BY RHYME OR REASON

Rapid Design Thinking by Digital Cross Referencing

MILTON TAN, BENG-KIANG TAN
School of Architecture, National University of Singapore
akitanm@nus.edu.sg, akitanbk@nus.edu.sg

AND

JASNI NGAHTEMIN
akijn@nus.edu.sg

Abstract. A prime objective of a visual database for design thinking is to support trains of thought. The game of "Rhyme or Reason" provides a clue for the cognitive basis for mind racing. In particular, it shows why in creative design speed matters, why we need memory cues, why reasoning by lateral association and conceptual positioning are as important as logical pattern matching. Unlike a conventional database, such as a banking system, which is concerned with the correct convergence on specific records, visual databases for design thinking need to support divergent exploration.

The paper presents a method of "multivalent" tagging of discrete items in the database. It provides for knowledge of *relations*. This achieves two things. Firstly, it enables the search engine to return a specific database item in different exploratory contexts because of the multiple ways it can meet the search criteria. Secondly, the different tagged aspects of the item can be used to trigger new exploratory routes. The user can explore other tagged aspects whose relationship to the original search criteria need not exist in the indexing system. Short of this, a search is dependent on direct literal or other variants of pattern matching to retrieve only *parts* of a database. The strategies for sustainable input-output, and for search-storage of a visual database demand high modularity and generic structures which are not dependent on specific software or computer system. The paper specifies its open structure and its transparent and re-configurable methods. These are non-trivial design issues.

1. Introduction — Context and General Issues of Design Thinking

Most databases are concerned with quick and accurate access to large capacities of organised information. A banking system is a prototypical example of such an application. However, in creative designing, a less convergent system for information retrieval is needed to support the designer's train of thought. This is well illustrated with the party game, "Rhyme or Reason" where players take turns to keep a sequence of words running by rapidly crying out a word which relates to the last one by rhyme (“bay”, “hay”) or by reason (“hay”, “cow”). The aggressive player plots to stump the others by unusual or surprising connections.

The creative designer is like the aggressive player in Rhyme or Reason, except that the mind is put through its paces in a series of interconnections of form or function. Speed is significant in this mind race (as it is for winning Rhyme or Reason) because the closer one can maintain the speed at which the mind can switch between relations, the clearer is the overall the train of thought. Slowness results in natural weakening of connections to previous relations[1]. To be sure, a living mind never stops working. Therefore, access to information determines how well it races, or wanders off course.

It is well known that the brain works as a series of 'firings' of the synapses. These ‘triggerings’ are consistent with the experience of memory cues and signposts, which takes the person to the next significant point of a train of thought. This procedural or episodic memory is a significant aspect of cognition, and is especially useful to manage complex tasks such as designing. An explicit example of this is the physical back tracking that we undertake to find a lost item. We seldom expect a direct route back to the item but we hope that our memory records will be jolted forth by the clues that we pick up along the way. These lateral paths are not short cuts but rather opportunities for more rigorous explorations. They can be understood as parts of a web of nodes and links, which make up nested collections of interrelated conceptual schemes, each grouping of which makes sense — by rhyme or reason, or by any other forms of relations. Conceptual positioning is therefore as important as logical problem solving [Bruner 1986].

The journey is as important as the destination. For creative thinking, the journey is of paramount importance because, by definition, a creative act must at some point cause a departure from the beaten track. Visual databases, which attempt to augment the natural memory capacity of our brains, have four common weaknesses:

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1. This is different to reflection or even procrastination [Scheffler 1991; pp 134-6] in which the mind can continue to work rapidly independently of the external task.

a) Indexing, the task of putting information away in a systematic way for ease and accuracy of recall, is a complex and arduous job
b) Viewing of the collection is constrained by technical limitations and poor man-machine interface
c) Searching is inflexible, limited often to simple pattern matching of keywords
d) Capacity of the repository is limited and immobile.
e) The first pair of weaknesses is concerned with input-output issues, whilst the second pair is concerned with search-storage issues (Figure 1)

