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_knowscape - A Collective Knowledge Architecture

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Abstract *- In stead of focusing on negative sides of the freedom observe on the Web, it can be more interesting to consider the Web as a support for the establishment of a collective knowledge. Considering the Web through this kind of perspective makes obvious that tools are missing in order to enhance and develop the awareness of users on the Web as well as the ability to share Web experiences with others. In this paper we propose a 3D Web based tool called _knowscape that offers a mean to users to share their Web experiences. We will describe concepts that guides our project and technologies and features that are used to try to enhance the Web experience and bring Web browsing to another level of consideration.*

I. INTRODUCTION

The advent of computers and the Internet gives birth to a new kind of human collaboration and interaction. Where all information vectors have muted to reach pyramidal organisation (knowledge diffusion controlled only by few companies/persons), the Internet and computers gave back the control to the collective conscience for the management and the diffusion of its knowledge. The Web gives the ability to everybody to make available information world wide generating an enormous amount of data. We are pretty far from imagery and consideration concerning new medias and computers that can be commonly and regularly exposed in classical medias.

Major web experience does not include any awareness of other people browsing the same web page as you. Browsing the Web is usually a lonely experience. Few Web sites exposed the number of users accessing the same Web page at the same time, but it is generally Web sites link to computers and there is no way to communicate with these users.

Usually, a lot of time is wasted on looking for other people working in the same field as you. The classical framework is to look for information and documents, then, eventually trying to e-mail to authors. Through the use of multi-user based application, data mining and information search can be made at the same time than taking contact with people. Awareness of people browsing the same Web page as you combined with the ability to communicate with them can make possible very easily the ability to keep in touch with people having the same interests as you.

II. CONCEPT

User profiling is now widely used on the Web. It is generally exploited in commercial Web site in order to surround user's habit. Collected and generated Data are usually not directly available to the user, neither shareable with other users. An experiment was made in order to try to share a browsing experience by making available these profiling information to the user. The project was called *panorama* [1] (2001) and was linked to the activity report for year 2001 of the *Swiss federal institute of technology of Lausanne*. It was the Web version of the official report (Fig. 1).

User's activity was tracked: which page was visited, how long the user remained on the same Web page, etc… All these rough data constitutes the profile of the user and was available to the user through different graphical representations. As a basic and classical use, the user can exploit its profile data to retrieve faster a given information when coming back on the web site.

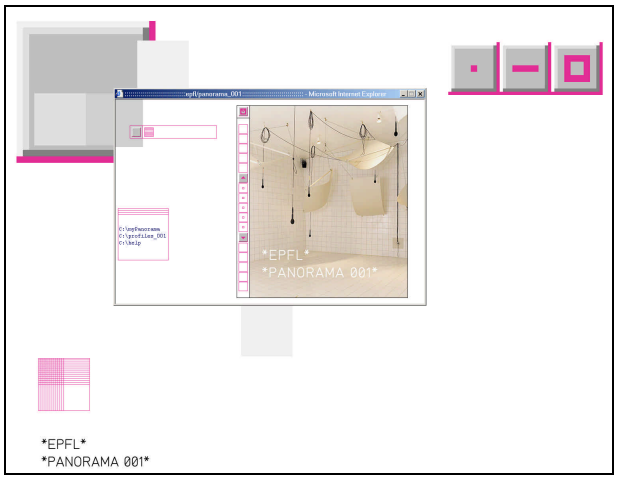

Fig. 1 : *panorama* home page

It was also possible to share the profile by sending it to a friend by email or even by *SMS* (mobile phone short message system) using a dedicated web page (Fig. 2).

