

# Linking and Thinking: The Use of Typed Informational Relationships in Aid of Semantic Navigation

**Rich Kopak**

School of Library, Archival and Information Studies, University of British Columbia, 301 – 6190 Agronomy Road, Vancouver, B.C. V6T 1Z3. [rkopak@interchange.ubc.ca](mailto:rkopak@interchange.ubc.ca)

**Chia-Ning Chiang**

School of Library, Archival and Information Studies, University of British Columbia, 301 – 6190 Agronomy Road, Vancouver, B.C. V6T 1Z3. [chia\\_ning\\_chiang@hotmail.com](mailto:chia_ning_chiang@hotmail.com)

**An underlying challenge of hypertext systems is that of maintaining coherence in meaning when traversing nodes. Functional link typing is one method that has been proposed to address this challenge with the consequent action of increasing global coherence within the hypertext and facilitating increased comprehension. As such, functional link types are efficacious for navigating through the meaning relationships (semantics) of a hypertext and reduce reliance of physical navigation metaphors. The study described here employs a previously developed link type taxonomy in a Web-based journal publishing system (OJS). The goal is to enable readers to create functionally meaningful relationships between journal articles with the outcome of enhancing later, semantic based, navigation through the collection as a whole.**

## Introduction

Dillon and Vaughan (1997) argue that in hypertext environments, physical navigation metaphors are limited in their ability to fully support users' movement through what is otherwise a semantic, not a physical space. They suggest that a meaningful solution toward solving users' navigational "problems" [Elm and Woods, 1985; Conklin, 1987; Edwards and Hardman, 1989; Hammond and Allinson, 1989] will be achieved only when proper account is taken of the role that information itself plays in providing cues in aid of this navigation. Dillon and Vaughan further state that this is likely to occur only when the representation of meaning is in some way indicated in the navigational choices offered to users. Since navigation through hypertext is

essentially navigation through semantic space, it has as its purpose the "endpoint of comprehension" (1997, p. 101), and thus directly involves movement through these representations of meaning.

The present study is based on previous research [Kopak, 2000; Kopak, 2002] that asserts link typing, in the rhetorical and/or pragmatic sense, and that describes the purposeful relationship between two nodes of information, can add significant functionality to hypertext by enabling navigation through the semantic space of a hypertext, and circumventing problems associated with a complete dependence on metaphors derived from navigation of physical space [Maes, van Geel and Cozijn, 2006; Bar-Ilan, 2005].

In this study we propose to investigate the efficacy of typed relationships through their instantiation as 'Reading Tools' in an open source journal publication system.

## Background

An underlying challenge of hypertext systems is that of maintaining coherence in meaning when traversing nodes. van Dijk & Kintsch (1983) regard coherence as one of the "fundamental properties" of discourse and essential in efficient comprehension of textbases. Key to the semantic navigation (navigation based on pursuit of understanding and meaning relationships) of textbases is the role of "global" coherence. Global coherence is achieved when the gist or theme of a larger text fragment (i.e. beyond the sentence level) is carried forward to meaningfully relate to the gist or theme of subsequent text fragments. van

Dijk & Kintsch posit the presence of cognitive ‘macrostructures’ where inferencing bridges are established by reducing a text to its “essential communicative message.” Global coherence is achieved when the macrostructure captures the meaning and referential relationships between the topical components of a complete text or, in the case at hand, a hypertext. The hypertext then becomes more than a loosely gathered collection of otherwise independent nodes of information.

Thuring et al. (1991; 1995) make an explicit connection between the lack of coherence in hypermedia documents and attendant problems in the use of these documents. They state that a major purpose, if not *the* major purpose, of reading a hyperdocument is comprehension. They also note the connection between comprehension and navigation – “In order to improve both, navigation and comprehension, an author has to construct hyperdocuments which enhance the perception of local and global coherence relations.” Achieving global coherence is difficult since the bounds of a hypertext document are not physically constrained. Furthermore, there is generally no accepted schema for hypertext documents, and no discernible physical connectedness between macropropositional elements. Hence, an explicit indication, or cue, must be provided that physically instantiates these propositions in the macrostructure:

Clearly, it is not sufficient to merely link the nodes, since a link only indicates the ‘existence’ of a relation without specifying its semantics. To convey the ‘meaning of a link’ to his readers the author needs a set of **typed links** which are labelled according to their functionality, i.e., link labels must express what the source and the destination of a link have to do with each other.

### **The Research Program**

In a previous study Kopak (2000) developed a taxonomy of typed links from a user-based card sort of 26 base functional relationships gathered from the extant literature (e.g. Trigg, 1983; Baron, Tague-Sutcliffe & Kinnucan, 1996). A multi-

dimensional scaling analysis revealed two high-level conceptual dimensions that individuals may use in discriminating between basic informational relationships: General/Specific, and Antecedent/Consequent. In a subsequent study [Kopak, 2002] a repertory grid analysis was carried out and provided further evidence that users can distinguish between these higher order informational relationships, and that distinct subsets of the original 26 link types were more strongly associated with the higher order relationships tested, e.g. Example, Generalization, and Summary were most strongly identified with the General/Specific higher order relationship type.

High-level attributes such as these are potentially useful in establishing a correspondence between the semantic and physical dimensions of information space, thus providing a way to achieve a ‘tighter coupling’ between the link as a physical access mechanism, and in its role in representing the underlying information semantics. A major research question is whether such conceptual pairs as General/Specific can be meaningfully associated with a sense of physical movement through the hypertext, and subsequently through the information itself. Does purpose represented via the relationship type aid in navigating the semantics of content nodes?