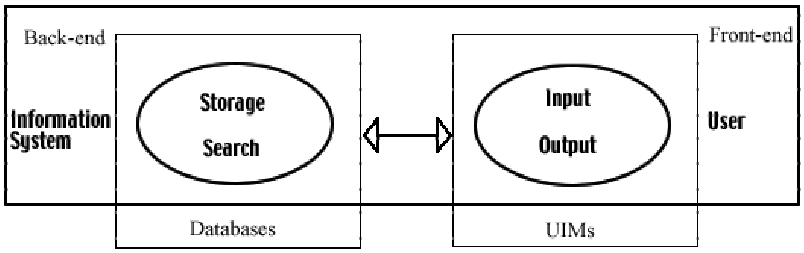

Figure 1. Basic Structure of an information system

This paper reports on the strategies and implementation of a research project at the National University of Singapore to build a multimedia repository, which addresses the issue of supporting trains of thought in creative design. Called OASIS (Online Architectural Studio Information System), the project is conceived as an open-ended vehicle for conceptual explorations in a stimulating design thinking environment. In particular, it deals with the weaknesses in conventional databases by using more user-friendly and sustainable strategies.

2. Key Strategies of OASIS

OASIS is made out of modular and re-configurable components within a simple information infrastructure. This is to ensure sustainability and transparency. Figure 2 shows the basic framework and alternative modular components.

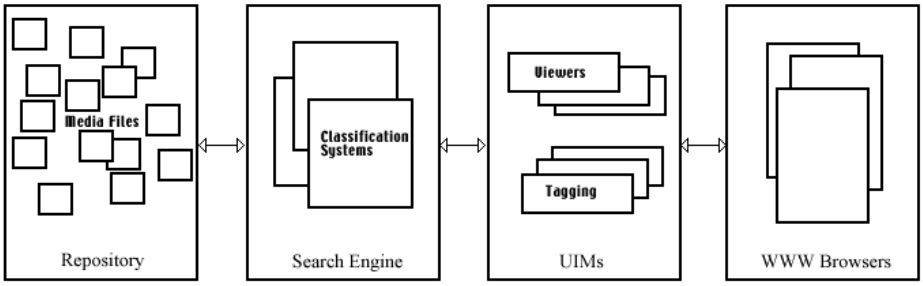

Figure 2. OASIS basic strategies and framework.

2.1 USER INTERFACE MODULES (UIMS)

For User Interface Modules (UIMs), the key strategy is to build these as local server-side modules on the World Wide Web (WWW). The file transfer protocol (FTP) basis of the Web effectively separates the issues of hardware and Operating System from data and the way it is to be viewed. It allows, on one hand, hardware and OS developments to forge ahead, and on the other hand, for software applications such as OASIS and content developments to be independently pursued and made accessible to a large number of users.

An important UIM in OASIS is the "Tagging" UIM. Tagging UIMs are important in OASIS as they are applications which enable authors and editors of multimedia collections to categorise each discrete file with one or more "Tags" that conform to the OASIS Indexing Scheme. There are 3 Tagging issues: a) multiple Indexing Schemes, b) multiple Tagging UIMs, and c) multiple Tags.

An Indexing Scheme is too large a universe of possibilities for tagging most collections. The concept of using customised Tagging UIMs is to simplify the work of authors and editors of these collections by presenting them with shortlists and defaults of tags that they need. Figures 3a, & 3b show examples of Tagging UIMs currently being developed for OASIS. (For alternative approaches to indexing, see Gross 1995, Chan, Maves and Cruz-Neira 1999, and Oxman 1995.)

