

The Archaeologist Files: An approach to the digital contextualization of archaeological finds in user adaptive information systems

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Abstract: While surveying the opinions of the general public it becomes evident that archaeological finds tend to be taken as hard to understand without expert knowledge on the subject. The consecutive problem is that this makes the finds easily rather uninteresting to the amateur audience. The presentation of context and giving meaning for archaeological finds in wider historical perspective is an apparent problem, and a considerable challenge for educational institutions and especially for museums. One plausible approach to this challenge is the use of digital presentation techniques and user adaptive information systems in giving context to archaeological collections. The Archaeologist Files project has explored different methods for providing museum visitors a more holistic approach, comparing to the traditional, to the archaeological material in historical perspective. The results do suggest that dynamic and adaptive hypermedia interfaces combining intelligent search facilities with narratives could be a feasible method for achieving these goals.

Key words: The Archaeologist Files, context, archaeology, human computer interfaces, narratives, hypermedia, adaptation, information systems

Introduction

While surveying the use of computer multimedia workstations in museum use, it has become increasingly evident that a museum is a rather demanding environment to set up functional information system for public use in an exhibition. This article discusses the general problematic of archaeological finds in a public display by exploring a possible solution to increase meaningful communication between the archaeological exhibition objects and the visitors by using digital information media applications.

The Archaeologist Files project has been a logical step in the development process of archaeological computing applications in Aboa Vetus Museum. Aboa Vetus is a rather small museum of archaeology and history located in Turku, in south western Finland. Despite the size of the institution, it has been a major player in the field of archaeological computing and hypermedia presentation in Finland since its founding in the mid 1990's.

The multimedia information systems applications of Aboa Vetus before the Archaeologist Files include the Lost Town –project which was launched to produce a complete 3D model of late medieval Turku based on exact archaeological data (Sartes & Uotila 2000). The other major project has been "Cheers! Fragments from the Middle Ages" which was to exhibit medieval North European glass vessels as a multimedia application containing video clips of digitally reconstructed objects. The museum has also launched a number experiments in smaller

scale aiming to explore various possibilities of computer technology in presenting archaeological data.

The first computer multimedia applications of Aboa Vetus were developed in co-operation with a professional multimedia design company. In spite of the fruitful co-operation the following projects were began as in-house operations because of the demands to streamline the production processes and the vision which saw the computer applications as an integral part of publication work and research done in the museum. Experiences of this renewal of processes have been encouraging and no reasons for outsourcing the CA projects has been encountered since then.

The project

Because the archaeological collection of Aboa Vetus is unique regarding its size and comprehensiveness in Nordic context, it was clear from the beginning, that this material should be forged into digital format sooner or later. The Aboa Vetus collection consists of the all the archaeological material excavated from the site where the museum is located. The collection is very comprehensive consisting of nearly 40.000 individual catalogued finds dating from the early middle ages to the beginning of the 20th century. This kind of material is however far more demanding for a museum than a traditional collection of antiquities and art objects. Because of its origins there is a rather small amount of completely preserved items and fine arts

objects comparing to the huge amount of sherds and other small remains. The somewhat limited visual attractiveness of the objects does not decrease their scholarly importance or the usability value in museum displays, but do increase the demand for supplying a comprehensive context to make them understandable. This is a common problem with all archaeological material. Only a minimal part of any finds can be considered interesting to amateurs as such. This leads to a controversy of having tens of thousands of finds in a collection without having but a few dozen which are of apparent interest to a common visitor.

The Archaeologist Files is based on the response gathered from the museum visitors and surveys done among users, which all do suggest that a new comprehensive method for presenting archaeological data to the wider audience was needed to satisfy the information needs in all user categories excluding the professional archaeologists. The lack of context and special expertise needed to interpret the basic archaeological data were the most critical factors hindering the communication. That is the reason why they were chosen to be the primary goals for the new project.

