8-25-1995

Design of a Structured Decision Process Support System for Asynchronous Groups

Karen Dowling
Arizona State University

Andrew Philippakis
Arizona State University

Design of a Structured Decision Process Support System for Asynchronous Groups

Karen Dowling and Andrew Philippakis
Decision and Information Systems, Arizona State University, Tempe, AZ 85287-4206
U.S.A.

Introduction

Organizational work is increasingly conducted by geographically dispersed individuals working as groups. Geographic dispersion and simultaneous membership in multiple groups often make it impractical to bring decision groups together for traditional, face-to-face meetings. Therefore, group decisions need to be carried out by physically and temporally dispersed *asynchronous* groups. This paper describes the development of computer support for asynchronous groups performing a specific task type.

Group decision support systems have focused on computer support for face-to-face decision groups and have been the subject of extensive research (e.g., Jessup and Valacich, 1993). In contrast, research on physically and temporally dispersed groups has been limited (e.g., Turoff, et al., 1993). To develop effective computer support for asynchronous groups we apply a system analysis and design approach: First, we employ a Requirements Analysis and then we proceed to develop an appropriate Systems Design to meet the identified requirements. Our ultimate goal is to test the effectiveness of the system under conditions of experimental control.

Requirements Analysis for

Asynchronous Groups

Because computer-supported asynchronous groups are a nascent organizational practice, the compilation of requirements will rely, at first, on previous research with asynchronous groups and known (face-to-face) group process characteristics. Long-term we envision an iterative process where requirements lead to design of specific system characteristics, which in turn, define new requirements, and so on.

First, the most obvious requirement for asynchronous group support is connectivity. For practical purposes this presupposes computer support. Because group members are dispersed, and may move around over the course of a decision, using a technology available to all members is necessary. In the future it may be practical to consider multimedia communication channels, but for now we consider text-only communication.

In previous research with asynchronous groups, participants had difficulty moving toward their goal of reaching a decision (Hiltz, et al., 1991; McCarthy, et al., 1993). A more restrictive system should direct the user to the final goal by adding structure to the decision making process (Silver, 1990). Because the asynchronous meeting environment is unfamiliar to users a restrictive system may be necessary to assist the users in reaching a decision. As the asynchronous meeting environment becomes more common and users become familiar with it, they will likely need less restrictive systems.

Different types of tasks require different forms of group support. For example, the needs of a collaborative writing project are very different from the needs of a brainstorming project. Ideally, group support should encompass all forms of support, synchronous and asynchronous (and the many varieties of support within those categories), in one system (Mandviwalla and Olfman, 1994). Our knowledge of how to support all group tasks is still incomplete, however.

For research purposes, we address only one type of task. That task, a common task type in business, requires a group to address some identified problem, generate possible solutions to the problem, and then reach a final decision. In McGrath's (1984) task circumplex, this is a generating ideas and decision-making task. It is a pooled interdependent task (Hackathorn and Keen, 1981) because group members must work together and share information to reach a decision. That is, the task cannot be divided into subtasks for individual group members to solve and then reassembled for an overall solution. Examining support for different task types is an extension of this research.

Certain benefits have been noted for synchronous group processes and productivity when communicating via computers. Negative aspects of group interactions that computer-support can help mitigate are excessive socializing, domination, conformity pressures, evaluation apprehension, limited air time, and production blocking (Burke and Chidambaram, 1994; Dubrovsky, Kiesler, and Sethna, 1991). Conversely, a negative aspect of computer-supported communication has been the potential for cognitive overload (Nunamaker, et al., 1991). Because time constraints are relaxed in the asynchronous environment, cognitive overload may be reduced or eliminated.

Synchronous groups with and without computer support have been observed to perform better (i.e., the group members are more satisfied with the outcome and the outcome quality is judged to be better) when using a structured group process. Process structure consists of a well-defined sequence of phases, each phase consisting of well-defined goals, activities, and desired end-products. The few studies of asynchronous groups that have been published indicate that these groups suffer even more process difficulties than synchronous groups. In particular, asynchronous groups experience difficulty with the lack of temporal linearity in their communication (Dufner, Hiltz, and Turoff, 1994; Hiltz, et al., 1991). It is hypothesized that employing a group process will provide the structure to offset that difficulty.

Facilitators are an integral component of meeting success whether groups do or do not use computer support systems (e.g., Anson, Bostrom, and Wynne, 1995; Grohowski, et al., 1990). Since asynchronous groups need even more assistance in reaching their goal than synchronous groups, it is expected that the facilitator role will be critical.

System Design

To address the results of the Requirements Analysis we design a system that enables, and possibly enhances, decision performance of asynchronous groups.

Technological Infrastructure

In keeping with the text-only communication, we developed a system that utilizes any general purpose e-mail system that support file transfer. This allows maximum access flexibility for the group members, a necessity with the asynchronous environment.

System Restrictiveness

To provide restrictiveness the system incorporates three mechanisms for structure: group process, human facilitator, and the system interface.

