Design processes from the mind to the screen on the WWW
Unisequence, multisequence and simultaneity

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Abstract
The World Wide Web has provided us with several tools of a gnoseological nature, such as the digitalised and hypertextual medium for the representation and transmission of knowledge, not only in a unilinear way, but also in a multilinear way and simultaneous way. It also provides us with a possible communication form in unreal time and uncommon physical space which differs from the predominant presential communication. This requires knowledge engineers who will consciously design new paradigms, i.e. multilinear and simultaneous texts, as well as new forms of telematic communication.

Key words
Design, linear paradigm, unilinear text, multilinearity, multilinear text, paradigm of simultaneity, paradigm of telematic communication, Hyper Media Decision Net, METODE, decision making.

Introduction

At the end of the day, everything is a problem of design, as Herbert Simon said, and especially where information technologies are concerned (Simon, Herbert A., 1973). The leading role in artificial intelligence, as far as simulating certain human thought processes is concerned, is played by knowledge engineers. This new engineering imitates the way in which human beings process information from certain rules or values, by designing the automatic processes of the machine in an artificial way. This has nothing to do with the types of engineering that were predominant up until a few years ago, which created devices such as cars, planes, washing machines and so on. The focus is now on thinking machines. Humanities play a decisive role in these technologies (Simon, H. A. and Newell, Allen, 1964).

The World Wide Web environment also provides us with several tools of a gnoseological nature, such as the digitalised and hypertextual medium for the representation and transmission of knowledge, not only in a unilinear way, but also in a multilinear and simultaneous way. At the same time, this internet environment also provides us with a possible communication form in unreal time and uncommon physical space which differs from the predominant presential communication (Rojo, Arcadio, 1998).

Consequently, this requires knowledge engineers who will consciously design new paradigms, i.e. multilinear and simultaneous texts, as well as new forms of telematic communication. At present, the danger is that this task is being left in the hands of improvisation. New designs are still the great challenge in presence, designs that begin in the mind and end up on the computer screen, having passed through all the intermediate stages (Covey, Preston K., 1990).

The linear paradigm: from unilinear to multilinear text (hypertext)

Unilinear text

The same as in other parts of this article, I shall only expose the main problematic areas and some ways to solve them. Owing to the shortness of this article, it is difficult to enter into more conclusive lines of argument and evidence, let alone the controversial issues that have arisen as a result.

The bases of the linear paradigm were defined perfectly by Aristotle in chapter seven of Poetics, in the paragraph that George P. Landow himself quotes in one of his most famous works:

«A whole is something that has a beginning, a middle and an ending. A beginning is something which in itself is necessarily not preceded by another thing and which is naturally followed by something else. An ending is what naturally comes after something else, as its necessary or customary consequence; a middle is something which by nature follows and is followed by something else.» (Aristotle, 1941:1462).

According to this conception, a whole can be understood as a process whose logical connection or link and ontological centre is the relationship of cause and effect in its most global sense. We must proceed from the beginning to the end in an uninterrupted succession of facts or contents that are all consequences of each other according to a type of relationship of cause and effect that is specific to each author.

Aristotle did not only understand narrative plots in this way, but also, and more importantly, historical events themselves. Western culture institutionalises the idea of progress in the same way as Aristotle, that is, that history is going from less to more, continuously moving upwards, and that any time in the past was either worse or more behind than the present. From an anthropological point of view, this way of looking at history constitutes a specific way of processing reality as a whole and ultimately, a way of organising and representing knowledge that is typical throughout most of Western culture (Robert Nisbet, 1980).

In this way, Aristotle radically breaks away from the Platonic paradigm in which cosmogonic events originate from and are installed in the eternal and unchanging sphere of the world of ideas, where everything comes in an archetypal form and in simultaneity, in other words, in an eternal present (Rojo, Arcadio; Iniesta, Ferran; Botinas, Lluís, 1999). Historical events, as part of cosmogonic ones, are cyclical events in which everything returns to its origins or beginning, and in which there is a continuous descent from the Golden Age (the cycle which is closest to the beginning and to its knowledge) to the Iron Age (the cycle furthest away from the beginning, in which ignorance increased in mankind).

