Participatory Design in Architecture: can computers help?

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ABSTRACT

Architectural firms are increasingly relying on computer technology to support design activities, facilitate project management and produce presentation material. However, little consideration has been given to the role computers could play to encourage and support participation of non-professionals in design projects. In this paper we discuss two research initiatives designed to promote computer-mediated participatory design: the first one is concerned with the collaboration of client and architect on a residential project, and the second one addresses the issue of community participation. Although very different in nature and purpose, both rely on World Wide Web technology and attempt to appropriate the medium for the bettering of our living environment.

Keywords

Architecture, Urban Design, World Wide Web, Design, Design Software, Community Participation

INTRODUCTION

Architectural and urban design are by nature interdisciplinary endeavors. Professional designers are trained to master a multiplicity of artistic and technical skills and learn to pay attention to a vast array of legal, economic, environmental and human factors. The designs that ultimately materialize into built structures make a profound and durable impact on all life forms and on human culture. Perhaps more than any other design discipline, architecture and urban design benefit from a process that involves the participation of the future inhabitants of the building, neighborhood or town.

In this paper we present two distinct projects geared towards taking advantage of the 1990's developments in the field of personal computing to encourage participation in architecture. The focus of the first project is the relationship between client and architect within the context of residential design.

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Our core argument is that new approaches to design cooperation between professional and non-professional are needed to challenge the current practices that treat housing as a commodity and essentially exclude creative design from a very large majority of the new dwellings built in the United States. The second project directly addresses the issue of community participation and proposes a computer-based approach to complement and strengthen existing participatory practices.

CURRENT USE OF COMPUTERS IN ARCHITECTURE

Architectural firms rely heavily on the use of computers, but this does not mean that information technologies have significantly altered the practices of the profession. The two broad categories of usage are design and communication. Concerning design, some practitioners and many schools of architecture are actively involved in research structured around the concept of the computer as a medium for design (Lynn, 1999). However in most firms the computer remains a tool facilitating a way of designing that existed before its development (for more on the computer as a medium rather than a tool a good reference is Kay, 1990). Most firms employ Computer-Aided Design (CAD) specialists who translate into electronic format a design that was primarily conceived in a physical medium (paper, model, etc.). In terms of communications, we witness two relatively new usages for the computer. The first one is to facilitate the design process through the use of e-mail and web-based project management. This is an application internal to the Architectural, Engineering and Construction (AEC) industry, but one that currently receives a large amount of attention. The subtitle of the AEC Systems 2000 conference was "e-Solutions for the AEC Industry". The other application of computers is to communicate the design intent. Increasingly sophisticated techniques of visualization, including photo-realistic rendering and fly-through animation, are used as presentation tools, raising many questions about the issue of representation.

This brief overview of the situation common to most architectural firms does not fully reflect the trends in schools of architecture. Recent conferences on architecture and computers (such as the ACADIA conference, organized by the Association for Computer-Aided Design in Architecture) indicate a high level of interest in exploring possibilities to use the World Wide Web for collaborative design. For example an experiment led by professors at the Swiss Federal Institute of Technology in Zurich, Switzerland, had students located in three different time zones (Zurich, Seattle and Hong Kong) work collaboratively in an intensive one-week studio. At the start of their day students would pick-up on the design worked on by their comrades of another time zone and add their contribution. The design at the end of the week was clearly the result of a collaborative effort, and therefore challenged traditional notions of authorship (Kolarevic, 1998). Unfortunately this very interesting experiment did not seem to include the direct involvement of the clients for whom a house was designed.

USER PARTICIPATION IN ARCHITECTURE AND URBAN DESIGN

Many examples of participatory design practices in urban planning have been documented, although most often within the context of architecture and urban design rather than that of participatory design. In a recently published book, Henry Sanoff discusses purposes and methods of participation before documenting specific examples of participation in educational facilities, housing, urban environments and rural environments (Sanoff, 2000). The extensive collection of examples illustrated by photographs hints to the many different forms community participation may take. Nevertheless a key feature of most workshops is the use of physical artifacts such as sketches, games, or layouts on which participants can place objects (representing houses, roads, vegetation, etc.). In fact planning kits have been developed and commercialized for the very purpose of facilitating participatory approaches to land development (Kehde, 1999). The physical dimension of participatory design seems therefore very important, and that is obviously a challenge to the application of computers to this field.

