1. WHY USE HYPERTEXT IN THE LAW

In recent years there has been increasing development in applications of hypertext technology to very different documentary environments, from the humanities to technical and scientific disciplines, also thanks to advances made in computer science over the last twenty years which have brought about an important evolution in the world of computer-based information retrieval systems: the progressive abandonment of retrieving information on demand to its gradual replacement with browsing in information systems.

Therefore, analysing the potentialities of this new way of organizing and communicating ideas, through electronic processing of both explicit and implicit association, overcoming the actual dynamics of the sequential organization of a text or, more generally, of documents within the legal domain seemed to be of interest, when considering the particular nature of legal documentation. Due to their features, legal texts are strongly linked together. Citations and references in the legal domain are a good example of this and are of such considerable importance that studying systems which have as their intrinsic characteristic that of managing logical links between documents appears to be very useful.

So, the idea arose of attempting an initial analysis of hypertext applications in such a complex world as that of legal documentation by asking computer scientists and legal informatics experts, in particular, to cooperate with us for the purpose of identifying – even through the description of early systems or prototypes – which elements distinguish hypertext systems compared to traditional automated documentation systems, which basic features enable legal information to be really enriched, where improvement in quality can be seen enabling information systems for the law to be designed that are more accessible to the citizen and, at the same time, also more useful for the lawyer who is called upon to give advice or solve specific cases.
From this point of view, a survey of scientific contributions focusing on hypertext technology finds its place. Today, it is important to know both how far research and applications have gone in this domain and, through this survey, to catch the attention of those who are not yet aware of the significance of using hypertext and hypermedia for making further progress in the world of communications.

2. Hypertext as a New Means of Communication

Even with their semantic aids that have already been well experimented and produced positive results – such as keywords, thesauri and classification tables – information retrieval systems are not adequate in providing exhaustive answers to richer, more refined and complex search needs nor natural and accessible to the user.

To introduce the concept of hypertext, it may be useful to make some comparisons with information retrieval techniques, in order to fix its boundaries, by focusing on the differences between the two. In the information base of an information retrieval system the documents, as well as the text, have a profile. A profile usually means a series of data describing the document (author/s, title, bibliographical references, keywords and classification code) which are the access keys to the document. Information is usually retrieved by making consecutive selections until the required specificity is reached, on the basis of progressively more restrictive conditions.

There are various search strategies, as they may be based on a more specifically semantic approach to the document or use data of a more external type, such as documentary type, year of publication, author, etc… Nevertheless, with the use of special logical operators and functions they let the user select sets of progressively more limited numbers of documents, in consecutive phases, until he reaches a subset which answers his query. The assumption behind this process is that the data bank user already knows, with a reasonable amount of precision, the type of information he wishes to retrieve. Changes in the selection phase occur, in fact, on the basis of the number of documents retrieved, and certainly not on the basis of their content, whereby there is no substantial enrichment in the search strategy.

The approach to information using hypertexts is different. The document and/or its parts become constituent elements of a network connected by associative links. The nodes of this network may be paragraphs, words, an
entire document, a figure, some graphics or any significant part whatsoever of the document. The presence of graphs allows linking relevant parts of every document to other documents or particularly significant elements within the same document in a way that is completely transparent to the user.

So far, the linear form has been the most suitable vehicle for information: we have in mind a story, in which the temporal dimension dominates. But a close look at other contents, from the fields of natural or exact sciences to those of the humanities and social sciences, reveals that these fields of knowledge are not structured in a linear way. In the case of the exact sciences or the humanities, «something which is closer to a simultaneous multidimensional structure is available that connects the different pieces of information in an extremely complex manner» [Rizk et al. 1990]. Experts move within their own disciplines by activating links on an intuitive basis. Linear type models are certainly not suitable for effectively representing this kind of knowledge. On the contrary, hypertext de-structures the text and restructures it according to different logics, enabling contexts to be created which are intrinsically new with respect to those at the start. In short, it means organizing new models of learning and knowledge as well as influencing the structure of the communications [Nielsen 1990]. In this sense, the hypertext approach seems very valuable. In fact, through links, it is able to deal with the complexity of references and implicit and explicit relations within specialized domains.

It should be noted that those dealing with hypertext systems generally emphasize the freedom of access and movement that these systems permit. It is important, instead, to understand what a step forward in quality the use of hypertext and hypermedia technology represents. Cross-referencing is a transgression compared to another order and reference structure, which organizes the text as such. On the contrary, it is precisely that transgressive structure that has to become the basic framework, over and above any linear organization [Antinucci 1993]. Breaking away from the concept of the text as a one-dimensional structure implies that there is no longer a beginning and end to it which are unambiguous and pre-arranged and, therefore, the same for all users. Each user may move about as he pleases, in any direction. The process of approaching the text is more active, since users must decide where and how to go and, furthermore, select the level of knowledge they want to reach or, in other words, how thoroughly they will go into any given problem.