The Archaeologist Files tries to explain what a tiny piece of wood or ceramics can really contribute to research, what it once was, where it was used and for what purpose, and what are the finds lying behind the closed doors of the museum storerooms. The project was titled The Archaeologist Files with purpose to emphasize presentative approach and the need to increase the attractiveness of finds especially among the general public.

The idea was further developed to a sketch of an information system capable of providing multiple media content to mass of different kinds of users giving them much demanded context and explanatory material.

Because of the promising earlier experiences the results were decided to be published on a number of platforms. The rather flexible portability of the raw media has enabled increasingly streamlined production of content to be published in museum based multimedia stations, on a CD and a DVD-ROM formats, and on interactive web pages. These all formats were included in project definition. They were prioritized to be completed in order to prepare first the multimedia station version for prototyping and gathering experiences, and then to proceed to further developed versions on CD-ROM and on the web platform.

The actual project was started in co-operation with a private enterprise Muuritutkimus ky. Aboa Vetus Museum has been providing the project framework, management services, project design and co-ordination and research work while the partner has been concentrating on the visualization of objects and scholarly consultation on some specific finds. The funding for the project has been provided by Matti Koivurinta Foundation and the Finnish Ministry of Education.

Theoretical background

Apart from being a commercial project with directly applicable results for the museum, the Archaeologist Files is also a re-

search project for developing the next generation of digital media systems for museum environment. The fact is that a simple computer multimedia programme placed in a museum is not anymore a valid answer to the integration of digital media use to the contemporary visions of the museums today or in the future.

The traditional view of delivering information in digital form with traditional paper oriented layout and systems design was considered inadequate for the goals of The Archaeologist Files project. A picture laid out with static text on the screen is not a plausible way to present information on a computer system. Digital information processing allows use of inter linked hypermedia content, dynamic processing and presentation and tools for human computer interaction.

The other view to the traditional versus more up to date way of presenting information on a digital media platform concerns the media content itself. Supplying an increasing amount of visual data in form of figures, photographs, computer modeled and reconstructed objects is plausible in a way because its apparent value in educational terms. In spite of that while implementing more visual data, the question arises, whether it does actually satisfy a need for specific information or answer a concrete question concerning some subject. While becoming more visual the information systems are actually facing a danger of loosing the vital interdependence between different kinds of content and becoming blind to the increasing amount of available data in comparison to the actual information it contains.

Visual images are perhaps the best example of this danger. They are self-explaining to some degree but rarely produced with such care that they would fulfill their full potential. The problem is tied especially to the virtual realities and 3d reconstructed finds and structures which are being produced nowadays in all increasing numbers. Reconstructed objects tend to be visually attractive. High resolution graphics, sound, perhaps even possibility to smell the item with so called natural user interface do increase the immersion. It is self evident that using advanced technology is plausible, and does apparently give added value as the level of virtual experience and its authenticity enhances. But the limit of such a solution is that a reconstruction do still quite rarely provide more than only a limited amount of actual information. A picture of an object, even reconstructed one, is still rather obscure if spectator is without any special knowledge on the given kind of objects.

During the earlier Aboa Vetus CA projects and according to the experience gathered during their evaluation it has become clear, that a museum exhibition is highly demanding environment for working IS applications. The most critical factors to meet were according to the experiences and surveys the variable background of potential users and extremely short time each individual actually uses a computer station placed in the museum environment. Of the different background factor two of the most difficult issues to comply were apparently the relatively large potential user group with only basic computer literacy, and the widely different levels of interest and previous knowledge on the subject among the users. The problem of extremely short time usage frame was decided to be included in the specification, but it was apparent that it was plausible rather to try to increase

the usage time than to try to adapt to it.

While concentrating more on the user issues it was noticed during the research, that the user needs were still formed in a rather common structure, similar than for instance in the AVANTI project described in Fink, Kobsa & Schrenck 1997. The resemblance was apparent even despite the fact that networking applications and some special groups were decided to be omitted during the first development phases in The Archaeologist Files. It was apparent that The Archaeologist Files should be implemented with fast but still reliably adaptive information retrieval procedures and a user interface that would use common easy-to-learn metaphors.