Another possible avenue for participatory practices in architecture is the more intimate setting of the architect designing the home of a specific client. According to Bruce Kunkel architects are interested in designing houses, even if few of the houses built today are custom designed by one: "Though only 5% of our housing market is custom designed by architects, evidence collected during the course of this study has revealed that most architects actually like designing houses". The objective of Mr. Kunkel's work is to facilitate the exchange of information between client and architect, therefore reducing the risk of misunderstandings and making residential architecture more economically viable for architects (Kunkel, 1973). Even if his work does not directly support a participatory approach to residential design, it does propose a framework for giving the client (and future user) a voice in the design. Surprisingly we have found no evidence of further developments of that work. Our discussions with architects suggest that there are many approaches to working with the client, and no formal framework for doing so (except of course in the legal sense).

The focus of our next section, which presents the first of the two projects described in this paper, is indeed residential design. With the advent of computers the status of the house as an object of consumption, rather than a haven with spiritual or emotional meaning and connections to the land, appears to have been strengthened. Software vendors have developed style-heavy do-it-yourself design software that offers little opportunity for prospective home owners to experiment or learn about design, and World Wide Web entrepreneurs offer instant access to catalogs containing thousands of house plans. Building a house has become a matter of choice rather than design. This situation motivates our research into ways computer technology may be appropriated to define an alternative framework within which client and architect can cooperate on the design.

CLIENT-ARCHITECT DESIGN COOPERATION

The objective of our project on client-architect cooperation is to use computer technology to create an environment that promotes a dynamic relationship between professional designers and their clients. This environment is built upon two technical developments, namely a preliminary design software and a web-based virtual studio. The software is conceived of as one of many media for communication between client and architect. The studio offers a practical and cost effective venue for a cooperative practice. In order to guide our design work we have enunciated the following set of key values.

Participation. There is intrinsic value in design emerging from a diversity of points of view rather than the expertise of one single individual. Furthermore, there is intrinsic value in participating to the creation of one's environment rather than simply exchanging it for other labor.

Experimentation. There is value in experimenting with one's living environment in order to learn about one's own likes and dislikes and to become appreciative of the surrounding richness and variety of possibilities. Through the design of his or her living environment, one may come to understand that qualitative criteria such as surface area, number of rooms or amenities do not necessarily permit one to foresee the living experience (Dovey, 1993).

Complexity. The world around us is diverse and complex. There is value in acknowledging and accepting diversity and complexity, and in welcoming difference in our lives. Complexity, diversity and difference in living environments connect us to similar qualities in the world around us (Schumacher, 1973).

We are interested in the concept of design software that someone who isn't a designer can use to experiment with the design of his or her home. It is with this objective in mind that we reviewed some existing software applications. There are many design applications available on the market. Each one of them exhibits strengths and limitations, and introduces specific design biases. Since our interest lies in involving the client in design at the preliminary or schematic level, we limited ourselves to a very focused analysis and a simple question: what can be done and by whom? The results indicate that a linear trend between flexibility and expertise is clearly manifest (Cimerman, 2000). A professional designer has at her or his disposal a variety of software applications that can be used to model highly complex shapes. However an individual who is computer-literate but untrained in the use of three-dimensional design software is limited to the use of a home design software. Visual Home by Sierra Home is one out of many such packages on the market. Working in plan view, the user is guided through a set of well-defined steps (creating rooms, adding windows and doors, then adding the roof, etc.) that ultimately result in three-dimensional visualization and walk-through. Rooms always exhibit right angles (even if L-shaped rooms complement rectangular ones), and the formal and stylistic iconography of detached developer housing is ever present (Figure 1). This application severely limits forays into any real design experimentation, and excludes the architect's creative input from the design process. It provides a striking example of the pervasiveness of the culture of multiple choice, exemplified in computer applications by drag-and-drop features and libraries.