The concept of flexibility in learning comes apparent. Hypertext allows spontaneous adaptation to individual needs. In fact, the background, learning
experiences and personal attitudes of each user are absolutely unique and so the information available in the system may be too difficult for some or too simple for others. With this new technology, learning processes become more natural and self-directed compared to traditional ones, which are basically hetero-directed. In other words, users have numerous routes they may or may not wish to take.

Another interesting feature of hypertext is that the information is not only in the text of the document, but also in the network of links. The network, then, does not merely appear as a logical support structure (such as the set of access keys in an information retrieval system), but as something visible, a conceptual path that enhances the search and gives the information real added value. It is here that the concept of hyperdocument arises, a kind of variable entity that takes shape in relation to the person involved in the search. It is something that did not exist before the search as a node may be retrieved from very different points of the database and may be a constituent element of a series of associative webs.

The difference between a traditional linear document and a hyperdocument lies in the nature of the links between the different parts of the text. Linear documents are intended by their authors to be read from beginning to end, even though they may contain references to sections of later text (cataphoresis) or to preceding sections (anaphoresis) or to other documents not included in the text (exaphoresis). Some of these references will be explicit, as for example when the authors use phrases like «as we shall see later» and «as we have already mentioned» [Diaper Rada 1991]. However, most of these reference links are implicit and must be formulated and remembered by the reader. A good author must be careful that his reader does not find consulting these references too tiring. Differently from linear documents, hyperdocuments attempt to make the links explicit, and the hypertext system user is actively stimulated to follow these links [Nielsen 1991]. The user creates a context within which his search will be made or, in other words, creates a particular navigation that will let him gradually acquire knowledge. In fact, along the route between the nodes of the information base, connections become apparent that are presumably completely unknown to the user. This is a special feature of hypertext, but it is not necessarily an advantage, as activating new links in a direction that has not expressly been requested may cause disorientation, which ends up interfering with the search itself.

Defining the types of links between nodes appears to be essential for efficient navigation within the hyperdocument. Texts contain many potential types of links which are activated implicitly and automatically but are
difficult to verbalize. Building an efficient hypertext system means being able to make the greatest possible number of these links explicit. Often hypertext users are not informed in sufficient detail about the type of link they are about to activate; that is, about the semantics of linkage. In current hypertext implementations, the user may get lost and this may be caused, in part, by the failure to indicate the type of links involved more precisely. This fact results in the need to pay closer attention to those supplementary functions that can aid the user in hyperdocument navigation. Currently, the most suitable appears to be a graphic layout of the system indicating where the user is or, in other words, mapping the nodes and tagging the links [McAleese Green 1990].

3. HYPERTEXT AND ITS ARCHITECTURE

The term hypertext was first coined by Theodor Holme Nelson, recognized ideologist of hypertext and author of Xanadu, a hypertext engine based on a radically new way of storing and viewing information, even if it was Vannevar Bush who had the idea of organising and retrieving information using associative-type logic. In 1945, in an article appeared in the Atlantic Monthly, he talked about a machine capable of connecting information through associative links.

In 1960, Douglas C. Englebart and Theodor H. Nelson began to design and implement information systems that would meet the requirements already suggested by Bush. At that time, the world of information technology did not recognise the innovative significance of these intuitions, namely, the fact that by using computers the nature of information could be distorted because organised in a strictly hierarchical way. Instead, Nelson and Englebart had a system in mind where pieces of information were independent from each other but virtually kept together by the meaning given to them which made them accessible. These theories have been applied to hypertext technology, where nodes are used for representing information and links represent conceptual associations. The interface enables the user to move about within the data base following the web of associations.

Hypertext is a model of non-sequential writing: a graph composed of points, nodes and links. Hot spots or buttons which activate the links connected to other related information (points) are located within the text. They allow us to know more about a particular subject, moving the mouse over the subject and clicking. Points, sometimes also called link anchors, are usually the most important piece of information in a document: they consist
of a word or a phrase that can be expanded upon. A node is a container for related pieces of information: it can correspond to a concept, but there can be many points within the node which lead to other nodes of related information. The user can go through the nodes sequentially, but is not limited to merely flipping through them. By using the points within the nodes he can navigate his way through the information, extracting what is important to him. Links hold hypertext together. Nodes can be linked together in a sequential manner. Points can be linked to other points within a node or to a separate node. These links, which can be simply seen as pointers to a source of information, allow the nonsequential navigation of hypertext documents. When a point is clicked upon, the link tells the program what node to present or where to go in the current node. Links therefore may be of different types: point-to-point, point-to-node, node-to-point, node-to-node. When text information is enhanced with graphics or drawings or pictures, points located on them as well will allow the user to interact with them. Point-to-node and point-to-point links with pictures, for instance, establish a pictorial reference to textual data as a memory aid [Howell 1992].

