DESIGN:
Between Pedagogy and Production

Teaching Architectural Studios Online:
An Evaluation of the "Internet Studio" Experience

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INTRODUCTION

The "Internet Studio" Academic Program initiative is designed to create academic relationships among architectural schools by working on semester-studio projects collaborating via the Internet. This experience has operated since 1999. Past participants included a maximum of 300 architectural students from Miami, Argentina, Chile, Ecuador and Venezuela, who collaborated in semester-long design studios via the Internet and videoconference technology during the Fall, 2001.

The initiative is using advanced telecommunication and digital technology to enrich the education and the Pan-American collaboration experience. The program is part of the AMPATH initiative at FIU, which in 2001 obtained a $25 million grant to connect National University Networks in Latin America and the Caribbean to the Internet 2 server at FIU. The BBC, Discovery Channel, Government Video Magazine, and media outlets in Argentina, Chile and Japan have documented the initiative.

The project is envisioned to position the "Internet Studio" network as a main hub for architectural education, research, and urban design thinking. Networking professionals and academic institutions will be essential for understanding the effects of the new speed of urbanization.

TRADITIONAL ARCHITECTURAL STUDIOS

Typically, architectural studios are very isolated social environments in which approximately 15 to 40 students, and 1 to 3 professors, spend between 5 to 10 hours per week in direct contact to search for design solutions. Design culture, knowledge, and solution strategies are transmitted by what Donald Schon [Schon, 1984] calls a process of "tacit learning." "Tacit learning" cannot be fully explained or structured. It is transmitted by examples, gestures, acts, and developed by the investigation of problems as they arise.

Figure 1. Weekly synchronous communication was supported by unstructured IP videoconferences via regular Internet. However, the most popular method for weekly synchronous reviews and communication, among schools of architecture, was via "web-chat."

THE OBJECTIVES

Most people who theorize about the impacts of computers on design focus on the drafting productivity issues or on the highly imaginative form/material relation that the computer model can bring to the design-build process. The Internet Studio initiative investigates a different type of digital architectural experience: a design community online. The primary objective of the "Internet Studio" is to remove architectural education from its isolated environment of the traditional studio and to enrich it with a large community of participants using new communication technologies. The idea is to gradually democratize the architectural studio. The final aim is to remove the design process from the traditional idea of the design genius into a more social environment in which architecture can be produced. The vision of the "Internet Studio" initiative is to build a design community with very specific urban problems in a region of the world. Architectural design is not only affected by form but also by the speed, in which it is produced, consumed and discarded.

THE VISION

It is fall of 2005; FIU Graduate Design 2 class is about to begin at 2:00pm. The subject for the studio this semester will be a large ocean-front development in the city of Lima, Peru. Representatives from the Municipality of Lima and two local developers are interested in participating in the studio's design process. For many years the site in Lima has been neglected but today it is at the center of controversy since a large sector of the area collapsed into the highway that borders the oceanfront. The design studio professor in Lima, with the design studio professors in Miami, Santiago de Chile, Buenos Aires, Cordoba, Caracas, and Montevideo, have agreed to pursue the "Miraflores, Lima, Ocean-Front" theme.

At 2:05pm, the six studios, with more than 120 students, are connected through IP video-conferencing; professors, a city official, and several professionals from Lima introduce the students to the subject. The school in Lima has thoroughly documented the site and published pertinent information on the studio web site. At 3:40pm the school professor invites 3 representatives of citizen groups to inform students of their concerns. At 4:16pm the professor from Lima concludes the meeting, then students ask some general questions. Before 5:00pm students are assigned design and research projects relevant to the project.

As the semester advances the students publish their designs on the web. The web site gets visited not only by the students and professors but also by citizens of Lima who are interested in the fate of this important. The Municipality of Miraflores, Lima, and the local school have encouraged the popularization of the web site and the participation of citizens via large city advertisements in Lima that reads: "see the future of our oceanfront," visit *http://istudio.fiu.edu/lima*. Since the subject is important in Lima, the student work has also attracted the curiosity of the media with some of the proposals produced in the studio have been seen animated on the local TV nightly news and renderings in newspaper.