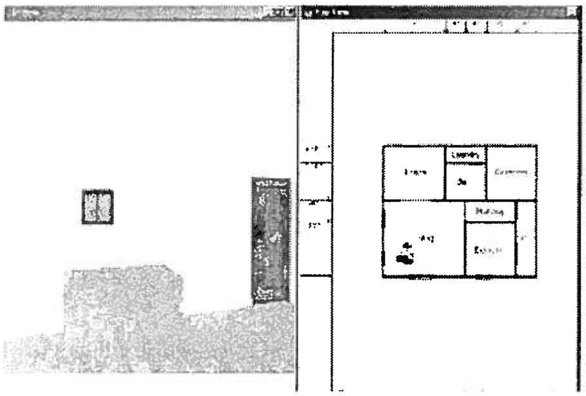

Figure 1 : House design with Visual Home

This analysis led us to the design of a software package that is easy to use for an individual who is only computer-literate but does not severely restrict the design investigation to the use of standard elements. The user is presented with what we consider a space-based interface rather than a form-based, or object-based interface. Theoretically, we are inspired by the strain of thinking in 19th century Western architectural design which reinvigorated the thinking of architecture as a spatial design problem (Zevi, 1957; Van de Ven, 1987). Since our objective is to enable the user's learning about the design process through participation, experimentation, and complexity, we believe that a focus on spatial modeling rather than on stylistic manipulation will help to provide a model which challenges the dominant models of popular home design.

On a residential project such software could be used by the client to take a proactive role in preliminary design. The hands-on involvement of the client allows him or her some autonomy to explore his or her desires, experiment with design, and begin to appreciate the value and complexity of architectural design. At the same time, it provides a venue for the architect and client to cooperate, reinforcing communication and mutual respect. It is important that the client's experimentation and the design professional's creativity complement each other. This contrasts with the model provided by Visual Home, for example, where the client is expected to present to a home developer or architect a nearly completed scheme. The software presents to the user a simple modeling interface which provides tools to explore the manipulation of space via a kind of sculptural modeling of volumes bounded by surfaces. Figure 2 shows a view from the inside of the space being modeled. The bounding surfaces are divided into tiles which can be individually manipulated. The row of icons at the top of the screen provides easy access to the most important functions. Strong emphasis is placed on the representation of the environment, so as to convey the importance of designing in relation to the land. The four components that model the environment are: topology, background, cardinal orientation and sun position.

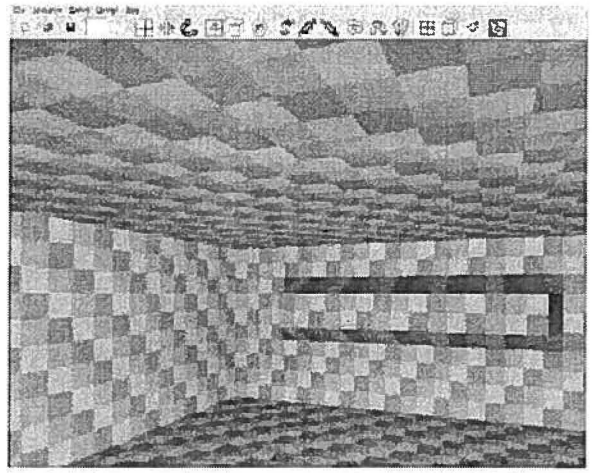

Figure 2: Inside view of space with tiles showing

The software was not designed using participatory design methods, but user testing has informed its development. A fully functional prototype has been tested by individuals from various backgrounds, including new architecture students. Users' feedback and suggestions on usability informed the development of the software in terms of functions and interface. Users' comments and the models resulting from their work provided some insight into whether or not the software permits investigation in design by non-professionals. At the time of writing our preliminary data suggests that indeed the software supports such investigations, but more research and analysis are needed. In the Fall of 2000, all new freshmen students at the RPI School of Architecture (approximately 90 students) will be using the software. These students constitute a perfect test group because:

- Many of them are very much at ease with the use of computers
- Many of them have developed 3D computer visualization skills while playing video games
- Most of them are interested in Architecture but have very little knowledge of the field

In addition to project work, the students will be asked to fill-in a short questionnaire that will help evaluate their level of familiarity with computers and correlate that with their overall impressions of the software.

However well-designed and properly implemented a piece of software may be, it cannot by itself transform an existing practice. It must become integrated with the working processes to influence them and generate a cultural shift. In that sense, the web-based virtual studio is a necessary complement to the design software.

