

Maps as Learning Tools: the SWISSLING Solution

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HYPertext IN LEARNING ENVIRONMENTS

Hypertext Exploitation in Teaching and Learning

One implicit assumption in the research on hypertexts is that the reader can be more active playing a more determining role in the construction of meaning. This is generally associated with the multiple reading paths enabled by the non-linear nature of hypertexts (Landow, G. P. 1998: 88-92). Conversely, the role of the writer is assumed to change from *author* to *knowledge provider and facilitator*. Without going in depth in hypertext theories, we will approach the issue from an applied research viewpoint: how can we exploit the potentialities of non-linear structures in learning environments?

The issue of the non-linear nature of hypertexts becomes in fact particularly relevant in an educational environment. Even though knowledge is more likely to be represented in a network-like structure, learning is actually a sequential process. Information is presented and learnt in a linear way, one lecture after the other, one page after the other, one concept after the other. From the point of view of the author (or rather of *content provider*), organizing the content for a hypertext is no easy matter. This is due to at least two reasons:

1. A long-lasting schoolbook and lecture tradition make it difficult for teacher at any level to feel comfortable with new media, and think of learning materials in a non-linear way.
2. The creation of digital (online) materials is more like a product-oriented pipeline than the usual handcraft writing style: it requires more people with complementary competencies to work together.

Text, Hypertext, Knowledge and Consistence

In our view two basic requirements for a didactic hypermedia are that it should support the student, both in the ongoing integration of new knowledge in a structured framework or hypothesis during the learning process, and in the activation of the acquired knowledge relevant to understanding in each given step of the learning process. These two requirements are based not only on the general observations outlined above, but also on insights from the field of human discourse processing.

Texts are not just haphazard sequences of sentences: they are perceived as semantically coherent wholes. People are able to say what a text is about and to summarize it. In order to do this readers need to have built, *inter alia*, a global representation of what is sometimes called the *world of the text*. In non narrative texts, most of the times this “world” representation, or knowledge base, is non-linear. Yet it has to be linearly constructed in the text understanding process.

Moreover, interpreting a new sentence in an ongoing discourse is very much like attaching new information in the proper place in a growing non-linear representation. Each new item of discourse is processed on the backdrop of a growing shared representation of the world of the text. So speakers/writers need tools to synthetically refer to large chunks of the global representation (overcoming short term memory limitations) in order to specify the proper

attachment of discourse items (van Dijk, T. A. 1977; Asher, N. 1993). *Anaphorical* structures are natural-language pointers that allow speakers/writers to synthetically refer back to more or less complex portions of the existing knowledge base that are relevant for the attachment of new information.

Studies in discourse pragmatics (Reboul, A. & Moeschler, J. 1998) have also shown that discourse interpretation involves, from the first sentence onwards, the formation on the part of the hearer of anticipatory hypotheses on the overall structure of the discourse. Natural languages also have at their disposal structures devoted to help the formation of such hypotheses by making synthetic anticipatory references to information yet to be introduced in the knowledge base. These are called *cataphorical* structures.

Construction of knowledge from a didactic hypermedia object also presupposes in the interpreter the ability of making anticipatory hypotheses on the overall structure of the world the hypermedia is about - i.e. the subject being studied - and the ability to access the knowledge that is relevant for the proper collocation of a new piece of information.

MAPS FOR LEARNING: THE SWISSLING DESIGN SOLUTION

A Metaphorical Working Hypothesis: Learning as Discovering a New Land

The issues summarized above were faced during the first phase of the SWISSLING project. Therefore we aimed at providing tools for enabling these very basic understanding processes in the context of a Linguistics course.

Our hypothesis is that such tools can be provided if we look at the process of structuring knowledge from a non linear source through the metaphor of the exploration of a territory. The metaphor "Learning is discovering a new land" plays the role of a *conceptual metaphor* (in the sense of Lakoff, G. & Johnson, M. 1980): a metaphor that shapes the understanding of a given domain by structuring it and is used to inform navigation and interface design at a structural level. Several studies have been carried on the use of conceptual and metaphorical maps to support the student in the process of acquiring and structuring new knowledge (Jacobson, M. J. et al. 1996; Skupin, A. 2000; Dieberger, A., Frank, U. 1998; McDonald S., Stevenson, R. J. 1999)

The Twofold Function of Maps

"Visualization provides context and orientation for readers and it helps the reader see a larger pattern in which to place the object before him" (Kahn, P. & Lenk, K. 2001).

In our view, maps have a twofold function in learning:

1. Maps are a support in structuring knowledge on the student side: thanks to visualization, a map can help the student to discover connections among the topics studied and to gain a wider perspective on the subject.
2. Maps are, from a "physical" point of view, an access layer to learning materials. Of course, with a structured tool as a map, which refers to the structure of knowledge itself, the access logic in itself is a way of learning.

