A Foundation for the Use of Hypertext-based Documentation Techniques

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Use of hypertext and hypermedia in organizations remains limited. Until hypertext is conceptualized in a workable way for users and developers, its functionalities will remain largely unexplored. In order to address this problem, hypertext is conceptualized as a pyramid with three successive levels of capability: the informational, the experiential (which includes the informational) and the collaborative (which includes both of the preceding levels). Capabilities, current uses, and limitations are discussed for each level. As one travels up the pyramid, fewer and fewer applications are found. In order to foster understanding of each level, case examples of hypertext applications are developed. For the experiential level, an original and innovative application called HyperCase is presented. On the collaborative level an original, internationally-implemented application called SOFTLORE is detailed.

Users are hesitant with hypertext. Hypertext authoring tools and hypertext systems have become widely available over the last few years (Conklin, 1987; Marchionini & Shneiderman, 1988; Minch, 1989; Nielsen, 1990, Ritchie, 1989; Shim, 1992; Straub & Wetherbe, 1989; Rada, 1991) yet use of hypertext in organizations remains limited and its workings are somewhat obscured. Unlike many other new technologies which are immediately seized upon and put to use, much of hypertext’s capabilities remain unexplored.

One possible reason for this lack of acceptance is that without an appropriate and imaginative way to conceptualize hypertext, users and information systems researchers alike have great difficulty envisioning what it is that hypertext enables them to do. In this paper we propose a pyramidal structure for conceptualizing three levels of hypertext: beginning at the bottom most level which is informational, going to the next level, which is experiential (including informational), and the top level which is collaborative (and includes the informational and experiential). Currently, as one travels up the pyramid, fewer and fewer applications are found. Most applications now exist at the informational level. There exists some general categorizations of hypertext systems (see for example, Leggett, J., Schnase, J. & Kacmar, Cleggett, 1990; and Rada, 1991). Because of the associative nature of hypertext, the specificity of the problem domain should be computerized in conceptualizing hypertexts. In our research the problem domain is meta-informational: use and development of consumer-based
information systems. In addition to the domain-specific framework of hypertext systems we provide examples of how each application is currently being used in an organization.

Our problem domain is information systems development and use. Our model is based on human-machine information accumulation (i.e. the FOLKLORE method of Kendall and Losee, 1986) and the experiential learning theory as discussed by Kolb (1984).

In addition, we provide examples of a specific application (some implemented internationally) within each level to facilitate understanding of the ways hypertext functions there. In this way, we hope to support the use of hypertext which is appropriate for many different organizational situations of information systems utilization. In the following sections we propose envisioning hypertext systems as a pyramid with three phases; and we discuss the specific applications which help users and researchers to visualize the capabilities of hypertext.

The Hypertext Pyramid

We propose that the three evolutionary phases of hypertext applications can usefully be conceptualized as a pyramid. Notice that Figure 1 depicts the base of the pyramid as informational applications, while experiential capabilities reside at the intermediate phase. The third phase shows hypertext applications which enable users to participate with each other on projects through collaborative capabilities. It can be noted that currently there are far fewer applications taking advantage of collaborative capabilities, which is one reason it has been depicted in the smallest space, at the top.

Informational Level

In the informational level, at the base of the pyramid, hypertext is used in its most basic, recognizable and widely-used form. Within this level, users query the system, asking for help. Hypertext responds by organizing text and linking multiple nodes of information together (Shneiderman, 1989; Woodhead, 1991). Hypertext allows users to make multiple associations, and to ask, “What is the meaning of a, given b and c?” and all iterations of that question. In the informational level, the capability for non-linear access to information emerges.

Another way to discuss this level is in terms of offering an elaborate help menu. Users then make their desired selections among pieces of stored information, whether they are text or graphics. Other characteristic

Experiential Level

In the next level of the hypertext pyramid, more capabilities are engaged. The experiential level enables users to step into a new set of circumstances and experience it interactively. No longer merely browsing, in this level users navigate through an experiential application.

The activities available in this level have been variously described as learning and analysis (Tazelaar, 1988), training (Horn, 1989), applying theoretical concepts (Barnes, Baskerville, Kendall & Kendall, 1992) as well as educating (Kendall & Kendall, 1992). Within the experiential level, users take an active part in discovery. The process and timing of interaction (how users make associations, when, and in what order), as well as which associations users make among graphics and text, be-

Figure 1: The Three Levels of Hypertext

actions the user can take in the informational level are that of browsing through material; getting on-line reference help; getting a briefing, and getting illustrations of queried material. Applications written for the informational level promote the goals of organization and efficiency for the user.
comes critical.