The appropriate metaphor for the virtual studio is that of a physical studio that would be shared by client and architect. Such a studio would contain information such as legal documents, models, sketches, pictures of houses the client likes, etc. The idea is to substitute a digital environment for this physical studio, while attempting to retain some of the "sense of place" one experiences in a physical space shared with others. For example, when walking in a room one may notice changes in the placement of objects that indicate the presence of another person since one last entered that room. This type of experience is simulated in the virtual studio by the following functions (Figure 3).

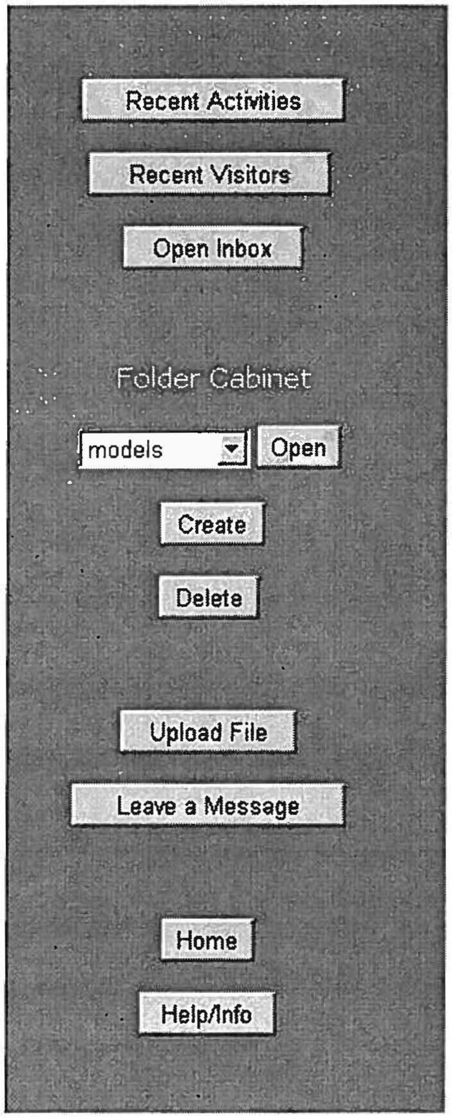

Figure 3: Functions of the virtual studio

- Upon entering the studio the member is greeted by a series of messages left by other members (they correspond to notes left on someone's desk in the physical world and can also be thought of as context-sensitive e-mail).
- A "Recent Activities" function indicates precisely which new documents have been brought into the studio since the member's last visit, who brought them and where they were placed (there is no direct equivalent to this function in the physical world, it is partially carried out by our visual sense).
- A "Recent Visitors" function indicates who visited and when since the member last came to the studio (various visual or olfactory clues may correspond in the physical world).
- An Inbox contains documents that were left specifically for this member.
- Folders contain the various electronic files used in the studio (same metaphor as that used on PCs)

Note that all studio members benefit from the same rights and privileges. The studio is jointly owned by architects and clients.

These functions serve very practical purposes in terms of organization and should help save some of the time typically spent on information management. For the architect one additional benefit is that all information and communication pertaining to a specific project is self-contained. Rather than getting interrupted by phone calls and e-mails regarding one project while working on another, the architect can decide when to enter a studio and work on a project.

Beyond the practical concerns, the role of these functions is to reinforce the impression of other people's former presence in the room. The concept of telepresence is essential to the success of the virtual studio (Mitchell, 1999). The central question is whether or not relationships can grow and develop through the digital interface. Experimentation is necessary to determine where the boundary between activities carried in physical presence and through telepresence should be. For example, would meeting once in person suffice for the relationship between client and architect to subsequently develop through electronic means? A corollary to this question is to study what role synchronous access to the virtual studio (using technologies such as whiteboard, text chat, voice chat and videoconferencing) may play.

The previously referenced paper by Kolarevic et al. reports that students in one location developed some form of relationship with students in another distant location while working on the same digital models (Kolarevic, 1998). Whether or not such a concept may be applied to a client-architect relationship remains to be seen, but the virtual studio can only prove fruitful if there is information for the architect and the client to share. This is why the concept of a preliminary design software that the client uses to explore new ideas is an integral part of the virtual studio. Through the act of sharing models the client and the architect take the virtual studio communication beyond the exchange of information into the realm of design cooperation.