In building hypertext, links are to be provided between related pieces of information in a way that the user can choose which links he wishes to explore. He can view the related information simply by pointing to a button or other indication on the screen; he can generally backtrack to his original position or follow further links. Too few links mean readers are restricted in their search and may find less relevant information. On the other side, too many links may lead readers to becoming lost in a mass of associations. The author may thus attempt to provide primary routes in order to guide users through the information, while allowing them to explore side routes at will. Anyhow, a considerable amount of work is still necessary for evaluating and understanding the way users may best apprehend within this type of environment [Brown 1991].

Access only through navigation is not, however, enough. In some applications, implemented in very wide and heterogeneous networks, users run a real risk of disorientation. Thus, to make access more user friendly – by integrating experience already acquired in the world of information retrieval –, inverted files of words, phrases or key words can be added within hypertext systems so that Boolean searches or searches by word can be made. Some programs permit hierarchical indexes, such as tables of contents, to be built, while others allow tables of indexes based on semantic content, like thesauri, to be constructed. When considering a thesaurus as a network of links interesting developments within the domain of information retrieval
theory result. Each node in such a web may, in fact, be a term in the thesaurus that leads to the relative network of semantically linked documents according to the typical relations of thesauri (preference, hierarchy and association).

Its use as a user interface for rapid and efficient access to large data banks organised in a traditional fashion is a natural application of hypertext. Here, the system should be organized according to the search strategies users apply in consulting printed volumes and/or in searching on-line data banks. The greatest difficulty in designing an interface of this kind is probably in finding an equilibrium between retrieval power and the systems' ability to converse.

4. HYPERMEDIA AND LEARNING PROCESSES

Modern technology allows the user to process not merely textual data on magnetic media. He can be provided with many kinds of information: text, graphics, animation (sequence of images), registered audio signals, fixed and moving images (filmed sequences).

The integration of unified systems of different forms of communication improves the quality of information, making it more understandable and exhaustive. An explanation in a text-type communication structure of the contents of a graph or a map, or a drawing or a painting, or an animated or video clip is certainly more complex and infinitely less clear than direct viewing, on one's own computer, of the information in the form originally chosen by the person who wished to communicate that particular piece of knowledge. This is what is meant by hypermedia — a complex and integrated form of communication made up of hypertext and multimedia but not simply the sum of these two concepts.

Even though a distinction should be made between hypertext and hypermedia, the two terms are often used interchangeably. Generally, hypertext refers to textual information, but the term is also used to refer to information containing graphics and images as well, while the term hypermedia refers mainly to information containing a high proportion of graphics and images and is almost always used where information also includes video sequences or any form of animated information. Their integration can be seen not only as a new way to structure information seamlessly but also as a unifying paradigm for managing diversity. Anyhow, it is with hypermedia that computer science faces emerging demands, while the user is confronted with the need to be informed rapidly in a more comprehensive and global
way and to explore new information trails which allow him to build his own information world.

Hypermedia is suitable for almost any type of application, but especially for information management systems, namely documentation and expert systems, training and educational aids. In training and educational aids, for example, great benefit may be gained by using sound and pictures. As the goal of any type of learning is to assist the learner in understanding the material presented, and it is generally accepted that visual and auditory aids may bring mnemonic advantages, learning can be greatly enhanced and be fun if it is coupled with the concept of allowing the learner to browse through the information at his own pace and navigate in his own way, [Howell 1992].

Cognitive theory – when referring to the learning process – focuses especially on the distinction between implicit and explicit forms of learning. Much learning is implicit and occurs without intention, while an artificially imposed strategy may even impair it. This distinction is of particular interest, since hypermedia provides a rich environment for implicit learning during exploratory tasks. It may be important to identify when implicit rather than explicit learning is appropriate and what the optimal instructional approach for each type might be. Then, such issues can take their place in a framework designed to support it not merely by providing explicit representations of the knowledge, but by suggesting how best to provide the right tools at the right time so that the learning process can improve.

When speaking of computer-based learning a distinction must be made between tutoring systems, where learning is rigidly guided by controlling instructional dialogue and strategy, and systems providing exploratory environments, encouraging the learner to explore concepts using a constrained set of tools. While the proponents of AI technologies underlying intelligent tutoring systems claim that a training course must be driven by explicit models of the learner's and expert's states of knowledge and of their acquisition processes, proponents of hypertext-based learning systems argue that more effective learning is achieved by allowing a learner maximum freedom to explore information bases, to discover relationships for himself and to form integrated structures as his learning goals demand.

