Using Hypertext for Group Decision Support Systems

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The ability to effectively and efficiently gather, manage, and retrieve voluminous amounts of information is essential to decision makers in today’s information age. Because of time constraints, decision makers face not only the problem of information access but also of information overload. The ability to integrate ideas and knowledge from various sources is particularly important for the effectiveness of group decision support systems (GDSSs).

One promising technology of the group-decision making environment is hypertext. In a hypertext system, information is grouped and linked to allow users easy access to related pieces of information. A hypertext-based GDSS therefore facilitates the collection of group process data and makes the tasks of idea generation, problem structuring, member-to-member communication, and voting/issue resolution more effective.

This chapter describes the design and the development of a hypertext-based GDSS called HyperGroup. The system is designed to support communication on small, face-to-face, decision-making groups. Three decision support tools—issue identification, criteria identification, and alternative identification—are built into the system. HyperGroup also has the capability to capture group decision-making processes.

Hypertext for Group Decision Making

Hypertext is an alternative approach to organizing and managing data. A hypertext system consists of two basic elements: nodes and links. A node represents a unit of information. Related nodes are then connected by links.
A hypertext system can be viewed as a network of nodes and links with no specific or global structure regarding size of nodes or the number of links to or from a specific node. Users interactively take control of a set of dynamic links among units of information that allow them to jump from one piece of information to other related units of information.

Hypertext is a promising technology for group decision making because it provides an environment suitable for supporting the functions of an effective GDSS. In a group decision-making environment, information elicited during the course of meetings must be gathered, organized, recorded, and accessed. Each piece of information is related to rather than isolated from others. Decision makers usually need to browse through the information base to see connections between pieces of information. In addition, each decision maker contributes information to the group piece by piece. The information is therefore grouped in a form equivalent to a node in hypertext systems.

**CONCEPTUAL DATA MODEL**

The conceptual data model proposed for the hypertext-based GDSS accommodates the various kinds of group decision-making techniques implemented by GDSSs. The model consists of two node types:

- List nodes, each of which contains a list of ideas on a certain topic.
- Comment nodes, each of which contains comments on certain ideas.

Both types of nodes are semistructured to facilitate the organization and management of information in GDSSs. Links in the model are not typed or structured.

Exhibit 1 presents the conceptual model on which the HyperGroup is based. In the model, a list node may contain a list of alternatives, a list of issues or problem statements, or a list of criteria. A list node containing a list of issues is linked to a corresponding list node containing a list of alternatives or criteria, or a certain comment node.

**SYSTEM FUNCTIONS**

The functional theory of communication and a conceptual GDSS framework were used to identify a set of system functions. Based on the functional theory, the system must assist decision makers in satisfying the following four requisite functions of effective group decision making.

1. Thorough and accurate understanding of a problem.
2. Identification of a range of realistic and acceptable alternatives.
3. Thorough and accurate assessment of the positive consequences or qualities associated with each alternative.
4. Thorough and accurate assessment of the negative consequences or qualities associated with each alternative.

These requirements helped identify the following set of minimum functions to be supported by the system.

- Problem identification and formulation.
- Criteria generation.
- Alternative generation.
- Alternative assessment.

Exhibit 2 presents a summary of HyperGroup’s features.

SYSTEM TOOLS

Systems functions and features as well as the implementation of selected group techniques were used to design and develop the system tools. Based on a review of the literature and findings on the effectiveness of different group decision-making techniques, two group techniques were selected: goal orientation and idea writing. Implementation of the two selected techniques to satisfy the system functions resulted in the development of three system tools displayed as three options on the main menu. The tools are:

1. Issue/problem identification.
2. Criteria identification.

**Issue/problem identification.** The issue/problem-identification tool assists users in satisfying the first system function: problem identification and
formulation. It implements the goal-orientation technique for idea generation and the idea-writing concept for idea reasoning.

Criteria identification. The second system tool helps users satisfy the second system function, i.e., criteria generation. The tool assists decision makers in generating and reasoning out a set of criteria that will be used to identify whether a certain alternative is realistic and acceptable when they apply the idea-writing technique.

Alternative identification. The alternative identification tool supports users in satisfying the third and fourth system functions, i.e., alternative generation and alternative assessment. The idea-writing technique not only helps users generate the alternatives but also assess the positive and negative associated with each alternative.

Exhibit 3 shows the relationships among the system functions, decision-making techniques implemented, system tools, requisite decision-making functions, and group activities supported.

COMMUNICATION AMONG GROUP MEMBERS

HyperGroup uses a public window, which is similar to a bulletin board facility to the extent that group members send their comments to the public database. The system provides a medium for recording private ideas and
Exhibit 3. Relationship among the elements of HyperGroup.
group discussion. The information in the public database is retrieved at both private and public terminals; as a result, group discussion focuses more on the topic under consideration than on finding or recalling pieces of information in previous discussions.

