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Hypertext Semiotics

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Abstract
Rather than delivering yet another Hypertext Model, this paper lays out prolegomena of a theory of "Hypertext Semiotics", developed by the same author in an extensive dissertation. The aim of this approach is to interlace the existing models with the findings of semiotic research on a multidisciplinary basis. Special care is given to human-machine interaction; to spatial components of hyper/text; to semantic, semiotic and virtual spaces; to hypertext navigation and the pointing device of standard Web browsers; and, finally, to non-sequential texts and the concept of Intertextuality.

Introduction

The paper delivered hereafter is an extract of this author's dissertation [60], an interdisciplinary work that was supervised by three professors that come from different disciplines and teach at various Universities1. It employs methods of Ethnology, Information and Media Theory, Economics, Cultural Studies, Semiotics, Philosophy and Art History in order to formulate prolegomena of a theory of "Hypertext Semiotics". The dissertation, finished in late 2001, adhered less strictly to literary theories and linguistics than comparable approaches (e.g. [41, 69, 34, 81]). Rather, the intention was to apply these insights and principles to analyze the state of the World Wide Web, at the time of writing. Special care has been given to format of the output of the findings. The paper version of the dissertation (just as well as this extract) follows most technical conventions of a published written work. But in fact, it is a printout of a PDF document which makes use of various hypertext functionalities2. Besides this hybrid version of electronic and physical publishing, there is also a HTML version derived from it – both electronic versions are available from the author and online.

Hypertext and Hypermedia

Semiotics has been applied to the notion of the Internet as a global network, a phenomenon of wired life, and the unbounded, self-organizing, rhizomatic nature of cyberspace, cf. [4, 18, 25, 33]. Semiotics has also entered the realms of Computer Science via Andersen's Computer Semiotics [2] and other approaches, e.g. programming languages, Semiotic Engineering, Artificial Intelligence and Computational Semiotics, cf. [77, 53, 54, 19, 63, 85]. To broaden traditional views and to look in new directions for inspiration, guidance, and lessons is becoming more and more natural for those hypermedia, computer science and structural computing scientists, who want to position themselves and the larger community closer to the humanities than to engineering. The intention of this work is to fertilize the field of Hypertext Semiotics for future research. A field which is still mined with terminology-mismatches, it has unknown border lines and is crowded with short-sighted gold-miners digging for quick results. In the tradition of hypertext research in the early 1990s, several theoretical approaches have narrowed the gap between semiotics and hypertext theory. However, the rise of the WWW and a vast need for technical solutions might have inhibited the growth of a broader basis for Hypertext Semiotics. Despite valuable contributions (e.g. [64, 63, 68, 58]) in the field, a lot of research has to be done to establish a firm fundament for this kind of analytic thinking.

”Computer Semiotics” is a term which has been gaining currency in recent years. Established by Peter Bøgh Andersen (cf. [2]) it may be an emergent field of inquiry, but as of yet there is little academic consensus as to its scope. By elaborating the concept of *Hypertext Semiotics*, I intend to test the stability of the *Computer Semiotics* construct and its applicability of its methods on hypertext structures which has often been implied but not yet fully explored, cf. [18, 57, 58, 59, 76]. The validity of a semiotic approach to computer science has been emphatically underlined by Nadin.4 Peirce’s classic distinction between iconic, indexical and symbolic signs has been cited in connection with hypertext theory by Colón [18]. It has also been pointed out that some of the ”icons” employed in GUIs, within the toolbar of Web browsers and on Web sites are in fact symbols, cf. [50]. However, many of these bridges between semiotics and hypertext theory are not quite theoretically founded. Besides a thorough consideration of classical semiotic approaches in the first chapters of my dissertation, I intended to draw on a broader theoretical framework of the symbol, including Cassirer, Langer and Lévi-Strauss on the one hand and Freud, Lacan and Derrida on the other. The analysis of signs in hypertext systems can also profit from the latest advances in image theory, namely Elkins [27], who weds Wittgenstein’s *Bildtheorie* with Goodman’s criteria of notation. The semiotic approach has proved to be a suitable and most elaborate tool when working with both words and images. It has been adopted by art history and media theory and is nowadays a standard tool when analyzing the domain of images, cf. [27].

The visualization of hypertext architecture depends largely on graph theory, itself a notation system. Some readers might be surprised by the exemplary regresses on cultural and artistic phenomena to illustrate my points of view. Yet, considering that the average Web page designer (knowingly or not) seems to recur on the same concepts, memories and experiences of a common visual culture, this strategy will present itself as appropriate for the purpose. The intention to make Web pages more appealing to users of different age and education from around the globe have pushed forward a wave of non-text media: Graphic and photographic elements of hypermedia design promise to ring in a Renaissance of the image while the semiotic limitations of picture languages have been long identified, cf. [29, 72]. Keeping these limitations in mind, I still tried to make use of Otto Neurath’s International Picture Language to elaborate a basic scheme for a new generation of ”icons”, which I call Graphic Link Markers (GLM), cf. [60, 61] Hypertext theory has always been strongly linked to usability and human factors, epitomized by Jakob Nielsen who is commonly referred to as a Web design guru today. Important as Nielsen’s usability studies are to understand the success or failure of corporate Web sites, online services and DotCom enterprises, they often lack a broader analytical basis. The discussion of the commercialization of the Internet has produced a large body of theoretical and practical work. The elaboration of my hypertext semiotic approach is placed in the framework of this sociological and economic research.

Communication at the Interface

Semiotics has often been applied to computer science in the field of interface design, e.g. [3, 19, 47]. As building ever faster, cheaper, smaller, more robust etc. machines and applications is an important branch of computer science, this development (and the growing accessibility of PCs) fosters the need to bring man and machine closer together. According to Keeler and Denning, the development of multimedia gives interface designers the ultimate challenge to develop interface technology that will simulate human-to-human communication. Referring to Peirce’s semiotic concept, they try to answer the question whether human communication theory can treat the conceptual deficiencies of interface design philosophy, cf. [36]. Andersen, however, insists that, although there are some resemblances between the system

concepts of Computer Science and Linguistics, ”the concepts cannot be considered identical, and therefore computers cannot play the role of participant in a communicative process. Instead, they are assigned the role of a medium for communication between human users. A computer system is described as a calculus of empty expression units, some of which can be part of the sign system that emerges when the system is used and interpreted by humans” [2, p. 134]. This opinion is shared by others who have developed semiotic approaches that perceive the user’s work at interface as a communication act between designers and users, using the computer as a medium, cf. [53, 19]. I propose linking the psychoanalytic notion of the computer as a transitional subject and Bahr’s view of machines as active counterparts that raise our receptive sensuality to superhuman levels. Analyzing hypertext as a sign system is not a mere extension of the semiotic project for the sake of completeness; rather, this approach promises insights that can help to make that medium a more useful, intuitive, rich and productive one: ”As opposed to any form of sequential closed communications, hypermedia requires means for and ways of generating an infinity of meaningful interpretations. A non-linear structure is, after all, a graph constituted from nodes and links. The semiotic level of such nodes and links is quite abstract, but without a good understanding of these communicational entities, we will never exercise an efficient command of the process of generating the infinity of meaningful interpretations” [54].

