

# CoOL Studio: Using Simple Tools to Expand the Discursive Space of the Design Studio

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**Abstract.** This paper discusses the use of a computer tool designed to aid an architecture studio by: 1) supporting input by distant critics; 2) providing access to online cases and reference materials; 3) encouraging students to be clear and articulate about their projects; 4) supporting collaboration among students. The project, called CoOL Studio, employed a CoWeb, which allowed easy creation and modification of Web pages without any security measures. Students posted their designs at several points during the term and six distant expert consultants provided critiques. This project demonstrates that a relatively simple representation tool—one that allowed students and critics to interact on editable web pages—can usefully open up the design space of the architecture studio but that care needs to be given in understanding how computer tools relate to the tasks and rituals of interaction that go on in everyday architecture studio pedagogy.

**Keywords.** Collaboration, online advice, computer tools, design studio, architectural design, asynchronous collaboration.

Studio classes in American architecture schools bring complex expectations for individual authorship and for collaboration. Students are usually evaluated individually and are expected to develop and articulate their own positions and skills. At the same time, studio instructors often attempt to build studio communities through reviews and team assignments, where students can learn informally from each other. This attempt to capitalize on informal learning is reflected in the open layout of the studio, where students can monitor each others' progress and overhear comments by the instructors on other students' work. Studios represent what Bernstein (1973) described as an "integration code," where a wide variety of disciplines and positions become integrated.

In contrast to the openness of the studio environment, teachers and students often consciously reduce the richness of the constraints and perspectives they address in their designs to focus on specific aspects of form-making or representation. This focusing of the design task represents the realities that teachers and students face: teachers have specific experience, knowledge and interests; students have limited resources available to them locally and limited time to pursue them. While these conditions mirror architectural practice, which also has limited time and resources, the available solution does not. Practitioners cannot simply choose to ignore part of the program or a set of stakeholders. This creates a dilemma: while the simplified and protected setting of design problems in the studio may be valuable for pedagogical reasons, the bounded nature of problem setting does not fully prepare students to operate in architectural practice, where they must simultaneously accommodate multiple functional and symbolic perspectives.

Recently, teachers and researchers have turned to information technology to attempt to resolve this conflict. Technologies such as the Internet, shared databases, shared computer workspaces and streaming video provide students and teachers access to a vast amount of information and to many potential collaborators. Several architecture schools have created *virtual design studios* (VDSs) to attempt to open up the design studio. Many of these have taken advantage of video and networked computers to allow people in different locations to collaborate simultaneously in real time. VDSs have allowed studio groups in different locations to collaborate and distant experts to offer critiques. For example, the virtual village project linked architecture studios at the University of Hong Kong, MIT, University of British Columbia, Barcelona, Cornell, and Washington University, where students designed coordinated infill housing in a historic village in China (Wojtowicz, 1995). Students and faculty exchanged electronic building models, renderings and other information and participated in video juries. In another VDS, MIT collaborated with Xerox PARC to create virtual desk crits using web cameras and DrawStream, a collaborative drawing tool being developed by Xerox (Yee et al, personal communication). Critics in Palo Alto provided regular critiques for the students in Cambridge. In this example, cameras were mounted in the MIT studio and at the critic's work stations in California. A document station on wheels was rolled to each student's drawing table. The remote critics could see the student's work on his workstation and could mark it up and make suggestions.

Many of the existing VDS projects have been aimed at testing relatively sophisticated technologies as a way of understanding new possibilities for asynchronous design practice and education. Indeed, the virtual design studio seems to offer opportunities for studying design education and practice where traditional barriers of space and time do not apply. In the current project, called *CoOL Studio* ("Collaborative Online Studio for Architecture"), our goals were simultaneously more ambitious and more modest. We were seeking to create an extremely easy-to-use framework and a technology that would apply equally to a wide range of studios and individuals, including both high-bandwidth technodesigners as well as those not yet fully immersed in the third wave of the computer revolution. We also saw this as an opportunity to involve critics and consultants in the studio who normally would not participate and who may not have access to high-end computer technology, or the time or expertise to employ it. And, we wanted to create a system that was configurable by the participants themselves, and could reflect the goals of individuals and groups within the studio. At a high level, the goal was to transform the social space of the traditional studio, making it more shared and informal, and hence more likely to support collaborative thinking.