As the key principles for creating the environment were chosen the previously evaluated criteria for well behaving user adapting information systems. According to the criteria the environment should be 1) appealing as the user should be feeling home using it, despite the premises. Appeal should mean also attractiveness, intuitiveness, understandable metaphors and consistent interaction. Secondly the system should be 2) communicative as being able to interact effectively with the user. The third criteria is the 3) knowledge or information content meaning that the system should be able to deliver relevant information in such quantities that will satisfy the user needs (Vatanen 2000).

As during the Archaeologist Files project the main concern was to counter the potential lack of meaning and absence of relevant information by applying digital technology to place individual finds and pieces of information into a common context, it resembles rather well common information distribution systems. The principle behind The Archaeologist Files was therefore decided to be to weave a network of chronology, of applicable written data, of historical background and of scientific interpretation done by professionals, and to tie all the finds in this structure of information.

The contextualization process was decided to be approached from two main directions. The interactive and adaptive user interface to the knowledge base was the first method and the second was the rebuilding of the information itself into narratives requiring only basic previous experience with computers and a limited amount of interactivity with the interface. The power of narrative in human computer interface had been pointed out by Abbe Don (Don 1990) but as the experiences gathered in the Aboa Vetus also suggested that most of the users were extremely interested in what was visible on the screen by the time they passed by the computer but hesitated to touch it and were literally afraid to interact with the programmes, the narrative seemed to be a correct approach to the problem of limited computer illiteracy.

A narrative was definitely an answer but it required quite extensive research to fulfill all the expectations. The main factor that determines the success of narratives was that they had to be relatively short to capture and keep the attention of an occasional visitor because of the average interest span of only a couple minutes that was determined in the computer use behaviour surveys. Another point was that the narratives had to be relatively easy to interrupt to cruise between them. It was also determined that the programme has to propose a new

narrative after one had ended and be able to proceed without direct or definite user interaction.

It was noticed that The Archaeologist Files project had to deal with a variety of design issues regarding the data itself, interface design and implementation and fundamental database management issues. The focus is however on the development of plausible information interrelation mechanisms and their presentation and implementation on the user interface.

Technical considerations

The Archaeologist Files platform was decided to be built on a potentially scalable but still standard office database platform. After some rather extensive testing and evaluation the platform was chosen to be an ordinary Microsoft Access database. The choice was made mostly because of readily available integration tools for interfacing in the existing production environment, the fact that Access is today a de facto standard in small scale database management also in a number of museums, and because it seemed to offer potential scalability to more powerful SQL Server environment if required in the future evolution versions and in the forthcoming web applications. Another point of interest was the announced coming support for XML which was specified as an imperative requirement for the database tool, because it was decided that the project had to be able to follow the international standardization process. If the specifications would have been required more demand on extensive scalability, performance with huge amounts of data or uptime specific requirements, the choice could have been some other database but in the current situation Access was evaluated to be the most feasible alternative.

The process of defining the database structure to ensure its coming interoperability on the XML based data transfer was apparently rather time consuming. A number of propositions and projects have been established to develop DTD's for archaeological XML (e.g. Gray and Walford 1999), but until now, no definite and widely accepted results have been achieved. As the global standards for representation of archaeological data in XML-format will develop the chosen implementation will be further developed to fit these specifications.

As being a hybrid of a pure technology project and a project with more strictly defined business plan, it was also vital to define the requirements for the actual data processing tools and for the front end design. If there would not have been any previous experiences on developing information systems with hypermedia interfaces this would have been a rather demanding phase in the specification cycle. The experiences gathered during the previous projects did however encourage to do only slight modifications to the existing workflow.