In the experiential level users not only query the system as to meanings, but also make different meanings from the information stored in hypertext by freely making associations, taking alternative pathways through the system. What will the user experience if they choose a straight and narrow path, with traditional selections and predictable outcomes? What will the user learn if they discover their path terminates in a dead end? What will they experience if what seems to be an optimal, efficiency-based path as in the first level, constrains them from learning what is effective, rather than efficient? In the second level, users go through an experience for themselves, guided by hypertext, but free to explore at their own pace, in their own way, whatever matters most to them.

At the top of the hypertext pyramid is the collaborative level. In this level, users participate together in sharing information and creating meanings and new information. The collaborative level departs from the other levels in two significant ways. The first difference is that the informational and experiential levels were centered around the work and needs of an individual user. The second difference is that the first two levels are typically “read only” and do not permit the user to tangibly contribute to the hypertext document which is already in place.

The growing importance of computer-supported collaborative work and their attendant technologies has been well documented (Lyytinen & Kendall, 1992). This category is broadly defined and includes group decision support systems and CASE tools as well as hypertext. (For a specific description of hypertext systems in information systems evolution or development, see Kerola and Oinas-Kukkonen (1992) who characterize hypertext as:

An open structured intermediary software agent between collaborative human actors, CASE tools, between the reader and author roles of human actors in CASE environments and in the target IS, and between other software agents in these systems. (p. 289).

The collaborative level empowers users to become contributors to the hypertext application being used. It enables users to build upon what each person knows, sharing their experiences and putting them together in a common, easily accessible, highly flexible, fluid and dynamic manner. At this time, very few applications exist which take advantage of the collaborative capabilities of hypertext. However, once users have been involved with this type of system their interest will more than likely create demand.

Levels of Hypertext: Three Cases

The following sections elaborate on the hypertext pyramid by describing cases of each level as described in Table 1. Microsoft Windows On-Screen Help is an example of the somewhat limited informational level of hypertext. The HyperCase® example shows that users can have more navigational freedom on the experiential level. Finally, SOFTLORE is described as an example of the collaborative level which encompasses the first two levels as well.

<table>
<thead>
<tr>
<th>Level</th>
<th>Characteristics</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Informational</td>
<td>Allows the user to find a definition or explanation of something s/he didn’t understand; allows little freedom of divergence because only limited are selected to be links.</td>
<td>A context-sensitive help system similar to the type of help systems found in Microsoft Windows®.</td>
</tr>
<tr>
<td>Experiential</td>
<td>Allows the user to experience heuristic browsing of information; allows decisions concerning the path to take; allows different users to draw different conclusions depending on the path they navigate.</td>
<td>A hypertext compendium of information such as HyperCase®. Each experience is meant to be unique.</td>
</tr>
<tr>
<td>Collaborative</td>
<td>Allows the user to read what other users contribute, and to write as well; allows inclusion of information that may be correct, partially correct, or even incorrect.</td>
<td>A hypertext system such as SOFTLORE that allows users to contribute information which may help a wide variety of users.</td>
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Table 1: Three Levels of Hypertext and Their Characteristics
Microsoft Windows Help

Microsoft Windows includes a hypertext system created primarily for users to find answers to their questions about a program. Almost every major program written to run in the Windows environment contains a help file. Figure 2 is a help screen from MasterWord® 2.0, an extended help system for Microsoft Word® for Windows.

Note that some words are underlined. These words serve as hypertext buttons that allow the user to jump to that topic. They are intended to be the words that either need defining (for the novice users) or topics that are covered in more detail (for the advanced users). Typically, no distinction is made regarding the purpose of the button, and that is one of the drawbacks of this particular hypertext system. Usually these words are colored green so the user can identify them as links to definitions or topics. MasterWord® also has another feature that displays related topics.

An exemplary hypertext help system would contain context sensitive help, in other words, it would try to guide users by observing what they were working on when they needed help. Today’s help programs do not contain artificial intelligence. However, most programs will directly jump to the relevant section on “Help using printers” if a user asks for help when they are trying to print. These simple rules point a user in the right direction and attempt to minimize the time it takes to find help.

The major limitation concerning this type of hypertext system is that the author chooses what topics are appropriate for further definition and which ones need to be explored in more detail. The help system is usually written by the program author (s) or someone representing the author. Clearly, users have no voice in the construction of help systems. When the user wishes to know more about a topic, the choices are limited and often there is only one possible path to the answer.

