Hypermedia analysis

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HYPERMEDIA ANALYSIS
SOME INSIGHTS FROM SEMIOTICS AND ANCIENT RHETORIC

The purpose of this article is to compare current Hypermedia practice and research with ancient and modern theories concerning the way people organize their communication (either oral or written). The paper analyzes well known facts and theories about Hypermedia, providing for them a perspective based on semiotic research. The goal is to convince the reader that this interpretation may be fruitful in several senses: to better understand the current (or past) practice or research; to develop new hypotheses; to refine current approaches.

Keywords: Hypermedia theory, semiotics, linguistics, rhetoric.

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Introduction

The origins of this article can be traced to a number of educational and research activities happening at the Faculty of Communication Sciences at the University of Italian Switzerland (USI) at Lugano. The need was to explain modern Hypermedia concepts to linguistic and semiotic researchers and students; also there was the need to take into account, while working on Hypermedia issues, modern research conducted in non-technical areas. It was immediately realized that if technical people ignore, at a great extent, research achievements of semiotics and linguistics, humanistic researchers have naive (or often confused) ideas about the objects created by technology.

A cross-fertilization of these two, apparently distant areas can have a twofold purpose: to provide semiotic researchers of better understanding of technical issues; to offer to the hypertext community theoretical considerations that may provide new points of view about well known phenomena and/or, consequently, to stimulate new directions for technical research. We firmly hope that one or two ideas, found here, can stimulate, at least, a slight change of attitude in the reader or, hopefully, a new way of conceiving (understanding) his/her research work.

General Issues (Hypermedia, nets, and other dangerous things we live by: a semiotic approach)

The astounding popularity the Internet has got in the last few years and its growth have made it a main research subject. Although most studies were and are conducted mainly by technology-oriented people, a number of other scholars, coming from different research areas and traditions, have started to investigate the phenomenon, each of them asking their own disciplinary-

driven questions. A specific target for this "non technical" research is, obviously, the Web[1] and its structure, since it seems an evolution of the old practice of writing linear texts. This new interest has also involved all the researchers concerned with Hypermedia and the Hypertext, bringing to them new forces and a greater deal of empirical evidence.

As long as the real world enters the net, being captured in its electronic web, all the disciplines which study it are starting new research branches to understand (and, sometimes, to try to foreseen) what's happening there, where neither real space nor real time seem to have room. This is the case for semiotics and linguistics, as well as for literary and educational studies; also scholars in economics and social sciences are every day more concerned with the electronic world(s).

As often happens, many researchers have started to trace back the roots of the new electronic media, looking for visionaries, prophets, anticipators and founders. Johan Huizinga (Huizinga 1960) suggests that history is the "form of the spirit, where a civilization acquires consciousness of its own past". It is therefore not surprising that many different interpretations of the Web were born (and are growing). These interpretations should be considered more as documents of specific cultural awareness than pieces of the "thing itself" of a complex history which, maybe, it is too much near to us to allow an adequate point of view.

That is why — and not because we think it is not interesting or even necessary to be studied — we will not devote much room to recall the history of the Hypermedia and the Internet. This section, instead, will mostly deal with definition issues, offering tools the rest of the paper will work on. It will accom-

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[1] The Hypertext community may regret that several issues, discussed and analyzed within its boundaries, for several years, were again considered (sometimes as "new" issues) with the advent of the Web. Whether we like it or not, this is what happens and we can not ignore it.

plish this task also discussing some relevant points of view on the subject, all of which can be labeled, at least at a certain extent, as "semiotic". Although not all the positions will be presented, which could not even be possible in a so fast moving research area, meeting some of the most influential ones can help not only outline the landscape where those researches are mainly situated, but also to trace the directions they are following.

Some (provisory) definitions

Following the proposal made by the researcher who invented the name itself (not the concept) of hypertext, Theodor Holm Nelson, Delany and and offered the following definition: "We can define Hypertext as the use of the computer to transcend the linear and fixed qualities of the linear text. Unlike the static form of the book, a hypertext can be composed, and read, non-sequentially; it is a variable structure, composed of blocks of text (or what Roland Barthes terms *lexia*) and the electronic links that join them" (Delany and Landow 1994).

