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COGNITIVE MAPS: NEW PARADIGMS IN INFORMATION ARCHITECTURE AND INTERFACE DESIGN FOR THE WEB. The Opsis Identifier Descriptive Model for web information architecture based on cognitive maps: Designing-X a case study[1]

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Abstract. The paper is aimed to introduce the application of the Cognitive Maps concept to the web design interfaces. Cognitive Maps allows the graphical representation of the information architecture highlighting the hierarchies, the nodes the physical (hypertextual) and conceptual connections between site contents. The interaction with the Information is based on a generative dynamics of ryzomatic connections where the cognitive and perceptive richness Human User is evident, giving a more direct representation than the usual static structure tree. Multimedia Authoring software tools are exploited to produce Multimodal cognitive Maps. The experimental Project Designing-X (design of a biomorphic Web Site) shows a practical, specific realization of the concepts the paper is based on.

1 MUI and cognitive *maps: new paradigms in interface design.*

The application of Multimodal Interfaces, based on the simultaneous exploitation of a multiple communicative channels and on a spatial and visual representation of the information is an emerging challenge to the presently used GUI and a possible future evolution.

Cognitive Maps allows the multimodal representation of the information architecture highlighting the hierarchies, the nodes the physical (hypertextual) and conceptual connections between site contents. The interaction with the information is based on a generative dynamics of ryzomatic connections where the *cognitive and perceptive richness Human User* is evident, giving a more direct representation than the usual static structure tree (Bollini, 2003).

Asubel introduced the *cognitive* (or *conceptual*) maps investigating the human learning (Ausubel, 1968). Conceptual maps are a tool to schematize and articulate those units; the maps also make evident the connections used to organize the units on hierarchy and pertinence criteria.

Furthermore they make evident the key concepts and the prepositions linking the concepts; the maps use the visual communication channel to improve the learning and the retaining of the concepts. Verbal communication and the related verbal transcription are a sequential, linear process.

The cognitive maps have a mesh-like and hierarchical structure, where the typical hierarchical structure of an hypertext is reproduced. The learning principle stated by Ausubel can be transferred also to the dynamical cognitive model for the learning the Website exploration: this is a continuous, dynamical and interactive process. The concept has been revised and developed by Novak and Gowin in the seventies; the proposed and developed the application in order to produce a graphical representation of the knowledge. As a geographical map allows to be directed inside an unknown land, in the same way a conceptual map allows the interpretation, the transmission and to revise the knowledge, the information and the data. The visualizations of the links between the different concepts makes evident the path of the possible reasoning.

The cognitive maps then are: a graphical representation of concepts synthetically described (words, concepts) inside a geometrical form (a node) and linked together by lines showing the relations by means of words-links (Novak & Gowin, 1985).

2 Web Information Architecture and cognitive maps

The evolution of the discipline of the Information Architecture is developing methodologies for the search and for the information organization and systems for the visual representation of data. His proposed solutions are

[1] Although the paper is a result of the joint work of both authors, Letizia Bollini is in particular author of parts 1, 2, 6 and Giuseppe Palma is author of parts 3, 4, 5.

always closer and more similar to the *complexity of the human cognitive approach* (Bollini, 2001) less based on the navigation hierarchy through hypertextual structures, more based on the richness of the cognitive and conceptual maps.

If we examine the tools used in information Architecture, maps are used to give a spatial, visual presentation; they are used also to convey a detailed description for a synoptic, parallel perception of information , replacing a conventional, serial communication.

The application of cognitive maps as representation systems for the web produces a better interpretation and a more effective support for the user associative logic, exploiting a non mediated learning of informative elements and of specific relations between elements. In some aspects this solution is more efficient than the tree structure usually applied in many Web Sites.

The maps indeed:

- produce a visual hierarchy simple and evident
- allows the visualization of thematic nodes in the hypertext, and more mark up the logical and physical connections, say the links
- allows the visualization of many nesting levels of information at the same time in the same page

The solution based on the application of conceptual maps, as proposed by Novak and Gowin, overcomes the simple translation of contents to maps; a new interpretation of the method for setting up map is introduced, suggesting a critical approach to the structuring and to the navigation of the site.

Applying the map method, the site is getting a visual, synoptic representation where all is shown at the same time, and the structure, the branches, the connections and the links will be easily perceived.

At every time the user is able to get a complete knowledge about the kind of information contained in the site and about the number and the type of the sections inside the site.

The user experience is justified because: the visual characteristics of the map produce the activation of the right side of the brain and the lateral thinking, which integrates with the left side brain, the side of the logical, linear processes. The understanding, the learning, the communication will be empowered (Novak & Gowin, 1985).

