Internet Studios: Teaching Architectural Design On-Line between the United States and Latin America

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Traditionally, architectural culture has based its progress on the individual creativity of the design genius. But today many architectural and urban situations fall beyond the reach of individual endeavors. Contemporary solutions lie in the construction of a collective and public consciousness, one that can respond to popular calls for action and even to certain types of consumer behavior. The vision of the Internet Studios initiative is the creation of a design community that can deal with very specific urban problems in large urban settings. But building such a community takes years. Thus, in the past 4 years, schools of architecture in Miami, Santiago, Valparaíso, Buenos Aires, Rosario, Guayaquil and Caracas have worked together in understanding how we can collaborate architecturally via our emerging and modest networks. In the first 4 years, the schools have tested different technologies and collaborative strategies with Internet technology during the traditional academic semesters. Today the Internet Studios have up to 300 students collaborating on-line. In the next 4 years, the members of the initiative are planning to address large urban problems and democratize the design process via more powerful networks such as Internet2. The members of the initiative are planning to include in these remote studios not only architects, but users, potential clients, government officials and citizens, who will comment on the Internet Studios’ work.

TRADITIONAL ARCHITECTURAL STUDIOS

Typically, design studios are at the core of the curriculum in architectural teaching. Traditionally, these studios are held in rooms with drafting tables on which students develop models, sketches, architectural drawings and perspectives of the projects assigned during the semester. Architectural studios not only simulate the real-time experience of an architectural office but also offer very intense interpersonal environments in which students may learn from each other as they search for design solutions. Knowledge, solution strategies and design culture are transmitted by what Donald Schon calls a process of “tacit learning” [1]. Tacit learning cannot be fully explained or fully structured. It is transmitted by examples, gestures and acts and developed by the investigation of problems as they arise.

Studio reviews, or design juries, are the traditional method for assessing student architectural work. Conventionally, students pin their drawings to a wall behind their physical models and explain their design concepts orally to the professors, visiting critics and students who gather around the pin-up space. After the oral presentation is completed, critics develop oral arguments in favor of or against different aspects of the student’s design. After the presentation and the critique are completed, the pin-up spaces are dismantled, and the jury proceeds to review the next student.

THE OBJECTIVES

The primary question confronted in this experience was: How can these new media technologies enrich the learning environment of the traditional design studio? This is a very complex question, because most distance-education software design and on-line teaching experiments support a structured mode of teaching and learning, not an unstructured or, as Schon calls it, a tacit one. Thus, the objectives of the experiment were the following:

- The exploration of technologies and techniques that support intensive interaction among a large number of international participants with methodologies that sustain a variety of learning styles and technological conditions.
- The development of pedagogical strategies for these technologies and techniques with the objective of increasing the rate of architectural progress in these design communities.
- The repositioning of the creative processes of architecture in a highly digital environment not only by refining skills but ultimately also by developing students’ design methodologies, imagination and goals for improving urban life.
LOW-BANDWIDTH TECHNOLOGY

The initial experiments of the Internet Studios initiative explored synchronous and asynchronous collaboration using low-bandwidth technology. This was necessary due to the technological conditions in the Latin American schools of architecture that participated.

For weekly synchronous reviews of student work, the most popular method was a combination of chat and web publishing that participants called “web-chat” (see Fig. 1). Students posted their weekly work on individual web pages; professors and visiting critics all over the world then agreed upon a time to review the students’ pages. Student web pages contained computer-assisted design (CAD) renderings, process drawings, photographs of physical models, video animations with RealPlayer presentations and Flash animations. Students presented this work via web pages and chat and then received instant responses from reviewers (Fig. 2).

Weekly synchronous communication was also supported by unstructured Internet Protocol (IP) videoconferences through the low-bandwidth Internet software [2]. The IP videoconference technology worked well for one-to-one communication among students and/or for professor coordination. However, it was found to be too disruptive for on-line reviews involving a large number of participants. Initially, every effort was made to conduct reviews using a videoconference format, supported by students’ web page publication. Surprisingly, however, over time, the combination of chat and web pages became the preferred method of review, and videoconferences became unnecessary. The web-chat technology was universally available (it required only a Java-enabled web browser) and facilitated feedback more quickly. IP videoconferencing did prove to be useful in developing initial social contacts among the teams, however.

EVALUATING STUDIO REVIEWS

Several experimental evaluations were conducted to compare real and virtual studio reviews. The most important conclusions of the evaluations were the following:

• Review tolerance. It was discovered that participants in on-line reviews via web-chat mode tended to have lower levels of time tolerance. Typically, review teams using web-chat would spend no more than 5 minutes on each student project. By comparison, teams in traditional real-time settings were willing to spend up to 15 to 20 minutes per student.