Spatial and orientational metaphors

It is commonly agreed upon that, as computers get more powerful, it is possible to invest more computer power to make the user interface more realistic. In this context, spatialization has become an important issue: ”As mankind is a species used to live in a spatial environment it indeed makes sense to use a spatial concept for the overall user interface” [23, p. 61]. Enriching and spatializing a virtual world is possible in various ways, e.g. the use of a virtual sun and virtual shadows to show the passing of time or using different sizes for information objects according to their size, cf. [78]. ”A spatialized virtual space allows moving objects closer of farther from the user. Objects that are important for the present work should be closer than others. This spatialization leads to the extension of the desktop space to room, house or city spaces” [23, p. 76]. In fact, mankind shares this spatial orientation with other species, but is separated from them because it is a ”speaking-being” (l’être parlant, or parlêtre), cf. [39]. Ipsen claims that spatial deixis falls back on vocabulary describing laterality (left/right), verticality (above/ below) and sagittality (front/back). The most important semantic axis, however, seems to be close/distant: Ethnologists have found that societies depend upon this dichotomy in the structuring of their mythology, villages, hunting techniques, seasonal migrations, marriage policies, etc. and Lévi-Strauss has elaborated his structural anthropology on the basis of the proximity axis, cf. [44]. The difference of close and distant, or self and other, is the first spatial/ semantic relation a child has to learn. In the early stage, transitional objects mediate between the self and the world, cf. [83]. The dialectical relation of the ”I” to the ”you” is developed only at a later stage.5 Some theorists assert that, unlike verbal language, the visual image is not suited to exposition (e.g. [67, 2.291]; [30, p. 138, 175]; [43, p. 88]). In that logocentric view, syntagms are defined purely as sequential or temporal ’chains’. Chandler argues that spatial relations are also syntagmatic.6 Such structural relationships are not semantically neutral. George Lakoff and Mark Johnson have shown how fundamental ”orientational metaphors” are routinely linked to key concepts in a culture, cf. [40].7 These aspects of dimensionality also refer to textual environments, where ”we find the semiotic paradox of the (linear) text as a three-dimensional space” [34, p, 560].

According to Wenz [80], Lotman’s thesis, which says that there are certain parallels between consciousness/text/culture points to the capacity of texts to represent our perception of space. Signs

of space in texts are products of a complex process of linearization which have to transform three-dimensional space into linear and therefore one-dimensional language.

The term *sign spaces* refers to the possibility of texts to create their own spaces in a metaphorical sense. Spatial metaphors used in referring to the written text or to passages within the text create a textual space with places such as above, and below, center, and margin. These concepts refer to the physical and logical form of the written text: the shape as it appears on the page and the textual structure itself, cf. [80, 34]: In fact, ”writing is always spatial, and each technology in the history of writing (e.g. clay tablet, the papyrus roll, the codex, the printed book) has presented writers and readers with a different space to exploit” [11]. Readers form mental representations of a paper document’s structure in terms of spatial location and overall organization: Such representations or models are derived from years of exposure to the information type (e.g. academic journal articles) or can be formed in the case of spatial recall from a quick scan of the material, cf. [24, p. 100].

Text and Speech

On the one hand we have the two-dimensionality of the page or of the screen with its (visual) borders, on the other hand there is the one-dimensional linearity of speech and writing, as far as the result of the linearization process is concerned, and the one-dimensionality of reading in the sequence of time. At the intersection between space and time, we are confronted with ”the semiotic paradox of the spatial nature of the text” [65] which contrasts with the linearity of speech in its temporality. The metaphors of the written text with *loci* to which we can refer illustrate that the text is perceived as a static space. It has macro-textual structures, such as chapters, sections, headings, paragraphs, footnotes, etc. and is bounded by margins, a top, and a bottom to which the text makes reference, cf. [80, p. 579]. Such references construct connections between different passages in the text which are semantically connected but separated in the surface structure in the linearizing of complex ideas. Thus, the reading process follows the linear ordering from the beginning to the end and can be compared to a way from a starting point to a goal, cf. [80, p. 577].

Philosophers from Hobbes to Derrida have pointed out that there is no stopping the generation of meaning by contiguity, and spatial adjacency allows uncontrollable contiguities. While physical space allows for unintended adjacencies, in a standard node-and-link hypertext, nothing is officially next to anything else until a link is created. In such hypertexts, all connections are supposed to be intentional. There should be no unavoidable and uncontrollable adjacencies such as occur in physical space, e.g. if a barber shop happens to be located besides a café, the costumer can be served a coffee while waiting for his haircut, cf. [37]. There may be adjacency effects also in hypertexts, due to window location and other accidents of implementation, as well as the unavoidable effects of linguistic echoes and associations.

If the node-and-link hypertext includes an overview or map, then there may be additional modes of accidental adjacency within that presentation. Furthermore, textual linearity is more than mere sequence. It depends on devices which provide cohesion, such as deixis, anaphora or reader instructions of the type ”see above”. These cohesive devices construct larger syntactic entities which are hierarchically structured and in sum lead to macro-textual[8] structures, cf. [80, p. 579]. These structures can be compared to landmarks which provide the reader with information concerning his or her whereabouts. The text described in topological terms, consists of units and connections between them. Note the ethymological connection between topos – the place – and the topic, or subject, which indicates a strong spatio-semantic bond in our thinking: ”With or without the computer, whenever we write, we write topically” [2]. Furthermore, typographical convention will help the reader to

predict which object will follow next: a new section, paragraph, or a new sentence.