3 Analysis of positioning: the Opsis Identifier Descriptive Model (OIDM)

Any internet site can be analyzed from different points of view: at present the more applied criteria are usability, feasibility, efficient navigation, management of the contents and easy update.
Is not very usual that a web site will get analyzed from the point of view of its positioning in reference to its target; furthermore the tools to perform such an analysis are nearly nonexistent. In our opinion an analysis along this line can offer interesting answers and possibly can produce the evaluation of the match between the produced project to the design goals. Usually this aspect until now appears to be neglected, because it is preferred to center the efforts on the test of usability (the validity of the usability test is not generally accepted owing the nature of the test itself).

To solve the problem, we will introduce a new model, based on the application of conceptual maps; the model has been designed to provide an immediate check in reference to a set of objective parameters, selected between those more significant for the target of the site.

The Opsis Identifier Descriptive Model (**OIDM**) has been generated by the systematic use relational analysis of information design the web sites architecture. It is based on the mathematical concept of representation in the space using 3-D space coordinates. These values will be selected in reference to the purposes of the site and for each of the coordinates is created a staircase discrete classification, to which it is assigned a score (objective the most possible, even if personal) for every item representing the contents of the site (or item of the menu). Using this graphical representation all the items of the site menu can be displayed in the 3-D space and, connecting by lines the items that in the site are linked, a 3-D model of the site under examination will be created.

If a strong similarity has been verified, alternate actions can be considered:
1- to create a link between these menu items, if nonexistent;
2- to merge the multiple items into a single one and to make the item accessible from each of the primitive sources.

In example, if one of the 3-D coordinates is "information" and good part of the site is positioning near high values (beyond the + 5), it can be immediately perceived that the contents of the site are strongly aimed in this direction; and a frequent update of the site has to be provided. Moreover the results strongly suggests that the language to use should approach as more as possible the language of the “News”, fast, terse and direct in the first layer, and with more detail and deep explanations in the second layer. At this level is advisable to provide also some downloads and some easily printable pages.

4 OIDM for Designing-x

In order to create the OIDM of the present case study www.designing-x.com/demo.htm website the planned contents and the nature of the site sections have been examined. The site is targeted to students and professionals involved in the web site design: for this very reason “Education” has been selected to represent the specificity of the site, aimed to provide services and contents, mainly for educational purposes. The site presents also some sections devoted to information contents: this is one of the hot spots of the site. As second analysis coordinate “Information” has been selected. The third characterization of the site, valid above all for the Publishing House MODO, CID and in part DAA1, is the commercial one, that is the online sale of some products (books and review). The promotion of the initiatives targeted to peoples committed to web design, to the businesses or to the bookstores: for this reason, the third coordinate will be "Business”.

The three items were therefore assigned on three orthogonal axes: **Formation** to the abscissa (x), **Information** to the ordinate (y) and **Business** to the height (z). A score, relevant to three axis, has been assigned for every menu item. The score has been assigned on the basis of the **Statute** (or from the type of real activity) of each of the sections. In the OIDM model the proximity of the contents and the menu items displayed to the representation of the entity whose they take part, is an indicator that the site design returns a faithful image, in contents and in treatment, of the activity itself. On the opposite side, if the two displayed points are being at a significant distance or belong to space zones clearly different, the site has a unskilled design because does it not reflect what is the corporate image and its way to perform the actual activity.

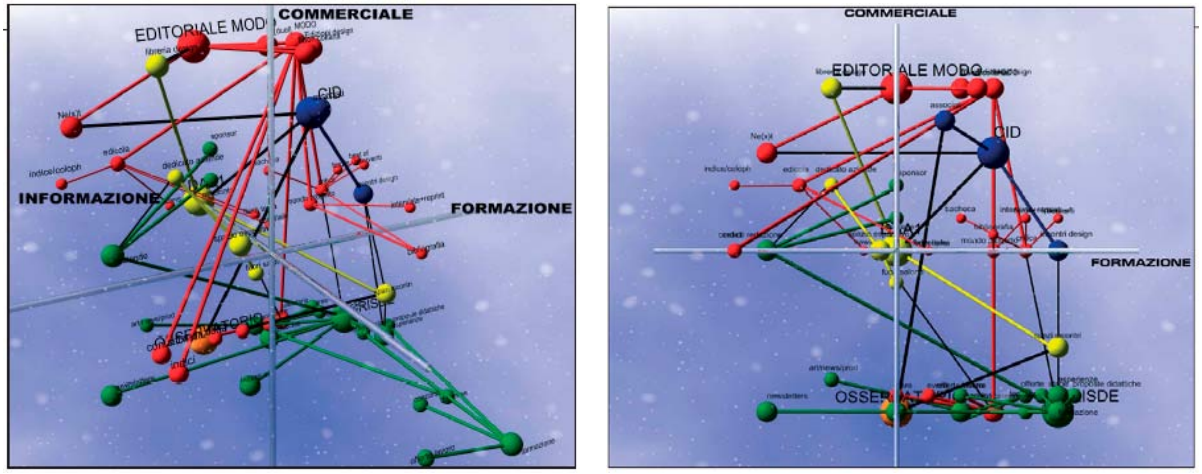

Figure 1. Grafical rapresentations of the model for Designing-x.