In CoOL Studio, we expected that an online forum for sharing, discussing, reflecting and integrating different design ideas could be helpful in several ways:

- 1) By facilitating access to information on the Internet, including cases the instructors prepared, it was hoped that the students would incorporate a wider range of technical information and exemplars in their designs.
- 2) By encouraging students to post and explain their designs, it was hoped that CoOL Studio would help the students become articulate in their explanations of their designs.
- 3) By allowing remote critics to participate, CoOL Studio provided students access to a wide range of expertise and stakeholders' perspectives without leaving their design studio.
- 4) By providing ways to share research asynchronously and to comment on each others' work, CoOL Studio provided students additional opportunities to collaborate.

In this paper we examine the first implementation of CoOL Studio, examining how the design of technologies and pedagogies influenced achieving these goals. Although many discussions of online education focus on technology per se, in evaluating the project we discovered that the role of CoOL Studio could only be understood by considering the expectations, skills and demands that each participant brought to the studio culture. In the following sections we briefly describe CoOL Studio and the experience of students and critics. We then discuss some of the implications of tools such as CoOL Studio for architectural education and for design thinking and learning.

## **CoOL Studio**

In Winter 1998, a traditional graduate architectural studio at Georgia Tech was given use of a shared on-line environment, called Collaborative On-line Studio or 'CoOL Studio'. Aside from having access to the on-line environment, the studio was conducted in a normal fashion. Students met in class roughly twelve hours per week, spending much of this time either working alone, talking individually with the instructors or participating in informal class reviews. The students were participating in an international student design competition, where they were asked to design a four-courtroom federal courthouse. The students were required to demonstrate a detailed understanding of the functioning of a courthouse and its relationship to a complex urban site. They were also required to demonstrate skill in using a range of architectural representations as well as considering multiple perspectives, such as those included in post-occupancy evaluations and those generic to certain user groups such as the public, jurors and staff. Each student was responsible for developing a single design concept over the course of the quarter. As part of the development process, they were required to research the problem given to them, experiment with abstract solutions, and, in the end, produce a fairly detailed specification of their final solution

The students had access to a tool that allowed them to create web pages containing descriptions of their proposed designs using common web browsers. A second Web site was created using conventional web authoring tools that provided cases about five recent significant courthouses. The on-line cases were initially created for the students with the expectation that they would be expanded and then hyper-linked to the individual design proposals in the web site. Also, a resource page was constructed where additional courthouse information was listed. This included at least 36 links to different web resources, a list of reserved books and government publications in the college library and on-line databases that were recommended for relevant information.

All students were assigned the same design problem. Five of them chose to work independently, with the remaining five splitting off into two multi-person teams. In addition to the students, six critics — individuals who possessed professional expertise related to the design of courthouses — were invited to participate. Most of the critics were geographically separated from the students. The one critic who happened to work locally was not otherwise involved in the studio. Apart from the critics, two local instructors led the class. One instructor focused on helping the students with their research and offered his own expert advice, while the other focused on helping students advance and articulate their design concepts

In CoOL Studio, each student could post his or her design and carry out conversations not only with their critics, but also with anyone in the Internet community. The teachers and critics, on the other hand, could provide feedback and guidance not only to individual students, but also to the whole group at once. Student specific comments could be given to the students individually, while more general comments could be posted in public areas. Several research questions dealt with these features: How does architectural interaction and evaluation take place? What are the consequences of an internet-based interaction? How does it compare with traditional face- to-face communication?

## **Co-Web**

The CoOL Studio computer environment consisted of a CoWeb (Collaborative Website) (Guzdia et al. 1999) . A CoWeb is a website that allows any user to create or edit web pages using plain language and common web browsers such as Netscape or Microsoft Explorer. CoWebs involve the use of a Pluggable WebServer (PWS) implemented in the programming language Squeak (<http://squeak.cs.uiuc.edu> ). PWS, and the CoWeb tool, have been run on a wide variety of platforms including Macintosh, Windows 95, Windows NT, and SunOS operating systems. When using CoWebs there are no security or synchronization checks; if something goes wrong it must be fixed by the administrator, or restored from the last saved copy. Given the prevalence of firewalls and multiple passwords, , CoWebs stand out in that they are accessible to anyone. When we began the CoOL Studio project, no previous class had used a CoWeb, so we literally had no idea if this openness would lead to problems, or conversely, whether it would engender productive behavior.