Almost all the definitions used in the field of semiotic and literary studies have concentrated onto the two elements outlined by this definition: content units, or "nodes", and links, emphasizing at the same time the non-linear, or multi-linear readings an hypertext elicits. "Things and links in-between", can be a good rephrasing of what hypertexts are mostly considered to be.

While, at first, the name suggested that nodes themselves were texts or textual pieces, nowadays it is frequently used as a synonym of hyper-multi-media, or Hypermedia, due to the fact that content can be made not only of text, but also of images, video, graphic, audio streams, etc.

Let us go deeper into the definition issue, following different taxonomies.

First of all, we can distinguish three dimensions forming a sort of hyper-textual cube (Hornung and Santos 1993): *Content*, *Organization* and *Access*, which we shall analyze starting from the last one.

Access

Hypertexts are to be accessed in an electronic environment, which entail a computational part, constituting the hypertext machine, representational tools (most frequently a computer screen, and loudspeakers, but also every Virtual Reality instrument) and interactive tools (most often a mouse, a keyboard, a microphone, etc.). These tools are necessary not only to activate the links, but also to input new materials, which can be, in their turn, both nodes — or nodes' parts — and links.

Due to their being electronic texts, hypertexts can't live outside their electronic milieu: outside, only single parts of them can be made manifest, through a living interaction session, or as dead fossil-like elements, for instance when a node or a screenshot are printed.

The access to the content that an hypertext allows for, is always a partial one, at least for two main reasons. First, nobody can have a direct access to the text in its internal format — because it is outside the perceptual capacity of a human being, being made of electronic states and impulses — but only to its external representations (as generated by presentational tools). Secondly, the hypertextual nature is an open structure, both in terms of nodes and in terms of possible fruition paths, and this means that it is (at least) hard to say whether an hypertext was or not read through completely; maybe it is not even a question which can be posed.

On the above ground research on hypertext has merged with research on oral-centered and writing-centered cultures, yielding to a conspicuous corpus of analyses, all of them underlying that a shift in the technology of writing and reading implies main

changes in the cultural settings themselves (Ong 1982; Bolter 1991; Chartier 1997).

Organization

A link establishes a connection between two different parts of an hypertext, it has so a departing point, an arrival one, and a direction. Activating a link means leaving the node one was reading, and getting the other one the link was pointing at. Depending on the different technologies, links may have different features, in any case, every piece of every node can — at least in theory — be linked to every other one. Actually, the coding of time-dependent objects, video and audio streams, for instance, does not usually allow direct connections to or from every single piece (Gonzalez 1997).

Content

In the most popular description of what an hypertext is, at the level of content we have established nodes (or "lexias"), as the arrival things the path of a link arrives at.

According to Nielsen (Nielsen 1990), nodes can be described in terms of "frame-based systems" or of "window-based systems", depending on their spatial organization being established and accessible at a single eyesight, or being less defined, and accessible through a window the reader can scroll. Nielsen himself provides a slight different taxonomy, to analyze the hypertextual structure: Presentation Level, Hypertext Abstract Machine (HAM) Level, Database Level.

The hypertext and its three levels: Presentation, Hypertext Abstract Machine [HAM], Database[2]

Looking at the hypertext from this point of view, we can find out three different layers. Looking at the deepest one, we can say that: "As far as the database level is concerned, the hypertext nodes and links are just data objects with no particular meaning" (Nielsen 1990: 101).

The higher level, which enables the user to access the hypertext, "deals with the presentation of the information in the HAM, including such issues as what commands should be made available to the user, how to show nodes and links, and whether to include overview diagrams or not" (Nielsen 1990: 104).

While this level works as an interface between the system and the user, the hypertext abstract machine works as an interface between the other two levels: "This center is where the hypertext system determines the basic nature of its nodes and links and where it maintains the relation among them" (Nielsen 1990: 102).

This intermediate layer is what Bettetini *et alii* (1999) call the hypertext "logical space", suggesting that there are two other spaces to be taken into account: the physical one (the one of the intra-node architecture) and the interactional one (the one defined by the actual way a reader follows).

Since nodes and links seem to constitute the hard core of the hypertextual story, a deeper analysis is thus required.