The key media content was produced in a number of applications. The textual material is basically the most straight forward type of media but the developed type of hyper textuality employed in the system required developing a specific notation for nested linking which could be translated into XML in the future.

The aim was to use digital-only workflow as far as possible. The most notable exceptions have been the bulk of artistic graphics in the narratives and approximately one third of all photographic material. The finds have been digitized using digital cameras, digital video cameras and scanned drawings which have been imported into AutoCAD and to 3D MAX for visualizations.

The user front end was decided to be designed in two phases. The main front end was decided to be a Windows and possibly a Macintosh hypermedia application authored in Macromedia Director environment. It was decided to be linked dynamically to the databases and appropriate media contents. An adapted version of this interface application was decided to be produced for web use and various desktop applications to maximize its portability.

The idea behind this concept of designing different versions of application interface is to be able to adapt the most costly part of this structure – the information – into as many uses as possible. The major drawback of multiple interfacing is potential for limited data access with some secondary interface and the need to design more than one front end. The first drawback is possible to avoid by strict specifications and well preplanned concepts. The second one is a major drawback, but with the evolutionary approach The Archaeologist Files is being developed, it is far less a drawback than in the traditional cyclic models of information systems development (for instance STRADIS methodology).

Present evolution versions: the concepts of the Hyper Objects and of the Hyper Doc

The present evolution version of The Archaeologist Files application interface is strongly based on the theoretical background of developing a dynamic interface which allows both narrative and interactive approaches to the information. The interface is intelligent into limited degree and allows seamless integration between different elements and analysis of the user behaviour.

Technically the application is divided into two main interfaces and one secondary desktop. The main view, called the Hyper Objects, allows user to interact with basically all kinds of media content available (Fig. 1). It is a dynamic rearranging interface of individual, in limited manner interdependent, data objects. The key features include the possibility to browse hyperlinked information, to create associations between different kinds of information. An integral part of the design are the features which allow user to choose between active, semi-active and passive interaction with the system. The principle is that more passive the user is, more narrative the system becomes and vice versa.

The working logic of Hyper Objects approach lies in the analysis of the user behaviour. Hyper Objects interface offers first time user a basic interface layout and begins to rearrange it slowly depending on user actions. The rearrangements made are very gradual and the interface never changes more than slightly. The basic methods for adaptation are rearrangement

of interface objects into an order which follows the expected user preference, enlargement and diminishing of more and less relevant items, and propositions made by front end of potentially interesting alternatives.

The technique is based on limited goal composition (Nielsen 1994) and on-fly user modelling. Hyper Objects does not at the present implementation preserve user models from one session to another as the user is not generally expected to return to the museum exhibition within reasonable time period again. This approach do pose disadvantages because the expected session is relatively short and the programme has to adapt itself to the user very fast while still trying to be as accurate as possible. The main advantages in the approach are that the system does not require space to preserve the user profiles, and security and user identification issues may be omitted (compare Fink, Kobsa, Schreck 1997).

The other main interface, a hypertext environment, called Hyper Doc (Fig 2), may be seen in some sense as a more traditional interface to the information. The traditional features are however mostly limited to the approach which expects user to have a slightly more formal question than when using the Hyper Objects. Hyper Doc was mainly designed for a limited audience using the system as a search tool to the available information resources and having more exact idea what they are looking for. While the main interface is designed around the concept of in a limited manner interdependent data objects, the hypermedia environment is based on a concept of dynamic self reorganizing hypermedia document. It is not traditional in the sense that a hyper media environment should consist of inter linked documents. The key idea is to dynamically create and maintain an intelligent desktop document containing required information according to the expectations and information needs of different users in different media formats.

The third interface, a map browser, was implemented on the front end application to allow more flexible access to cartographic information. A separate map browser was designed for basically two reasons. While the integrated Hyper Objects desktop allows user to browse the cartographic content, the possibility to inspect this kind of content in three dimensional graphic and temporal space required more specific browsing facilities. The second and more restrictive reason was the limited space available on standard graphic displays. An object on the integrated environment is always, despite the possibility to zoom, limited by the size of the desktop space available. By designing a separate cartographic browser enabled to use the available screen more efficiently and implement all the features expected by the specification.