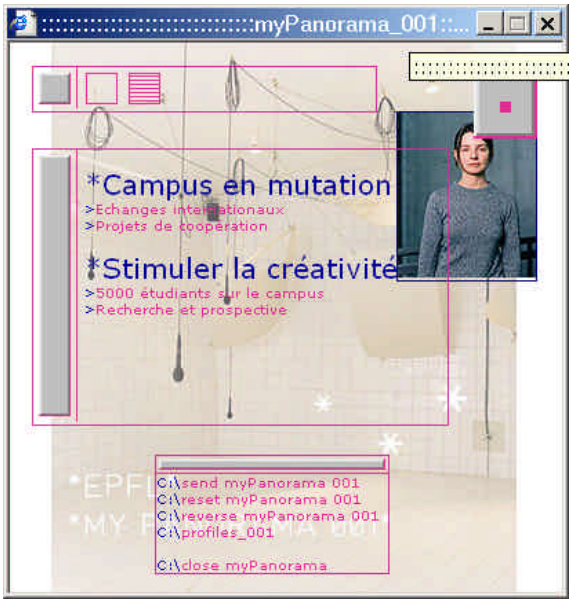

Fig. 2 : a generated profile and sharing options (bottom)

Moreover, all profiles were accessible to everybody, organised by date (Fig. 3). Of course it can be decided not to share all data, as privacy is a also a parameter to take in account. Within the particular context in this project, there was no reason why sharing all user's profiles could be a problem.

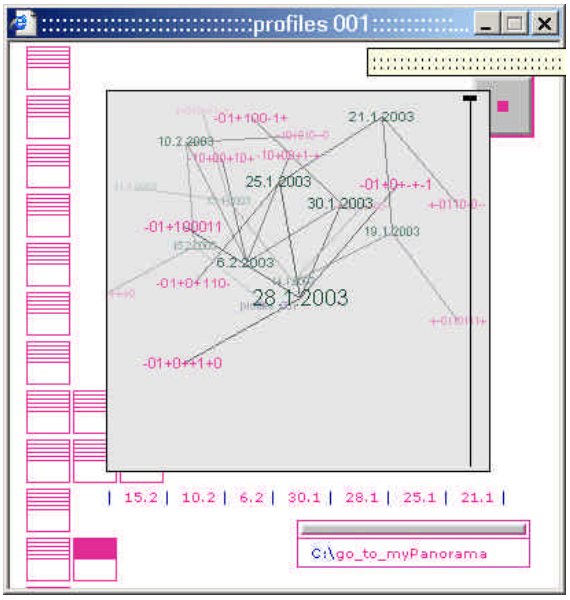

Fig. 3 : all generated profiles

Panorama was a first experiment in sharing user's Web experience. The particular context of the project has brought an important set of constraints (multi web browsers compatibility including those on *Macintosh*), which makes difficult the use of some technologies like 3D and even restricts the use of some *HTML* functionalities. Nevertheless its user interface, this project was pretty tricky to realise.

The *_knowscape* project (2001) can be considered as an another reflection on sharing Web browsing experience and by extension on sharing the collective knowledge. Through its massive use of more or less 'heavy' technologies (3D, multi-user framework see following section for details), it can be considered as the anti-*panorama* project. Basically, both projects are handling the same kind of data, but the use and interpretation (in 3D) of data in *_knowscape* makes more tangible the idea of a shared knowledge architecture: building an entire shared and navigable 3D world by exploiting the collective knowledge. These notions are existing because of the advent of the Internet and networks and are about to be considered by philosophers in order to set up experiments and methodologies [2].

III. _KNOWSCAPE

_knowscape is an experimental 3D browser accessible through the Web that let users browse online content, create 3D information environment and share it [or not] with other connected users thanks to its multi-user mode. Each user has a subjective 3D world, which belongs to a shared global world, and his own avatar [*IP* address or *GSM* number].