It is necessary to point out that deliberately a deep analysis has not been performed on the results produced by the OIDM for the site “**designing-x”**: we try here to supply a qualitative idea of the potential performances of this tool and of the advantages allowed by its systematic use in the design and in the analysis of web sites.

5 Designing a cognitive site: *Designing-x* a case study

The *Designing-X* project represents an experimental design for the realization of a cognitive, experiential Web site. User does not interact act only using a GUI, but can also exploit a tool for the exploration of a complex reality: a site *container* of a five different realities relating to the design world. The site collects contents, services, databases, papers, research reports in a homogeneous, complex and structured context. The site is more a “common place” of realities sharing a strong interest for the education and for the information; they are *virtually associated* in an effort to *create a room of contents useful to (to support) a designer continuing his education* (Palma, 2003).

The aim of *Designing-X* is to develop inside a coherent project all the services proposed by the formation actors (professional associations) using a relational modality. This choice is aimed to produce a direct and necessary perception of the complexity of the contents structure inside the sections and between the sections; at the same time a simple and direct content navigation can be produced, and an efficient use of information.
Unnecessary informations do not be displayed at every time; they will be exposed only at the time they are needed on user demand. It is necessary to mark up that only two *mouse-click* selections are necessary to explore contents on the site: the first to enter one of the main sections, the second to select an option displayed inside the selected section. We have proceeded to the second level of interaction; at the same time it looks as if we are in the first one. However this is the deepest level of interaction with the map; not withstanding that we can perceive on the display all the site structure. A clear advantage is that we can master at any time all the site contents, and we do not risk to get lost in our navigation.

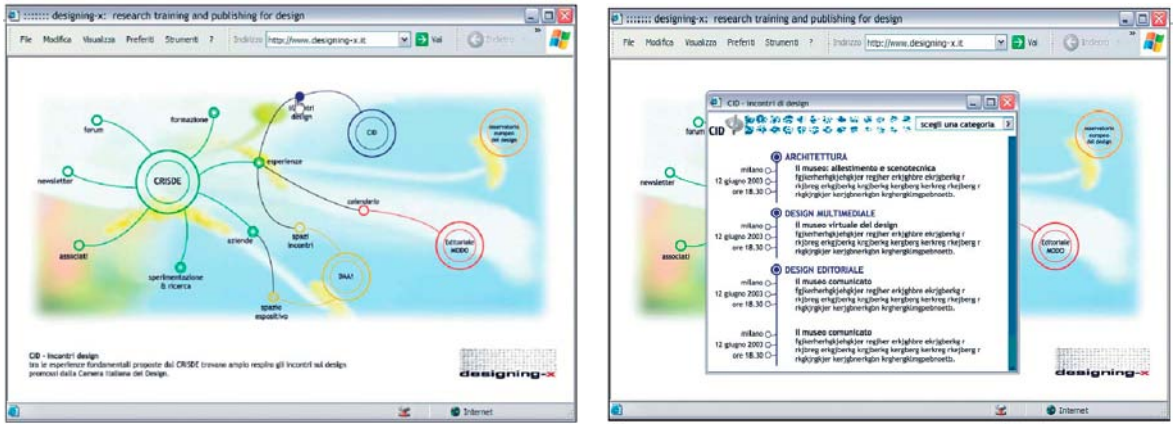

Figure 2. Mouse over to explicit relations and a contextual information in pop-up window.

A last remark: in *Designing-X* it is useless to provide the usual "*go back to the Home Page*" feature; in every Windows of *Designing-X* is always allowed the possibility to go from the present Window to a new one. The *mouse-over* produces the same information displayed in the Home Page. Inside this project has been decided that *go back to the Home Page* is not provided because is useless in navigation, harmless in cognition: an holistic vision of the contents and of the links of the sections will be lost.

6 Conclusion

Cognitive Maps are tools to represent the knowledge and to support learning and retaining.The maps are organized by means of conceptual-semantic nodes interconnected by prepositions-links; they can be used in order to represent the learning and the knowledge using a non linear processes.

The network structure of the maps is very similar to the information hypertext, based on information nodes, say communications unit self sustaining, autonomous and correlated. The application of the cognitive map concept to the Web interfaces supports the user with a tool simple and direct for the site exploration.

The maps present a simultaneous visualization of the site macroareas and at the same time the different layers of information nesting. The maps visualize the connections and the hierarchy between the contents; they allow to reach in a short time the information core the user is interested on. Exploiting the visual-hypertextual-relational structure they are more efficient than the usual hierarchical-verbal tree structure in order to cope with the human cognitive processes to explore and to learn in a complex, rich information structure.

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