• Oral vs. written explanations. Surveys showed that student explanations via
chat were more direct, articulate and memorable for the reviewer than oral explanations.

- Oral vs. written responses. Reviewers also found that on-line comments, via chat, could be written simultaneously, and similarities in their criticisms regarding a student’s work could then be quickly noted, thus increasing the speed of the review.

- Electronic anonymity. Another important observation concerned the lower level of diplomacy required in chat environments; one could get directly to the point without observing the facial reactions of the presenting student.

- Synchronous and asynchronous review space. Also of note was the extended time professors and reviewers had to observe the student work; in traditional environments, reviewers can view a student’s work only during the time of the pin-up. In the online environment, reviewers usually can become familiar with student web pages prior to the time of the web-chat review.

### High-Bandwidth Technology

During 1999 and 2000, the participants of the Internet Studios were only able to test high-bandwidth ISDN videoconference technology. Due to cost constraints, this technology was reserved for very structured sessions, which occurred only two to three times per semester.

Grants obtained by Florida International University (FIU) via the “Americas Pathway” (AMPATH) project is allowing the interconnection of the research and education networks of Latin America and the Caribbean to the U.S. and the rest of the world via Internet2’s Abilene network using the Inter-Oceanic Global Crossing link at 40 gigabits per second (gigabits per second). These grants offer a free Digital Service Level 3 (DSL3) connection to each country participating in the AMPATH project, for a period of three years.

The DSL3 connection will link to the FIU point of presence (POP) server in the U.S., which in turn will connect the Latin American universities to Internet2. In testing this new bandwidth, the participants of the Internet Studio environment began to experiment with wide IP Multicasting technologies such as Access Grid on Internet2. Access Grid allows constant videoconferencing among a large number of participants. Each video and audio channel is connected at the speed of 800 kilobits per second (kbps), which allows for excellent quality of transmission. The experiment used a system that cost under $15,000. It included three computers, three projectors and a specially designed audio-video system.

### Studio Reviews in Real Classrooms vs. High-Bandwidth Environments

As stated above, our experience using high-bandwidth technology has been very limited. However, the following points emerged from the initial evaluation:

- Similarity of reviewing culture. Design reviewers in both real life and on high-bandwidth networks tended to exhibit the diplomacy, time tolerance and review format of traditional studio jury processes.

- Potential for distraction. Although time tolerance and review formats were
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A synthetic world: the iStudio, for low-bandwidth interfaces. During the fall of 2001, two schools were working on introducing webcams into their studio space with web-based CUSeeMe conferencing to allow more social interaction among students in the studios. iStudio participants also began to develop 3D worlds that can structure community behavior in virtual systems. This work was based on critical observations of similar experiments such as MUS, MOOS, DIVE [3], MASSIVE [4], and many other popular virtual worlds. The “virtual studio space” prototype, named iStudio, designed by some of the participants in the Internet Studio, investigates the software design and human behavior of studio life with digital conditions. The design of the prototype does not reflect an attempt to re-create the space of the traditional studio, but is intended to reinforce the communal aspects of design education. Large virtual rooms appear when one enters the iStudio (see Fig. 3):

1. The exhibit room, in which students pin up their work virtually throughout the semester.
2. The review rooms: four virtual rooms where virtual reviews are held.
3. The forum: a space for building virtual community life. This space includes private meetings in secluded rooms and public meetings such as exhibitions and lectures.

One of the most important requirements of a virtual world is that it re-create the human body. The representation of the body helps to convey a sense of scale and a feeling of community. A red avatar represents each user. Upon entering the world the user can see all the other avatars using the system at all times.

The eye and the body are attached but separate entities in the iStudio. The body of the avatar only moves horizontally in the planes visited; however, the user can freely move the cursor in three dimensions. Whenever the user selects one of the elements in the 3D space, it triggers a movement of the avatar. In this way, the user can travel quickly between student files and rooms.

Communication among users occurs via chat. Local software transforms the text of the chat into computerized speech. Icons can also trigger other communication applications, such as IP videoconferences, web-page browsing, etc., to open. Students are required to design their own exhibit spaces and review rooms. Files in such formats as JPEG, CAD, video and audio are uploaded into the iStudio via a simple web page. Each one of the virtual walls, in which work can be “pinned up,” can be edited remotely using Java applets in the students’ web pages.

Because the iStudio is designed to render different areas in stages, the user never sees the complete world at one time. The idea is to keep the world accessible to users with low-bandwidth technology—less than 1000 polygons—and with a reduced number of texture maps.

