell, Oxford.
36. Weick K. E., Sutcliffe K.M., and Obstfeld D. (2005) Organizing and the Process of Sensemaking, *Organizational Science*, 16, 4, 409–421.
37. Yunggar, M. (2005) Environment Scanning for Strategic Information: Content Analysis from Malaysia, *The Journal of American Academy of Business*, *Cambridge*, 2, 324-331.