Figure 2: A Typical Screen From Master Word Help 2.0 Allows the User to Follow Limited Paths
One example of a hypertext system on the experiential level is the interactive case study labeled HyperCase (Barnes, Baskerville, Kendall & Kendall, 1992; and Kendall, Kendall, & Baskerville, 1992). Embedded in HyperCase there exists a rich fabric of links among multiple aspects of the subject. This offers a high degree of realism in the user’s experience in applying the concepts of systems analysis and design. The non-linear nature of HyperCase means that users experience and explore, rather than read, the case study. Highly graphical hypertext screens depict the offices of a fictional company, Maple Ridge Engineering (MRE), based on a real-life problem from the authors’ consulting experience.

Figure 3 shows the MRE reception area, through which the systems analyst enters the company. By clicking on the framed building plan hung on the wall, the user brings up on the screen a close-up view of the layout. Clicking on the receptionist’s phone causes it to ring aloud, and the user must pick it up to answer it. When they do, they hear the receptionist’s side of the phone conversation. Alternatively, the user may want to leaf through the magazines on the table in the reception area. One is a company phone directory, and when users click on it, a list of company employees, their positions, and phone extensions appears. The user can interview an employee just by clicking on their name. Visiting all of the offices and public areas may help decide where to go next, return to offices to examine existing systems, data flow diagrams, data dictionaries, memoranda, and reports. In this way, HyperCase requires the participating analyst to develop their own strategies navigating through the wealth of information.

At some point in their exploration of the company, the user may reveal a pop-up window which asks,
“Would you like to <<experiment>> with PSRS?” By clicking on any word or phrase bracketed by this symbol < > a user can learn more. By clicking on the word <<experiment>> in this instance, the user jumps to one in a complete series of prototype screens for the proposed PSRS project tracking system, which can be seen in Figure 4. At this time, the user may decide to explore the entire group of prototyped screens to see what kind of new system is being proposed. Several such levels can be programmed in this way. When users want to know more, they can easily access it.

Hypertext permits the use of graphics, including photographs and diagrams, so many different kinds of information display are made available to users. Although there are certain rules that must be followed, the point of organizing the material in hypertext is to provide as many linkages among pieces of information as possible, allowing users many different ways to navigate through the case, in what evolves into an original process of discovery.

**SOFTLORE**

SOFTLORE is a hypertext-based documentation technique based on Kendall and Losee’s (1986) system documentation method of FOLKLORE. SOFTLORE is an example of a collaborative hypertext system. Much of what is valuable to know about systems and other large projects is within the minds of people and in their private notes and diagrams. SOFTLORE helps users know more about the project (be it a computer system, or some other corporate decisions and procedures) by using an original set of FOLKLORE-based categories for collecting information from key contributors.

There are many reasons people do not formally document what they know (even though it could be useful to others). It can be time consuming; what they use as a heuristic may work (but they may not know why); they may have inherited an undocumented project for which they can only guess at the proper procedures and they do not want to be held responsible for saying something that is incorrect. Additionally, documentation is often considered a chore rather than a joy, and so many would-be writers of documentation procrastinate, or do not document their work at all.

Knowing full well the importance of capturing what group members know in order to facilitate collaboration, SOFTLORE was developed. Users of SOFTLORE can read what others have done, but they can also contribute to the group documentation. Hypertext is an ideal medium for SOFTLORE since at the collaborative level it is flexible, graphical, easy to use, and makes the process of contributing to the group documentation effortless. SOFTLORE sets up the hypertext system in four different categories: customs, tales, sayings and art forms. When a group member accesses SOFTLORE to contribute (or read), they are reminded of the guidelines (Kendall & Losee, 1986) for contributing which are:

1. Assume the material in the SOFTLORE documentation may be totally accurate, partially accurate, or even incorrect.

2. Assume that the material contained herein has been passed down from group member to group member, not necessarily the originator of the project or system.

3. Feel free to add, change or even delete items from the SOFTLORE section if you feel that it makes the documentation more understandable or accurate.

4. Try to think of the information you add as one of the following:
   a. customs
   b. tales
   c. sayings, or
   d. art forms,

   and use the pertinent hypertext tool for documenting each.
Figure 5 depicts the interrelationships among the four categories of SOFTLORE, and the guidelines for contributing to it. The following is a brief description of SOFTLORE, to enable the reader to be able to see what is meant by each category, and why it is useful to document using the SOFTLORE structure. Following that, we provide a case example of the use of SOFTLORE for documenting a system in Finland.