Connection by reader instructions undermine partly the congruence and linearity of discourse, [80, p. 579]. Here, we think of Langer's distinction between discursive and presentational language: "The meanings given through language are successively understood, and gathered into a whole by the process called discourse. . . " [42, p. 89]. Discursive in this context means sequential: Words cannot be piled one upon the other, neither can they be arranged arbitrarily in a sentence because they have to follow a pre-defined grammar. It takes time to form, listen to, or read each word of a sentence and only once you have perceived the last word of a sentence you know its meaning. Langer thought that, even if our ideas are nested (like clothes that are draped around a body), we have to string them in order to communicate them to others, like hanging them out to dry on a clothes-line: You place one piece of language at a time onto the straight line; at the end of the process the parts add up to a whole argument or proposition, cf. [43, p. 88]. The argument of hypertext is that ideas do not have to be arranged on a long clothes-line. In fact, hypertext represents a variable structure that permits an interlinked presentation of ideas. Wenz, who is approaching hypermedia semiotics from a literary studies background, points out that spatial metaphors of textuality and hypertextuality produce a textual space which guides the reader's orientation in the process of reading. For her, metaphor is not just a figure of speech and a linguistic phenomenon, but includes a cognitive dimension, cf. [80, p. 576]. Writing and reading lead to awareness of linguistic structure and awareness of language structure, which is a product of writing, and not a precondition for its development.

In the same sense, spatial configurations are not only a product, but the producers of a cognitive system, cf. [80, p. 575]. Derrida who positioned writing as being prior to speech defines writing not as the activity of writing, but as the movement of differentiation of sign systems (différance).9 Language, like any other code, constitutes itself as a texture of differences: "Difference and opposition are the cognitive foundations of semiosis and therefore the precondition for every semiotic coding. This is a process which leads to an unbounded referring of signs. Writing in Derrida's sense creates networks by 'spacing of speech' and can be interpreted as a metaphor of the human mind" [80, p. 575], cf. [21].

Studies that formalize their view of the Web as a graph "ignore the text and other content in pages, focusing instead on the links between pages" [12]. Furthermore, formal graph theory sets all possible spatial representations of a graph as equal. I follow those authors insisting that a theory of space is essential for any advance in hypermedia design, cf. [35, 52, 70]. In fact, spatialization plays an important role in the development of new hypertext models, such as FOHM (cf. [52]) that concentrate on the nodes and links as part of a (visual and textual) sign system.

Semantic, Semiotic and Virtual Space

Catherine C. Marshall and Frank M. Shipman [48] noticed that authors sometimes prefer to express relationships among nodes by using geometric cues like proximity and alignment, and visual cues like graphical similarity: "These geometric and visual cues correspond to Bertin's notion of planar and retinal variables. By combining geometric and visual cues, authors may build up surprisingly complex hypertext structures" [49]. The work they refer to is Bertin's *Semiology of Graphics* [8]. According to Bertin, a network becomes a map, if the planar relationships between all parts of each component are represented by their location on the plane. Only if nodes have a "geographic order", we may visualize them in navigation maps, otherwise they stay topological constructs. This construction of meaning does not only correspond to our *natural* semiotic environment, but also to our cultural sign systems: It is important, if a text block in a book

precedes or follows other lexia; they might be separated by other lexia, an empty page, or three more volumes. In the electronic text, we have lost the tactile connection with the medium, which used to indicate the difference between a paperback novel, a leaflet, or a book of three volumes, cf. [73]. Bolter [11] suggests that hypertext creates a new ”writing space”, a field whose boundaries can always be expanded by the introduction of new material. The traces of texts and images make hypermedia an augmented reality, an enriched reality in contrast to virtual reality, the 3-dimensional, artificial reality.

Schulmeister thinks that the multimedia space consists of a representation space, a symbol space, and an event space. Wexelblat [82] invokes the term “semantic space”, an environment that is quite different from any physical or constructed/mapped space we know. The nature of this space resists easy definition as familiar metaphors from physics, architecture, and everyday experience have only limited value here ”since it is deeply connected to the production of meaning, interpretation, and other activities involving symbols” [35, p. 207]. It becomes obvious that this notion of a ”semantic space [. . .] involving symbols” is a proto-semiotic one: The term ”symbol” is used in its widest sense (cf. [66, p. 142]) and the ”semantic” value of the sign is seen as isolated from its semiotic context. It is not clear if the authors refer to semantics as the branch of Semiotics that is devoted to the study of the relationship between signs and their objects (to be exact: between the sign vehicles and their designata). It seems, rather, that they refer to ”semantic” as ”relating to meaning” in the most general sense. I could not agree more to the general conclusion that ”semantic and architectonic spaces cannot be perfectly reconciled [and that] we should aim for systems that harmonize the two as well as possible, but which acknowledge the contingent nature of any such harmony” [35, p. 215]. Yet, it seems important to place this conclusion in the semiotic context. In this discussion of the roots and aims of Hypertext Semiotics, I believe that changing ”symbol” to ”sign” and ”semantic” to ”semiotic” in Kaplan/Moulthrop’s definition is more than a mere terminology purism: Semiotics and that branch of linguistics known as semantics have a common concern with the meaning of signs, but John Sturrock argues that whereas semantics focuses on *what* words mean, semiotics is concerned with *how* signs mean, cf. [16, 26]. With this in mind, let us go back a few lines in Kaplan/Moulthrop’s argumentation to show the impact of this maneuver. They criticize Marshall and Shipman’s conception of Spatial Hypertext as reflecting only one aspect of the complex phenomenology of virtual space: Their general idea of space ”tends to collapse into the much narrower domain of *screen real estate*. The user’s manipulation of objects within a graphic representation implies some related transformation in a mental or linguistic space, but that space is accessible only through the representation. Space comes to be defined in terms of the active window on a display screen” [35, p. 207]. So, if Marshall/Shipman’s concept of spatial hypertext invoke architectonic space in the context of writing, ”semantic [read: semiotic, MN] space emerges more clearly in the act of reading or reception – though since hypertext tend to blur the roles of reader and writer, these distinctions cannot be absolute” [35, p. 207]. The semiotic space I impose on hypertext has more to do with Lotman’s ”semiosphere”, a pansemiotic space outside of which the existence of semiosis is impossible.10 The concept of space used in this account shares little of the clarity and unambiguousness of architectonic space. As McKnight et al. [51, 169-190] observe, the psycholinguistic or semantic space of a text (electronic or otherwise) can never be represented with perfect accuracy by any physical system: ”We cannot navigate semantic space, at least not the way we navigate physical environments, we can only navigate the physical instantiation that we develop of the semantic space” [51, 187]. Harpold, who applies a ”semiology [of] Lacanian flavor” discusses hypertextual linking as detour, not a definitive trajectory from departure point to arrival point, but an elliptical and fundamentally uncertain

displacement. The hypertextual detour, he says, is ”a turn around a place you never get to, where something drops away between the multiple paths you might follow. The consequence of this falling away is that the fabric of a hypertext is riddled with holes” [32, p. 172f.].