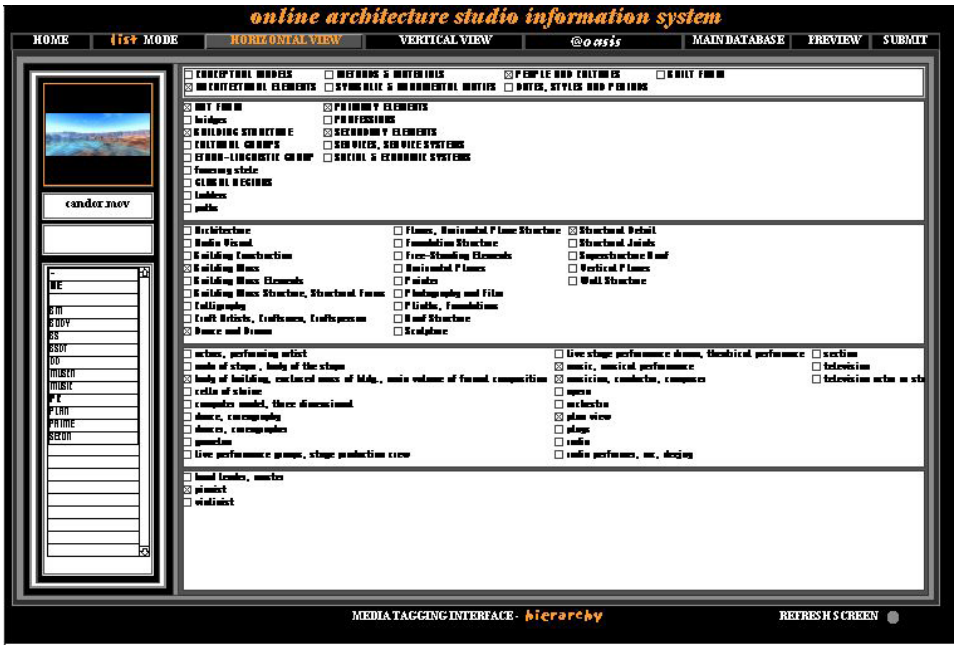

Figure 3a. Examples of Tagging UIMs —Horizontal view.

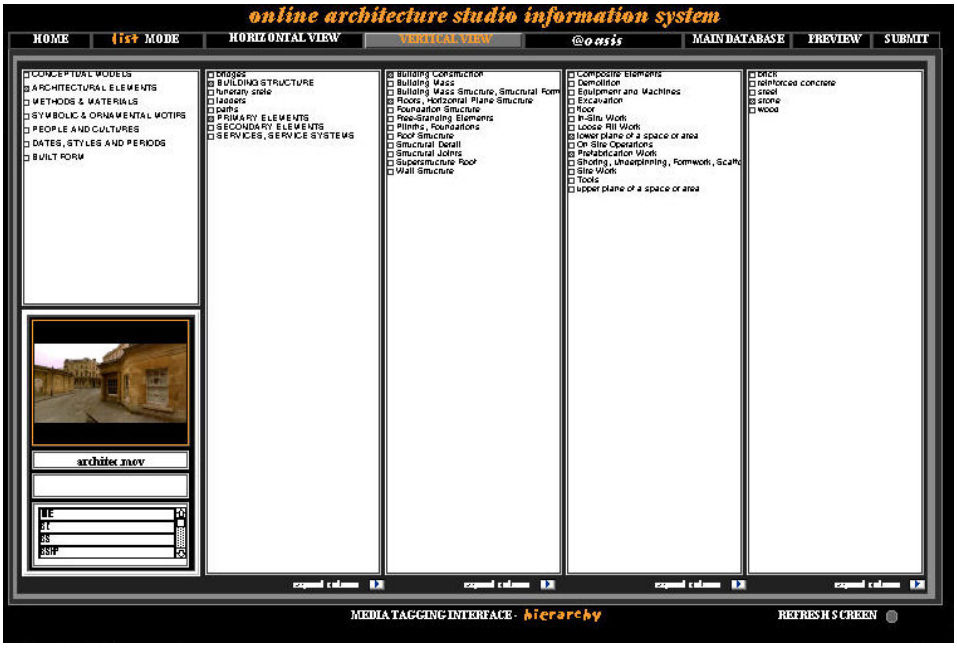

Figure 3b. Examples of Tagging UIMs — Hierarchical view

Interestingly, Tagging UIMs are also mirror-opposites of Viewer UIMs, for in the same way that media files are tagged to be put away, they can be retrieved through the reverse use of the tags. The design and function of Navigators are of course not constrained by available Tagging UIMs in the system. They are separate modules. Figures 4a, 4b & 4c show examples of Viewer UIMs.