At the time of writing both design software and studio have undergone testing, but we have not yet had the opportunity to evaluate the overall concept (the obvious next step is to find architects and clients willing to participate to a real-life experiment). However interaction models proposing a framework for combined utilization of design software, virtual studio and synchronous computer-aided communication (videoconferencing and whiteboard) have been derived, as illustrated in Figure 4 for the conceptual design phase.

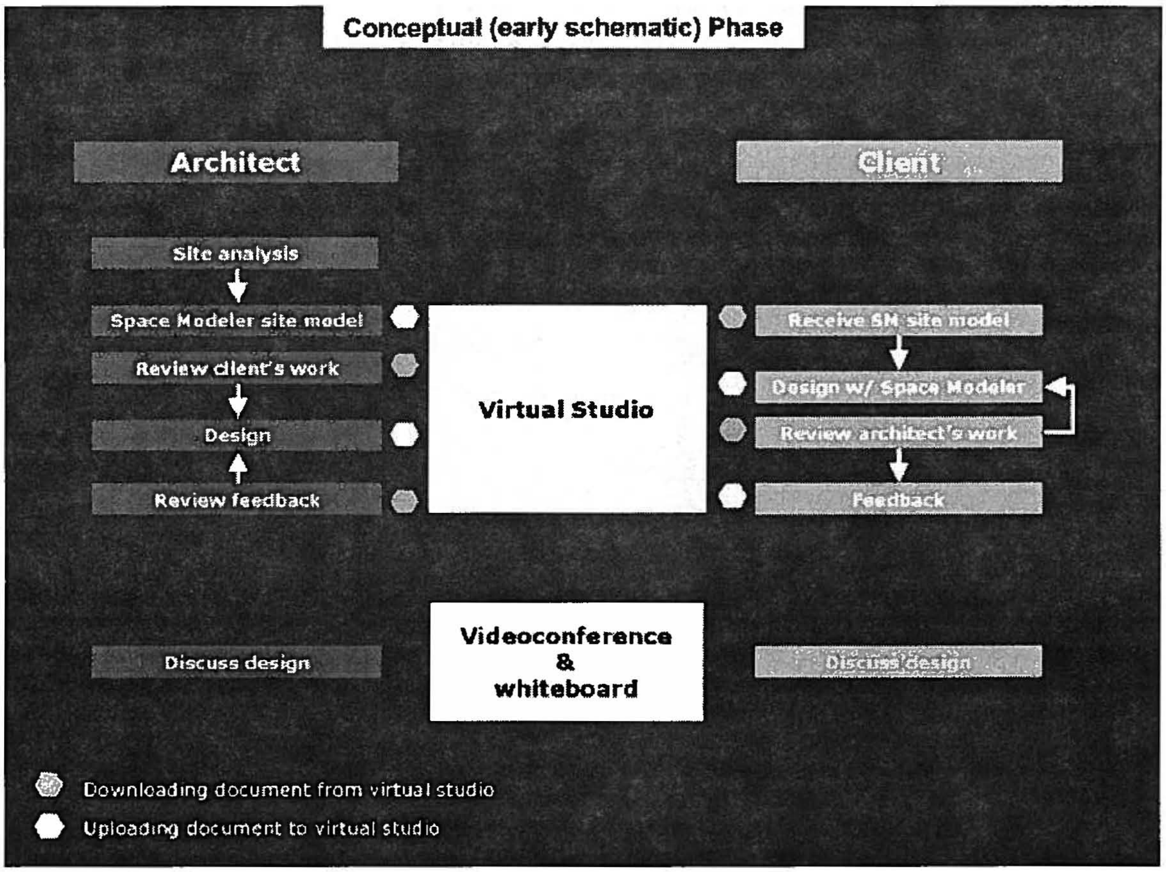

Figure 4: Interaction Model for Conceptual Design Phase

WEB-AUGMENTED PARTICIPATION

The design cooperation between client and architect discussed in the previous section is a private affair between a small number of people. In this section we discuss recent work that considers participation to design on a larger scale.

As discussed in the section on community participation in architecture and urban design, the manipulation of physical artifacts seems to constitute a fundamental aspect of the participatory process. Work on the integration of the physical and computational dimensions of design environments has been carried out at the University of Colorado (Arias, 1997). The prototype for the system that resulted from the research is composed of a "computationally enhanced table "that shows a layout on which participants can place artifacts and of a "computational whiteboard" used for complementary learning activities such as inquiring about the environmental impact of a design decision. Ultimately the system empowers users by providing an opportunity for learning, and enhances the experience of the design workshop.