Former alumni and professionals that would like to maintain a close relationship with academia, and the process of teaching and learning work as volunteer mentors or visiting jurors. They adopt a group of students and are extremely helpful directing them in solving technical and design issues of their projects.

It is the beginning of December and the studio is ending. A final review is held via videoconference, the students, professors, visiting jurors, and sponsors in Lima gather to do the final presentation and elaborate on final comments. Most of the projects were finished on time. But there was more, the school in Lima, with the help of the local sponsors had organized a final presentation of the studio at the actual site of the project. At 9:00pm five large projectors began to show the 30 studio proposals. Animations, drawings, digital renderings, short explanations, and introductions are seen and heard by more than 10,000 people that pass by.

BUILDING AN ONLINE DESIGN COMMUNITY

The "Internet Studio" emerged from earlier experiences in 1993 and 1994, and placed as a full semester academic experience in 1998. The first step to build an Online Design Community was to develop a growing academic community with very limited resources via regular Internet. From 1998 to 2001 the objectives were to test low and high bandwidth technologies and consolidate a reliable group of academic institutions. The collaboration was done during this period between one or two architectural studios at Florida International University in Miami, and two to eight studios at seven schools of architecture in Latin America. The participants of the Internet Studio began the collaboration by setting up a semester design studio online with similar programs, assignments, and exam dates. During this first step, we maintained traditional hierarchies. Professors locally conducted each studio, and students typically shared reviews and assignments. As the experience progressed in 2001 we began experimenting with higher-level interaction by generating group projects and distributing students among faculty groups from different countries. For the period of 2002 to 2005 the participants of the Internet Studio have defined three higher-level objectives in building this community: a.) to gradually increase group collaboration, b.) to design semester projects closer to real urban problems in the Americas, and c.) consistently include in the design process other participants such as government officials, potential clients, and others.

LOW-BANDWIDTH TECHNOLOGY: CHAT, WEB PUBLISHING, AND IP VIDEOCONFERENCES (1998-2001)

The initial experiments of the "Internet Studios" initiative explored synchronous and asynchronous collaboration with low-bandwidth technology. This was necessary due to the technological conditions in the Latin American schools of architecture that participated.
The most popular method, for weekly synchronous reviews of student work, was a combination of chat and web publishing that we called: "web-chat." Students posted their work weekly on individual web pages, then professors and visiting critics from all over the world set a time to review the students' pages. Student web pages contained CAD renderings, process drawings, photographs of physical models, video animations with Real-Player presentations, and Flash animations. Students presented this work, via web pages and chat, and then received instant responses from reviewers.

Weekly synchronous communication was also supported by unstructured IP videoconferences through the low-bandwidth Internet (software: Netmeeting, Vocaltec and CU-SeeMe). The IP

videoconference technology worked well for one-to-one communication among students and/or for professor coordination. However, it was considered to be too disruptive for online reviews with a large number of participants. Initially every effort was made to conduct reviews using an IP videoconference format supported by each student's web page publication. However, surprisingly, over time the combination of chat and web pages became the preferred method for reviews, and videoconferences became unnecessary. The web-chat technology was universally available (it only required a java enabled web browser), and quicker for conducting instantaneous feedback. IP videoconferencing proved to be useful for developing initial social contacts among the teams.

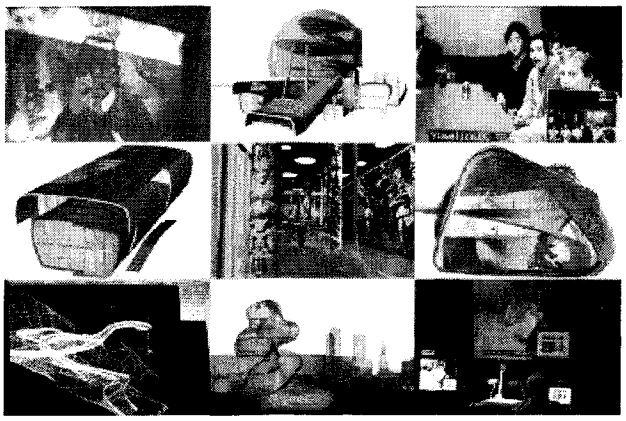


Figure 2. Images from the "Internet Studios" among Miami, Buenos Aires, Argentina, Vancouver, Valparaiso, Santiago, Guayaquil and Caracas.