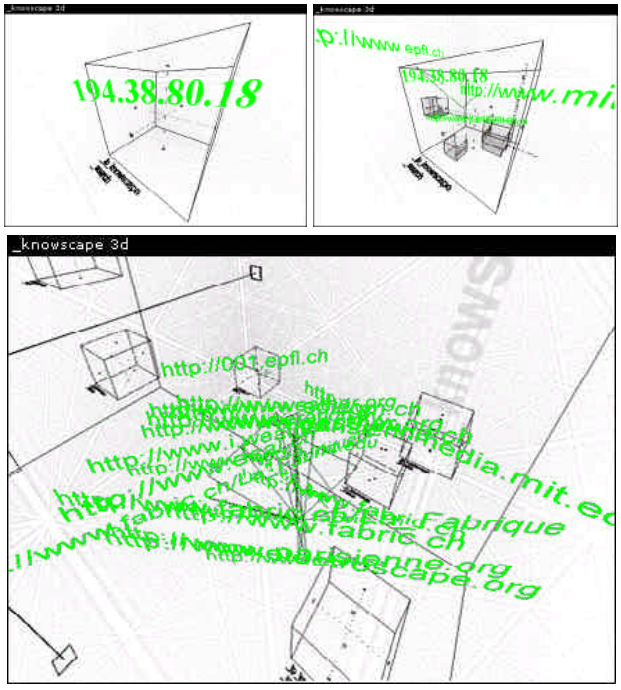

Fig. 4 : avatar building mechanism, web addresses addon to user's avatar

The main idea behind *_knowscape* is to build virtual spaces and avatars made out of users browsing choices and experience.

As a multi-user based environment, a connected user is represented by an electronic body (an avatar) within the 3D shared world. Thus, all users are aware of each others. In its initial state, the user's avatar is made of the Internet address of the user's computer (Fig. 4, top-left). When connecting to the world, a initial volume is assigned to the user. This volume (a wire frame cube) constitutes (and localises in space) the knowledge the user will build in 3D by browsing the web.

For the browsing experience, the user can use a normal web address (*URL* formatted) or a set of words in order to perform a search on the web (using the *google* search engine). Every input (*URL*) are used to modified the user's avatar. Browsed web page's *URL* becomes extension to the user's avatar, making possible for everybody connected to the world to be aware (in a basic way) of what every single user is browsing (Fig. 4). It implies that avatar updates are shared with every connected users, e.g. all avatar modifications (adding or removing a web address) is relayed to all users.

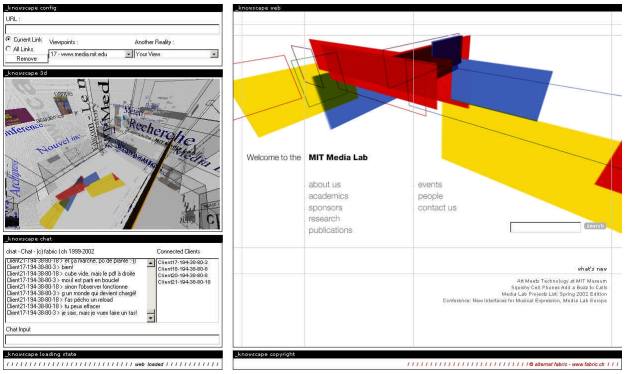

Fig. 5 : a _knowscape experience

When entering a new web address the web page specified by the user is displayed, in a normal way (2D) on the right part of the *_knowscape* browser (Fig. 5). Simultaneously, the user is automatically moved to a new location within its knowledge space. At this new location, a 3D transcription/translation of the 2D web page will be added, as new elements of the user's knowledge. To continue his browsing experience, the user uses the 3D translation to follow web links. Right part of the browser will be updated with the new web page and a new 3D element will be added, translation in 3D of the new followed link, and so on.

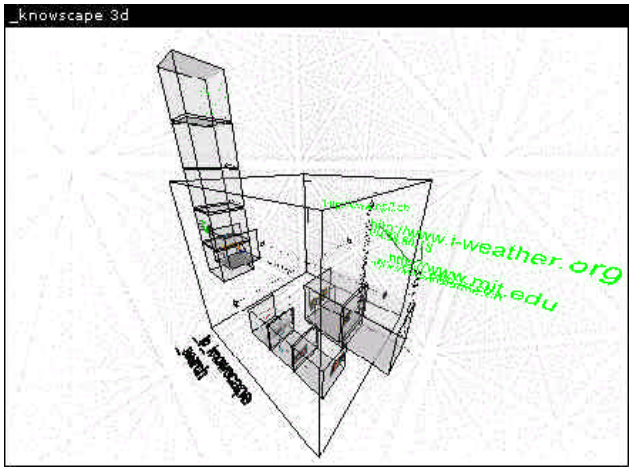

Fig. 6 : the 3D space knowledge of a user

Step by step, the user will fill his space with its knowledge. Browsing links from a web site will make appear aggregated horizontal or vertical structures (Fig. 6). It makes possible to distinguish one browsing session from another one. By navigating in 3D within these structures, a user can go through its knowledge space again and again. The user keep a tangible track of its experience and it will be possible to share it with other users.