Nodes' issues

When one tries to define a node, a number of difficulties arise. Nodes, first of all, are not a sort of "atoms", units you can not

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[2] The authors are fully aware of the fact that several other authors have used similar partitions of an hypertext in different parts; lack of space prevents us from enumerating all the different definitions, that, anyway, revolve around concepts similar to those examined in the paper.

divide any more. Moreover they frequently are neither conceived nor stored as being units at all.

Medium and large size websites are nowadays usually based on pages which are pulled together dynamically, each session, combining templates with data fetched from databases. In addition, the use of "banners" or other "commercial" information, added to traditional pages, creates an even further level dynamically.

What happens, in the end, is that the page that the reader sees was not designed or produced as an "atom", but it is the result of several concurrent actions, performed when the node itself was requested. It is possible that, if sophisticated strategies based on user profiles are used, nobody else in the world has seen or will see that page. Where is there a node then? Many educational titles on CD-ROMs, for instance, build up nodes "on the fly", depending on the learning history of the reader. This opens the vast field of hypertext customization (Brusilovsky 1997).

If we return for a moment to the Web world, you never know exactly what the surfers are going to see on their screen due to the kind of monitor they have, and to the — more constraining — systems and browsing software they use. Moreover: the limits of the available bandwidth often suggest to make internal links anchors inside the same web page (/node), while in an offline product different nodes would be built. Where are the nodes then?

When active media, that evolve with time, are considered (e.g.: a video), are there as many nodes as the number of frames? Or is there only one node? And what about having the same piece of music being played, over and over, during a complete reading session?

Although the concept of nodes as being sort of atomic units has to show its naivetes, once probed against real experience, nonetheless the "node" as a conceptual tool seems not to be completely dismissible: it seems to be deeply rooted in our experience of the electronic text. This situation seems to paral-

lel, in some sense, that of "words" in the linguistic research: although being questionable, and actually questioned by so many researchers due to good theoretical reasons, words do not seem to be ready to completely leave room to other objects.

At this point we can re-articulate the node issue this way: nodes are not (necessarily) units inside the hypertext (units someone must have written or composed as such), but something which is perceived as a unit by the hypertext reader. A node is something s/he has to receive at once, without being given the possibility of choosing to get only a part of it. They are, in other words, outside the range of choices one can make when reading through an hypertext.

In other words the notion of "node" is transposed from the realm of precise design notions to the realm of perception: if the reader perceives it as a "unit of consumption" while navigating around, then it can (or must) be called node.

If this proposal does not change much the receiver point of view, it affects the hypertext producers' activity, suggesting that: (1) they do not produce the nodes "in themselves" — single, auto-sufficient atoms, to be later connected by adding several links — but sets of syntactic and semantic rules according to which all and each node is to be constructed; (2) the connective/syntactic structure does not concerns only the "links" layer, but percolates all the hypertext reality, nodes included, (3) the hypertext unity has to be granted also by a careful planning of the nodes' internal structure, and not only by an adequate link policy and consistent graphical choices.

Links' issues

If we accept this interpretation of the notion of "node" as being associated to a "perception", possibly induced by several concurrent actions of the system, we must also revise the notion of link.

Maybe, we would better re-frame the "link" metaphor into an action one: links are actions one can perform when "reading" an hypertext. The "meaning" of "invoking" a link is, very often, to ask for another piece of content (another node). It is possible to associate to each single part of a node an action (or — depending on the software — more than one), leaving to the reader the choice of having it performed or not.

This more general definition does give account not only of what a link is generally meant to do: connecting a node to another, but also of everything that happens in the hypertext backstage: the building up of a node, for instance. But there are a number of other activities that an hypertext reader can perform through links: buying and selling products, subscribing to services, etc. By activating a link the inter-actor says "[I want] something [to happen]", and it happens.

Sometimes this creates, in a sense, a situation quite similar to that of performative sentences: sentences which describe a reality while at the same time creating it (Benveniste 1974; Austin 1962). For instance: saying "I promise X..." or "I baptize you..." one says what s/he does, at the same time doing it. These sentences depend on who utters them, as well as on the context they are uttered within. If a chairperson, in fact, declares "the session is opened", s/he describes a state s/he produces, while the same sentence uttered by a journalist describes the same state, but has no effect on it.