Unilinear text is the purest concrete representation of the paradigm of linearity. A book should have a beginning, a middle and an ending in an uninterrupted progress. A single or univocal line is ascertained and it will have obligatory prevalence throughout the whole exposition and will bring the whole text together in one great link based on a specific relationship of cause and effect.

The conception of a whole as a great line which goes from less to more involves understanding that a whole must reach an ending by assembling all of its parts in a progressive way. This is a gnoseological Darwinism, accumulative evolutionism. A whole is never at the beginning, but at the ending: what is more can never become what is less.

A unilinear text is perfectly suitable for expressing scientific contents on the basis of linear plots of cause and effect from which relevant hypotheses may then be drawn.

What all of this conveys is that a unilinear text will always come in the form of spatial inalterability, of a unitary text, with a definitive version in its corresponding edition.

A unilinear text provides its author with a kind of physical isolation which makes it harder for his authority to be disputed and which gives the contents exposed a lasting and permanent hallmark of truth which reinforces the spatial inalterability of the text. (Ong, Walter, J. 1982).

Two multilinear or hypertextual models

The feature that multilinear or hypertextual models have in common is the launch of browsing multilines or numerous links, that is, they establish numerous centres facing the single great link or uniline of unilinear texts. The other characteristic is that these numerous links connect information nodes, that should preferably be «lexias» or «blocks of text», «fragments of text» with a certain amount of autonomy. (Nelson, Theodor H., 1981).

These models are within the linear paradigm insofar as they are parts (multilines) that will make up a whole, which is found in the ending after all the browsing has been carried out. Multilines make it possible for the uniline of a unilinear reference text to be understood from within itself and from the interrelations and comparisons it has with other unilinear plots. We shall come back to this point later on to see how it contrasts with the paradigm of simultaneity.

First model: multilinearity applied to a unilinear text

George P. Landow's model is the most representative when it comes to analysing what is mostly understood nowadays by hypertext. His efforts have made up a very complete synthesis of the different elements that the history of hypertext has contributed over many

decades, from Vannevar Bush, Nelson, Engelbart, up until today (Engelbart, 1963).

In this sense, all of George P. Landow's work has been dedicated to searching for new ways in which the knowledge of literature can be approached at an educational level. He has used hypertext to make multilinear routes of texts or unilinear books. This involves covering literary works from several browsing criteria or links, that is, from several logical connections.

This way of understanding hypertext means that the nodes or units of information make up the different parts of a unilinear text: a word, a paragraph, a page, a chapter, and soon.

George P. Landow designed a central browsing chart depicting the different nodes or concepts which a student is able to activate. As far as he is concerned, it is a kind of conceptual graphic map, in a similar way to the «Charles Dickens Overview» (fig. 1).

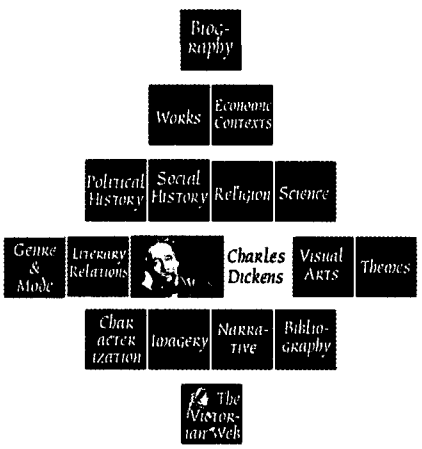

Figure 1.

The other feature of George P. Landow's multilinear system is that it makes it possible for the user to have the different texts that have been browsed on the screen at the same time and thus be able to compare them. See the screen created by a student from the «Waterland (1983) (fig. 2)» central browsing chart. The different nodes (such as «Doomsday clock», «Waterland»...) have made different unilinear texts appear on the screen (Landow, George P., 1995:186).

For George P. Landow, when the multilinear system is applied to a text, the reader can take the initiative to build his own centres, decentring the uniline or single line that the text follows. As a result, the writer, the author of the text, loses basic control over what has been written (Landow, George P., 1995:24).