As semiotic space resists isomorphous transformation to an architectonic space, all navigational tools based on a travel metaphor can only succeed by actively using bricolage techniques. If system designs are to reflect an intelligent anticipation of breakdowns [35, 84], we must understand that any attempt to represent the two domains of virtual space, the architectonic space of mapping and the space of semiosis must inevitably reach a point of obvious constraint. In fact, bricolage is a magnificent technique to deal with breakdown situations and unbridgable, or unintelligible antagonisms.11 Thus, research that is aiming at developing ”intuitive” interfaces should be disposed to adapt and extend structuralist methods: ”If it is true that the systems are the real things and humans only manifestations of them, then the most sensible way to build a computer system is to begin by constructing the system, without regard if to whether processes are performed by human or computer” [2, p. 21]. Spatial Hypertext developers have become aware of these issues and the breakdown situation and call the bug (”mismatch between architectonic and semantic spaces” [35, 51]) a feature (”ability to leave structure implicit and informal” [49, p. 90]).

Pointing and touching

Marshall and Shipman claim that the characteristics of spatial hypertext include ”the separation of symbol and underlying content [and] the use of these visual symbols to create hypertextual meaning” [49, p. 90]. What they mean by ”the separation of symbol and underlying content”, is actually a development of a language that can draw on visual signs as well as on written signs. In our normal lives, we use several sign systems at the same time to communicate with our environment.

We use codes, such as clothes, perfume and body language simultaneously and we use them in concerted action (cf. [66, 26, 75] for an overview of the different sub-disciplines of semiotic research). For example, if we want to communicate to our business partners that we are interested in a long term relationship, we will not only tell them verbally, but use other codes as well, e.g. invite them to an exclusive restaurant, show them our premises, switch off our mobile phones while we are in a meeting with them, etc. In computer interaction, however, we have to separate and omit most of these sign systems. On today’s terminals, we can either write (command line interface) or point (GUIs), but we cannot fully reproduce the integrated, multi-channel communication of real-life actions, like negotiating. Following Schmauks’s vision of deixis in HCI, Ipsen comes to a similar result: ”Pointing actions consist of verbal and nonverbal components, resembling multimedia actions” [34, p, 560]. He takes the example of a customer asking the question ”Is this computer IBM compatible?” accompanied by a pointing movement of our finger ( ) at the shelf: ”Here, linguistic (’this computer’) and gestural (pointing finger) means of communication are used. In computing [esp. in hypertext, MN], language is assisted by other pointing tools, such as the cursor moved by keyboard or mouse, a figure on the screen, or other graphical devices. In cyberspace, a representation of one’s hand may appear” [34, p, 560].12 Of course this shopping example has even more facets to it: The secondary function of the question might be more important than the primary function: Instead of the message ”Tell me if this computer is IBM compatible”, the sender might want to communicate ”I know that this computer is not IBM compatible, and I want to lower the price”. The mouse has followed the keyboard as the main input device in hypertext structures. To move within the WWW, we do not have to use complicated commands but simply mouse-click on a link marker to follow the link. Thus, we point on it, using the mouse as our prolongated index finger. This is also indicated by

the way the cursor changes its appearance when dragged over a hyperlink. Most standard browsers show ”a view from above” on a hand with a stretched-out index finger.13 Interestingly enough, only the LINUX version of the Netscape Navigator still uses an index finger that indicates a pointing movement in a direction (”if you follow this link, it will lead you to. . . ”) rather than a tactile pressing on an object. The German word ”peilen” (to take the bearings of, to get a fix on) shares its etymology with the ”Pfeil” (arrow). An arrow – in hunting just as well as in taking the bearings of celestial bodies to calculate one’s position – is used for long-distance aiming, just like the finger that points on an object that is out of reach. The touching finger is a short-ranged device identifying a near-by object, that can possibly be lifted, dragged and dropped again. Most standard browsers have followed Microsoft Internet Explorer’s adaption to the desktop metaphor: The drag & drop metaphor highlights the implied tactile relationship between the user’s hand and the objects on the GUI’s virtual desktop, cf. [73]. By showing the mouse pointer as an index finger that taps on the link markers, the spatial character of the hypertext docuverse was tied to the ”small world” on the top of a virtual writing desk14. The pointing finger and the index are etymologically connected with *digitus index*, the Latin word for forefinger. In printing, index refers to an arrow-shaped character to call attention to a particular paragraph or section. In this function, the index is somehow related to the bookmark, as it marks (indicates) a point to start reading. The pictorial connection of the index finger ( ), the pointing act and the concept of leaving a mark became very strong in book illustration: In a certain medieval illuminated manuscript, the script/illustrator Isodorus shows himself writing the inscription in which he says he executed the picture in his Gospels15.

The notion of leaving a mark is, of course, also connected with the finger print, a unique sign of individuality and an indexical sinsign in Peircean terminology, like the hand signature, or the electronic password, cf. [55]. Ipsen’s example shows that combining communication channels (e.g. linguistic and gestural) produce meaning economically: Being precise in just one of the channels affords much more time and cognitive effort: ”Is the forth computer from the left on the second lowest shelf on the right hand side of your showroom IBM compatible?” or asking the question in a charade-like manner. In both cases, the coding in a single channel complicates the communication significantly in comparison to the multi-channel variant, cf. [34, 15].

Hypertext Navigation and Intertextuality

Generally, hypertext is defined as the use of the computer to transcend linear, bounded and fixed qualities of the traditional written text, as it is 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,” [20, p. 3], cf. [5]. The passage from one node to the other (navigation) is based on the selection and combination of elements. The act of navigation means a linearization of those nodes that the hypertext user chooses to read along a personal thread that is laid upon the network. According to Wenz [80, p. 581], such linearization can be compared to linearization processes which underlie the transfer of complex and simultaneous nonverbal perceptions into language, as different possibilities of selection in different situations create a multiplicity of linear discourses. Wenz concludes: ”Therefore, multiplicity of linearity instead of non-linearity should be the key word in discussing the reading process in hypermedia” [80, p. 581]. Of course, the critical reader is reminded of Kristeva’s concept of intertextuality which divides the text into two axes: a horizontal axis, which is the linear connection between author and reader through the text, and a vertical axis, which connects the text to other texts ”of the anterior literary corpus and the text as an absorption of a reply to another text” [38, p. 69]. These two axes create a two-dimensional space. There is no fixed position in the connection between these four elements. There is only movement between author, reader, text, and intertext, cf. [68]. This

movement is the movement of différance, only available as a trace which can be elucidated in interpretation. The virtual presence of many voices is interwoven in these intertextual relations. As Barthes puts it, ”the text is not a line of words but a multidimensional space in which a variety of writings, none of them original, blend and clash” [6, p. 146]. In conclusion of my prolegomena of a theory of hypertext semiotics, I do not think to have produced a new ”hypertext model”. Yet, I was able to interlace the existing models with the findings of semiotic research, on all levels of the textual, aural, visual, tactile and olfactory channels. While this connection between hypermedia and the field of media semiotics is clearly visible in Nöth’s *Semiotics of the Media* [64], computers play no role whatsoever in Bignell’s *Media Semiotics* [10] published the same year! The long-term goal of Hypertext Semiotics (as I see it) is to enhance hypermedia as a multi-level semiotic system that incorporates spatio-temporal aspects, the power of the image and ”language as the ultimate upgrade” [17, p. 182].