Once set up, a CoWeb requires knowledge of just a few commands for operation by the users. When editing page on the server, users send formatting commands simply by typing them in the body of the page, alongside regular text. For example, if a random text string is put between asterisks (for example, \*ABC\*), a new page will be created on the server with that name (for example, a page called "ABC"). Subsequently, a link to that page will be inserted into the current page. Graphics and hyperlinks can similarly be created using simple commands.

CoOL Studio was intended not simply to be a collaborative tool, but a learning environment especially tuned to the needs of a studio setting in which students and critics could interact. Integrating the learning aspects of CoOL Studio with the design-support aspects was important. Previous findings suggest that students often use tools because they are given them and not because they feel they need to use them to support their learning (Turns, Guzdial et al. 1995). Students do not always know what enables their learning, so often the most effective approach to getting students to use a learning environment is to convince them that it is useful for getting their tasks done, first, and then for learning

## **Operation of the CoWeb in CoOl Studio**

Basically, CoOL Studio sought to make the design process more visible to both the designers and the critics. Students were asked to create Web pages consisting of scanned drawings and text to present their research and their design concepts. Compared to CoWeb users in other disciplines, CoOL Studio students had to learn a few extra steps dealing with the scanning, retouching and uploading of images. However, to carry out their work, only a passing knowledge of the programs was necessary and thus the students were able to learn quickly. Getting up to speed seemed to require only three or four sessions<sup>1</sup>. After that, all the participants became familiar with the different routines and were able to independently operate all of the software and hardware

The students were initially required to create an online journal. This was simply meant to be an individual record of all the considerations, evaluations, discussions, concepts, ideas and so forth that a designer entertained as he or she progressed through the quarter. It was to be similar to a design sketchbook, having the added advantage of being easily accessed and searched by anyone on the Internet. As a pedagogical device, these journals were conceived as a reflective tool.

It was thought that the virtual critics would look at the journals as the students progressed and comment and converse with the designers about different aspects of their designs in a continuous back-and-forth manner. This would have been entirely unstructured and unscheduled. Unfortunately, casual interaction was not prevalent. We quickly realized that the initial stage of design involves a flurry of many ideas which are rapidly evaluated either as having potential or not. When students put all of these thoughts in their journals they became too long and scattered. In addition, some students were simply reluctant to commit such initial conceptions to a public environment.

There were also lessons about the critics' involvement. They were mostly connected to the Internet by modems and hence experienced delays in downloading large documents. Additionally, we realized that since they were in different cities and had little knowledge of downtown Atlanta where the proposed site was located, they needed some introduction to it. As such, they tended to spend more time on those pages that included descriptions of the city and the site of the design in order to prepare themselves to comment on the rest of the designs.

## **The Nature of the On-line Presentations**

Presentations in CoOL Studio included text, scanned photographs and sketches and in some cases computer rendered images and animations. The main difficulty was scanning and uploading images, which required students to use computers located outside the studio. Although initially it was thought that the on-line presentations would serve as a running journal of the student's projects, it was quickly realized that

they would have to be economized due to the effort involved in scanning them and the time then required to download them once on-line. Students reported that they learned to pick out drawings that they knew would look good at low resolution but would still communicate their ideas. It is not clear that the outside critics were aware of this limitation since some commented on what they thought was simply low-quality work. On the positive side, having to economize may have forced students to take a much closer and more critical look at their projects in order to find their “essences”.

Another characteristic of the on-line presentations was that they were mostly linear in form. Most began with a statement outlining a “position”—that is, a particular interpretation of the problem—followed by a textual description of the various pieces of the design, interspersed with drawings and photographs. Although they were given the freedom to add hyperlinks and additional pages, students kept their presentations as single narratives. It may have been that the added effort required to organize a nonlinear presentation made it impractical or that the students lacked experience in creating non-linear presentations. For most students, CoOL Studio was their first attempt at Web authoring and hence most stuck to simple text and image insertion. A few students personalized their pages by adding links to Internet sites not specifically related to their projects.