In the Hypermedia world when someone clicks onto the "I agree" button, s/he both agrees on the terms of the contract and "says it", or choosing the "I buy it" declares his or her intention and realizes the economical transaction. And calls for another node. This broader definition of links, while trying to unify what Hypermedia, man-machine interfaces and software engineering are all about, takes into account the very intrinsic quality of interactivity: actions being performed depending on reader choices. We meet here the figure of dialogue.

Hypertext readers engage in a continuous dialogue with the hypertext (structure) itself, by the mean of action/links they offer the needed feedback, upon which the reading session is build up. The hypertext, somehow, re-acts to the readers' answers (actions). It has thus a dialogical structure; better said: *it is a dialogical structure*. Due to the fact that the paradigm of activities/answers a reader can do is established by the hypertext itself, we can also say that readers continuously are requested to answer hypertext's questions: "what do you want afterwards?".

From this point of view, a hypertext can be seen as a (partially foreseen) dialogue, being actualized by (partially foreseen) dialogical exchanges. The more an hypertext takes into account the readers' interests and needs, the questions and challenges they would like to pose, the more it fulfils its communicational purpose, *the better it is*.

It may be worth to emphasize that the above definition has two different aspects in it:
A. an Hypermedia in action is a dialogue (and this is not so original or surprising);
B. within the dialogue the Hypermedia asks the questions, and the human being replies (which is probably the opposite of what a reader would expect).

A linguistic approach: two syntaxes are thus required

The research, up to this point, has shown the need for two different, although closely interconnected, syntactic theories: one dealing with the nodes' layer, the other dealing with the links' layer (Andersen 1990).

Having defined a node as a "consumption unit", it has to be granted a sort of utter-ability: each node can stay, at a certain extent, by itself. Nodes are quite similar, from this point of view, to phrases, where all the morpho-syntactic structures are saturated.

Moreover, each node is, in itself, a complex unity of different elements, all belonging to the same semiotic language or not, and all these elements stay together — *in praesentia* — and bear reciprocal interactions. Such a node-layer syntax will have to take into account the kind of different elements that can constitute a node, and their reciprocal distribution in the electronic space: it will thus offer a sort of architectural description of the "what and where" a reader gets when accessing that node. Being a general syntactic theory, it will not deal with empirical elements, with "tokens" (those that the reader gets), though, it will deal with general categories, with "types" of what a reader can get.

Links deserve another syntactic theory, which is more closed to a text-theory. This syntax has to explain which different activities can be performed connected to which content. This second syntax will deal with elements whose fruition can not be contemporary, setting rules of accessibility between elements which have to be accessed one-after-the-other (*in absentia*).

Maybe we can find here, in the recent history of the Web, an instance (and its re-definition) of what the semiotician Roman Jakobson (1990) called the "signe zero". We encounter a "signe zero" each time we have a closed paradigm of possible choices, and when also not choosing an element has a given meaning. The paradigm of articles in English, for example, presents this characteristic: we can say "*a* cat and *a* dog are friends", or "*the* cat and *the* dog are friends", or "cat and dog are friends", were the lack of articles itself provides a specific meaning. While, at first, it seemed that adding a link just meant that there was something connected somewhere in the Internet, nowadays — due to the fact that you can be sure that for every subject you can think of, there is somewhere something connected —, in order to add a link one has to guarantee that the related material is really relevant to the actual discourse. So, the lack of a link (signe zero) does not mean any longer "there is nothing else connected", but "I (the multimedia designer) didn't think there

is something you'd better jump to, leaving your actual path". The more the Hypermedia author(s) takes responsibility of the choices the readers are given, the better defined links' syntax we have. The fruition session faces thus different degrees of freedom: from the zero level of the node: something you can not control (at least directly), to the more free step-by-step movements, where the set of links establishes a sort of "supervised freedom", up to the overall session path, where the freedom the (reader is given is the highest possible.