Glosario:

Bricolage A term introduced by Lévi-Strauss [317] to designate a manner of construction that relies on improvisional (*or ad hoc*) and makeshift responses and far-flung analogies for problem-solving and to explain the world. In a general sense, bricolage is the process of creating something not as a matter of calculated choice and use of whatever materials are technically best-adapted to a clearly predetermined purpose, but rather in a dialogue with the materials and means of execution. In such a dialogue, the materials which are ready-to-hand may suggest adaptive courses of action, and the initial aim may be modified.
Code The establishment of a conventional rule-following relation in a symbol, represented as a deterministic, functional relation between two sets of entities.
Communication The process of transmitting and receiving messages. According to Roman Jakobson and others, an analysis of this process yields six factors: addresser, addressee, contact (or channel), context, code, and the message itself. Corresponding to these factors are six functions: emotive, conative, phatic, reference, metalinguistic (or metacommunicative), and aesthetic or poetic. This process has been taken as the focal object of semiotics.
Différance A word coined by Jacques Derrida as part of his critique of phonocentrism and of the metaphysics of presence. It involves a pun, for he is playing on two senses of differ: to *differ* and to defer (postpone or put off). In addition, this word itself is supposed to show the dependence on speech upon writing, for the difference to a French speaker between *difference* and *differance* is no difference at all. That is, the difference is discernible to the eye but not to the ear.
Discourse A term sometimes used to translate parole (more usually rendered ”speech”). Ferdinand de Saussure [468] separated language (langue), conceived as a self-contained system of formal differences, from speech (parole), the actual utterance of individual speakers. He did so for the purpose of making language for the formal object of linguistic and he thought that the study of language should focus on language, not speech or discourse.
Graph Informally, a graph is a finite set of dots called vertices (or nodes) connected by links called edges (or arcs).
HTML HyperText Markup Language (HTML) is a simple programming language used to format documents for display on the World Wide Web. When displayed using a World Wide Web browser, documents prepared in HTML include formatting, graphics, and hypertext links to other documents or multimedia.
Hypermedia Most hypertext researchers view the terms hypertext and hypermedia as synonymous and use them interchangeably, with a preference to sticking to hypertext.
Hypertext A body of electronic text that can be authored, and read, non-sequentially. In classic hypertext theory, blocks of text (lexia or nodes) are joined by electronic hyperlinks. In this approach, hypertext also includes linked multimedia material (hypermedia) and alternative hypertext approaches, such as time-based hypermedia and spatial hypertext.
Icon Ultimately from Greek eikon (likeness, image, portrait), an icon (or ikon) is an image, a representation, a simile. Semiotically incorrect, but nevertheless widely used, is the denomination of the symbols on the GUI desktop and in WWW documents as ”icons”. In this paper, I call the graphic representations of hyperlinks Graphical Link Markers (GLMs).
Image Stemming from Latin imago (imitation, copy, likeness, bust), the image is generally a representation, or double of something. The emphasis of this term does not lie on a graphic quality, but on the likeness (a difference that can be compared to index vs. icon).
Index In the general context of science, an index is mostly understood as an alphabetized list of names, places, and subjects treated in a printed work, giving the page or pages on which each item is mentioned. Accordingly, indexing has become an important method to store and retrieve information in computer science. Indexicality, in its semiotic sense, however, is a quite different concept: In Semiotics, the index is a proper sign where the motivation is due to some kind of physical connection or causal relation between the sign vehicle and reference object.
Intertextuality A term introduced by Julia Kristeva and widely adopted by literary theorists to designate the complex ways in which a given text is related to other texts. As every text is constructed as a mosaic of other texts, every text is an absorption and transformation of other texts. According to Kristeva, the notion of intertextuality comes to replace that of intersubjectivity.
Lexia In the sense of Roland Barthes’ S/Z [37], lexia are units of textual meaning that can be analyzed according to their codes of signification. In hypertext theory, lexia are unordered blocks of texts connected by links. Lexia are also referred to as nodes.

Link In a hypertext, (hyper-)links are connectors between nodes.
Link marker The link marker is the visual representation of the link anchor, or, point of departure of a link. Some authors use the term ”button” for the link marker. The link marker can be a word or an image.
Node In graph theory, a node (or vertex) is a dot in a graph. In hypertext theory, it is one of many blocks of text connected by links and to be read in an unsequential order.
Pansemiotic, pansemiotism The view that everything is, in some manner and measure, a sign.
Semantic General, relating to meaning or signification. In Semiotics, semantic means more narrowly, concerned with the relationship between the signs and the objects.
Semiotics The study of doctrine of signs, sometimes supposed to be a science of signs; the systematic investigation of the nature, properties, and kinds of sign, especially when undertaken in a self-conscious way. While semiology is sometimes used to refer to the Saussurean tradition, and semiotics sometimes refers to the Peircean tradition, nowadays the term semiotics is more likely to be used as an umbrella term to embrace the whole field, cf. [468, 416]
Sender One who sends or conveys a message, thus a synonym for addresser.
Sinsign A term used by Charles S. Peirce to designate a specific type of sign, one in which an individual event or object (not a category) serves as the sign vehicle.
Symbol A term frequently used to designate a conventional sign (for instance, a sign based on convention or established usage). But this term refers to various other types of signs as well. For Ferdinand de Saussure, a symbol is a sign in which the correlation between signifier and signified is, in some measure, motivated (that is, nonarbitrary). In Charles S. Peirce’s elaborate classification of signs, a symbol is almost the opposite of this. Peirce defines symbol as part of a trichotomy: icon, index, symbol. This trichotomy is based on the relationship between the sign vehicle and its (reference) object. If a sign vehicle is related to its object by virtue of a resemblance to that object (for instance, a map to its territory), it is an icon. If it is related to its object by virtue of an actual or physical connection (for example, the direction of the weather vane to the direction of the wind being indicated by the vane), it is an index. If it is related to its object by virtue of a habit or convention (for instance a single red rose as the symbol of affection-or more), it is a symbol.
Topology The topographic study of a given place, especially the history of a region as indicated by its topography;
WWW The World Wide Web (WWW) is an Internet-based hypermedium that consists of text, graphics, audio, animation, and video.