Because of the effort involved in setting up on-line presentations, they were not continuously updated throughout the quarter. In fact, in order to manage the work involved and to ensure that when the critics visited the site they would see only current and complete pages, three presentations were formally scheduled over the course of the quarter. This meant that some of the design decisions made between presentations might have been left undocumented. In some cases students tried to pick up where they left off in previous presentations and often recycled old content. However, in many cases, students had changed their designs considerably in the interim and hence little overlap could be detected. Although discontinuities between presentations may have made it difficult to see where a design was going, the critics did not seem particularly bothered. Criticism could still be offered by looking at each presentation independently from those that preceded it.

## **The Nature of the On-line Critiques**

The critiques offered by the outside reviewers were varied, addressing the projects at different levels of abstraction and from different points of view. The critiques raised questions, pointed out problems, provided encouragement, reinforced design decisions, reinterpreted design features and suggested new ideas. In some cases the critiques included references to books and well-known works of architecture. Rarely, though, did a critique of one project include a reference to another. Although traditional architectural critiques have been known to become overly negative (Anthony 1991) and on-line environments have been known to support abusive behavior (Donath 1994), sharp criticism was never posted in CoOL Studio. In one case a critic reported that he was about to censure a student when his network connection was suddenly broken. He never went back to rewrite it, saying that it would have only embarrassed himself and the student.

Most critics posted their comments inside the page they were critiquing. For the most part this meant breaking off a small section at the bottom of the page, although in some cases comments were inserted in the middle. A few critics, citing their lack of free time, posted comments in a central location—namely, on a critique page set up for their use.

It is not clear which approach was better. On the one hand, putting comments on one page may have led students to read other comments out of curiosity; on the other hand, putting comments inside the project pages may have brought the critics together more, since they would have seen what others were writing. While there is no direct evidence of the former—that is, of students making use of comments not directed at them—there is evidence that the critics read the comments posted by others before posting their own. In several cases, for example, critics explicitly agreed with other critics or offered complementary arguments. This may have been advantageous if the critics were then able to avoid contradicting one another. It may

also have been bad, however, if it distracted them from issues they would have otherwise raised on their own.

Although the critiques were for the most part clearly worded and insightful, not all were seen by the students as having hit their mark. Students sometimes felt that the comments did not address the problems they were dealing with. This may have been because by the time the students had their presentations scanned in, written up, organized and then commented on, they had already moved on to other issues or had changed their designs. Nonetheless, positive comments were always found to be encouraging. Since students were planning on sending their projects to a national competition at the end of the quarter, they relied on the critiques to gauge how well their presentations communicated their concepts.

## **Accessibility of the Presentations**

Surprisingly perhaps, the critics who were interviewed said they had little problem understanding the presentations. It was expected that some difficulties would arise because of the Web format. Simply not being aware of the limitations associated with scanning and with the Web, the critics may have simply assumed that the presentations were fair representations of what went on in the studio. Students had a much different perspective. One student, frustrated with his inability to show in detail what he was working on, suggested that it might be better to simply send e-mail to the critics requesting specific advice. Some students, in fact, used their presentation pages to pose questions directly to the critics. In at least one case, the student received fairly detailed responses, although the critics tended to say very similar things. In this respect, there may be a tradeoff between getting a diverse array of responses by letting critics say whatever comes to mind and getting answers to specific questions.

## **Collaboration Between Students**

Initially it was expected that the CoOL Studio environment would provide an opportunity for students to openly discuss their projects with each other. Although the traditional studio environment is open and thus allows students to see what other students are working on, the on-line environment was potentially better for interaction among students for several reasons. First, the on-line environment allowed asynchronous interaction; hence, students could view and comment on material at any time. Second, the on-line environment also provided a social context separate from the physical environment; and as some studies have shown (Sproull and Kiesler 1991), on-line interaction may be less socially constrained than face-to-face interaction. Finally, the on-line environment gave students the opportunity to structure interaction amongst many people at once; in the physical studio environment, by contrast, it is not always easy to get a dozen or so students to interact in a coherent way.

Unfortunately, while students may have viewed the on-line presentations of their fellow students, they never exchanged comments on-line. This, of course, may have simply been because they were not explicitly instructed to do so. Or, they might have viewed the pages, then provided the comments verbally. It may have also been because students did not feel that they shared exactly the same interests as their fellow students. Looking at the projects, it is clear that interests tended to diverge as the quarter progressed. The way the CoOL Studio was structured—specifically, the way the presentations were set up and organized—may have reinforced the perceived distance between projects. Each project page was named after the student that created it, implying ownership. Commenting inside a student's page may have thus been perceived as a sort of invasion. While implied ownership may get in the way of open interaction (Stefik, Foster et al. 1987), there is also the worry that closeness may inhibit candid exchanges (Lea and Spears 1991). Unfortunately, CoOL Studio may have suffered at both extremes: project pages naturally implied exclusivity while the freedom to comment within those pages may have suggested intense closeness.