Grants for “last mile” high-bandwidth projects. Six international companies are working to complete an inter-oceanic fiber-optic network, and by 2002 it is expected that transmission capacity from the U.S. to Latin America will soar to more than 4000 gigabits per second, a significant increase from the 15 gbps network completed in 1999.

However, despite this progress, the “last mile” between the universities and the national nodes was recognized as the most difficult aspect of wiring Latin America at the Summit of American Presidents held in Santiago de Chile in 1998. The Internet Studio experience has demonstrated the viability of the technology, however. Members of the Internet Studio consortium are working closely with national institutions and consortia such as AMPATH (in Miami), Retina and Educ.ar (in Argentina), and Reuna (in Chile) to develop “last mile” grants and projects that will allow high-bandwidth access for Latin American schools of architecture.

Space design for high-bandwidth video spaces. Observers noted that high-bandwidth videoconferences engaged participants at the level of a television screen. As architects, some of the participants are taking the initiative to design new multicasting video spaces that can engage other senses. For example, one group is working on developing a prototype of an Internet Studio room in which video projectors enlarge human figures to a 1:1 scale. The wall on which the image is projected becomes, rather than just a video wall, an area of social interaction in which ad hoc events can occur. Another technique is to project horizontally by using blue-screened table surfaces upon which physical models and drawings can be placed, viewed, touched and acted on remotely.

NEW PROPOSALS

Our evaluations and observations are to be translated into the following specific projects for the next academic year:

An improved low-bandwidth review space. Two schools of architecture within the Internet studio consortium are designing and testing a video-chat interface for design review. The video-chat combines three frames in a single web page. In the bottom-right frame there is a chat area; on the bottom-left frame is an embedded RealPlayer video window for live broadcast; and in the top frame of the web page there is a space in which students can present their work.

Web cams for low-bandwidth social space. During the fall of 2001, two schools were working on including webcams into their studio space with web-based CUSeeMe conferencing to allow more social interaction among students in the studios.

Potential for supporting a new studio culture on-line. In the initial evaluations of IP multicasting technology such as Access Grid on Internet 2, it was found that this technology has more value in building on-line social relationships during the semester than in the more structured process of the reviews themselves. These relationships are a very important factor in the studio experience and one that bears further study in the future.

Lack of spatial orientation. Most videoconference technology today engages the user at the level of television or video-projection technologies. The evaluators observed that classrooms with videoconference equipment are well suited for events in which a speaker delivers a lecture but are not well designed for architectural reviews. The user, during review conditions, cannot develop high levels of interaction and develops a lack of spatial orientation in relation to the room and students’ work being displayed remotely. For example, it is difficult to translate the scale of models, the scale of drawings, and the presence of the presenters. The recommendations suggested that more work is needed in the physical design and layout of this technology in order to engage audiences with the actions and behaviors that occur in these virtual studios.
CONCLUSION

In experiments with several low-bandwidth Internet technologies, the participants in this experience have found the preferred method for virtual design reviews to be the combination of student web-page publishing and chat. Initially favored technologies such as IP videoconferencing were found to be useful in one-to-one conversations but did not support large design review sessions. Several differences were found between traditional review procedures and on-line ones: Time tolerance among on-line reviewers tended to be lower; student and reviewer explanations and commentaries tended to be more direct and precise, being shielded by electronic anonymity. This is a product of the edited information on the students’ web pages and the reviewers’ constant access to on-line student material during the semester. This experience has triggered a set of observations and conclusions about conducting Internet studios in low-bandwidth conditions, which have been translated into a series of projects, which participants are currently pursuing: improving the web-page interface, mixing web publishing, chat and IP video broadcasting; testing web-cam technology to support spontaneous multimedia collaboration; and creating low-bandwidth virtual reality prototypes that support the creation of virtual communities.

The participants have limited experience with high-bandwidth technology but expect to continue to work with it thanks to a series of grants that have permitted us to experiment with Internet2 in Latin America. In our initial observations, we found that in situ design reviews, and the ones using high bandwidth, do not differ considerably. Similar cultural and behavioral codes are observed on both sides of the virtual experience. Among the slight differences we found were the higher potential for on-line audiences to be distracted and the need for developing better spaces for interaction.

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These experiences, during 1999 and 2000, proved that the technological
experience envisioned can be accomplished, and all of the participants acquired an increased appreciation of their ability to communicate, teach and learn remotely. As the participants continue to experiment with the technology, they are also starting to develop academic agreements and to develop curriculum to offer post-graduate degrees in conjunction with the participating U.S. and Latin American universities.

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References and Notes

2. The applications used were Netmeeting, Vocaltec and CUSeeMe.