Our approach is different, smaller in scale, and complementary to the traditional or computer-enhanced workshop. We are interested in extending the design workshop beyond the walls of the meeting room and beyond the immediate control of the organizers. The concept stems from the personal experience of the designers who observed shortcomings in design meetings as they are usually organized. Observations were carried out in two types of settings: design meeting between management, employees and designers at companies for which new headquarters were being designed, and public meetings and workshops in towns were urban renovation projects were being defined. Although these meetings were without a doubt valuable for the designers and provided information about users' needs and aspirations, in both types of meetings the following shortcomings were observed:

- Long meetings resulted in fatigue and lack of attention.
- Dialogue between designers and participants indicated miscommunication that may result in errors in the design proposal.
- Reluctance from certain individuals to voice their concerns, particularly if members of the company's management were present.
- Inability to attend.

Furthermore in the case of community projects it appeared that the impact of these meetings on the final design proposal was difficult to evaluate. There was no clear way to establish connections between the final proposal and the work generated during workshops or the comments provided orally during public meetings. Such lack of accountability of the designer/client team is nurturing ground for cynicism.

Sanoff discusses explicitly how meetings should be set-up in order to permit genuine participation: "People's participation wherein control of a project rests with administrators is pseudoparticipation. Here the level of participation is that of people being present to listen to what is being planned for them. This is definitely nonparticipatory. Genuine participation occurs when people are empowered to control the action taken" (Sanoff, 2000). Our personal experience is that most meetings we have attended promote pseudoparticipation more often than genuine participation.

The idea of a web site serving as a communication hub for a project is not new. Many web-based project management tools have been developed in recent years, but products currently on the market are geared towards the facilitation of the working relationship between professionals, and do not challenge established practices. Design Participator (as it came to be known) was created with a different agenda in mind: complementing the existing practice of the design meeting by offering access to a design proposal through an intuitive web-based interface. The proposal may contain text as well as plans, pictures, drawings or even animations.

The issues of civility, privacy, and accountability were discussed early on in the design phase of the system. Referring to Habermas' "ideal speech situation" (Habermas, 1990), Sanoff describes the four components "necessary to facilitate an iterative dialogue": "First, there must be no constraints in the discussion process. The individual must be free to express his or her personal interests without intimidation from more powerful participants. Second, each participant must be given an equal platform from which to express his or her concerns. No one participant should have more or less opportunity to discuss personal desires and needs. Third, all participants assume equal power. [...] Finally, the ideal speech situation calls for the rational process of discussion. Persuasion by good reason is more effective than threats." (Sanoff, 2000). In our opinion the physical distance and asynchronicity (at least as proposed here) introduced by the web interface may go a long way in providing an environment favorable to the establishment of the "ideal speech situation". It is certainly worth exploring that possibility and trying to build it in. The resulting specifications called for a system that differentiates between design team members (designers and their clients) and stakeholders (employees of the client company, citizens of the town, etc.). This is an example of the concept of roles discussed by Patel et al. With each role are associated access rights, contribution rights and specific authority which of course should not conflict with the four components facilitating an iterative dialog (Patel, 1997). Whereas stakeholders may want to review only certain portions of the design proposal, designers and their clients should be interested in reviewing all stakeholder input. Stakeholders provide such input by writing comments, with each comment relating to a specific article of the proposal. Review of other stakeholders' comments is open to all participants. Upon reviewing a comment, a member of the design team can choose to respond to this comment by providing feedback. In turn the feedback can be reviewed by all. Although limited in features and functionality, the first prototype of Design Participator illustrates how the system works. Figure 5 shows the browser interface through which stakeholders review articles of the proposal. While the article under review is displayed on the right, the left panel indicates for that article and other articles pertaining to the same section:

- Stakeholder's personal setting for each article (of interest, not of interest, no decision made yet),
- Number of comments of each type (correction or opinion),
- Whether or not members of the designer/client team have entered feedback on the comments.

After reviewing an article the stakeholder can choose to review the corresponding comments and feedback. Figure 6 shows the interface for the review of comments, where the left panel indicates:

- Type of comment (a correction comment is shown as a red cross, an opinion comment is qualified as favorable, unfavorable, or neutral),

- Whether or not the comment has already been reviewed,
- Comment's author.