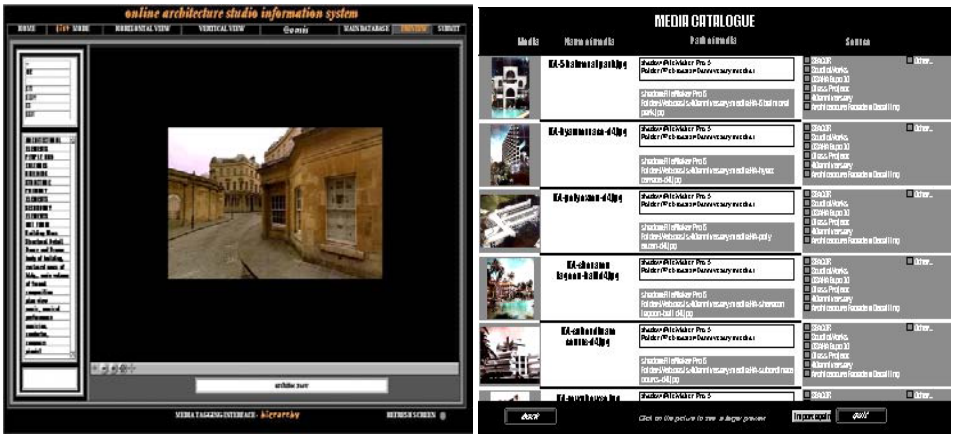

Figure 4a & 4b. Examples of Viewer UIMs — Single and Multiple views.

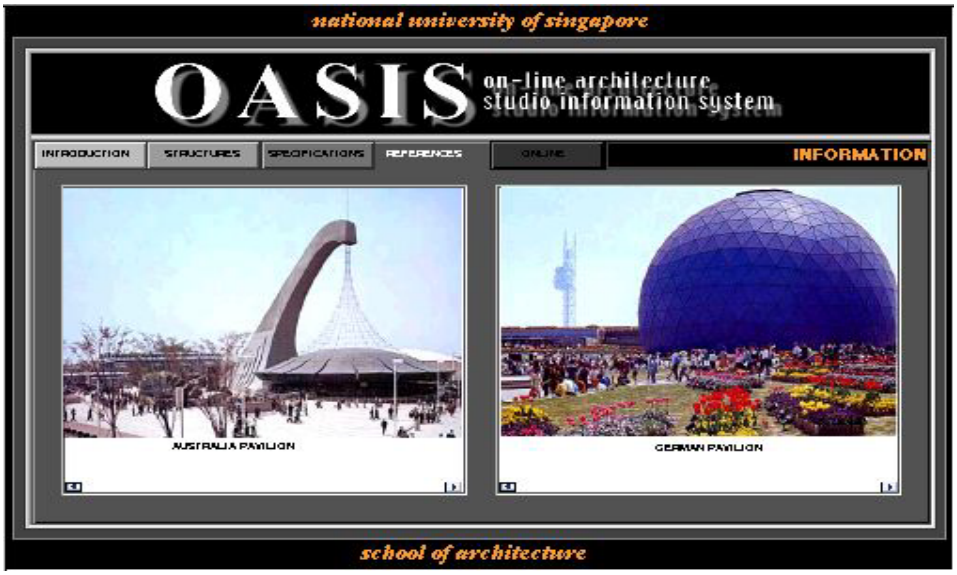

Figure 4c. Example of Viewer UIMs — Comparative view

2.2 SEARCH ENGINE AND MULTIPLE INDEXING SCHEMES

The key concept for OASIS's search engine is Multivalency. This concept from Chemistry aptly describes how discrete 'atoms' of information can be compounded to form coherent and 'stable' collections and, more importantly, recombined with others to form other compound [Tan et al 1995a]. Another way of understanding this is the "unbound book" whose pages can be recombined with or without others into another publication. Depending on the interest of the user at a particular time, a 'book' can be put together at little or no notice. This method of digital cross-referencing proves to be highly effective in supporting case-based reasoning, and in enabling a designer to pursue trains of thought by supporting "what else?" and "such as?" queries. A multivalent indexing scheme provides for knowledge of *relations*. It is therefore in the indexing schemes that domain knowledge of interconnections and cross-references is encoded. Short of this, a search is dependent on direct literal or other variants of pattern matching to retrieve only the *parts* of a database.

OASIS allows for the use of multiple indexing schemes. This is necessary because any indexing scheme has its bias or worldview and is not value or culture free. CI/SfB, for instance, has a bias towards technical specifications. The Search Engine is designed to work with single or multiple indexing schemes. It also supports the accessing of information outside the host system by indexing websites and other on-line databases. It is therefore an open system, which not only allows exploration within its own database, but also within other databases on the World Wide Web.

To ensure ease of implementation, sustainability and portability, each indexing scheme comprises lists of simple binary pairs of associated terms. Figure 5 shows a section of the OASIS 'host' indexing scheme, called IHAA. A search path simply links up pairs of similar adjoining terms; as in Rhyme or Reason. Backtracking up the indexing system loosens the scope of search as well as opens up the possibility of branching down from the higher nodes. The session is therefore characterised more as an exploration than a search. The binary pairs provide links to associated material, which enriches the design process. At a meta level, recommended or personalised exploration paths can be stored for others to traverse the steps of trailblazers.