EVALUATING REAL-TIME STUDIOS VS. ONLINE LOW-BANDWIDTH STUDIOS

Several experimental evaluations were conducted to compare real vs. virtual studio reviews. In order to develop our study we conducted online and local reviews at the same time and began to compare results from evaluations, to record anecdotal references, and to document the behavioral differences of participants based on each of the environments. The most important conclusions of the evaluations were the following:

Review Tolerance. We discovered that participants in online 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 per student project. Comparatively teams in traditional real time settings were willing to spend up to 15 to 20 minutes per student.

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

Oral vs. written response. Reviewers also expressed that comments online could be written simultaneously and reviewers were able to quickly notice the similarity of their criticism regarding the student's work without having to wait for everybody to speak.

Electronic anonymity. Another important observation refers to the lower level of diplomacy that can be experienced in chat environments, one can go directly to the point without having a physical facial reaction from the presenting student.

Synchronous and Asynchronous review space. Another important observation refers to the opportunities and contact time professors and reviewers look at the student work; in traditional environments the reviewers can see the student work only during the time of the pin-up. In the online environment reviewers usually become familiar with the student web pages prior to the time when the web-chat reviews occurred.

HIGH-BANDWIDTH TECHNOLOGY: ISDN VIDEO-CONFERENCE AND INTERNET2 IP MULTICASTING (2001–2005)

We were able to test ISDN videoconference technology in our Internet Studios only during 1999 and 2000. Due to financial constraints, we kept this technology for very structured sessions, which occurred only two to three times per semester. We will be able to improve this situation since we obtained grants, in 2000, which will allow us to connect with major academic networks in the Americas through the Inter-Oceanic Global Crossing link with 40 Gbps. The grant offers a DS3 connection in every country where the intercontinental network lands in Latin America and the Caribbean. The DS3 connection will link to our POP server in the US, which in turn will connect the universities to Internet 2. In testing this new bandwidth we began to experiment with node-rooms with wide IP Multicasting technologies such as "Access Grid" on Internet 2. The "Access Grid" allows constant videoconference concurrency of a large number of participants. Each video and audio channel is connected at the speed of 800 kbps, which allows for excellent quality transmission. The experiment used a system that cost less than $15,000, which included 3 computers, 3 projectors, and a specially designed audio-video system.

EVALUATING REAL-TIME STUDIOS VS. ONLINE-HIGH BANDWIDTH STUDIOS

As we stated above, our experience using high-bandwidth technology is very limited. However, from our initial evaluation we can find the following:

Similar review culture. Design reviewers in real condition and the reviewers using high-bandwidth networks tend to follow the diplomacy, time tolerance, and review format of tradi-

tional studio jury processes.

Potential for distraction. Although time tolerance and review formats are similar, spectators of the multicasting tend to get more easily distracted than if they were in real review spaces. Techniques for moderating multicasting events have became elements for design. It is generally recommended to follow a very structured program. The experience also suggests that the tolerance, for online juries, last 1 to 1Ω hours, while in real environments they last approximately 3 hours.

Potential for supporting new studio culture online. In our initial evaluations of IP multicasting technology, such as the "Access Grid" on Internet 2, we can see that this technology has more value in building social relationships online, during the semester, than in the more structured reviews themselves. This is a very important factor in the studio experience and one that needs to continue in the future.

Lack of spatial orientation spaces. Most of the high-bandwidth technology still resembles human interaction at the level of a television monitor. The evaluators observed that more work needs to be developed in the physical design and layout in order to engage audiences with the actions and behaviors that transpire in traditional studios.