Following these linguistic suggestions, we could say that the Hypermedia author(s) does not produce a text, neither a number of texts, but sets of syntactic rules and basic elements. At a certain extent, it can be said that s/he produces a sort of new language, which allows only discourses on specific realities (e.g.: a CD-ROM on geography), and excludes some stands about them (e.g.: Milan is in Switzerland). Of course, only some specific stands on the concerned subject are allowed (Milan is in Italy), but they are taken only under the condition that some links are activated and specific nodes are got.

When the linguistic code is concerned, in this (sort of) language, basic elements are mainly phrases and text sequences, and not lexical items. The completion of actual texts is usually done only by the readers themselves.

From deepness to surface: the web and its structures (hypermedia rhetorics)

In the remaining part of the article, we will compare "classic" rhetoric definitions with Hypermedia concepts[3]. In order to

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[3] Similar comparison can be found, for instance, in De Rose (1989), Delany and Landow (1994), Liestøl (1994a; 1994b), Moulthrop (1992), Landow (1997).

simplify the comparison, the concepts for Hypermedia will be taken from the HDM model (Fraïssé et al. 1996; Garzotto et al. 1994; 1995a; 1995b; 1996; 1993), which allows to "talk about" Hypermedia, without facing implementation issues. The reader fond of other Hypermedia models could easily "translate" our comparison in an analogous one.

In the classic rhetoric description, every discourse was based upon five elements/activities: *inventio, dispositio, elocutio, memoria* and *actio*. In fact, in order to say something, one has to find and collect all the ideas s/he wants to communicate (*inventio*); then, a specific discourse path has to be chosen, establishing what will be said at which point (*dispositio*); linguistic tools are to be adopted to convey those meanings (*elocutio*). Once planned the discourse, the speaker has to learn it (*memoria*), and to actually deliver it (*actio*).

Inventio

If we ask ourselves what the inventio is about for Hypermedia, we could have several possible answers: the idea about the content, the idea about the information or navigation structure, the overall idea about the Hypermedia, the narrative idea, etc. All the answers, probably, are good ones, although not fully satisfactory. Overall we may conclude that it is the idea behind what that Hypermedia work/title actually is.

It may be also remarked that, while building a Web site, sometimes we do not even know to whom we are talking: therefore the "inventio" of the content is even more difficult than before. Nevertheless we should be aware that often the fact that the content is accessible from everywhere becomes an *alibi* not to do it for anybody, not to take into account the receivers themselves.

Within HDM, we could say that, in a partial sense, the inventio corresponds to shaping up the Hyperbase (entity types +

semantic links): i.e. deciding what the application is about in terms of content structure and basic semantic properties.

Dispositio

We should make here a clear distinction between "dispositio" as it appears to the reader and "dispositio" as it is designed. While navigating on the Web the reader gets a linear sequence (dispositio) of nodes, one after the other, s/he never gets a non linear session; therefore, if we compare the result of a session with classic rhetoric, we may conclude that "dispositio" has exactly the same meaning. When we come to design, instead, it is a completely different story: the arrangements of the nodes are specified, in HDM, by several devices. Structural links, semantic links (previously called *application links*), collection links, etc. are conceptual devices to control the dispositiones. They are not the dispositio in its own, however: the designer, in fact, never specifies sequences of nodes; s/he specifies the rules upon which such sequences could be built. This makes the task of the designer difficult, since s/he must make sure that all the good dispositiones are generated (at the proper time, for the proper user, easily, etc.) and that bad dispositio are avoided.

We may conclude saying that, from the reader point of view, the result of a session with the Web represents a "classic" dispositio of nodes. The designer, instead, must create a machinery for generating possible dispositiones, rather than explicitly defining one or more of them. An additional complexity is due to the fact that the reader must understand the machinery, in order to "drive" it to proper and meaningful generations.

If we consider the inventio level a sort of brainstorm, the dispositio realized by designers is a sort of brain-map, outside every time-boundary, whereas that built by the reader, connected with time, is more closely related with the traditional dispositio.

Elocutio

Let us just start with a little exercise, to better clarify what "elocutio" is, or, at least, how it is used here.