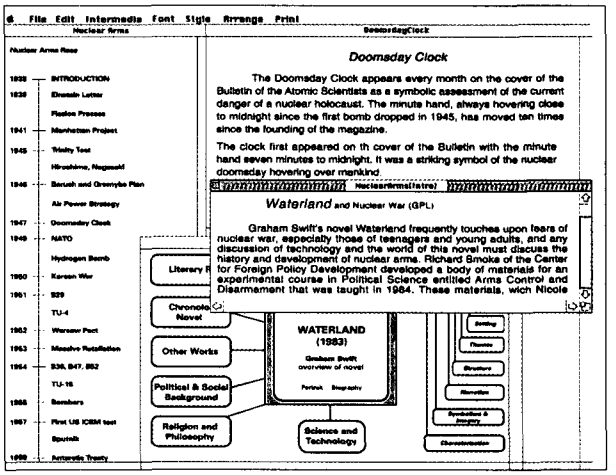

Figure 2.

Likewise, when a unilinear text is fragmented and split up into lexias or blocks of text, these nodes or units are removed from the unilinear process and take on a life of their own (Landow, George P., 1995:73).

Hypertext in the World Wide Web Environment

In principle, the appearance of the World Wide Web has allowed the possibilities of hypertext to expand greatly. However, different webs have been designed on the fringes of the knowledge and techniques that have been acquired throughout history in the hypertextual environment. Web pages have mainly focused on the digitalisation of documents and their availability to the users who employ the browsing possibilities of hypertextuality itself in a rather unscientific way. For a long time now, those of us who worked in the hypertextual environment have seen how misunderstood and diminished hypertext has become, when our aim was to make it a new form of knowledge representation with techniques that had already been acquired, and which were necessary to get under control.

What has prevailed most in the presentation of web pages is the imitation of the unilinear page where there is a beginning, middle and ending of the text. Central browsing charts have become interminable and badly organised lists of texts and concepts, which are as easy to get lost in as the jungle. Central browsing charts, instead of expounding the different nodes in an orderly and interrelated fashion within the space of a single computer screen, force the user to

scroll down the screen, as if it were a endless unilinear page.

Second model: multilinear texts

Between the academic years of 1992-1993 and 1996 - 1997, I directed an ambitious project of interdisciplinary investigation which was carried out in the Universidad de Barcelona. The aim of this project was to put the contents of five subjects corresponding to five different branches of knowledge into hypertextual form. These projects were named METODE projects (Rojo, Arcadio, 1993).

The characteristics of my hypertextual model were based on taking to an extreme the purest postulates of hypertext formulated by George P. Landow himself. This entailed designing nodes that were exclusively lexias and finding the multilinear links between them. This meant that as far as printed books and the physical screen were concerned, the unilinear text would no longer exist, as it had been previously broken down and fragmented into lexias and then presented on the screen only as such.

For my part, I wanted to try out a new kind of hypertextuality that would differ from George P. Landow's, as well as trying to find a prototype that could be applied to all branches of scientific knowledge despite their specific differences.

My new hypertextual model was used as a framework by professors of different subjects, who I directed in the task of designing their own academic contents from the investigation work I had previously carried out over two and a half years in the University of Carnegie Mellon (USA). The Universidad de Barcelona in collaboration with MacGraw Hill publishing house has published part of this work in the form of hypertextual books, to which, it must be underlined, I have written the prologues.

In short, the phases of this new hypertextual design are the following:

- Beginning with a unilinear text of the corresponding subject, recognising the fundamental concepts and elements that were incorporated within the scientific contents of the subject as well as the different links that connected them, their expression in different educational units and the central linking between them.
- Fragmenting the unilinear text into different fundamental concepts along with their terminology, and into the lexias or blocks of text that explained them, which could be no more than ten lines long.
- Using these elements to begin designing the multilinear text, the part prior to it appearing on the screen. Therefore, it is necessary to design the "hierarchical-vertical tree of terms and concepts", beginning with the broadest and most generic ones and ending with the most concrete ones, following the logical relation imposed by different classification criteria. Once the classifications have been established, the "tree" will open out a new branch for the elements that are incorporated within a certain scientific content (fig. 3) (Alegre, Antonio, 1997:27). This tree opens out the classification of different financial regimes vertically at the first level, and then it opens out a third and fourth level of browsing for the two elements that make up any type of financial regime, the «deals» and the «factor», which will then reach a final level of browsing with the elements of explanation incorporated within them, i.e. «theory» and «example». Each one of these terms are assigned respective lexias for their explanation or definition.
- Even though they may not appear in the previous graph, the other fundamental task is to design horizontal links or browsers, that is, those that are able to «decentre», or better said, that play a complementing role from the different types of relationships within the hierarchical vertical tree. From any given existing node at any level of the multilines of the hierarchical vertical tree, it is possible to design different links that can cover as many links as are

