

Submitted to:

*International Workshop on WWW Design Issues 1994
November 29-December 1, 1994
Amsterdam, The Netherlands*

Exploiting Navigation Capabilities in Hypertext/Hypermedia

Oreste Signore

CNUCE - Institute of CNR - via S. Maria, 36 - 56126 Pisa (Italy)
Phone: +39 (50) 593201 - FAX: +39 (50) 904052
E.mail: oreste@vm.cnuce.cnr.it

Hypertext was originally conceived essentially as a personal, single user tool, intended for the management of the information needed by the single researcher for his/her own purposes. As a consequence, the user of a hypertext was thought as having a complete awareness of the content and the organisation of the information. This implies that all the links, either they represent a "structural" organisation, either they just accomplish the task of representing some association among different information nodes, should be quite evident and natural to the user.

In addition, we must stress that the richness of the hypertext resides in the representation of the associative mechanism, that was his inspiring principle, by means of the links; therefore the association among the nodes constitutes probably the most relevant aspect in the hypertext.

However, *user's disorientation* and *cognitive overhead* are well-known problems arising in hypertext navigation: to our understanding, this can be caused by a poor design of the hypertext. Too often the designers consider the hypertext design to be simply a "creative" task, and implement the hypertext/hypermedia (HT/HM) just following their "inspiration", without a careful thinking to the organisation of the information and to the modelling of the associations. This leads to poorly consistent design, in spite of some brilliant solutions taken step by step, where mere technical effects (sound, colour, animation, etc.) mask obscure design choices, if any.

These two problems can become particularly relevant when the designer realises that a large number of links can enhance the associative capabilities of the hypertext. The obvious result is that the designer's knowledge is hard-coded in the hypertext, so forcing the user to follow paths that can appear not relevant, or even unreasonable. On the other hand, too few links result in a "flat" and not stimulating hypertext.

These problems are emphasised in WWW, when information is distributed across the world and organised by different persons, for different purposes.

As a consequence, the modelling of the knowledge and the structuring of information nodes and related links become a major design issue in the implementation of WWW hypertext applications.

Database design, information retrieval, artificial intelligence and cognitive psychology all are "mature" disciplines that can contribute to the definition of design methodology that can help in implementing effective WWW applications. Their contribution can help in the information structuring process, the free text indexing techniques, the implementation of connections among the data items, the design of effective user interfaces.

Really, the designer should concentrate on avoiding obliged connections among the information nodes. It appears much more helpful to give to the user the possibility of

associating the concepts that can be tied to the information nodes, so that he/she will be able to exploit the navigation capabilities at the highest level.

The user can achieve this goal if he/she will have the possibility of choosing *several interaction paradigms*, as several reasons (contiguity in space or time, relationship among the associated concepts, etc.) can dictate the associations among the nodes. In addition the user must have the possibility of *switching* from one paradigm to another, so emulating the way the human mind works.

Finally, the implemented *links* must be of different *types* (or, at least, their meaning must be quite evident to the user). Even more important is to *visualise* the link, so that the user can have a clear idea of how much a link is “promising” in terms of the number of nodes he/she can access. Finally, the *weight* of the links (i.e. the importance given to the specific association) should vary accordingly to the user’s interests.

We developed an integrated methodological approach to the design of the hypertext (nodes and links), the underlying database and the user interface.

One of the characteristics of the methodology is the importance given to the links: they are classified in two main classes: *extensional* and *intensional* links, each one of them is subdivided in more subclasses, and so on.

The proposed approach moves from a conceptual representation of the world of interest as entities and relationships among them, and then, generally speaking, maps the entities on different information nodes, and the relationships into links of several different types. Some links are explicitly stored, some others can be activated following the associations among the concepts that can be attached to the information nodes, or to their representations (this applies especially to the free-text nodes).

The key concept is the formalization of two different spaces the user can navigate across. The *data space* is the conventional navigational level where the user can go from one information node to another, just following the extensional links that model the “structural” relationships among the chunks of information.

The *concept space* maps onto the conceptual level, where the designer can make explicit the interrelationships among the entities, so implementing the intensional links.

A further refinement of the conceptual level leads to the identification of the data items a thesaurus is defined upon. Therefore, it is possible to know when and where it is possible to represent concepts’ hierarchies, that allows to connect text chunks on the basis of their semantic relationships.

Obviously, the user can navigate at both levels, and move from one to another. The main advantage of the splitting in two navigational spaces and levels, is the possibility of reducing the overloading of every node with too many intensional links, that can confuse the user. On the other hand, the implementation of the higher level helps in supplying the hypertext with rich associative mechanisms, so exploiting the power of the basic idea of hypertext.

As far as the nodes are concerned, we remember that every node is an instantiation of an entity, and that every entity has several “components” that can be seen from different “perspectives”. The implementation of such a concept, that presents some differences in respect to other similar proposed in the literature, allows the support of rich multimedia applications and of the multilingual data.

Quite automatically, the importance paid to the links lead to the implementation of several interaction metaphors (map, classification scheme, physical contiguity, etc.). The user can choose any of them, and switch from one to another at will, so maintaining either the control of his/her position, and the freedom of moving towards the most “promising” information nodes. This last aspect is emphasised by the availability of a “map of links” that shows all the information nodes that can be reached starting from the current one, and gives account of the “affinity” of the nodes by their distance in the map. The affinity of the nodes is affected by the user’s specific interests; therefore, the user can define and modify his/her profile, depending on the importance given to the different types of links.

We refined and tested all these ideas in several case studies, paying attention to the issues raised by the implementation of a HT/HM in a client/server architecture, where all the textual data are stored and maintained on a database allocated on the server machine, while the user interface is available on the client.