NEW TECHNOLOGICAL PROPOSALS

Our evaluations and observations will be translated into the following specific projects for this new academic year:

An improved low-bandwidth review space. Two schools of architecture that belong to the "internet studio" consortium are designing and testing a video-chat interface for design review. The video-chat combines, in a single web page, three frames. In the bottom right frame there is a chat area, the bottom left frame is an embedded RealPlayer video window for live broadcast, and the top frame of the web page there is a space where students can publish their work.

Synthetic World: "iStudio," for low-bandwidth interface. We are also beginning to work with developing 3D-worlds that can structure "community behavior" in virtual systems. We have initiated this work based on critical observations of similar experiments such as MUS, MOOS, DIVE [Carlsson and Hagsand,1993], MASSIVE [Greenhalgh and Benford, 1995], and many other popular virtual world versions developed today. The "Virtual Studio Space" prototype, named "iStudio," investigates the software design and human behavior of studio life with digital conditions. The design of the prototype does not attempt to recreate the space of the traditional studio, but to support the community actions in design education.

Communication among users is done via chat. Through the use of local software the text produced in the chat is transformed into voice. Icons in the world can also trigger other communication applications to open, such as IP videoconferences, web page browsing, etc. Students are required to design their own exhibit space and review rooms. Files such as JPGS, CAD, Videos, and audio files are uploaded onto "iStudio" via a simple web page. Each one of the virtual walls can be edited remotely by using java applets in the student web pages.

The "iStudio" world prototype was designed to render different spaces in stages therefore 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 at all times.

Grants for "last mile" high-bandwidth projects. Despite the accelerated growth in bandwidth, among the Americas the "last mile," between the regional nodes and the schools of architecture, remains difficult to connect. Members of the "Internet Studio" consortium are working closely with national institutions and consortiums such as Ampath (Miami), Retina and Educ.ar (Argentina), RNP2 (Brasil), and Reuna (Chile) to develop "last mile" grants and projects that can allow high-bandwidth access by the Latin American schools of architecture.

Space design for high-bandwidth video-spaces. One of our frequently observed situations, when high-bandwidth videoconferences are conducted, is that they engage the participants at the level of a television screen. As architects, some of the participants are taking the initiative to design new video spaces, where multi-casting occurs, that can absorb other senses of the human body. For example, one group is working to developing a prototype of an "Internet Studio" room in which video projectors enlarge human figures to 1:1 scale. The walls in which the image is projected is no longer a video-wall but an area of social interaction in which ad hoc events can occur. Another technique is to project horizontally by using blue-screened table surfaces, where physical models and drawings can be placed, viewed, touched, and acted on remotely.

ORGANIZATIONAL ASPECTS

Beyond the technological issues, the experience revealed that the most difficult aspect to overcome, in creating these design communities, is not technological but organizational. "Internet Studios," similar to most online teaching experiences, requires two or three times the amount of time to organize and develop. This consumes a considerable quantity of time from the studio professors and students.

The studios experimented with a variety of schools and a large number of student participants. In 1998 and 1999, the studio was conducted between two schools with approximately 30 students. In 2000, there were 5 studios with 135 students online. And in 2001, the numbers increased to 7 studios online with approximately 300 students participating. The experience demonstrated that as the number of studios increased so did the communication problems and academic experiences. The best results, in interactivity, were obtained during weekly reviews where we had two to three studios online.

Another important evaluation, which has emerged from this experience, refers to the need to incorporate information technology and CAD modeling in these studios. This represents a major problem in large state run universities in Latin America where usually design studios and computer stations are separated.

As part of the maturation of the experience, during 2002, the Internet Studio is participating in semester projects that are more aligned with relatively significant real projects in the Americas. During 2002 we have planned the following studio projects:

IT Town, Colon, Panama. A live/work Information Technology Campus for 10,000 workers located on a 300-acre site in the Panama Canal region. The sponsorship of the private developer includes a trip for 13 students and the studio professors to Panama.