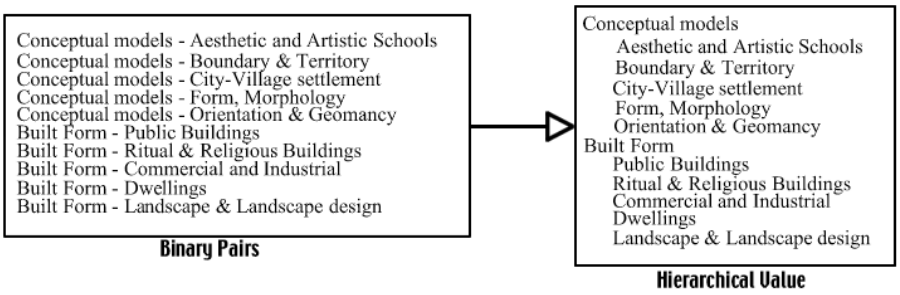

Figure 5. Part of the OASIS host-indexing scheme

2.3 MULTIPLE TAGS

Unlike a conventional database, which is concerned with the correct convergence on specific records — no more and no less — visual databases for design thinking needs to support divergent exploration. In OASIS, a method of multiple tagging of discrete items in the database provides two important things: a) multiple-contexts search, and b) content-based links.

Firstly, it enables the search engine to return a specific database item in different exploratory contexts because of the multiple ways it can meet the search criteria. Figure 6 shows an example of a file, which can be retrieved by the index "lion" as well as "shrine".

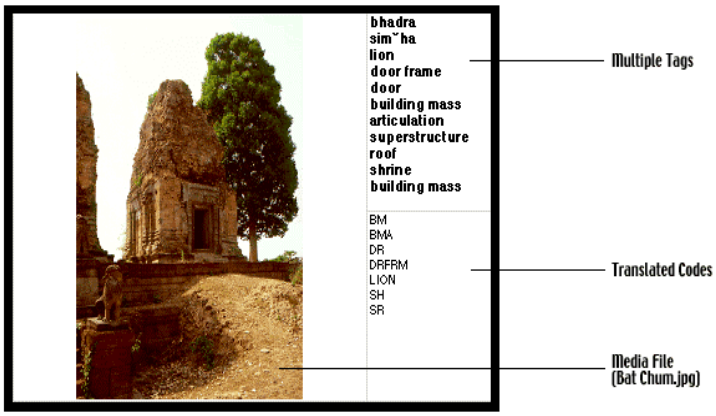

Figure 6. Example of an OASIS media file, which has multiple tags

Secondly, the different Tags of the item can be used to trigger other exploratory routes. The user can be encouraged to explore other tagged aspects whose relationship to the original search criteria need not exist in the indexing system. This is not unlike the value-added prompting from Amazon.com for other titles also acquired by others who bought a book in question. From the example in Figure 6, above, a user can choose to explore other trains of thought

provided by other tags for this media file such as “bhadra”, “simha” and “articulation”.

3 Implementation of OASIS

The design of OASIS is structured in 3 parts (Figure 7)