The current research is making efforts to instantiate and test these higher order relationships (and the strongly related primitives) in an operational system. The Open Journal System (OJS), is a Web-based, open access, scholarly journal publishing and management application developed as part of the Public Knowledge Project at the University of British Columbia (Willinsky, 2005).

Currently being developed within OJS are a set of ‘Reading Tools’ which are aimed at enhancing the online reading experience and facilitating critical engagement with online journal articles. Toward the goal of increasing this engagement a linking and annotation tool is being developed that seeks to leverage the functional relationships established in earlier research toward increasing the level of coherence between fragments of journal articles being read within the system and enhancing

navigation through the journal corpus [Fu, Ciszek, Marchionini & Solomon, 2005). Readers become authors by creating functionally meaningful relationships between these fragments. Movement through the articles within the system can be recalled and retraced with navigation guided by the purpose and role that associated information has in facilitating comprehension. The tool will enable the identification of related information (from the perspective of the reader), and the ability to type the relationship (e.g. 'illustrates', 'defines', 'generalizes', 'exemplifies'). The typed traces can then be used to provide navigation aids to bring together identified text fragments into a meaningful whole for later use including composition. As well, the identified types can be aggregated to provide "points of departure" (Landow, 1991) for other users of the system enabling a socially created hypertext taking readers beyond the limits of individual articles contained within the system.

### **Current Work**

The linking and annotation tools as described are in the development stage. Our immediate goal is to assess the efficacy of reader created links in providing reproducible, navigable paths within the journal corpus. Furthermore, we are interested in determining the relative ease (or difficulty) readers have in applying the link types from the established taxonomy with the purpose of characterizing the meaning relationship between the nodes of information forming the link, and how much consistency there is in the application of these types. Towards this end we will conduct a series of task specific information seeking trials with a discipline specific user group employing a traditional mixed-methods approach that will provide both behavioural and expository data. It is anticipated that the results of these trials will provide useful information concerning the frequency with which links are created, and the number and kinds of link types that are consistently employed.

### **Acknowledgment**

We gratefully acknowledge the assistance of the Social Sciences and Humanities Research Council of Canada in providing support for this research.

### **References**

- Bar-Ilan, J. (2005). What do we know about links and linking? A framework for studying links in academic environments, *Information Processing & Management*, 41, pp. 973-986.
- Baron, L., Tague-Sutcliffe, J. & Kinnucan, M. (1996). Labeled, typed links as cues when reading hypertext documents. *Journal of the American Association for Information Science*, 47 (12), pp. 896 – 908.
- Conklin, J. (1987). Hypertext: An introduction and survey. *IEEE Computer*, 20 (9), pp. 17 – 41.
- Dillon, A., & Vaughan, M. (1997). 'It's the journey and the destination': Shape and the emergent property of genre in evaluating digital documents. *The New Review of Hypermedia and Multimedia*, 3, pp. 91 – 106.
- Edwards, D., & Hardman, L. (1989). 'Lost in hyperspace': Cognitive mapping and navigation in a hypertext environment. In R. McAleese (Ed.), *Hypertext: Theory into practice* (pp. 90 – 105). Norwood, NJ: Ablex Publishing.
- Elm, W. & Woods, D. Getting lost: A case study in interface design. In *Proceedings of the human factors society 29th Annual Meeting*, pp. 927 – 931. Santa Monica, CA: Human Factors Society.
- Fu, X., Ciszek, T., Marchionini, G. & Solomon, P. (2005). Annotating the Web: An exploratory study of Web users' needs for personal annotation tools. *ASIS&T Proceedings*, Vol. 42, n.p.
- Kopak, R. (2000). A Taxonomy of Link types for use in hypertext. Unpublished PhD dissertation, Faculty of Information Studies, University of Toronto.
- Kopak, R. (2002). Link typing in hypertext: Defining Conceptual Attributes. *Proceedings of the Canadian Association for Information Science*, pp. 215 – 222. Toronto, Ontario.
- Landow, G.P. (1991). The rhetoric of hypermedia: Some rules for authors. In P. Delany, & G.P. Landow, (Eds.), *Hypermedia and literary studies*, pp. 81 – 103. Cambridge MA: MIT Press.
- Maes, A., van Geel, A., & Cozjin, R. (2006). Signposts on the digital highway: The effect of

- semantic and pragmatic hyperlink previews. *Interacting with computers*, 18, pp. 265-282.
- Thuring, M., Hannemann, J., & Haake, J.M. (1995). *Hypermedia and cognition: Designing for comprehension*. *Communications of the ACM*, 38 (8), pp. 57 – 66.
- Thuring, M., Haake, J.M., & Hannemann, J. (1991). What's Eliza doing in the Chinese room? Incoherent hyperdocuments – and how to avoid them. *Proceedings of Hypertext '91*, pp. 161 – 177.
- Trigg, R.H. (1983). *A network-based approach to text handling for the online scientific community*. Unpublished doctoral dissertation, University of Maryland, College Park.
- Van Dijk, T.A., & Kintsch, W. (1983). *Strategies of discourse comprehension*. New York: Academic Press.
- Willinsky, J. (2005). *Open Journal Systems: An example of Open Source Software for journal management and publishing*. *Library Hi-Tech*, 23 (4): 504-519.