As both types of systems may have negative effects, more recent approaches are moving away from these two standards. The rigid model-driven control in intelligent tutoring is loosening through the development of advice-giving systems with guided discovery techniques, while exploratory systems tend to provide means for some degree of tutorial control. Promoters of hypertext-based learning, in order to avoid the sense of looseness,
talk increasingly of navigation and guidance tools, of more directed support, of intelligent or adaptive links and even of AI-based advising tools [Hammond 1991].

Although hypertext technology has many prospects, the use of hypertext tools in education and training is still growing slowly. Traditionally, hypertext serves as a mechanism for delivering information to University students. So-called basic hypertext systems allow a learner to explore material by browsing through a knowledge structure, guided in part by his aims and in part by the imposed structure of the knowledge base. In some cases, facilities may be added to the basic hypertext mechanism to guide the learner through the material, to provide tutoring information or to allow him to generate or inter-link materials for himself. However, problems may arise that require special attention: users may find it difficult to gain an overview of the material; may ramble through the knowledge base in an instructionally insufficient way, the interface structure for controlling the various facilities may interfere with the main task of exploring and learning. Nevertheless, hypertext systems are to be seen as an important feature of the educational technologist's toolbox, to be used together with more traditional tools [Hammond Allinson 1989].

5. Towards a Technological Revolution

Although hypertext could have a revolutionary impact on the management of on-line information, it did not develop at that time when it originated, as technological support for its diffusion was not yet available. The more recent development of optic technologies and their application to traditional media has considerably increased the potential for processing information. Today, we can manage multimedia, by condensing all kinds of data into digital form and keeping it on optical media, making it easier to disseminate and store [Ciacci 1993]. As we have seen earlier, the capacity to manage multimedia and interact with it transforms the computer from a tool for simply storing information into a tool for distributing information and, therefore, knowledge; it gives rise to new prospects for communication. Navigation in a number of media at the same time substitutes single-use practice in information management (namely, we either read or hear or see it).

The availability of CD-ROM capable of storing vast amounts of information (up to 150,000 typed pages on a single disk) permits data to be processed in different formats with the result that the CD is an excellent and
essential support for the development of hypertext and hypermedia applications. Also in the legal domain, complete collections of data—generally statutes and decisions or great encyclopaedic works for large dissemination—periodically updated, are available and the user can consult them directly on his computer through an optic reader.

A development which is awaited but has still to be achieved, except in very special cases, is that of the electronic book. Its main feature is the large amount of information of various kinds it can store and the powerful retrieval systems that could substitute the printed volume; the user will read by going forwards and backwards, to the right and to the left without limitations in time or linear graphics where texts, images and sounds can all be found [Gasperetti 1993].

At present, there are few «multimedia authors, graphic artists of ideas»—to adopt an expression of Eco—who are able to combine the practice of using different kinds of communication with creativity, who may, in other words, to some degree, be film directors, and to some degree editors with a propensity for technology [Eco 1993].

The development of telecommunications networks is another important element that will further stimulate the use of hypertext technology and make it a basic element for the world of communications. The recent spread of wide band networks, that enable data, applications, software, video and services to be transmitted, will make it possible to access information distributed on millions of computers. In fact, tools that can be more or less easily used, hypertext catalogues that can be called up locally through Internet—permitting the user to acquire information locally and to search remote databanks—are in an advanced development stage. At present, the most popular is NCSA-Mosaic, a free circulation retrieval hypertext system capable of operating on many platforms (MMac, Unix, Window). The spread of NCSA-Mosaic will favour its use in personal systems with local files (eventually on CD-ROM) and the strengthening of what is commonly defined as data highways will increase information collection and exchange at a global level.

Internet may be considered a cyberspace where the user can enter, navigate and observe various entities, modify them, meet people, take part in discussions, make resources available to others, work, etc. with the aid of hypertext catalogues that favour a standard mode of access to all available resources and information (gophers, www). Internet’s complete connectivity between individuals and organizations will be an incentive for co-operation and productivity—as Degli Antoni suggests—thanks to the sharing of large processing resources and skills and will make it possible to create
virtual worlds, telecommunication places, where everyone can move according to his own information needs and work requirements.

A new way of carrying out one’s own profession is arising that is enriched and supported in real time by all the information that was once difficult to collect without a great deal of effort and almost never in a contiguous manner. Even the legal profession will gain by this and will be stimulated to gradually pass from consulting numerous printed lists and reviews to paperless documentation.