**Customs**

Customs are repeated or habitual practices common to a place or group (Katz, 1978). These are habits which the group member forms, and which can be accomplished as a coping strategy without thinking; they are a traditional way of behaving. Customs can be stored in hypertext and then be made to pop up at the appropriate time. For instance, if a group member is thinking about changing meeting times to 4:00 p.m. Fridays, SOFTLORE can display an icon in the calendaring system showing that there is a custom regarding meeting times. The group member can then use hypertext to jump to that custom (as a refresher) if they wish. The custom display reads: “Meetings for our group are traditionally scheduled for Mondays or Wednesdays, always before 3:00 p.m.” This can obviously be a help to a newcomer. Of course, someone may wish to ignore the custom, but SOFTLORE affords a way of introducing it, if the group member is curious. Upon reading the original custom, another group member may add: “Every first Friday of the month from 4:00-5:00 is reserved for an informal cheese and wine party. People never are absent from work on first Fridays!”

**Tales**

A tale is a traditional form of narrative with a beginning, middle, and end, which can be used to explain the genesis of something, display the consequences of some action or provide cautionary warnings (Kendall & Losee, p. 106). A tale often features a hero and a villain, acting within some sort of dramatic pattern to resolve a conflict.

In SOFTLORE, the tale can be woven by the user exploring the system. Although the beginning, middle, and end are all present, the user can make the linkages; explain and supplement them visually; navigate through the different paths, discover, and explore. In this way, each tale may unfold differently with emphasis on different points. Users can also add features along the path. A cautionary tale may be built around budgeting practices. For example, a user may write:

Once upon a time, there was a group member who played games with budgeting, padding cost estimates and making unrealistic estimates. When group members found out, they were upset, since these practices reflected on them too. The group member is no longer with us.

Another member may add, that:

Something good came out of this budget mess. The real hero in all of this was the group, since we met to decide on new budgeting procedures. We implemented them, and haven’t had any problems getting our budgets approved.

**Sayings**

Sayings are distillations of many tales, they are shorter generalizations about the way the world works (Rohrich, 1980). Sayings do not have a complete narrative structure, rather they are truncated into a short blanket statement that help the hearer to understand relationships. In SOFTLORE group members may read and contribute sayings that help them get their group going, such as:

- “Winning isn’t everything, it’s the only thing,” or
- “Quality is our most important product,” or (as far as communicating informally and effectively) with people, “The smaller the loop, the truer the poop.”

**Art Forms**

Art forms are traditional graphic expressions of people which have been handed down by the community. They are not only text, but are visual as well. SOFTLORE permits users to view and contribute color graphics, scanned images such as photographs or hand drawn diagrams which they use to help them understand their group work. Oftentimes, art forms are private, remaining in people’s personal files, when they could be helping the group with their thinking.

Only users’ imaginations limit what can be included in the art forms section of SOFTLORE documentation. Photographs of work sites or group members; colorful graphics depicting important trends; and any
Example: Rules for using OPI

Scanning:
Save scanned images in folder "Graphics_in". You do not have to process images. Images will disappear from "Graphics_in" folder and reappear in folder "Graphics to use".

Page layout:
Images to be used in page layout will be found in folder "Graphics to use". Images are low resolution, so your work will be fast.

Printing:
Print your work in normal fashion. High resolution image file will be used automatically in printing.

Figure 6: An Example of Customs Contributed by Collaborators using SOFTLORE to Document Their Application

Example: The nature of OPI

"High quality with low quality"

"Large in, small out. Final outcome gradually as original"

Figure 7: An Example of Sayings Contributed by Collaborators using SOFTLORE to Document Their Application
other visual aspect of group work can be captured and shared within SOFTLORE. As the group’s thinking changes, hand-drawn diagrams can be easily modified to reflect current conceptualizations of problems and projects. Interestingly, as with any of the SOFTLORE categories, the art forms category is not just for contributions concerning group collaboration on the task. It can also be usefully employed to capture the social interactions of the group. For example, it can capture who begins an interaction, who interrupts it, how long each participant “holds the floor” who talks to whom, and where group members sit during meetings. Other social interaction examples include providing maps and diagrams showing where the group’s annual picnic will be held and layouts of the recreational facilities there, or hand drawing a map to a colleague’s house for an informal get together.