Antartic-Tactics. A semester studio that develops infrastructures for ecological tourism for the next 20 years in Antarctica. Sponsored by Universidad Federico Santa Maria, Chilean Air Force, and Comnap.

Urban Periphery. A semester studio project consisting of work in a low-income housing area in South Africa and Latin America. Organized by Universidad de Buenos Aires and the Division of Information and Communication Technology (icomtek) - CSIR in South Africa.

Each one of the studio subjects has a local sponsor or organizer (non-architect) to whom we plan to communicate with, from our studio, on a weekly basis online.

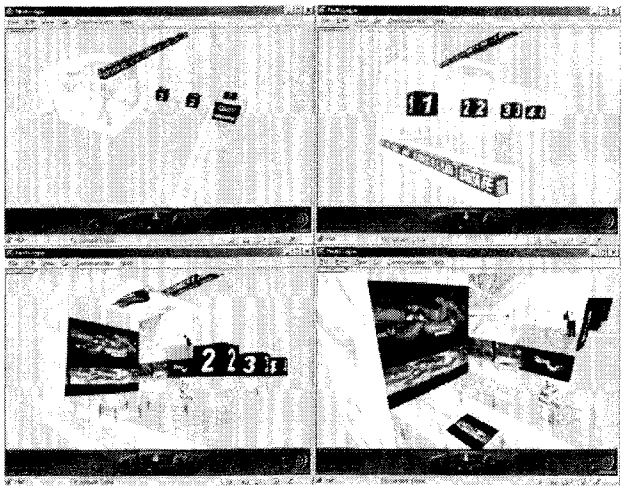
In short, the results are based still on an early stage of the experience. Many of the Latin American schools participating have very poor access to the technology, and during 2000 or 2001, ran their first experiences online. As we run the first experiments developing group projects online we continue to encounter a large number of traditional barriers among studio professors and students that want to achieve individual vs. group solutions.

CONCLUSION

After testing several low-bandwidth Internet technologies, the method preferred, for virtual design reviews, is the mixture of student web page publishing and chat. IP videoconferencing was initially the favored technology, which was found to be useful in one-to-one conversations but did not support large design review sessions. Between the traditional review procedures and online ones several differences were found. The time tolerance of online reviewers tends to be smaller, student explanations and commentaries tends to be more precise, and shielded by electronic anonymity. This is a product of the constant accessibility reviewers have with student material during the semester and the edited information found online. This experience has generated a set of observations and conclusions, for conducting Internet studios, with low-bandwidth conditions. They have been rendered into a series of projects we are currently pursuing. We are improving the web page interface with web publishing, chat, and IP video broadcasting. In order to support spontaneous multimedia collaboration we are testing web-cam technology. Also, to support the creation of virtual communities we are generating virtual reality prototypes.

We expect to work with high-bandwidth technology more in 2002 using a series of grants that are enabling us to experiment with Internet 2 in Latin America; we currently have limited experience with it. Our preliminary observations found that *in situ* design reviews, and the ones using high-bandwidth do not substantially vary. Similar cultural and behavioral codes are observed on both sides of the virtual experience. Among the slight variations we found were the higher potential for online participants to be distracted, and the need for developing better spaces for interaction. These conclusions have driven a number of initiatives for improving the physical design of interactive spaces. In the future, the new designs will attempt to increase the engagement of the body and senses of the participants in their meetings.

In the past two years, we have proven that technologically the experience can be accomplished. All of the participants acquired an increased appreciation of their ability to communicate, teach, and learn remotely. We are beginning to develop academic agreements as we continue to experiment with the technology, and to develop a curriculum to offer post-graduate degrees in conjunction with participating U.S. and Latin American universities.



The "Virtual Studio Space" prototype named "iStudio" investigates the software design and human behavior of studio life in digital conditions. Students and professors interact in the prototype with avatars in two VRML review-rooms that are supported with chat and web page links.

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