A glimpse of the future professional able to communicate in an infinite and unlimited fashion is here caught. Even though we cannot ignore the fact that the diffusion of networks will pose considerable problems in terms of security, data redundancy, excess information, privacy, and reliability – problems that must be faced and solved – the possibility of representing multimedia data, of fusing and displaying it with a great deal of freedom is an important asset, an essential pre-condition for building a new global culture.

6. HYPERTEXT AND HYPERMEDIA APPLICATIONS IN THE LEGAL DOMAIN

The contributions to this monographic issue, which have been prepared by many of the experts who have kindly accepted our invitation, have been collected together – according to the focus given within the framework of the main theme – into five sections: Hypertext and Hypermedia Technologies: Theoretical Aspects; Open Systems in the Law; Semantic Models and Knowledge Representation in Legal Hypertext and Hypermedia Systems; Hypertext-aided Legal Expert Systems; Hypermedia-based Teaching Systems.

The first part of the issue, Hypertext and Hypermedia Technologies: Theoretical Aspects, collects introductory articles on some basic features of hypertext technology.

Roy Rada, while describing the structure of hypertext systems, illustrates their innovations as compared to data organization in traditional information systems. From his analysis, the innovative potential of hypertext emerges, in relation to the constantly more diversified needs of information system users. He introduces and discusses the concept of the association of ideas, along with the difficulties connected with navigation methodologies within hypertext databases. The structuralization of the nodes is looked at with regard to various user groups. He proposes the introduction of semantic models for the nodes as well as the typifying of the links so that
the user can be more easily oriented in its navigation. He also introduces the concept of «conditional link» or «virtual link», which are special links that can only be activated when particular conditions occur. He talks, therefore, about freedom of movement within a hypertext system, but of freedom that is conditioned and structured, so that disorientation does not occur in the search phase, but rather more complete understanding is provided thanks to self-oriented and hetero-directed searching.

Marc and Jocelyne Nanard develop the concept of «information gardening», used to describe activities consisting in building some interpretation from documentary materials, also look at the issues involved in information processing, with special attention placed on legal information. In fact, the authors argue that available information is often not used effectively, because there is a lack of tools enabling basic information to be transformed into value-added information, enriched with additional knowledge. An initial step is represented by hypertext that allows complex relations between documents to be managed, but it is not enough to remain at a navigational level, however rich and complex it may be. It is necessary to take a step forward in quality, to manage instruments allowing for the document’s conceptual interpretation, or for managing a higher level providing additional information. The MacWeb system, designed by the authors and described here, sets out to meet this need. In fact, it shows how a hypertext tool should contribute in making the interpretation structure emerge from documents, thus providing the means for exploiting information from these documents.

Lucarella and Zanzi go further into the subject of browsing and searching within hypertext systems and propose models capable of profitably orienting the user within hypertext databases through fruitful interaction between the two methodologies. The assumption is that «the interaction of hypertext and information retrieval systems can bring obvious advantages to the process of knowledge transfer». In particular, they propose a system unifying «query-based retrieval strategies and browsing» in a single environment. The hypertext network is like a knowledge base and the retrieval process like an inference process which can be performed by either the user or the system. According to the authors, the objective is to create models for a hypertext-based retrieval system using plausible reasoning.

In the world of on-line information, hypertext technology is often identified with the development of interfaces enabling users to effectively access very large databases. This means organizing semantic structures, a kind of conceptual metalevel, linked to real documents through specific identifiers. Hypertext becomes the support used for organizing the co-
gnitive superstructure, the access key for documentary retrieval. Marchetti outlines these problems in describing a system called BRAQUE, featuring a dual level architecture whereby the user can move between the meta-information structure (that is, a thesaurus) and specific information elements (that is, references or documents).

The contributions by Wilson, Degli Antoni, Di Pietro and Lauritsen, found in the section Open Systems in the Law, provide an overall panorama of legal applications, paying particular attention to the potentiality of hypertext and hypermedia technologies. Starting from various legal support systems for the public administration or the courts or law firms, the basic elements of various applied technologies and their facilities are illustrated.

According to Wilson, the objective seems to be that of creating systems supported by local and wide area networks (LANs and WANs), linking workstations with open architecture and platforms. Based on this, the need arises to guarantee that connected systems are fully compatible and, therefore, that a suitable standard for the legal document scheme is adopted. The data is to be structured so that it will be available for all applications, independently of the applications themselves. This ensures that one application can communicate with another, so that integrated systems may be designed which contribute to increasing not only individual productivity, but also group work. The development of research in the sector is rich in prospects. HTML (Hypertext Markup Language) is a Standardised General Markup Language (SGML), a Document Type Definition (DTD) designed to support, for instance, WWW (World Wide Web) hypertext browsers. The aim is to provide open and distributed systems, aided by appropriate standards, which, as Wilson concludes, successfully integrate the disparate tasks that fall, i.e., under the heading of litigation support: document drafting, researching case specific documents and evidence, giving and receiving case specific advice and instruction and consultation with colleagues.