The stakeholder can add his or her own comment and decides on type and qualification.

These functions are reminiscent of those found in the hypertext tool gIBIS (Graphical Issue Based Information Systems). Describing the IBIS method Conklin et al. wrote: "[It] is based on the principle that the design process for complex problems [...] is fundamentally a conversation among the stakeholders in which they bring their respective expertise and viewpoints to the resolution of design issues." (Conklin, 1988).

Our concern for setting up a system that would promote genuine participation lead to discussing specific questions that in turn informed the interface design and resulted in additional specifications that introduce some flexibility in the set-up. Those questions were:

- Should every participant have full access to the review of other participant's comments?
- Should the author of each comment be identified?
- Should there be different types of comments?

We answered positively to the first of these questions as we indeed felt that information should be accessible to all without restrictions. Concerning the second question we introduced requirements for a two-way set-up. In most cases an anonymous system may be more appropriate, but it may happen that specific individuals are competent in a way that makes their comment particularly relevant (an example is the design of a technical space, where some employees may be more knowledgeable about the needs of the department than others). The third question in fact deals directly with the issue of competence. We feel that there are two broad categories of comments: corrections and opinions. Corrections will typically address requirements for the building that may not have been properly understood by the design team, while opinions are the expression of personal preferences. The set-up system will allow correction-type comments to be available only to selected individuals, or to be eliminated.

Concerns for genuine participation also guided the design of additional features that will be implemented in further prototypes, including:

- Group affiliation: stakeholders may be affiliated with a group, which may help counteract the typical unbalance between a cohesive design/client team on one side and isolated individuals on the other side.
- A voting system will allow a stakeholder to add weight to a comment entered by another stakeholder.
- A history function will keep track of the modifications to the proposal and document the responsiveness of the design/client team to stakeholders' input.
- Sorting and statistics functions will allow any user of the system to rank the design proposal articles based on number of comments, find out what comments were entered by a specific individual or group, and track feedback.

Finally the possibility for stakeholders to provide input in non-textual forms should also be considered. For example Craig and Zimring have developed a web-based application that permits the mark-up of three-dimensional designs (Craig, 1999). However even with such added capability Design Participator would remain primarily a responsive system: the designers are seeking comments about their design but the public is not truly empowered to design. Because it is a simple web-based application Design Participator should be looked at as an integrator. In the future it should be possible to link it to all sorts of applications that are being developed to facilitate design (possibly, for example, variations of the design software and studio discussed in the previous section), so that stakeholders can work on their own designs and then reference them for easy access by others through the Design Participator interface. However a note of caution is required: one of our greatest concerns in developing the prototype was to keep the interface simple. We feel that doing so is crucial in order for the system to be accessible to a larger majority. Adding more features must be done without jeopardizing that goal.

CONCLUSION

Fast-developing cultural practices that make financial and intellectual investment in the World Wide Web almost exclusively driven by marketing and consumption must be counter-balanced by discourses that propose responsible alternative applications. One of those is to use the World Wide Web as a medium for participation. In this paper we have presented preliminary concepts for taking advantage of computer technology to redefine the relationship between professional architects, their clients and their users. Although much work remains to be done, we believe that the ideas discussed in this paper can be applied to many more fields of human activity, and we hope that our small contribution will participate in altering the cultural practices of the society we live in. As Schuler and Namioka write, "Participation stands in contrast to the cult of the specialist" (Schuler and Namioka, 1993).