By default, 3D structures built by the user while browsing the web are private. It means that these 3D objects, translation of 2D data, are used to build the subjective view of a user. It is not possible to other users to see what a given user is building (exception made of links added to the user's avatars). In order to do so, a user have to switch from its knowledge space to the one belonging to the user he wants to reach. This is done through the *_knowscape* browser interface by selecting the desired user in the connected users list (Fig. 8, top). Once switched, the user is able to see the 3D knowledge-scape constructed by the selected user (Fig. 8 bottom). Through 3D, it is possible to explore this knowledge and even using it for his own knowledge-scape. Meanwhile, you can have a chat with the user, making possible to have an explanation on a given link or on a given topic.

IV.TECHNOLOGY

_knowscape, which is based on our own multi-user system *rhizoreality.mu*, demonstrates the ability for a user to modify and to make evolve the content of a 3D shared world. *rhizoreality.mu* has also been used in our *La_Fabrique* [13] project and for our *electroscape.org* [14] [15] framework. *rhizoreality.mu* system has follow a particular development way, trying to merge technologies (network, 3D) with concepts.

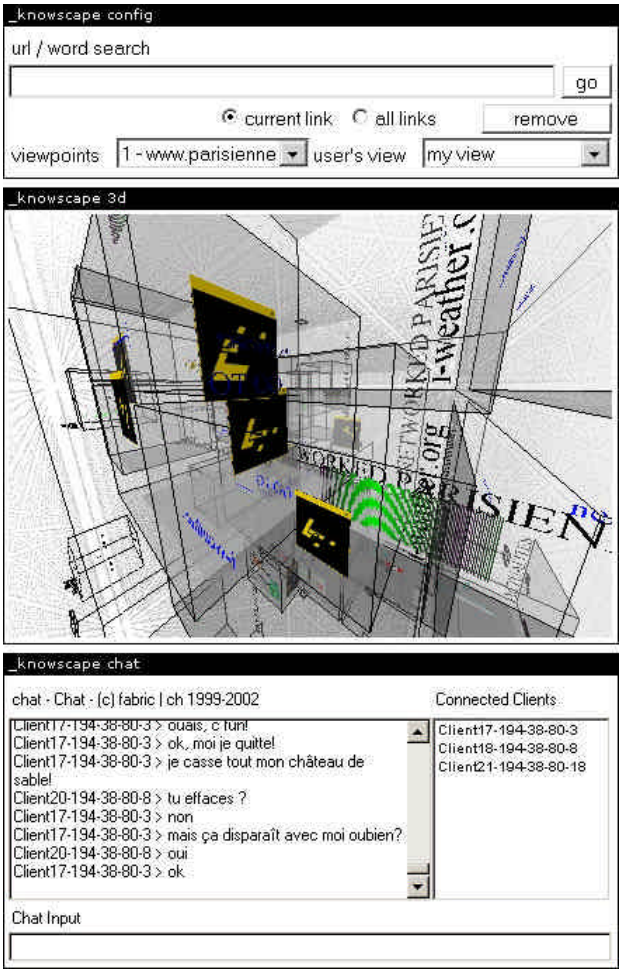

Fig. 7 : _knowscape interface (text input and subjective view management - top, chat interface - bottom)