Beginning with the assumption that societies and their relative legislative frameworks are becoming more and more complex, Degli Antoni and Di Pietro argue that information technology is increasingly important as an aid in the various phases of law enforcement, from the «distribution of legal knowledge, the collection and evaluation of law-breaking, ... the recording and integration of information relating to proceedings (civil, penal, etc.)» to the «imposition of penalties». New hypermedia technologies permit these phases to be managed more productively, by considering the legal document not necessarily as a text but also as an image or sound. In
the application of justice new media emerge: audio and video recordings, photographic documentation, «as well as small or very large exhibits, including drawings, computer programs, and many other items». Here the authors refer to the experience they had during the recent and famous proceedings in Italy, the Cusani trial, relating to bribes within the public administration and within political parties. A hypermedia system was developed which allowed court rooms to be exposed to, these new information technologies for the first time in Italy.

The development of this kind of tools will facilitate cooperation between different departments within the public administration and produce greater synergy, with a view to increasing the productivity of public bodies. This means disseminating information between «operators working on the same problem (lawyers, judges, policemen, journalists, defendants and prosecutors) to construct, with care and rigour, the interactive documentation of the case in question».

Lauritsen provides a key to interpretation and outlines the panorama of that which in his opinion will be the future of information technology applied to the law. Information will no longer be transmitted through ink-on-paper, but in various digital formats. Books will be interactive and managed from a linear organization to the hyperspatial. Therefore, the main feature of the book of the future is that it will link up to other online sources able to dynamically integrate it. This will occur through information networks supported by standards. In systems of this kind, hypertext links do not simply connect to elsewhere in the local book, but invoke communications software to log on to remote services. The development of that kind of collaboration which Wilson, Degli Antoni and Di Pietro also talk about, is further explained here: that network of experts who communicate together, a kind of «electronic marketplace» for lawyers involved in the public administration, courts, law firms and corporations.

Within this prospect, the distinction between texts and programs, between books and machines, between information products and services no longer exists: as the author concludes, document collections or books are rapidly being transformed, «evolving from passive objects to productive tools, interactive devices, information appliances, maybe literary machines».

The third section of the issue, Semantic Models and Knowledge Representation in Legal Hypertext and Hypermedia Systems, deals more specifically with problems related to processing legal data, through a series of articles analysing and discussing this new technology, in an attempt to
bring out the particular nature that makes its use valuable for legal information systems.

Mital and Elliman move from a wider environment than that of computer-aided legal documentation and arrive at the specificity of hypertext. They find it very useful for this particular domain, even compared to knowledge-based template systems which — they believe — are too rigid and closed for representing a real aid for the legal profession. In fact, the knowledge base is rule-based and matters are loaded on a once and for all basis which do not take new elements that might be crucial for the decision into account. Nevertheless, greater elasticity and, therefore, greater efficiency is possible by using hypertext.

In describing HyperNotary and Empower, the two systems they have implemented, Mital and Elliman discuss the need for building a semantic structure for supporting the hypertext network between documents. Furthermore, they talk about the requirement for hypertext systems to typify links, in order to provide the user who moves about in the hypodocument with additional information, with regard to the structure of the documents and their semantic aspects.

Future development in research — according to the authors — will be to provide the system with the ability to interpret the link in the context of the facts made known to it by the user, to make suitable inferences and to use that to drive the direction of browsing or provide guidance on what new links a user can add.

The same problem is faced in the article by Bench-Capon, Dunne and Staniford who start from the assumption that traditional information retrieval systems have demonstrated their limitations. Even other approaches, including conceptual retrieval, the connectionist approach and hypertext itself cause problems. As a result, the authors propose to create a model in which documents are organized in a graph defined by rules corresponding to conventions associated with particular classes of documents. The rules are intended to capture both the organizational structure which is so relevant in legal documents, and the conceptual structure of the documents. The edges of this structural model can then form a subset of the links in the hyperised document, and these will constrain passage through the hypertext, so that structural conventions are observed, however the reader chooses to follow the semantic links.

The article by Colotti, Di Giorgi, Inghiramì and Nannucci, focuses on the organization of hypertext databases enriched with semantic supports orienting the user in his search. In the authors opinion, the hypertext approach, which has had a great impact in the legal world, allows the user
to be provided with *the global legal datum*, because it is possible with these systems and advances in them which are moving towards hypermedia, to process and integrate different kinds of data and, therefore, to enrich the patrimony of information available to the user, thanks to the possibility of providing information in the form chosen by the information provider.

