Maps as Hyperobjects: An Approach to Knowledge (Re)presentation in Hypertexts

Lars Johnsen, Southern Denmark Business School, Kolding, Denmark

Abstract: This paper describes an approach to knowledge (re)presentation in hypertext based on the map, a well-defined information unit used in the Information Mapping method. It is argued that although maps provide a useful vehicle for communication, their potential may be enhanced if they are construed and constructed as hyperobjects, dynamic software objects capable of acquiring and disseminating information and knowledge in a number of ways.

Introduction

A popular concept in the field of communication is electronic publishing. The term denotes a form of communication in which documents are not only created by means of a computer but also distributed and presented electronically.

One of the most flexible forms of electronic document is the hypertext. Hypertexts are electronic texts containing links between related information units to which the reader has access. Links are typically realized as:

* jumps from one information unit to another ("electronic cross-references")
* pop-up windows
* stretch text - text which may be folded or unfolded on the screen

Links may also contain more or less complex procedures making the reader’s access to certain information units contingent upon certain requirements being fulfilled (legal password, satisfactory level of user competence, activation of certain menus or buttons etc.)

Today hypertext is used for a number of purposes: information systems, online documentation, computer-based training, sales demos etc. Furthermore, hypertext is being increasingly used to present knowledge in expert systems (Rada et al. (1990)).

With the greater interest in, and use of, hypertext comes also the need for useful methods, methodologies and tools for the design and development of hypertexts.

Broadly speaking, two paradigms can currently be said to exist in terms of knowledge (re)presentation methodology: one - the knowledge-based approach - which focuses on methods and techniques employed in applied AI or knowledge engineering (Loo (1991) and Chignell et al. (1991)) and one in which ideas and
practices are adapted from fields basically concerned with document-based communication, such as technical writing or document engineering.

**Information Mapping**

An example of an approach derived from the latter paradigm is the Information Mapping method. Information Mapping comprises a number of principles, guidelines and formats which specify in detail how documents may be built up. However, primary importance is attached to the communicative aspect: the overall aim is to create effective communication which focuses on the reader and his or her needs for relevant information in a task-related context.

Information Mapping is based on two sets of principles: one set of principles indicating how information in general may be analysed, modulised and presented and one set describing how certain information types - processes, procedures, concepts etc. - may be identified and communicated in an effective manner.

Maps are the smallest free information units in Information Mapping. A map is composed of up to nine information blocks, text units or graphics about, or relating to, the same topic. Maps - as well as information blocks - are modulised and organized according to four general principles:

* the chunking principle (group all information into small, manageable units, called blocks and maps)

* the relevance principle (include in one chunk only information that relates to one main point based on that information’s purpose or function for the reader)

* the consistency principle (for similar subject matters, use similar words, labels, format, organizations, and sequences)

* the labeling principle (label every chunk and group according to specific criteria)

(Horn (1989:85))

The way in which the actual information content of a map is communicated depends on the type(s) of information contained in the map. Altogether, seven categories of information are claimed to exist at least as far as professional communication is concerned. To each of these seven types of information belong a number of clearly defined block types, so-called key blocks, the function of which is to convey the information type in question as effectively as possible.
Concepts are introduced by definition blocks and possibly blocks listing examples or non-examples of the concept; procedures are described in various types of tables depending on the structure and complexity of the individual procedure; physical objects or structures as they are called in Information Mapping are depicted visually and the functions of their components are listed in tables.

Figure 1 below contains an example of a map constructed according to the principles of Information Mapping. Note

- the map title indicating the main purpose of the map for the reader
- the block labels providing an overview of the contents of the individual information blocks
- the lines clearly separating the information blocks
- the accessibility of the procedure table

**Autonomous information units**

One advantage of using Information Mapping in relation to hypertext is that maps are created, if at all possible, as self-contained modules both in terms of their contents and their linguistic form.

For instance, maps should be *cohesively autonomous* (cf. Kuhlen (1991)). That is to say, ideally there should be no linguistic structures in a map implicitly referring to the contents of other maps. Typical unwanted markers of linguistic cohesion are pronouns and initial connecting adverbials like „consequently“, „on the other hand“, „furthermore“ and so on.

The high degree of (cohesive) autonomy in maps is significant because the access to information in hypertexts need not be linear. An end user reading a map is not necessarily familiar with the contents of the preceding maps as he or she may have gained access to the current map through the activation of a jump link or a search facility.

**Document management**

The modular approach also has a bearing on document structuring and document management.

In certain hypertext systems, for example, it facilitates the formation of dynamic
structures in which selected information units in the basic structure may be organized in secondary groupings. In other words, it is possible to create complete information units consisting of elements physically apart in the hypertext.

Updating becomes less troublesome. A map, or an information block for that matter, containing outdated information can just be plugged out and a new map put in without other maps having to undergo major revisions.

In theory, the modular approach means that maps and blocks may be regarded as a kind of LEGO bricks which may be assembled in all sorts of ways to provide new materials, electronic or paper-based (cf. Jensen (1993)).