**SOFTLORE Implementations**

In order to document creation of the Open Prepress Interface (OPI) system, a hypertext application using SOFTLORE was implemented in Oulu, Finland. This proved to be an excellent test of the collaborative capabilities of SOFTLORE, since it was implemented for an application where documentation had been negligible and group interaction had been minimal. Through using SOFTLORE the users found that their confidence with the new system was heightened, and their interest in using it and documenting their experiences increased concomitantly.

Figure 6 shows an example of the SOFTLORE screen³ for documenting customs for the OPI application. Notice that users have contributed three different customs on scanning, page layout, and printing. Remember that customs are group habits which enable members to cope with events without thinking anew how to handle them each time. In this example, users chronicle habitual ways of saving scanned images. Hints about the speed of work in page layout are given, and users have also included a preferable printing mode.

At the bottom of each SOFTLORE screen an options bar is displayed with words (and where appropriate, icons) which allows the users in a collaborative mode to create new tales, sayings, customs or art forms; link to other existing files in an informational mode; search for a particular occurrence; or navigate through the documentation in an experiential mode. The words coupled with icons serve as a powerful reminder to users of the capabilities available within the SOFTLORE hypertext system.

An example of a SOFTLORE screen displaying sayings of the user group involved with the OPI application is shown in Figure 7. There are two sayings here contributed by users trying to capture the essence of the nature of OPI in sayings, which are distillations of longer tales. Sayings are minus the long narrative structure of tales, and as such they attempt to crystallize an attitude or piece of advice that may help the group get going or help it reach its goals. Since any contributions to SOFTLORE are acceptable, and need not be true, sayings can be in conflict. Once again, notice that the options bar displayed at the bottom of the “sayings” screen permit users to jump to collaborative sections, or to use informational or experiential capabilities.

When using SOFTLORE, users are encouraged to create and contribute original art forms which help them understand the system or project better. Figure 8 shows a graphical view of the OPI System which group members have hand drawn in order to show what they believe happens to input graphics. This has an advantage of capturing what users are actually seeing when they look at the system processes. Any group member is free to examine, update, correct, change or delete this art form as they try to document the OPI system. Rather than maintaining such views in private files, the collaborative nature of the SOFTLORE hypertext system encourages group members to share art forms which can help the group reach their goals.

**Conclusions**

We have used domain specific examples in order to illustrate our domain independent framework for understanding and classifying the capabilities of hypertext. We have conceptualized our model of hypertext as a pyramid which has grown out of our experience and reflection about the nature and uses of hypertext over the last three years in two different countries.

Our approach is most usefully characterized as an inductive one, moving from specific experiences with hypertext and hypermedia to generalize about the differing capabilities each level affords its users. We suggest that there are three different levels of hypertext: the informational level, the experiential level and the collaborative level.

In the base level, hypertext is in its most common and recognizable form. Individual users are capable of using hypertext to jump from one topic to another to get more information about a topic. A basic path of links that permits accessing a new topic is written by the program...
author. However, in the informational mode, users are not capable of exploring, nor are they expected to explore different pathways or experience taking different paths. Neither can users contribute to the hypertext document in the informational level.

In the experiential level, individual users have both informational and experiential capabilities. Users are provided with multiple links to multiple topics. The purpose of the links is to frame information in new and unpredictable ways. The exploring and navigating processes of finding one’s way become the purpose of the hypertext. Users gain new meanings and insights by creating new paths. Authoring, or adding to the hypertext document is not a part of the experiential level.

The third level we suggest is the collaborative one, which includes the foregoing capabilities of information and experience, but adds an important capability of group collaboration within the hypertext document. In the collaborative level, group members can author and share information, actually creating something that had not previously existed, and actually altering the hypertext as they do so.

We have attempted to distinguish among levels in order to get a clearer grasp of what users should expect from hypertext and what functionalities and synergies developers should be attentive to as they create new hypertext systems in the future.

Editorial Note
Microsoft is a registered trademark of the Microsoft Corporation. Windows and Word for Windows are trademarks of the Microsoft Corporation. MasterWord is a registered trademark of Alki Software Corporation. HyperCase is a registered trademark of Raymond J. Barnes, Richard L. Baskerville, Julie E. Kendall, and Kenneth E. Kendall.

Endnotes
1HyperCase® is an original hypertext program developed jointly by R. Barnes and R. Baskerville at State University of New York at Binghamton and J.E. Kendall and K. E. Kendall, Rutgers University, School of Business-Camden.
2SOFTLORE is an original program developed at Oulu University in Finland. SOFTLORE has been implemented as a Hypercard program in the Macintosh environment.
3Original Finnish screens have been translated into English for illustrative purposes in this paper.

References


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