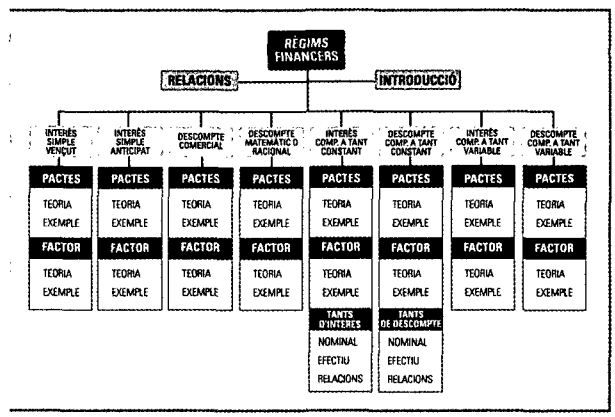

Figure 3.

wished. A link may have many horizontal browsers crossing through it.

- However, a multilinear text must convey the structure of this «hierarchical-vertical tree of terms and concepts» to the screen, which is a digitalised medium which ultimately operates as a substitute of printed books. The screen thus becomes a gnoseological space which presents the different browsing levels of the «tree», including the concepts and the links that interrelate them and the lexias or blocks of texts that explain them.

Every browsing level becomes a browsing chart or conceptual map, at a time of multilines, which comes from behind and then launches a new level of browsing forward.

The computer screen must be designed according to specific criteria of knowledge representation, which have to be able to express the interrelations or links between different nodes and distinguish their categories in a hierarchical way.

If we take a close look at figure 4 (Alegre, Antonio, 1997: 30), we will see that I have assigned several fields of fixed knowledge to the screen. The upper left-hand side shows the different browsing areas that have been covered in order to reach this particular level of browsing. The hyper-reader can go back to any previous level whatsoever. The top middle part of the screen will always be taken up by the term or concept (in this case, «Geometric income») which we have browsed on the previous screen and which must now be shown explicitly. The central information regarding this term will always occupy the centre of the screen, so that it is the focus point of the reader and so that the lexias that explain the terms may be opened out. In this case, there are four types of income in the centre of the screen.

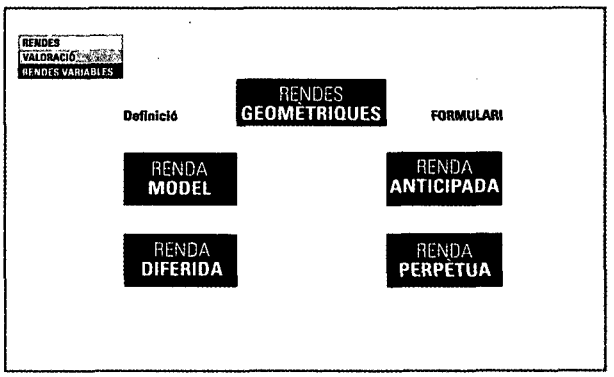

Figure 4.

Above the centre of the screen, on the left-hand side, there is a field which is reserved for explanations or definitions, and on the upper right-hand side of the screen, there is a field for tools, in this case, a mathematical form. The aim here is to provide all the information necessary at this level at the same time.

It is not possible to enter into the details of the multilinear text design at this point. What matters most is to provide a basic understanding of how it works and to clarify the differences between multilinearity compared to a unilinear text.

The paradigm of simultaneity: traditional symbolism

The most important aspect of these two hypertextual models is to determine whether they are a more complex form of the unilinear paradigm or whether they break away from it altogether. My investigation has led me to assert that no such rupture occurs.