The availability of a private terminal for each member allows members to simultaneously contribute their ideas to the group instead of each having to wait for a turn. Because this system feature reduces the time needed to elicit ideas from group members, group communication and discussions are more productive.

DESCRIPTION OF HYPERGROUP

HyperGroup was developed using HyperCard on a Macintosh computer network comprising five computers. One computer acts as a server (i.e., a public machine) and the others as private machines. HyperGroup supports up to four decision makers. HyperTalk, a scripting language, is used to extend the functionality of HyperCard.

The software component of HyperGroup consists of two folders: a public and a private folder (Exhibit 4). The private folder, which is installed in each of the four private machines, contains five stacks:

1. MainStack.
2. HomeMenu.
3. HGTools.
4. Public View.
5. epsiTalk.

The public folder is installed in the public machine. It contains the following 10 stacks:

1. HGPublic.
2. HGView.
3. PublicMenu.
4. NeedDB.
5. ConstraintDB.
6. ObstacleDB.
7. IssueDB.
8. CriteriaDB.
9. AlternativeDB.
10. epsiTalk.

The conceptual model is implemented by imposing templates on cards, each of which represents a node. HyperGroup consists of two types of cards: one implements the structure of a list node, and the other implements the structure of a comment node.
HyperGroup uses scrolling fields to accommodate variable lengths of idea lists and comments. Organization of cards, or of the information in HyperGroup, follows a hierarchical approach from a topic to its detail. Each text item of cards containing a list of ideas in HyperGroup connects to another card, which may contain a comment on that text item or another list of ideas.

The destination of a link in HyperGroup is always a whole card. Links in HyperGroup are not typed or structured. The role of links is to provide navigation through the system’s information base.

ASSESSMENT OF SYSTEM FUNCTIONALITY

The objective of assessment is to preliminarily test the functionality of HyperGroup and to gather feedback from users. Specific issue of interest is users’ reaction to the system’s functionality, especially the organization and management of information in HyperGroup.

The study involved small face-to-face groups in laboratory setting. Six of the fifteen group the participated in this study consisted of three members. Each of the remaining nine groups had four members. Based on the review of the decision tasks previously used in published GDSS studies, an IS budget crisis task was developed and used in this study. Participants consisted of MBA students from two sections of a System Analysis and Design course. Participation in this study was voluntary.

Two week prior to the laboratory exercise, participants attended a training session which consisted of a one-hour session on the group decision-making and a one-hour demonstration and tutorial on how to use HyperGroup. At the beginning of each laboratory session, participants received fifteen minutes of lab training. The training was intended to familiarize the subjects with the computer and HyperGroup. At the end of each session, questionnaire were administered to gather individual reactions to the system’s functionality.

Exhibit 5 summarizes responses from fifty-four students representing the fifteen groups that participated in this study. Eight questions were included in the questionnaires to measure users’ reactions to HyperGroup’s functionality. The users were asked to rate their reactions to the system’s functionality on the scale of 1 to 7, the higher the rating, the more favorable the users’ reactions.

The questions focused on the users’ reactions as to how information was organized and managed. Their responses indicated that the appropriateness of using the proposed conceptual model in organizing and managing data in a computer-supported group decision-making environment. The average rating for the users’ reaction to the system’s functionality was 5.16.
Thirteen of the 15 groups favorably rated the system’s functionality. Overall, most of the users were satisfied with the functionality of HyperGroup, especially the way the system organized, managed, and presented the information. The findings confirmed our expectation that hypertext technology could be effectively used to manage, organize, and present unstructured data such as ideas and comments.

CONCLUSION

HyperGroup captures group decision-making process and enhances the effectiveness of group decision making. As a communication and recording medium for group decision making, it provides an example of how hypertext is incorporated into a group decision support system to support the decision-making tasks of small, face-to-face groups.

<table>
<thead>
<tr>
<th>System Functions</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Present information</td>
<td>5.35</td>
</tr>
<tr>
<td>2. Connect ideas</td>
<td>5.00</td>
</tr>
<tr>
<td>3. Information contained in each screen</td>
<td>4.43</td>
</tr>
<tr>
<td>4. Allow access to information needed</td>
<td>4.80</td>
</tr>
<tr>
<td>5. Give and receive information</td>
<td>5.39</td>
</tr>
<tr>
<td>6. Assist generation of ideas</td>
<td>5.04</td>
</tr>
<tr>
<td>7. Assist exchange of opinions</td>
<td>5.39</td>
</tr>
<tr>
<td>8. Overall rating of functionality</td>
<td>5.09</td>
</tr>
<tr>
<td>Average rating of reactions to the system’s functions</td>
<td>5.16</td>
</tr>
</tbody>
</table>

Exhibit 5. Users’ reactions to the system’s functions.