In the current evolution version the Archaeologist Files front end design is based on a networked approach of different interfaces including the two primary interfaces and secondary browsers. The main difference between the two primary interfaces, the Hyper Doc and the Hyper Objects is in the approach. Hyper Objects is designed for browsing while it allows also more formal requests for information. The Hyper Doc is a logical opposite designed for formal queries, but with browsing functions implemented for refinement and evolvment of the retrieved results. The workflow diagrams of both interface

designs (Figs 3-4) give a graphic view of the working logic of both approaches.

Conclusion and future prospects

During the summer 2001 The Archaeologist Files project is well under way heading to the next development phase which will result in actual production applications. The present state of the project is promising and the lately closed last definition phase did produce even more far reaching results it was expected beforehand. The coming tests will provide the project with more actual data on user behaviour for developing further the two interface concepts which will apparently push forward the research.

The main results from The Archaeologist Files have been so far in the development of new working concepts for presenting, storing and managing archaeological data for an audience with extremely varying background knowledge, interests and concepts to approach the data retrieved in archaeological excavations in form of objects combined with other information and data recoverable of the given place and period. The two concepts: Hyper Objects and Hyper Doc will be in the centre of development in the future applications as well as the current production versions. Within the Archaeologist Files results these two interfacing concepts are a major starting point for beginning to be able to provide more meaning to the finds, to increase something that could be called "factual immersion", and to make the finds more understandable especially to the public audience. The principal theme that no one can overemphasize is that the archaeological data have to be presented, and deserves to be presented, in a way which is the best possible also according to the standards of information storing and retrieval, and of communication.

Apart from continuing with the original goals, the research has so far opened a number of new interesting leads. The two interfacing concepts will be no doubt pushed forward and implemented also on more scientifically oriented information systems. Even in the beginning it was apparent that the problem of context with archaeological data did concern also professional archaeologists and historians doing research. Managing the data during the process of trying to understand the past is extremely time consuming when trying to get a somewhat holistic picture of the field of study. The plausible way of organizing data and storing information is vital also for experts who do all have the basic knowledge, but who would still gain advantage by being able to manage their research data more efficiently. The possibilities of implementing the information

system including the interfacing engines created during the Archaeologist Files project, and expanding it to wider use, would be a very promising prospect for future work. The theoretical background of creating computer aided archaeological workspace applied in the Archaeologist Files project could contribute to the development of a common interdisciplinary tool for researchers studying the past.