When multilinearity is applied to a unilinear text, the multilines are but sublines that are contained implicitly or explicitly in the main univocal line, which cannot be broken, given that this great sequence is still the red thread that the whole of the narrative plot is built on.The purpose of multilines is to understand and explain the main sequence and its interrelations in a more satisfactory way.

In the case of the kind of multilinear text that I have designed, the central uniline that prevails in scientific explanation has not been broken either, as far as the red thread that develops the whole explanatory plot of the subject contents is concerned, even though the unilinear text may no longer exist. This is clearly visible in the hierarchical vertical form of the tree, where the multilines were already present in the unilinear text, although they acquire more significance here. Horizontal browsing from any node opens out an infinite number of explanatory lines, but always in such a way that will allow the hierarchical vertical tree to be better understood.

The fact that this operates by means of lexias and numerous links does not in itself infer that it breaks away from the paradigm of linearity, whose main feature is to move from the parts to the whole, where we will always find the end of the route.

It is even possible to break away from the uniline in a more extreme case, whether it be in one or oth-

er hypertextual model, but it has to be done by means of the composition of multilines, that is, the multicentres that keep moving from the parts to the whole, from the different links and the different lexias. Once the uniline has been broken, numerous multilines are established and this gives way to a kind of relativism of the different unilines. Nevertheless, every line has a beginning, a middle and an ending and it is progressive, moving from the analytical linking of the parts that eventually come together as a whole.

Robert Coover also tends to favour this theory, stating that hypertextuality does not exceed the «linearity of the reading experience» (Coover, Robert, 1990). Even George P. Landow was surprised by Dorothy Lee's work, called *Lineal and non Lineal Codifications of Reality*, in which the islanders of Trobiand «do not describe their activity in a linear way, they do not give dynamic accounts of what they do; they do not even use the conjunction «and» (Lee, Dorothy, 1997:151-164). The Trobiand people's culture sees linearity in a negative way. George P. Landow textually states that:

«If we were to place a spectrum with the Trobiand islands culture at one end, and the Western printed culture at the other, hypertextuality would be quite close to the patterns in Western cultures (Landow, George P., 1995:261).

I believe that the cultural vision of the Trobiand islanders follows the same line as all traditional cultures, including the Western one, founded on Pythagoras and Plato.

As far as Plato was concerned, in principle, there is a whole, i.e. archetypal ideas that explain every concrete whole insofar as they form part of that whole. This is not in disagreement with the fact that cyclical earthly occurrences go from less to more, but this can occur insofar as the whole, even if in a virtual way, can already be found at the beginning. The historical cycle of every being is the unfolding of a previous whole.

It is important to point out that even though Plato expresses his philosophical conception by means of a sequential book, this is merely a faulty instrument used to explain cyclic circular evolution and its inscription in the eternal present. For this reason, geometric and numerical symbolism became the most appropriate representation of Platonic knowledge: «he who does not know geometry may not come in», read the sign at the entrance of the Academy. A simultaneous and circular whole thus came across its appropriate symbolic representation. In any case, what Platonic texts do is to reveal this geometric and numerical symbolism.

The paradigm of simultaneity, which is represented in the various types of traditional symbolisms (constructive symbolism, geometric symbolism, and so on) is what really breaks away from the paradigm of linearity, but entails another background view of reality (Guenon, René 1976).

The paradigm of simultaneity is based on a more ecological view of reality, as a whole –one and diverse– which is completely interrelated and where everything that is fleeting and sequential is found in an extensive present which also includes what the modern-day West calls past and present.

If the West does not recover the conception of the first Platonic Pythagorean foundation, hypertextual techniques will not be enough to break away from the paradigm of linearity. There are two cultures at stake within the West itself.

The paradigm of telematic communication: multilocational and in unreal time

The World Wide Web confronts us with a new type of paradigm in which we encounter linear and simultaneous paradigms, as the representation and transmission of knowledge and information. The paradigm of telematic communication facilitated by the World Wide Web makes it feasible for the first time to be able to change the presential paradigm, which uses oral and written linear discourse in real time and in common physical space as a key for the transmission of our knowledge and skills.