Take a printed page, with some sentences onto it, and put it on a table, take also a notebook and a pen, and put them somewhere else in the room, distant five or more meters from the table. Now, go to the table, read the first two or three sentences, than, leaving there the paper, go to the other side of the room, take the pen and the book, and re-write the same sentences with exactly the same words and commas, and everything else that was printed on the page you read. It will be quite impossible to reproduce them with the same wording. Sure you remember the meaning — the "plot" (if there was one) — but hardly every single word. There is a way to reproduce the text, which is not trying to remember (nor even to grasp) its meaning, but considering it simply as a sequence of words to be reproduced. So, to put it this way: leaving aside the meaning helps you remembering the words, but concentrating on the meaning makes you forget the wording.

What stays between the meaning and the actual words is the *elocutio*: the activity of dressing meanings with suitable words and — more in general — with a linguistic form. When we translate a text, we almost completely loose its *elocutio*.

In the Middle Ages linguistic theory, for instance, this distinction was made distinguishing three different words. (1) What stays before (and beyond) a specific linguistic form was called "verbum cordis": *word of the heart*; (2) what could be expressed (but before any actual expression), "verbum interius, quod habet imaginem vocis": *inner word, which has its spelling pattern*; and (3) what is expressed in an actual discourse, according to the second "word": "verbum exterius expressum, quod dicitur verbum vocis": *externally expressed word, which is also said uttered word* (Cantoni 1994).

Three different activities seem to belong to this level of the Hypermedial production structure.

First of all, there is the choice of what to put in each node/component: how many elements (slots), and of which nature: texts, images, animations, and so on. Every element, both more closed to the content, or to the utility set of the applications (navigation buttons, background, etc.) has to be planned at this stage.

Secondly, there is the architectural planning of their relative disposition in the electronic space of the node, and — if animations or audio/video are concerned — also their theatrical disposition in time.

The third activity concerns each single element: and calls into play its own semiotic structure, its actual "language": how the text is organized, how the pictures look like, etc.

In HDM terminology the elocutio could be assimilated to the design-in-the-small, i.e. to specify the nature of each single information item within each node. Also, and consequently, the choice of media (e.g. should I express this meaning via a text, or using a picture with an audio comment?) is part of "elocutio".

Memoria

The first temptation is to dismiss the concept as related to the difficulty for human beings to memorize what they have to say, and therefore not related at all with Hypermedia.

A little more attention instead may find some interesting aspects. Let us consider a reader using the Hypermedia for a long session, or several times:

A. the Hypermedia remembers where s/he has been (e.g.: back button, history, the color of anchors);

B. the reader may be able to customize the dispositio creating new contexts (*collections* in HDM terminology) new links or new entry-points (bookmarks), which are remembered by the system;

C. the system may learn user preferences and styles of navigation, modifying accordingly its behavior (adaptive Hypermedia);
D. a specific case of this memory in the Internet world is that provided by systems which try to embed collective human experience (memory) in (semi-)automatic tools: for instance "alexa", or human made "subject gateways".

Are all the above examples of a different way of interpreting the notion of "memoria" for the Web?

Actio

If the "actio" was the way for the speaker of interpreting her or his discourse, the closest analogy is with the dynamic behavior of the Hypermedia. Therefore navigation style and rules, interactions, multimedia playing, etc. are the Web counterpart for it.

There is a conceptual problem though: the dynamic part of an Hypermedia is also used to "generate" dispositiones, as it was said before. If this is true, we should conclude that in Hypermedia dispositio and actio tend to converge toward a unique dynamic notion.

If this is accepted, it could be considered an important novelty introduced by Hypermedia.

Conclusions

The reader may wonder what was the purpose of the exercise conducted in this paper: what is the purpose of using a linguistic (semiotic) conceptual machinery, to describe Hypermedia applications?

The authors are convinced that a number of benefits may arise from such an activity:
A. a better understanding of the conceptual roots of Hypermedia could allow a better understanding of the needs for improvement of current practice and research;

B. if the correlation is valid and holds, some results already achieved by linguistic and semiotic research could be used to improve practice and research in Hypermedia;

C. if linguistic and semiotic researchers understand better what Hypermedia is about, they could provide a better contribution to the improvement of the current state of the art, and this seems to be particularly needed, looking at the situation of the Web;

D. a reconciliation of technological and humanistic theories could help recreate a cultural unity between different research communities, that have lost the capacity of thinking in a unified framework, where (apparently) different phenomena could be accounted for.

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