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Figures



Figure 1A: screen shot of the Hyper Objects interface

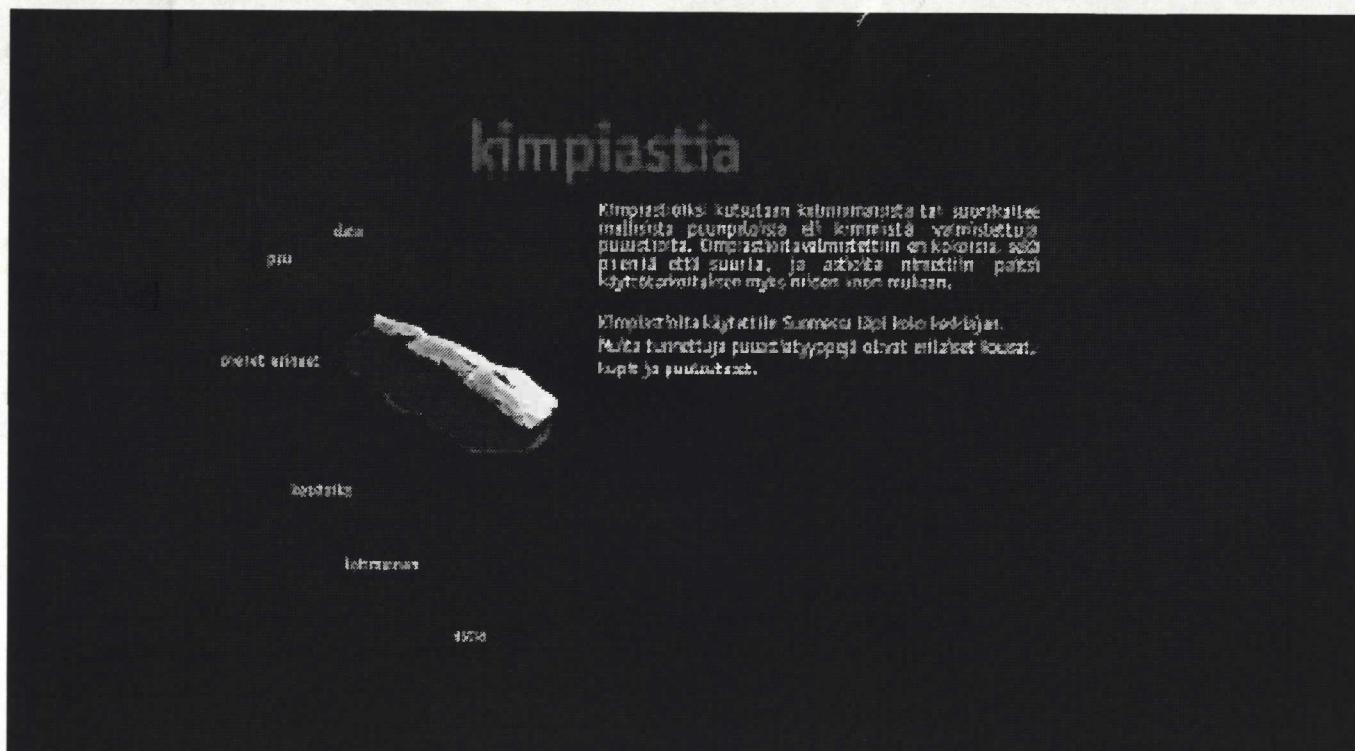


Figure 2A: screen shot of the Hyper Doc interface