The paradigm of telematic communication opens up the possibility of transmitting knowledge in unreal time and uncommon physical space (in a multilocational way). Consequently, it opens the possibility for collective work in every environment, in which presentiality and unilinear text do not prevail.

On these bases, we can describe the World Wide Web environment as a community of telematic communities. We could summarise design criteria of a telematic community as a community grouped around the aims that must be reached (defined in projects that

are carried out from decision making, sharing knowledge and skills, and with the capacity of reaching a world-wide audience). This all takes place in a non-presential environment, which is not located in a specific geographic place or at any concrete time, that is in unreal, asynchronous time.

Design of a first paradigm of telematic communication: Hyper Media Decision Net

Hyper Media Decision Net is the name I have given to a first design model of a new paradigm that I propose as an alternative to the traditional presential type of university paradigm. This new paradigm has four main focal points:

- The use of telematic communication in the World Wide Web environment based in unreal time and in uncommon physical space.
- The use of hypertexts in this environment and the investigation of non-linear forms of knowledge representation.
- The expression of different paradigms or visions of the world that determine the different ways of processing information.
- The consideration of decision making as a new parameter of information organised into a hierarchy.

Central elements of the standard university paradigm

As I have stated before, I will summarise what I believe to be the key elements that make up the standard university paradigm (beyond the different forms it may adopt: more theoretical, more practical, and so on), in such a way that if we were to remove one of them, the paradigm as a whole would cease to work:

- Certain knowledge is structured and transmitted to the students as a unilinear text.
- This knowledge is transmitted by means of a lecture, a speech carried out by a lecturer, which is fundamentally based on logical coherence, and which the students will receive through written language from their notes in a passive way.
- The class: this kind of lecture means that the lecturer and the students necessarily have to share a common physical space and have to work in real time.
- The real aim is to pass on theoretical knowledge to the student: learning and memorising notions and concepts. In practise, the transmission of professional skills is put into second place, even where experimental knowledge is concerned.

Keys to a new educational-professional-telematic paradigm: Hyper Media Decision Net

- Knowledge structuring and hypertextual transmission. This is not fundamentally a problem of computing. In any case, current computer science does actually provide us with a technical medium, maybe even the most suitable one for us to be able to express knowledge in a hypertextual way. Only if serious investigation is carried out in universities will this paradigmatic change move forward, given that large computer companies cannot see beyond its most utilitarian practical side of immediate commercial profit.
- The use of five multimedia languages. Multimedia technology offers us a digital medium with five languages: text, graphics, sound, animation and video. This means that knowledge can be designed in any of these five languages, depending on what we wish to express and the way in which we wish to do so. Up until now, a teacher had to know how to write and had to complement written material with photos or graphs. The language of lecturers was mostly oral and the language of students, mostly written. Now the contents and professional skills of a subject are being designed in theses five languages which the student will receive in all of their richness and complexity, and will be able to interact with these materials as many times as he or she wishes.
  The various information nodes, expressed in these five multimedia languages and joined together vertically and horizontally bring about the fusion between hypertextual knowledge organisation and the five multimedia languages, which is what hypermedia is all about (Nelson, 1988).
- Centering the purpose of university education on training competent professionals to make decisions.

The transmission of notions and concepts will be subordinate to this aim. We understand professionals as those who prepare students for a specific profession, be it pure philosophy or medicine. Therefore, this does not only concern subjects with practical or experimental contents. One thing is to teach History or Philosophy and another thing is to prepare the student to become a good historian or philosopher, that is, a good professional with investigation skills of his or her own.

A professional must able to do more than just understand notions and concepts, he must be able to make decisions and choose different ways out, with all of the risks that this might entail: an investigator must decide whether to pursue one hypothesis or another and to back it up in one or other concrete way; a doctor must be able to make different decisions which will lead him to the diagnosis of a patient (Simon, H. A., 1982). In order to do this, beginning in the first year, a student must become familiar with the dynamics of decision making in a simulated way (group or personal decisions), and must be taught precise skills and habits and, bearing this in mind, theoretical notions and concepts. This involves another paradigmatic change in the current university educational system. The hypermedial form, by means of five languages and with as many simulations as necessary, means that a student can organise all the elements (skills, concepts and instruments used to process information) needed to simulate making a decision. The hypertextual form makes it quicker to gain access to different information nodes (concepts, simulations, skills) from the criterion that is required, in a specific way, without needing the lecturer to be present, i.e., without requiring a lecture.