The Many Sides of a Map

These two major functions have been discussed and analyzed. The practical outcome were four different map-like tools for learning online:

1. *Cataphoric Maps* are maps for beginning the exploration. They just present an overview of the subject with some orientation landmarks - such as prior explorers annotations may have been. The goal of these maps is mainly to provide a general framework for contextualizing the new information students acquire. Moreover, they can stimulate curiosity for the new subject.

2. The *Fil-rouge Map* is an animation showing a privileged path through the new land. These maps act as hypothesis setting from the teacher's. The teacher is implicitly present thanks to the track presented in these maps. The paths selected are the "most economical" ones: the ones offering the easiest way for the student, to proceed in the new land. Fil-rouges are suggested as preferential first-reading path, while for self-study and repetitions, students are encouraged to use learning materials freely, i.e. according to their own conceptualization of the subject matter.
3. *Anaphoric Maps* are an evolution of cataphoric maps: they represent the same maps with annotations and recall signs. For instance, near the area representing a concept, a small drawing recalls the example presented in the learning materials. These maps are provided to the students after learning at the end of the module, in order to facilitate repetition and in-depth study.
4. Finally, reformulation and specific details are offered in *detail schemas* that provide in-depth information in side maps.

Two examples of the maps proposed in the module "Verbal Semiotics" are shown in the following figures.

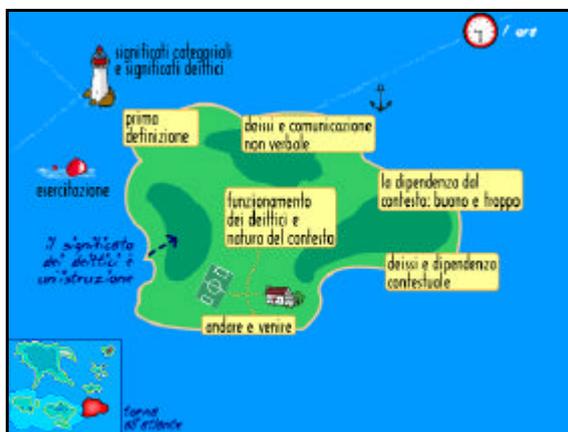


Figure 1 - Cataphoric Map



Figure 2 - Anaphoric map

Thinking, Drawing and Implementing Maps

Once conceived this articulated idea of learning maps and of their functions, the work was just started. In fact "mapping is a process of creating than revealing knowledge" (Dodge, M. & Kitchins, R. 2001: 3). Drawing the actual maps was no easy matter at all: it is an issue concerning creativity and pleasant interface design, usability as well as rigorous scientific knowledge on the subject. The procedure we followed for the implementation of the first SWISSLING module *Fundamentals of Verbal Semiotics* is the following:

1. The first step is creating a *Table of Content* (TOC): learning materials are, in their first phase and how we observed above, written in a pretty linear form. The TOC is in itself a suitable map-like guiding tool, easily jotted down by any content author. In this sense the TOC is as well a communication and shared thinking-tool between the author and the media designers.
2. TOCs are then evolved into *abstract concept maps*, that show concepts as nodes and relationships between nodes as arcs (these maps can be more or less semantically defined).
3. Finally, maps undergo a process of *simplification* in order to be more suitable to students. Often the whole complexity of a subject matter is not required, while a simple representation of just the essential parts of it is more efficient and communicative. Here, the criteria of *relevance* in the context of the course, plays the main role.

4. *Visualization* is the last concern of map development. The metaphor of exploration also plays a role at the level of the visual clues used in the interface. In the module "Verbal Semiotics" maps really look like explorer's maps of an exotic archipelago. In other modules, different metaphors have been chosen, according to the subject matter itself. The "Lexicon & Morphology" module e.g. has been visualized according to the metaphor of an information flux in a machine.

CONCLUSIONS

A first testing of the SWISSLING map solution has been done during the Winter Semester 2001 in the University of Lugano, where 170 freshmen in the Faculty of Communication Sciences attended online the modules "Verbal Semiotics" and "Lexicon & Morphology". Although a complete and systematic evaluation will be done in the next months, the first results are encouraging. The maps helped students to manage synthetically their learning activity, and helped structuring the discussion. "I still need time to review the last small island" is the sentence reported by several students.

This paper presented an innovative conception of maps as learning tool emerged during the first phases of the SWISSLING project. Moreover, it showed both the underlying motivations and the design solutions adopted during the development. The next step will be the definition of a map dictionary, so that the next maps produced during the project could be designed relying on a common set of landmarks and visual signs.

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