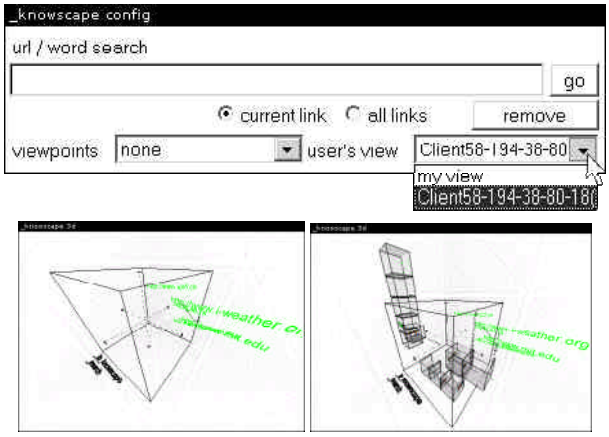

Fig. 8 : switching to another user's subjective view.

A. rhizoreality.mu

rhizoreality.mu [16] is based on a client-server architecture. The system is fully written in *JAVA* making possible to run servers on any kind of operating system and computer (*Windows, Linux, IRIX - PC, SGI, SUN, XBox game console*).

In its very last version, *rhizoreality.mu* is able to handle connection request through *TCP/IP* as well as through *UDP/IP* using a circular distribution system [CDS]. Both protocols can be available at the same time. For web clients, it is possible to have a *JAVA* based client as well as *Shockwave* based clients. 3D shared world can be modelled by using *VRML* [3] or *Shockwave3D* [6] or even both at same time. 3D visualisation is done through the use of plugins [4] [5].This flexibility permi ts to face a large set of different needs and applications [11] [13] [14] [15].

Functionalities linked to the *_knowscape* project have to be seen as a particular use of the entire *rhizoreality.mu* system. It is able to receive information from a lot of different sources: it includes dedicated services that are producing and making available a particular information (such as sound server for example, delivering information on live music) but also particular devices such as movement or light detectors. In the same way, behaviours within *rhizoreality.mu* clients are not confined to the display of 3D worlds. A client can control a set of lights in order to produce a particular atmosphere in a room for example.

As *rhizoreality.mu* was also used in commercial application, it includes features like connected users management as well as remote administration (through a dedicated *JAVA* applet, on the Web). Usually, a *rhizoreality.mu* based system generally deals with a set of servers (3D servers and/or chat servers). Each server is aware of the existence of others, making possible the exchange of information between them. In addition to these servers linked to the core system, an unlimited set of services can be used to enhanced basic *rhizoreality.mu* functionalities. It relays on the integration of *rhizoreality.mu* servers in a meta network based system in charge of maintaining a clear view of the state of the network, including a list of available services. When a server receives a request that concerns a given service, the server will ask to the meta-system where to find such a service and how to establish a basic connection with it. A direct connection to the service is then established, information about the protocol are exchanged, making possible to the server to finally perform the request received from the client. This system makes possible to include a lot of functionalities within *rhizoreality.mu* system (making them available client side) just by the set up of new services (no need to modify the core implementation of the system).

B. _knowscape related services

HTML *to 3D translation*

This service is invoked by a client when a web address is specified. In its actual version, it converts a *HTML* web page in *VRML*. Followed rules to ensure the conversion can be changed at any time. Basically links and images are selected to be reproduced in 3D in order to construct the volume associated to the Web page. This task consists in retrieving the Web page content, translating in *VRML* and sending back the result to the requesting client.

SMS login

As a demonstration on how mobile phone world and the Web can be connected, a login system using *SMS* is proposed. Users that connect this way to *_knowscape* are represented in 3D by their mobile phone number in place of the *IP* address of their computer. By clicking on avatar, it is possible to send them *SMS*. Of course, it can be decided not to display real mobile phone number while keeping the functionality (all relevant information are kept safe server side). When logging in, the user is asked to send to a fixed mobile phone number a *SMS* containing a given code. The user will then receive back a final code that have to be entered as a password on the Web page. If the matching mobile phone number/entered code works, the user will be allowed to access *_knowscape* system. The *SMS* login system will then generate relevant information to be passed to the multi-user application (which will determine user's avatar and linked functionalities).