a. Database Design
b. Search Engine Design
c. User Interface Module (UIM) Design

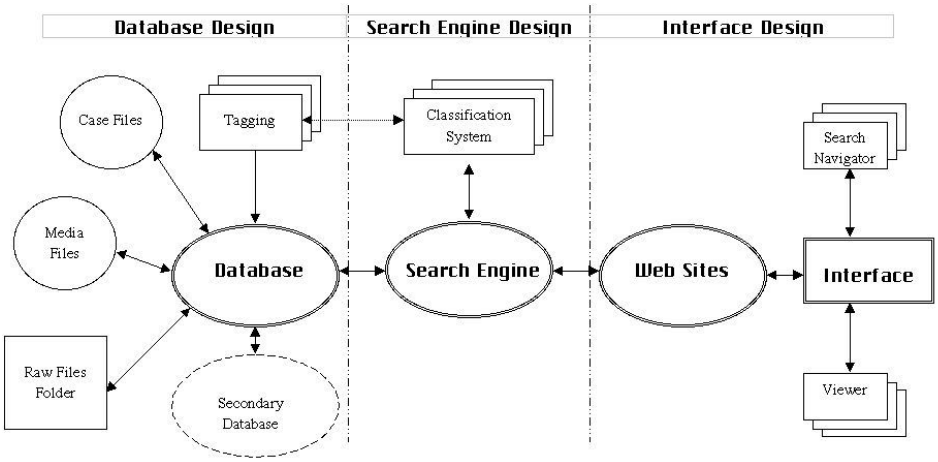

Figure 7. OASIS System Structure

3.1 DATABASE DESIGN

At the ‘back end’ is a database. Records of links to tagged multimedia files or other pointers such as website addresses are kept in the “Main Database”. The multimedia files (without any tags attached) are stored separately in folders. This keeps the main database lean and efficient, easier to manage and portable.
Special “Case Sets” are set up by collaborators to conveniently put all files of a case in one location. Examples of Case Sets are:

- **SEACOR** (South East Asian Corpus) by Associate Professor Dr. Pinna Indorf. This is a collection of visual material on the historical shrines in South East Asia. [Indorf et al 1999]
- **OSAKA EXPO 70** by Assistant Professors Dr. Wong YC and Tan BK. This is a documentation of the 1970 World Exposition in Osaka, Japan.
- **StudioWorks** from the NUS School of Architecture's Digital Design Studios.

3.2 SEARCH ENGINE DESIGN

The search engine is built around a Host Classification Scheme developed within the OASIS project [Tan et al 1995b], called the IHAA (Indigenous & Historical Art & Architecture) Classification Scheme. It is structured as lists of binary pairs of relations. The search process uses these relations to determine exploratory paths which have a connection (no matter how tenuous) to the focus of the search. Because OASIS is designed for creative exploration, many of these tracks should be surprising but nevertheless relevant.

In response to the fact that there is no absolute classification scheme, the OASIS system is designed to handle multiple classification schemes. The crossover between schemes occurs when there are similar objects. The interesting thing is that a search process can start in one classification scheme and switch over to another when there is a common object in the schemes. Currently, the project is incorporating the CI/SfB (Construction Index/Samarbetrskommitten for Byggnadsfragor) classification scheme as an auxiliary to the OASIS Host Classification Scheme.

3.3 THE USER INTERFACE MODULE (UIM) DESIGN

UIM designs are done entirely as web pages. This ensures maximum accessibility, ease of development and portability. End users will simply gain access through their personal web browsers, which run off their personal computers. Thankfully, the project does not have to be concerned with “user side” requirements, supplements or “plug-ins”. The project’s main home page, as well as a collection of other UIMs, is expected to evolve and be replaced later by better ones. UIMs have 'active' access to the back end OASIS database and search engines. These links will also evolve with the breadth and depth of the system.

3.4 HARDWARE & SOFTWARE

The principal hardware for OASIS development is Apple Computer's PowerMac G3 Server (running OS X) and Workstations. It is part of the project's policy that hardware and software used in the development and subsequent management of the system is to be transparent to the user. Because computer technology is never stable, every attempt is also made to ensure that the OASIS system itself is not permanently locked into specific hardware or software. Unique cutting-edge features, no matter how superior, are viewed with skepticism.

The database used for the OASIS project development is Claris FileMaker Pro. It was chosen for its flexibility and ease of integration with web interface development. As the system begins to support more demanding users and in far-flung places, other database engines may be required. Power still seems to be irreconcilable with ease of use.

A number of web development tools are used. These include Macromedia Dreamweaver, Fireworks and Flash, Claris HomePage, and other Html editors. For "server-side" programming, various Mac OS X Server, Java and QuickTime programming tools are used. These tools are expected to come and go, and any system development and management strategy must be flexible enough to take advantage of new tools, and not to be constrained by specific ones.

4. Conclusion

Rhyme or Reason is most interesting and challenging when unexpected, unusual and surprising links are attempted. A stimulating design exploration is no different. A visual database which supports such an experience has no 'real-world' parallel, and goes beyond the comparatively crude reliance on arbitrary browsing of glossy design magazines on one hand, and on narrowly converging electronic encyclopedias which attempt to deliver 'correct' searches on the other. OASIS, with its open 'architecture' on the World Wide Web, generic User Interface Modules, multivalent indexing schemes and the concept of the unbound book, offers an ideal exploration tool, which could foster a lively information "space" for creative design. The project is therefore in the spirit of Nelson Goodman's "Many Ways of Worldmaking" [1986] for creative designers to construct and explore new "design worlds".

Acknowledgements

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