A Structured Group Process: Groups perform better when a structured process guides their activity. It is hypothesized that asynchronous groups with their intrinsic need for improved coordination will also benefit from use of a structured process. We developed a three-phase process adapted from the well-known Nominal Group Technique (NGT). The basic components of NGT, brainstorming, clarification, and voting, (along with other components) have been used by many synchronous group support systems (e.g., Bostrom and Anson, 1992). Each phase has unique goals and activities that are reinforced by the interface and the facilitator.

Facilitator: The process structure is coordinated and enhanced by a well-defined human facilitator role. The facilitator acts as the clearinghouse for group communication and filters participant comments while moving the group toward their final goal of a decision.

Interface Design: A graphic interface including multi-window overlays and embedded browsing tools provides the orientation and coordination features to address the system requirements. Each stage of the group process has specific templates (Malone, et al., 1988) which contribute to the system restrictiveness.

Summary

Asynchronous meetings are a relatively new form of meeting for organizations. Little research has been done on the support for those meetings. Among the many variables to be considered when supporting meetings is task type. In this research we look at one type of task only, the idea generating/decision -making task. This research attempts to identify the needs of asycnhronous groups from previous research with asycnhronous, and also synchronous, computer-supported meetings. From these requirements a system design is developed. It is the intention of the researchers to test the resulting system in a laboratory experiment. In an iterative process, the system design will be modified as further design requirements are identified.

Selected References

Anson, R., Bostrom, R., and Wynne, B. "An Experiment Assessing Group Support System and Facilitator Effects on Meeting Outcomes," *Management Science* (41:2), pp. 189-208.

Bostrom, R.P. and Anson, R. "The Face-to-Face Electronic Meeting: A Tutorial," in *Computer Augmented Teamwork: A Guided Tour*, R.P. Bostrom, R. T. Watson, and S. T. Kinney (eds.), Van Nostrand Reinhold, New York, NY, 1992, pp. 16-33.

Burke, K. and Chidambaram, L. " Development in Electronically-Supported Groups: A Preliminary Longitudinal Study of Distributed and Face-to-Face Meetings, " in *Proceedings of the Twenty-Seventh Annual Hawaii International Conference on Systems Sciences (IV)*, IEEE Computer Society Press, Los Alamitos, CA, 1994, pp. 104-113.

Dubrovsky, V.J., Kiesler, S., and Sethna, B.N. "The Equalization Phenomenon: Status Effects in Computer-Mediated and Face-to-Face Decision-Making Groups," *Human-Computer Interaction* (6:2), 1991, pp. 119-146.

Dufner, D., Hiltz, S.R., and Turoff, M. "Distributed Group Support: A Preliminary Analysis of the Effects of the Use of Voting Tools and Sequential Procedures," *Proceedings of the Twenty-Seventh Annual Hawaii International Conference on Systems Sciences (IV)* , IEEE Computer Society Press, Los Alamitos, CA, 1994, pp. 114-123.

Grohowski, R., McGoff, C., Vogel, D., Martz, B., and Nunamaker, J. "Implementing Electronic Meeting Systems at IBM: Lessons Learned and Success Factors," *MIS Quarterly* (14:4), 1990, pp. 368-382.

Hackathorn, R.D. and Keen, P.G.W. "Organizational Strategies for Personal Computing in Decision Support Systems," *MIS Quarterly* (5:3), 1981, pp. 21-27.

Hiltz, S.R., Dufner, D., Holmes, M., and Poole, S. "Distributed Group Support Systems: Social Dynamics and Design Dilemmas," *Journal of Organizational Computing* (2:1), 1991, pp. 135-159.

Jessup, L.M. and Valacich, J.S. *Group Support Systems: New Perspectives,* Macmillan, New York, NY, 1993.

Malone, R.W., Grant, K.R., Lai, K.-Y., Rao, R., and Rosenblitt, D. "Semistructured Messages are Surprisingly Useful for Computer-Supported Coordination," in *Computer-Supported Cooperative Work: A Book of Readings*, I. Greif (ed.), Morgan Kaufmann, San Mateo, CA, 1988.

Mandviwalla, M. and Olfman, L. "What Do Groups Need? A Proposed Set of Generic Groupware Requirements," *ACM Transactions on Computer-Human Interaction* (1:3), 1994, pp. 245-268.

McCarthy, J.C., Miles, V.C., Monk, A.F., Harrison, M.D., Dix, A.J., and Wright, P.C. "Text-Based On-Line Conferencing: A Conceptual and Empirical Analysis Using a Minimal Prototype," *Human-Computer Interaction* (8:2), 1993, pp. 147-183.

McGrath, J.E. *Groups: Interaction and Performance,* Prentice-Hall, Englewood Cliffs, NJ, 1984.

Nunamaker, J.F., Dennis, A.R., Valacich, J.S., Vogel, D.R., and George, J.F. "Electronic Meeting Systems to Support Group Work," *Communications of the ACM* (34:7), 1991, pp. 40-61.

Silver, M.S. "Decision Support Systems: Directed and Nondirected Change," *Information Systems Research* (1:1), 1990, pp. 47-70.

Turoff, M., Hiltz, S.R., Bahgat, A.N.F., and Rana, A.R. "Distributed Group Support Systems," *MIS Quarterly* (17:4), 1993, pp. 399-417.