The proposed structure for the application described here, namely Hyperlaw2, consists of two interconnected superimposed levels, one relating to the documents stored in the various documentary bases (legislation, case law, legal authority) - of different types, including image processing - and the other to a conceptual network properly designed (keywords, organized in a classification table). The browsing is enriched by information retrieval functions, so the user can navigate within the system also by using Boolean syntax. The application moves in the direction of a harmonization of the two paradigms hypertext and information retrieval, considering the inadequacy of currently existing legal information systems, which are very rich from the documentary point of view but under-used by legal professionals.

The integration of search and navigation functions is also covered in the article by Pietrosanti, Mussetto and Marchignoli, where the need to consider the structure of the legal document is analysed, as well as the concepts of semantically linked references also connected to the documents. The model proposed here is a *document space* interacting with a *concept space*.

As the authors point out, it is important to consider models that explicitly consider the qualification of concepts by means of contexts (examples of context are «definition», «general rules», thus allowing contextual access to technical documents. The feature of model, applied in the Navilex prototype presented here, is that the functional schemata are a structured context, in which the user can specify not only a context type (for example, the definition schema type), but also the functional roles associated with the concepts of interest.

The article also looks at one of the most important problems in building hypertext databases, namely the semi-automated updating of hypertext systems. This function is performed by a set of linguistic tools devoted to extracting new information from external databases using standard elements usually present in legal texts such as typographical layout or formal and recurrent expressions.

In the article by Gasparri, the question of the intelligent scanning of legal documents is dealt with: traditional database searches produce documents, but do not deal with relations between them; the use of hypertext, instead, permits relations between one document and another to be
expressed without, however, providing an overall framework of the logical structure of the database. The attempt made with the HTLEX system is precisely that of meeting the demand for building actual tools as an aid to legal interpretation. The logical links between documents are managed in a database: the system activates the chains of pre-established logical links between documents through the concepts expressed in them and represents them graphically. The logical structure expressed in this way can be followed through hypertext navigation.

The basic ideas of hypertext and hypermedia in the law are also presented in the article by Fanning, who analyses legal databases and argues that the legal world needs to take a step forward, as, up until now, most legal databases are only the electronic versions of the printed form and, therefore, product developers are trying to apply hypertext and hypermedia technology to electronic versions of printed texts. Nevertheless, it is useful to reassess our understanding of what constitutes legal documents and collections of legal documents: what is global legal information? It is not the content of a single database, but the result of detailed interaction between many databases, between documents of different kinds, which have not up until now been managed on the same support, due to the rigidity of the actual documentary structures of traditional information retrieval systems.

Fanning touches on these complex questions and maintains that only by making an effort in this direction can hypertext and hypermedia technology find innovative practical application in the legal world.

The articles under the heading *Hypertext-aided Legal Expert Systems* describe the interaction between expert systems and hypertext in the law. Artificial intelligence may be a support for a hypertext system, just as a hypertext system can be an aid for an expert system.

In the former case – as Sammarco, Cardillo and Salberini point out – they refer to tools that guide navigation within the hypertext network, by activating the logical inferences built by using hypertext links. In the latter case, it is, instead, a matter of using hypertext features for creating interfaces that aid in the consultation of expert systems. Yet another case is when, along with the expert system, a hypertext database is built that integrates the information found in the system's knowledge base with additional information based on the direct consultation of legal sources. The user may use this new information when he makes his search, or he may also introduce and manage it in subsequent phases. In building expert systems, therefore, hypertext can be used for linking up to the rules that lead to the solution, or the grounds for the solution chosen by the system, by display-
ing the significant documents that have led the expert who built the system to opt for that solution.

In the system the authors present here, apart from integrating different applications in a single environment (expert system, hypertext and database) and from the interaction between user and system with the possibility of verifying the suggested solutions, a further development is proposed, namely using hypertext systems managed on networks such as MOSAIC on Internet is proposed. In fact, being able to transfer specific applications from a local management system to a system managed on a network and, therefore, available to a greater number of users is proffered.

Integrating hypertext technologies with artificial intelligence is also discussed in the article by Quirchmayr, Traunmüller and Bauer. The main idea of the proposed approach is to make use of hypermedia technology in an integrated way by combining it with a traditional rule-oriented inference mechanism and allowing this mechanism to access databases as sources of information. So the HyperReasoner system uses hypermedia technology for creating a user-friendly interface for consulting the expert system and for searching an ad hoc database, built alongside the system, accessible at any time for up-dating and controlling the expert system. Additional information may be loaded in the system in the form of input batch files, so the result of overcoming the usual isolation of expert systems is reached.