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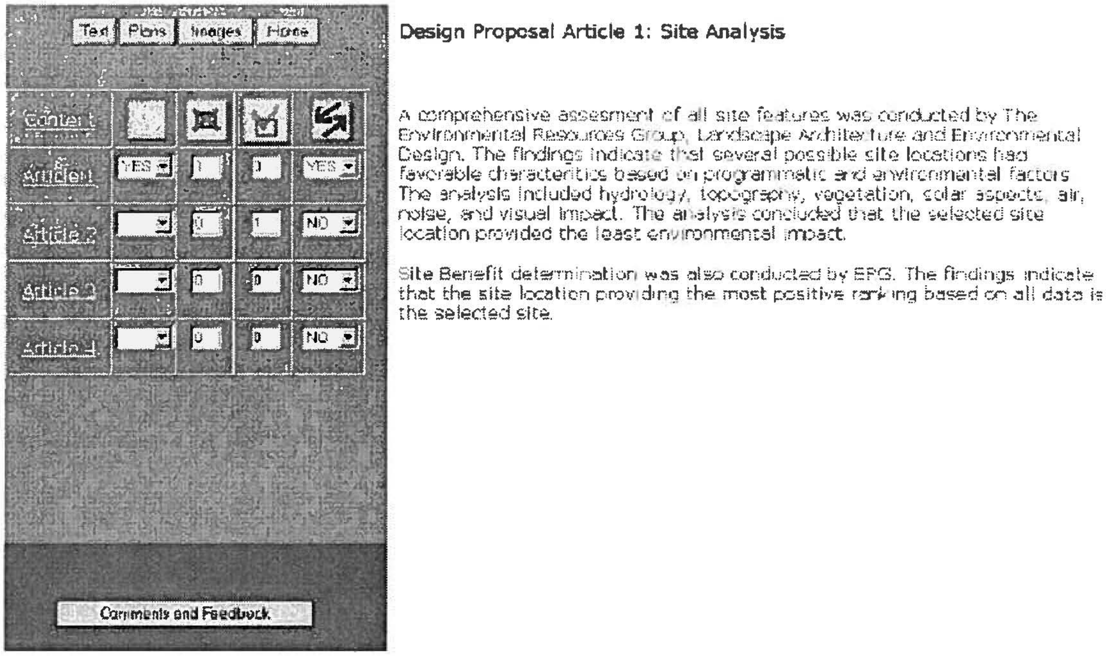

Figure 5: View of Article 1 of the design proposal

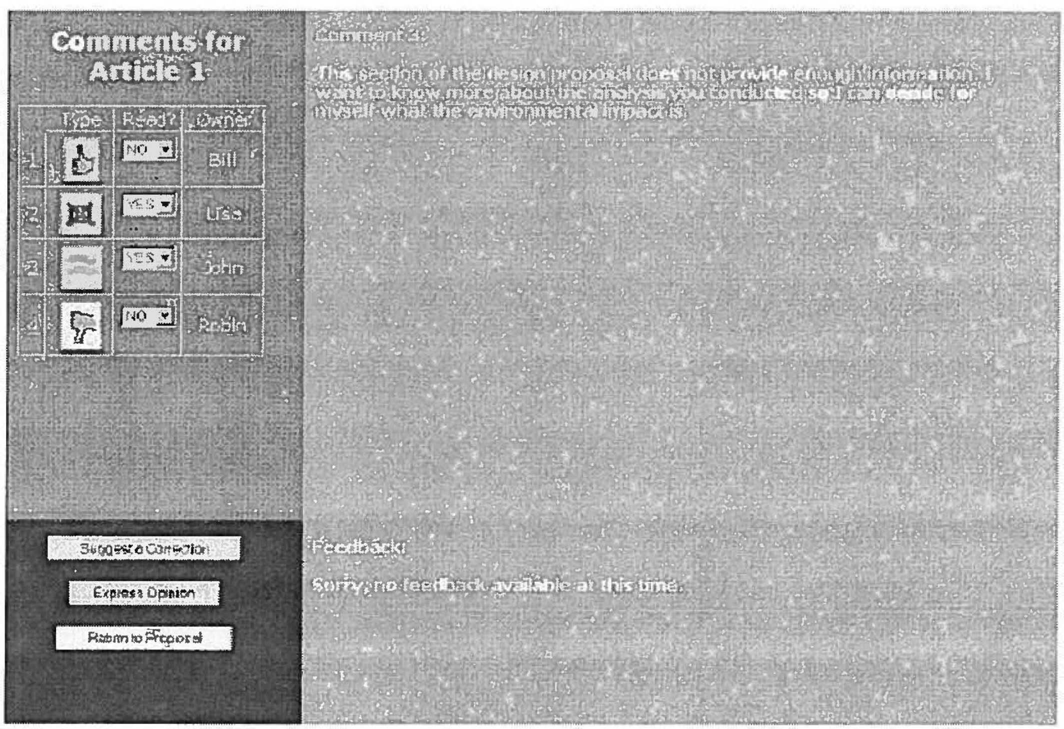

Figure 6: View of comments for Article 1

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