**Relocation Policy: Income Tax**

<table>
<thead>
<tr>
<th>Background</th>
<th>Reimbursed relocation expenses are considered to be income by the Internal Revenue Service. The IRS requires the company to</th>
</tr>
</thead>
</table>
|            | • report all reimbursed relocation expenses  
|            | • withhold income tax from reimbursements estimated to be over the amount allowed tax deductible by the employee. |

| Policy | The company attempts to limit the employee’s tax liability caused by reimbursement of relocating expenses. |
|        | The company will “gross up” money paid to the employee covering the estimated tax resulting from non-deductible expenses. |

<table>
<thead>
<tr>
<th>&quot;Gross up&quot; limits</th>
<th>“Gross up” limits are</th>
</tr>
</thead>
</table>
|                   | • 32% for federal taxes  
|                   | • 10% for applicable state taxes. |

<table>
<thead>
<tr>
<th>Procedure: &quot;gross up&quot; limits exceeded</th>
<th>If an employee’s tax bracket is higher than the &quot;gross up&quot; limits then the employee should follow this procedure.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step</td>
<td>Action</td>
</tr>
<tr>
<td>------</td>
<td>--------</td>
</tr>
<tr>
<td>1</td>
<td>Obtain copies of tax return.</td>
</tr>
<tr>
<td>2</td>
<td>Indicate the tax liability incurred because of non-deductible reimbursement expenses.</td>
</tr>
<tr>
<td>3</td>
<td>Submit the documents to Personnel for reimbursement.</td>
</tr>
</tbody>
</table>

Figure 1: By courtesy of Information Mapping Europe
Reducing orientation problems

Using Information Mapping can improve the interaction between the reader and the hypertext. Most importantly, it can minimize the risk of the reader losing his or her sense of orientation - a major problem of hypertext.

One important factor is the consistent way in which information units are put together in a document. Five hierarchical levels are recognized: documents, chapters, sections, maps and information blocks. Any module consists of up to nine sub-modules.

Another factor already touched upon is the fact that all document units are labelled and therefore scanable. This is helpful especially because electronic documents often tend to be reference works and not texts meant for extensive reading.

Quality control

Last but not least the observance of Information Mapping principles provides a form of quality control which will secure a high degree of consistency in the document. This quality control is particularly important in the case of collaborative writing, a form of writing often associated with hypertext.

Maps as hyperobjects

Although maps constitute a useful vehicle for effective communication, more dynamic, flexible, and interactive hypertexts may, in my opinion, be developed if maps are construed and constructed as a kind of hyperobjects. Hyperobjects are software modules derived from the object-oriented programming paradigm. According to Priha (1991:209) a hyperobject has the following properties:

* an object identifier which identifies the hyperobject uniquely
* information contents stored in its attributes;
* an ability to form structures with other hyperobjects;
* an ability to contain links to other hyperobjects;
* behavior programmed to its methods;
* an ability to communicate with other hyperobjects by sending and receiving messages;
* an ability to display its contents and to communicate with users through its own user interface;
* an ability to be stored in a database as a separate unit.
Maps do possess some of these properties. A map title is a kind of object identifier and sections constitute map structures. However, if maps, or hypermaps if you like, are endowed with all these properties, their potential may be enhanced considerably.

For instance hypermaps may

* exchange data with their environment (other maps, external sources such as databases and spreadsheets and of course the reader)
* carry out calculations
* convey their block contents to the reader in different ways depending on his or her interests, needs or prior knowledge of the topic of the map

This last point is in fact taking one of the main tenets of Information Mapping - the Accessible Detail Principle - to its logical conclusion. This principle states that the author of any text should ...

* Present detail to support abstractions in a manner that makes it readily accessible to users (Horn 1989:197)

In other words, maps will no longer just be effective, albeit static means of communication but rather dynamic information objects capable of acquiring and disseminating information and knowledge in a number of ways. They will become truly malleable (cf. Whalley (1993:7)).

**Implementing hypermaps**

Implementing hypermaps, or prototype hypermaps, does not necessarily require sophisticated software. It may be done using a general purpose tool like ToolBook - an inexpensive and easy-to-use software construction set for Windows.

ToolBook makes explicit use of the book metaphor. The biggest unit in a ToolBook application is thus called a book. A book consists of a number of sequentially ordered pages which may be filled with objects of various kinds - text fields, graphics, groups of objects etc.

A page is divided into layers the most important of which are the foreground and the background. A background is a basic structure of objects, colours and patterns common to a set of pages. A foreground, on the other hand, is the objects, colours and patterns unique to a particular page.

One reason for using ToolBook as a tool for developing hypermaps - besides the price and its user-friendliness - is that Information Mapping elements may more
or less directly be realized as ToolBook components as is shown in the following table:

<table>
<thead>
<tr>
<th>Information Mapping</th>
<th>ToolBook</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information block</td>
<td>Object (graphic, (record) field, group)</td>
</tr>
<tr>
<td>Block label</td>
<td>Name of object</td>
</tr>
<tr>
<td>Map</td>
<td>Page</td>
</tr>
<tr>
<td>Map title</td>
<td>Name of page</td>
</tr>
<tr>
<td>Map type</td>
<td>Background</td>
</tr>
<tr>
<td>Document/Chapter/Section</td>
<td>Book</td>
</tr>
</tbody>
</table>

Another reason is that all information elements in a ToolBook application (books, backgrounds, pages and objects) may be given unique names and may be manipulated by ToolBook’s programming language OpenScript. With respect to hypermaps, OpenScript may for instance be used to

* establish links between maps/pages or within maps/pages
* establish links to other programmes
* create pop-up objects (windows, graphics, text fields etc.) or stretch text to cater for differentiated information presentation
* control the dialogue with the user
* produce user-friendly orientation and navigation facilities

**Concluding remarks**

However, if ToolBook is to be of any use as an authoring tool in an Information Mapping setting, a customized version of the programme must be created. That is to say, ToolBook must be set up in such a way as to enable the author to create hypermaps quickly and efficiently.

A customization of the programme at author level includes the setting up of menu-driven facilities to generate specific key blocks or map types, a library of relevant OpenScript programmes, links to relevant ancillary software such as graphics packages and so on. And a number of help functions, preferably semi-intelligent ones, must be provided to help the author select the right Information Mapping tools for the job.

**References**


Information Mapping is a registered trademark of Information Mapping, Inc.

ToolBook is a registered trademark of Asymetrix Corporation

Windows is a registered trademark of Microsoft Corporation