The problem of assessing solutions suggested by expert systems is dealt with in the article by Moens which describes the PARCOM system, equipped with a hypertext database containing the system’s information sources on which the rules and definitions used in building the expert system’s knowledge file are based. The documents found in the hypertext documentation system are statutory and case law, legal literature and human expertise, that may also be queried independently of the expert system. The application’s objective is to give the user the possibility of consulting the documentary sources and in this regard, «the knowledge engineer builds links between the production rules and related pages of the hypertext documentation system».

A section of the volume is devoted to Hypermedia-based Teaching Systems. In this area, three experimental applications are presented, that propose using hypermedia for teaching in North American law faculties. We have placed along with these the description of a prototype designed for Italian schools.

The proposed experimental courseware has taken into account what has come out of theoretical studies. In fact, it allows the learner to use his
freedom in exploring viable information, in linking materials and creating
his knowledge according to his goals, but they also have some mechanisms
for helping navigation and enhancing the learning process.

The prevalent US law classroom teaching method is a question and answer
exchange between professor and students examining court opinions and
analyzing the relationships between these cases and within the legal system
in general: printed casebooks edited by professors and including comments,
questions and cross-references are commonly used.

Then, «law is a verbally rich activity and the computer screen, compa­
red to the pages of a book, has a special feature, that is its instant expan­
dability: the computer screen can be seen as a window through which the
user can go to immediately explore other topics», as Andersen states in his
article.

His hypertext system is based on the expandability of the tool in accor­
dance with multiple layers of information. The system starts from a concept
map on which all the principal components of the topic can be related, as
an index to a traditional book, to avoid disorientation. The student goes
ahead viewing one question at a time, but he can click on one point and
be moved to a screen which deepens the information on the subject. Each
piece of information may have additional buttons for further exploration.
An audio media enhancement has been added to the screen through a
button labelled Audio Notes: when the student clicks this button he will
see a picture of the author and hear some short comments attempting to
«highlight features shown on the screen, explain relationships depicted,
identify examples, suggest questions».

Staudt and Shiels present a complete computer law electronic book
recently created for replacing printed casebooks which is given to each
student on a computer loaned by the law school for the semester. Students
use the hypertext course kit to face all tasks involved in their law learning
such as reading cases, preparing pre-class notes, participating in class
discussions. There are full-text Boolean queries for searching and browsing,
readings are present and numerous links have been inserted, also containing
preformed queries or instructions for running other software for multimedia
objects like audio and video.

This kind of learning tool is very versatile: the author/teacher can add
new cases, remove or rearrange older ones. Students can also modify the
material through insertions, deletions or hypertext links to external sources
by means of shadow files that allow them to modify and annotate the
material without changing the integrity of the author's original. Group
work is also possible, because every piece of work done by a student is
loaded in the infobase and subsequently discussed by the whole class. Jump links to the full text of statutes and other material answer any question the student may have. Query links to select information that a law student would probably require for preparing class work or for final examination complete the kit.

Savoy presents a hypertext prototype designed and implemented for law students in Canada. His aim is to demonstrate that hypertext-based systems are especially useful for teaching law, even when limited to a particular legal domain, as this approach is similar to the way lawyers work. The system incorporates the automatic transformation of legal texts into hypertext by subdividing large documents into nodes according to their logical structure and by automatically establishing hierarchical links between single elements. As within this hierarchical structure the linking capabilities may be very restricted, an automata has been built capable of establishing relevant cross-reference links. This can be done in the legal domain because legislative drafting follows a strict syntax when inserting references to other legal sources. Glossary links are also included for establishing a relationship between a given word appearing in a law and its definition as provided in statutes. An autonomous query-based retrieval system that takes hypertext links into account has been added to give students some guidance in exploration.

ECOLAND is a hypermedia learning tool especially designed by Cesareni for Italian schools on environment protection issues. The student starts exploration from a spatial metaphor: the image of a region appears on the screen, which contains three small towns, each of which represents a single environmental educational topic. In each town the student can enter four different places (the town hall, the library, the town’s archives and the main square) from where he can gather different kinds of information at different levels of depth and complexity (environment protection legislation, economic and political issues, technical measures, etc.).

The student is guided in his exploration by an expert on environmental problems, through a phone call in which the expert introduces himself and provides some useful advice on how to organize a search within the system.

ECOLAND simulates an imaginary and yet realistic environment in which the student moving around in it encounters real-life issues. It was built on the base of a mixed structure. Although a hierarchical structure tends to make navigation easier, it can also result in too rigid and simple knowledge representation. Therefore, referential links were provided to allow for more complex knowledge representation.
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REFERENCES