Notas:

1 Univ. Doz. Dipl.-Ing. Dr. Veith Risak, Institut für Computerwissenschaften der Universität-Salzburg; Univ. Prof. Dipl.-Ing. Dr. Wolfgang Panny, Institut für Informationsverarbeitung und Informationswirtschaft der Wirtschaftsuniversität Wien; Univ. Prof. Dr. Herbert Hrachovec, Institut für Philosophie der Universität Wien. Of course, the purpose of this multidisciplinary advance was not so much to dismantle disciplinary boundaries as to be able to move across them.
2 Besides the uncountable bibliography links, the dissertation includes more than 2500 handcrafted links to the glossary, to external Web sites and between sections.
3 Hopefully, the insights gained from building non-visual hypermedia systems for blind users can soon be used for navigation in auditory hyperspace.
4 ”Computation is about meaning, not electrons. Regardless of the type of computation, what interests computer users is not the electrons moving along sophisticated circuits, but the various bearers of meaningful information signs subjected to their programmed processing. Whether electron, light, quantum, or DNA-based, the computer is a medium for sign processes! Numbers turned into images, simulations, database operations, etc. are examples of how the signs of the object of our practical interest are processed according to our goals” [55].
5 Emile Benveniste argued that ”language is possible only because each speaker sets himself up as a subject by referring to himself as ‘I’ in his discourse. Because of this, ‘I’ posits another person, the one who, being as he is completely exterior to ‘me’, becomes my echo to whom I say ‘you’ and who says ‘you’ to me”. For Benveniste, neither of these terms can be considered without the other: ”they are complementary [. . .] and at the same time they are reversible”, cf. [46, p. 225]. The connexion to the spatial dimension can be shown by the social phenomenon that the person who sits down *first* defines all other relations.
6 ”Whilst most obviously associated with art and photography, they are no less structurally important alongside temporal syntagms in media such as television, cinema and the World Wide Web. Unlike sequential syntagmatic relations, which are essentially about before and after, spatial syntagmatic relations include: above/below, in front/behind, close/distant, left/right (which can also have sequential significance), north/south/east/west, and inside/outside (or centre/periphery)” [16, Syntagmatic Analysis].
7 The metaphor, in general, ”is pervasive in everyday life, not just in language, but in thought and action. Our ordinary conceptual system, in terms of which we both think and act, is fundamentally metaphorical in nature” [40, p. 3]. For Wenz, ”metaphor is not just a figure of speech and a linguistic phenomenon, but includes a cognitive dimension” [80, p. 576].
8 8 Just as the reader of a linear document constructs a local and global mental representation of the document, the author of a linear document uses cues both at the local and at the global levels, ”dividing the document into chapters, sections, paragraphs, sentences, words etc. This facilitates comprehension and navigation” [79].
9 Derrida sought to challenge the phonocentric privileging of speech over writing in Western culture and to demonstrate the instability of this opposition, cf. [135]. He also challenged the privileging of the signified over the signifier, seeing it as a perpetuation of the traditional opposition of matter and spirit or substance and thought.
10 Thinking in ‘ecological’ terms (e.g. biospheres) about the interaction of different semiotic structures and languages led the Russian cultural semiotician Yuri Lotman to coin the term semiosphere to refer to ”the whole semiotic space of the culture in question” [46, p. 124-125].
11 Lévi-Strauss coined the term bricolage as the process of creating something not as a matter of calculated choice and use of whatever materials are technically best-

adapted to a clearly predetermined purpose, but rather in a ”dialogue with the materials and means of execution” [45, p. 29].
12 Many other authors use the term cyberspace interchangeably for VR, hyperspace, the Internet, etc. In regards to the spatial relativity of the Human-Computer Interfaces, Ipsen continues: ”There is an interface device for the user to be connected with the machine or rather with the application. By means of this interface, the user’s origo is set to the coordinates defined by the software, which is the most crucial point of the whole story. [. . .] The user’s point of view is shifted to some virtual place that is totally separated from the real environment” [34, p, 560].
13 Naturally, this does not hold true for all text-based browsers, such as lynx. The Guide system had four different cursors, according to the link type.
14 Consequently, the Opera browser allows to drag links out of the browser window. On dropping the link, the users get asked whether they want to copy the *node*, or the *link* itself to the new location.
15 “His pen is once again on the letter ’x’ of ’finxit’, in a clever conceit which draws attention both to his making of the manuscript (’finxit – he made it) and shows him as if in the process of actually writing it” [1, p. 18]. In Latin codices of the *corpus iuris civilis*, we find little drawings of hands and index fingers that mark certain passages. In a fresco cycle in the Palazzo Pubblico of Siena, we see a little boy that can be interpreted as a ”personification of the index finger” that we usually find in the codices, cf. [31, p. 140].

Referencias:

[1] Jonathan J. G. Alexander. Scribes as artists: The arabesque initial in twelfth-century english manuscripts. In Medieval Scribes, Manusripts and Libraries. Essays Presented to N.R. Ker. Watson, London, 1978.
[2] Peter Bøgh Andersen. A Theory of Computer Semiotics. Cambridge Series on Human-Computer Interaction. Cambridge University Press, Cambridge, UK, [1990] 1997.
[3] Vladimir Andreev and Gennady Uzilevsky. Iconic signs and languages in user interface design. In East-West International Conference on Human-Computer Interaction: Proceedings of the EWHCI’93, volume 1 of Foundations of HCI, pages 180–190, 1993.
[4] Edward Barrett, editor. The Society of Text - Hypertext, Hypermedia and the Social Construction of Information. MIT, 1989.
[5] Roland Barthes. S/Z. Cape, London, [1970] 1974. trans. R. Miller.
[6] Roland Barthes. Image – Music – Text. Hill and Wang, New York, 1977.
[7] Emile Benveniste. Problems in General Linguistics. University of Miami Press, Coral Gables, 1971. Trans. by Mary E. Meek.
[8] Jacques Bertin. Sémiologie graphique. Editions Gauthier-Villars, Paris, 1967.
[9] Michael Bieber, Fabio Vitali, Helen Ashman, V. Balasubramanian, and Harri Oinas-Kukkonen. Fourth Generation Hypermedia: Some Missing Links for the World Wide Web. International Journal of Human-Computer Studies, 47(1):31–65, 1997.
[10] Jonathan Bignell, editor. Media Semiotics. An Introduction. Manchester University Press, Manchester, 1997.
[11] Jay David Bolter. Writing Space; The Computer, Hypertext and the History of Writing. Lawrence Erlbaum, Hillsdale, NJ, 1991.
[12] Andrei Broder, Ravi Kumar, Farzin Maghoul, Prabhakar Raghavan, Sridhar Rajagopalan, Raymie Stata, Andrew Tomkins, and Janet Wiener. Graph structure in the Web. Computer Networks (Amsterdam, Netherlands: 1999), 33(1–6):309–320, June 2000. <http://www9.org/w9cdrom/160/160.html>. Last visited: May 07, 2001.
[13] Heather Brown, editor. Hypermedia/Hypertext and Object-oriented Databases. UNICOM Applied Information Technology. Chapman & Hall, 1991.
[14] Vannevar Bush. As we may think. The Atlantic Monthly, 176(1):101–108, jul 1945. <http://www.theatlantic.com/unbound/flashbks/computer/bushf.htm> Last visited: May 07, 2001.
[15] Peter Carruthers and Jill Boucher, editors. Language and thought. Inderdisciplinary themes. Cambridge University Press, 1998.
[16] Daniel Glen Joel Chandler. Semiotics: The Basics. Routhledge, London, 2001. Citations taken from WWW version, Semiotics for Beginners, <http://www.aber.ac.uk/media/Documents/S4B/semiotic.html>. Last visited: Jul. 18, 2001.
[17] Andy Clark. Magic words: how language augments human computation. In Carruthers and Boucher [15].
[18] Carlos Colón. Semiotics in Cyberspace. <http://php.indiana.edu/~ccolon/Semiotics/ccolon3.html>, Apr. 1995. Last visited: Jun 13, 1999.
[19] Clarisse Sieckenius de Souza. The Semiotic Engineering of User Interface Languages. International Journal of Man-Machine Studies, 39(5):753–773, 1993.
[20] Paul Delany and George P. Landow, editors. Hypermedia and Literary Studies. MIT Press, Cambridge, Massachusetts, 4. edition, 1991.
[21] Jacques Derrida. La structure, le signe et le jeu dans le discurs des sciences humaines. In Conférende au Colloque International de l’Un, Baltimore, 10 1966. John Hopkins University.
[22] Jacques Derrida. Grammatology. Johns Hopkins University Press, Baltimore, [1967] 1976.
[23] Andreas Dieberger. Navigation in Textual Virtual Environments Using a City Metaphor. PhD thesis, Vienna University of Technology, 1994. Quoted according to online version available at: <http://juggle5.50megs.com/other/PhDThesis.html>. Last checked: Jul. 10, 2001.
[24] Andrew Dillon. Human Factors Issues in the Design of Hypermedia Interfaces, pages 93–106. In Brown [13], 1991.
[25] Timothy Druckerey, editor. Electronic Culture. Technology and Visual Represetation. Aperture, New York, 1996.
[26] Umberto Eco. A Theory of Semiotics. Macmillan, London, 1976.
[27] James Elkins. The Domain of Images. Cornell University Press, Ithaca/London, 1999.
[28] Douglas C. Engelbart and William K. English. A research center for augmenting human intellect. In Proceedings of the Fall Joint Computing Conference, volume 33, pages 395–410, Montvale, NY, 1968. AFIPS Press.
[29] Achim Eschbach. Bildsprache. ISOTYPE und die Grenzen. In Jeff Bernard and Gloria Withalm, editors. Neurath. Zeichen. S-Labor. ÖGS-ISSS, 1996, pages 15–48.
[30] Ernst Gombrich. The Image and the Eye: Further Studies in the Psychology of