- Telematic networks allows us to organise all of this professional training for students on decision making in unreal time and in a multilocational way. Once all of the material has been organised in a hypermedial way, the student will simulate different types of group decision making, via telematic networks, from our homes, where he or she will spend 70% of his or her time working. Only 30% of his or her time will be spent at the university to work in real time on what he or she has prepared in group at home in unreal time. This 30% of the time will be dedicated to "practise sessions" in experimental Medicine or Science, to assessment sessions, and to reinforcing his or her capacity to investigate and think about other types of subjects such as Philosophy and History, comparing the hypotheses that have been worked on in group via telematics with those of other groups. The lecturer will now play the part of a real tutor, not just someone who gives lectures and then sets and corrects the individualised, secret exam of every student.

Design of METODE as the interface for the paradigm of communication

Going back to the point mentioned previously, when I returned from Carnegie Mellon in 1992, I designed the master lines of the new educational-professional-telematic paradigm, which I named Hyper media decision net, that is, the words of its key contents.

Undoubtedly, what I had done was to back up the reasons which led me to apply the key elements of a radical design that Preston K. Covey and Robert Cavalier had presented and tested at Carnagie Mellon in the field of ethics («Interactive Media», «Hypertext», «Ethics NET» and «Electronic Agora») to university education and then formulate them as a set and in a paradigmatic way.

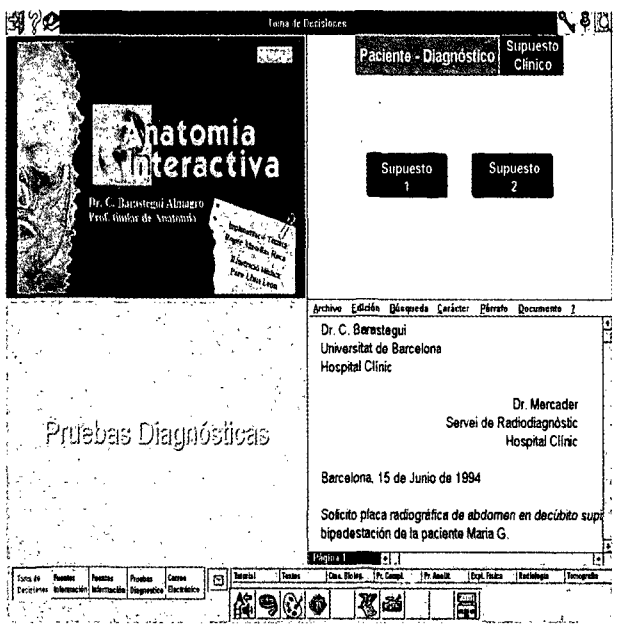

Figure 5. Global management of the interface and its resources.

Following the methodology I had proposed (fig. 5), I designed a Shell-Interface in which the computer could manage in an intelligent and friendly way the whole complex process of decision making in a hypermedial way using a telematic network I called METODE (Método Estructurado de Toma de Decisiones, Structured Method of Decision Making). The Shell-Interface was managed from the «Management and Integration Area», made up of four windows that appeared simultaneously on the screen, and which corresponded to the «decision making units»; the «multimedia editor» to elaborate decision making and send it telematically; the «hypermedial guide of the subject», and a last window for «instruments».

The other areas (with four windows in each one) were «area of information sources» (articles, bibliography, glossaries, and so on), «the instrument area» (software applications to transform initial information into new outputs) and the «work area of telematic groups» (where the different decisions made by the telematic group were received and compared).

When the final decision had to be made, the user could take any of the applications which had been used in different areas to the «Management and Integration Area» so as to be able to have all of the different elements necessary to make a final decision on the screen at the same time, as well as the multimedia editor, by means of which everything could be copied, interrelated, explained, and finally sent to the group.

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