V. DISCUSSION

In *_knowscape*, we have tried to emphasize the use of 3D as a real advantage in comparison with more classical 2D based interface. If 3D is not that much used on the Web, it is mainly because of the lack of killer applications, proving that 3D can be of a real interest only if used correctly and at the right place. Browsing a Web with *_knowscape* gives the ability to build in real-time a 3D visualisation of the Web site structure. In particular, it keeps visual tracks of links between browsed Web pages. When coming back to a previous volume and clicking on a new link, the structure will fork in order to make possible to distinguish this new browsing session.

The simple fact of browsing the Web can bring to the apparition of a new online communities based on 3D. Then it is possible to users to connect to these communities without having to use the *_knowscape* browser, as 'passive guests' (as they will not participate to the raise of the world, but they will be able to take advantage of it). Overload of the graphic hardware can be avoided by the use of level of details on objects. The world is apt to increase a lot in terms of complexity and volume. It is important to optimise objects to render in 3D by minimising their weight (in terms of geometry). This is especially true with text rendered in 3D. This problem will rise as soon as we authorise to visualise all subjective views at the same time, in order to perceive the world in its entire complexity.

The main idea is not to replace the Web. It is obvious that 3D is not well adapted to visualise text, which constitutes major part of content on the Web. It is the reason why we have kept a classical 2D view in the *_knowscape* browser. The goal is much more linked to the establishment of a knowledge communities through the use of 3D technology (to visualise the knowledge) and multi-user features.

VI. EVOLVEMENT

One of the most obvious thing to do is to enhance the conversion process that translate *HTML* to *VRML* (or any 3D language). *HTML* is now a very complete language that includes many dynamic functions. Structure *TAGs* can be much more exploited in order to generate a much more complex structure in 3D. It is also important to keep in mind that each converted Web page should stay connected with each other in a way or another to make possible to identify one browsing session. We can imagine setting up a set of conversion rules based on a set of generic 3D objects that can be used as containers for converted data. Then, the generated world will be much more complex than in the present version. We can imagine to use these structures to build the entire world (and not only the subjective world of each user). Through the conversion rules mentioned previously, it is possible to make this world following a given logic, avoiding to dive in a chaotic set of data where user just get lost.

Spatial distribution can also take in account proximity in terms of content between different Web pages. Through content analysis, a 'distance' and other parameters (content, type of content…) can be generated for each pages. These parameters can be used for determining where translated contents are located in space. Depending on parameters that are considered, it can build the same world in completely different spatial configurations. By making available to the user the ability to choose one parameter or another, he can decide what configuration to use in order to visualise and navigate the 3D world (according to its interests). With this kind of functionality, the spatial location of a given user will give instantaneously information on its actual interest: its 3D coordinates will reveal what kind of content the user is considering (relatively to the kind of spatial distribution of the world the user has chosen).

The actual version of *_knowscape* does not include any recording of what users are doing. When a user quit the application, all his browsing experience is lost. In the same way as in the *panorama* project, user's action can be

recorded and saved. These data can be used in many different manners. As a very obvious one, it can be possible to rebuild the world of a given user when this one is coming back to *_knowscape*. This ability can easily be handled by the persistence feature ensured by the *rhizoreality.mu* system. Moreover, user's profile can be also used elsewhere than in the *_knowscape* browser. The profile can be sent to a mobile phone. New mobile phone generation includes graphics capabilities (colour display, graphic libraries (*JAVA* based with *J2ME* and *MIDP* [17], *Mophun* [18]) which gives the ability to develop software for mobile phone. The advent of new types of connection (*GPRS*, *UMTS*) even allows the establishment of network connections from a cell phone. It brings new capabilities for online communities as it will not be an obligation anymore to be in front of a computer in order to be connected and access content.

VII. CONCLUSION

We have pointed out the fact that the Web can be considered as the advent of a collective knowledge structure/architecture. *_knowscape* browser gives the ability to users to be aware of each other and to communicate at the same time they are browsing the Web. Through a mixed of 2D and 3D interfaces *_knowscape* permits to build and to visualise every user's Web experiences, result of a subjective selection of all information available world wide. Such interface can make easier for a user to contact people with the same interest while browsing/discovering a content.

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