Pictorial Representation. Phaidon, London, 1982.
[31] Dorothee Hansen. Antike Helden als 'causae'. Ein gemaltes Programm im Palazzo Pubblico von Siena. pages 133–148. Beck, München, 1989.
[32] Terence Harpold. Threnodity: Psychoanalytic Disgressions on the Subject of Hypertexts. In Delany and Landow [20], pages 171–181.
[33] Herbert Hrachovec. Netz-Werke. In W. Loth, editor, Wissenschaftszentrum Nordrhein-Westfalen. Kulturwissenschaftliches Institut: Jahrbuch 1995, pages 201–207. Essen, 1996.
[34] Guido Ipsen. Linguistic Orientation in Computational Space. In Nöth [64], pages 547–558.
[35] Nancy Kaplan and Stuart Moulthrop. Where No Mind Has Gone Before: Ontological Design for Virtual Spaces. In ECHT '94 Proceedings, pages 206–216. ACM, 1994.
[36] Mary A. Keeler and Susan M. Denning. The Challenge of Interface Design for Communication Theory: From Interaction Metaphor to Contexts of Discovery. Interacting with Computers, 3(3):283–301, 1991.
[37] David Kolb. Places and Spaces: Adjacency Effects. Position Paper for the First Workshop on Spatial Hypertext. <http://www.well.com/user/jer/SH1/kolb.pdf>, 2001. Last visited: Jul. 27, 2001.
[38] Julia Kristeva. Desire in Language: A Semiotic Approach to Literature and Art. Columbia University Press, New York, 1980.
[39] Jacques Lacan. Écrits. Éditions du Seuil, Paris, 1966.
[40] G. Lakoff and M. Johnson. Metaphors We Live By. University of Chicago Press, Chicago, 1980.
[41] George P. Landow, editor. Hyper/Text/Theory. Johns Hopkins University Press, Baltimore, 1994.
[42] Suzanne K. Langer. Philosophy in a New Key. Harvard University Press, Cambridge, MA, 1942.
[43] Suzanne K. Langer. Philosophie auf neuem Wege. Fischer Verlag, Berlin, 1965. German translation of Philosophy in a New Key by Ada Löwith.
[44] Claude Lévi-Strauss. Anthropologie structurale. Plon, Paris, 1958.
[45] Claude Lévi-Strauss. The Savage Mind. Weidenfeld & Nicolson, London, [1962] 1974.
[46] Jurij Lotman. The Universe of Mind: A Semiotic Theory of Culture. Indiana University Press, Bloomington, 1990.
[47] Aaron Marcus. Metaphor Design in User Interfaces: How to Effectively Manage Expectation, Surprise, Comprehension, and Delight. In Proceedings of ACM CHI'95 Conference on Human Factors in Computing Systems, volume 2 of Tutorials, pages 373–374, 1995.
[48] Catherine C. Marshall and Frank M. Shipman, III. Searching for the Missing Link: Discovering Implicit Structure in Spatial Hypertext. In Proceedings of ACM Hypertext'93, Papers, pages 217–230, 1993.
[49] Catherine C. Marshall and Frank M. Shipman III. Spatial Hypertext: Designing for Change. Communications of the ACM, (38):88–97, 8 1995.
[50] A. T. Y. McGuire. Some Semiotic Aspects of Web Navigation. <http://www.comfortableplace.demon.co.uk/semiotic1.html>, jun 1999. Last visited: 28. Apr. 2001.
[51] Cliff McKnight, Andrew Dillon, and John Richardson, editors. Hypertext: A Psychological Perspective. Ellis Horwood, 1991.
[52] David E. Millard, Luc Moreau, Hugh C. Davis, and Siegfried Reich. FOHM: A Fundamental Open Hypertext Model for Investigating Interoperability between Hypertext Domains. In UK Conference on Hypertext, pages 93–102, 2000.
[53] Mihai Nadin. The Semiotics of Man-Machine Communication. pages 463–470. University Press of America, Lanham, 1985.
[54] Mihai Nadin. Signs and Systems. A Semiotic Introduction to Systems Design, chapter Visible Signs – The Language of Multimedia. University Press, Cambridge, 1997.
[55] Mihai Nadin. Semiotics for the HCI Community, 2001. <http://www.code.uni-wuppertal.de/uk/hci/>. Last visited Jul. 30, 2001.
[56] Theodor H. Nelson. The Hypertext. In Proceedings International Documentation Federation Annual Conference, 1965.
[57] Moritz Neumüller. A Semiotic Analysis of iMarketing Tools. In HT'00. Proceedings of the Eleventh ACM Conference on Hypertext and Hypermedia, pages 238–239, May 30-June 4, San Antonio, TX 2000.
[58] Moritz Neumüller. Applying Computer Semiotics to Hypertext Theory and the World Wide Web. In OHS-6/SC-2, volume 1903 of Lecture Notes in Computer Science. Springer, 2000.
[59] Moritz Neumüller. Mind the Eye! On the Relevance of Composition in Spatial Organization. The New Review of Hypermedia and Multimedia, pages 197–202, 12 2000.
[60]Moritz Neumüller. Hypertext Semiotics in the Commercialized Internet. PhD thesis, Wirtschaftsuniversität Wien, 2001.
[61] Otto Neurath. Gesammelte bildpädagogische Schriften. Verlag Hölder-Pichler-Tempsky,Wien, 1991.
[62] Jakob Nielsen. Hypertext and Hypermedia. Academic Press, San Diego, 1990.
[63] Wilfried Nöth. Representation in Semiotics and in Computer Science. Semiotica, 115:203–213, 1997.
[64] Wilfried Nöth, editor. Semiotics of the Media: State of the Art, Projects and Perspectives. Mouton de Gruyter, Berlin, 1997.
[65] Wilfried Nöth. The (meta-)textual space. In René Dirven and Martin Pütz, editors, The Construal of Space in Language and Thought, pages 599–612. Mouton de Gruyter, Berlin, 1997.
[66] Wilfried Nöth. Handbuch der Semiotik. Metzler, Stuttgart/Weimar, 2 edition, 2000.
[67] Charles Sanders Peirce. Collected Papers 1931-35. Harvard University Press, Cambridge, 1935.
[68] Gabriele Resl. Hypertext und Intertextualität. Master's thesis, UniversitätWien, 1999.
[69] Jim Rosenberg. Navigating Nowhere / Hypertext Infrawhere. SIGLINK Newsletter, 3(3), dec 1994. <http://www.well.com/user/jer/NNHI.html>. Last visited: June 03, 2000.
[70] Jim Rosenberg. The Structure of Hypertext Activity. In Proceedings of the Seventh ACM Conference on Hypertext, Spatial Hypertexts, pages 22–30, 1996. <http://www.cs.unc.edu/~barman/HT96/P17/SHA_out.html>. Last visited: June 03, 2001.
[71] Ferdinand de Saussure. Course de linguistique générale. Payot, Paris, 1916.

[72] Dagmar Schmauks. Wittgenstein kauft Gavagai: vom Nutzen sprachfreier Bildwörterbücher. Semiotische Berichte, 21:367–384, 1997.
[73] Dagmar Schmauks. Tactile Perception as a Means of Object Recognition: Its Contribution in Everyday Life. In Walter Schmitz, editor, Proceedings of the 7th International IASS-Congress (Dresden 1999), volume 21, 2001.
[74] Rolf Schulmeister. Hypermedia Learning Systems. <http://www.izhd.uni-hamburg.de/Book/Frames/start_frame.html>, 1997. Last visited: Aug. 02, 2001.
[75] Thomas A. Sebeok, editor. Encyclopedic Dictionary of Semiotics. Mouton de Gruyter, Berlin/New York/Amsterdam, 1986.
[76] Linda Serenson Colet and Moritz Neumüller. Educational Hypermedia in a Museum Environment. In Proceedings of the EDICT 2000 Conference, pages 323–329, Vienna, Austria, 12 2000. OCG.
[77] John F. Sowa. Knowledge Representation: Logical, Philosophical, and Computational Foundations. Thomson Learning, Stamford, Connecticut, 1999.
[78] Loretta Staples. Representation in Virtual Space: Visual Convention in the Graphical User Interface. In Proceedings of ACM INTERCHI'93 Conference on Human Factors in Computing Systems, Perspectives and Illusions, pages 348–354, 1993.
[79] Manfred Thüring, Jörg M. Haake, and Jörg Hannemann. What's Eliza Doing in the Chinese Room? Incoherent Hyperdocuments – and How to Avoid Them. In Proceedings of ACM Hypertext'91, Construction and Authoring, pages 161–177, 1991.
[80] Karin Wenz. Principles of Spatialization in Text and Hypertext. In Nöth [64], pages 575–586.
[81] Karin Wenz. Cybertextspace. <http://www.uni-kassel.de/fb8/privat/wenz/space/intro.html>, Aug. 2000. Last visited: Jul 25, 2001.
[82] Alan Wexelblat. Giving Meaning to Place: Semantic Space. In M. Benedikt, editor, Cyberspace: First Steps, pages 255–272. MIT Press, Cambridge (Mass.), London, 1991.
[83] D. W. Winnicott. Transitional Objects and Transitional Phenomena, a Study of the First Not-Me Possession. International Journal of Psycho-Analysis, 34:89–97, 1953.
[84] Terry Winograd and Fernando Flores. Understanding Computers and Cognition: A New Foundation for Design. Addison-Wesley Publishing, reissue edition, 1995.
[85] H. Zemanek. Semiotics and programming languages. Communications of the ACM, 9(3):139–143, March 1966. Originally presented at the Proceedings of the ACM Programming Language and Pragmatics Conference, August 8–12, 1965.

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