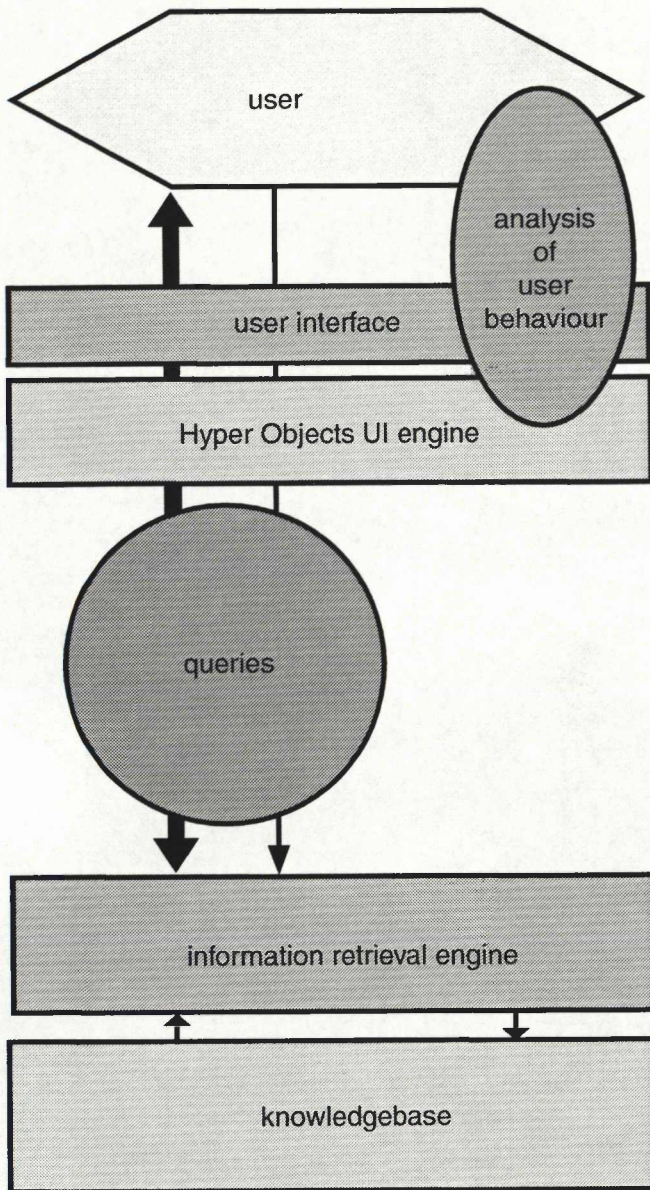


Figure 3: Workflow diagram of the Hyper Objects interface

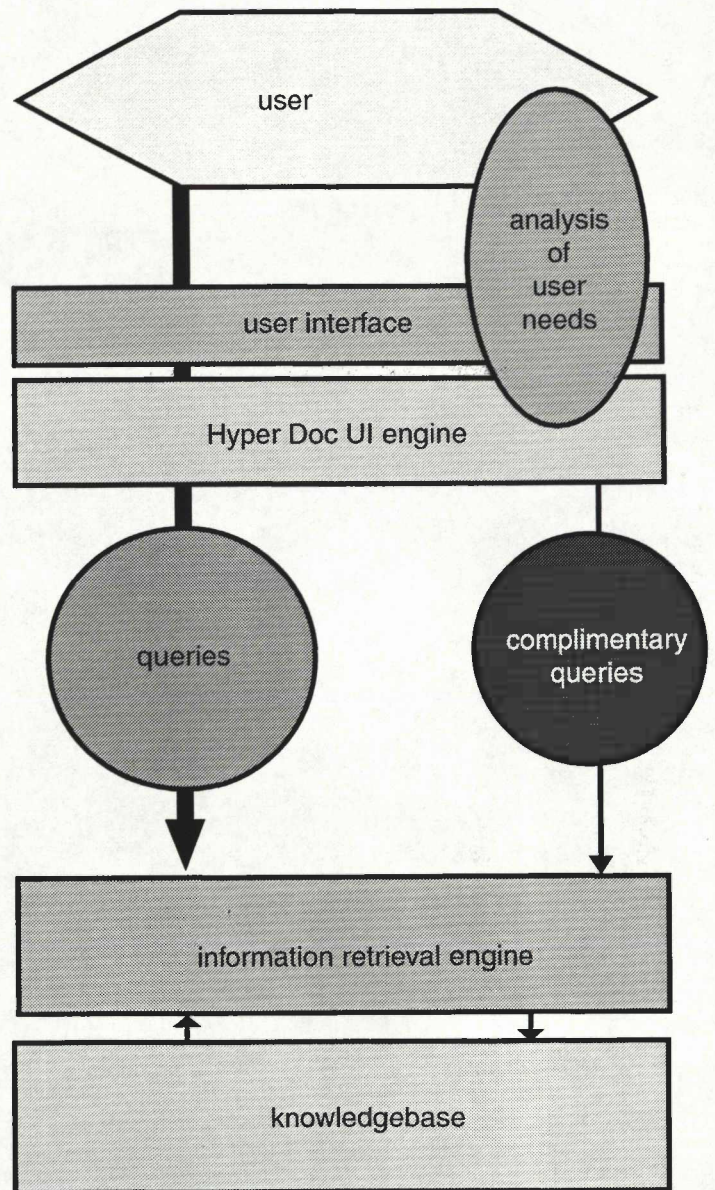


Figure 4: Workflow diagram of the Hyper Doc interface