## **The Critic's Experience of CoOL Studio**

In addition to having technical problems, the critics who were interviewed commented that they were not always sure that their comments were being heard. Since they only viewed students' projects on a monthly basis, they could not easily tell if a student had developed his or her design in consideration of anything they had said. In some cases, in fact, it may have appeared that the critiques were completely disregarded by the students. One student, for example, cut and pasted text from an older presentation into a newer one despite the fact that sharp challenges to the material had been posted by the critics. It also seemed that whenever a critic posed a question directly to a student (which, admittedly, did not happen often), the question was never answered, again most likely because of the long delay between student postings. Frustrated with the one-way dialogue, one critic mentioned that when he hit the "post" button to upload his comments, he felt like he was "sending them off into the ether, where they might drift forever."

One critic commented that one of the most interesting aspects of CoOL Studio had been seeing what the other critics said. While interacting with the students may not have been a professionally rewarding experience for the critics, interacting with the other critics, by contrast, may have been interesting simply because it gave them a chance to see what other like-minded people were up to and to participate in a stimulating exchange.

## **On-line Criticism**

On-line criticism was initially envisioned as an ongoing unstructured dialogue between students and critics. Ultimately, this was not achieved due to limitations in both hardware and human interest. Nevertheless, the structured reviews were still effective. For one thing, they allowed students and critics to interact despite being separated in space and time. The critics also had the unique opportunity to simultaneously address both individuals and the collective. Such a dual podium is unique in any setting, but seems especially relevant in the architectural studio because although students are given the same design problem, they each pursue unique design solutions.

The fact that participants could interact on their own time was also significant. Critics could respond at a time when it was suitable for them and spend as much time as their schedule allowed. Hence they were free to consult relevant materials, talk to colleagues or partners, reflect on issues, and carefully organize their comments before posting them. The critics also had the opportunity to scroll back through previous sections of a presentation and compare the work of multiple students at once. Some critics, in fact, printed out all the presentations and performed comparative evaluations before posting their comments.

Of course, this asynchronous format was at the expense of any face-to-face interaction. The students and the critics never met in person<sup>1</sup> or spoke by phone. On the one hand, this lessened the likelihood that personality conflicts were an issue. On the other hand, due to the absence of verbal presentations, the Web pages had to be of sufficient quality to convey all of the designer's intentions. That was not an easy task, especially since preliminary ideas are abstract and typically in need of refinement.

## **Discussion**

The pertinent question from the point of view of the design teacher is, "how does all these help the students improve their skills in designing?" Perhaps this question does not have a direct answer. But the tasks that CoOL Studio demanded for the students certainly had positive influence.

Strangely enough, the first such positive influence was on the students who worked in traditional paper and pencil media. The task of on-line presentation of design concepts and ideas that were worked out in paper forced upon the students a stage of evaluation, re-evaluation and revision. Naturally such stages

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<sup>1</sup> However, two critics visited Georgia Tech in the early part of the quarter.

served for reflection on and maturity of those ideas. Although students who worked with computer tools had a lesser transformation to go through, yet the fact of designing a web page brought to their thinking too, a certain amount of re-evaluation. The requirement to represent their work highly economically in these “virtual pin-ups” also required students to focus on issues of presentation while they were developing their design ideas. This was particularly useful for this studio class, where the final product was to be competition boards that were to be judged by distant evaluators who did not have the benefit of the students’ verbal presentations.

CoOL Studio did successfully inject the perspectives of the distant critics, many of whom daily face the problem of designing and managing actual courthouses. CoOL Studio opened up the discursive space of the studio. Unlike many face-to-face pin-ups, the experts could take time to review the students’ projects, and the students could take time to incorporate the experts’ suggestions.

CoOL Studio also highlighted the importance of considering how shared electronic representations fit into the culture of daily pedagogical practice. The students did not use the online environment to comment on or link to each others’ projects, perhaps because they could see no clear instrumental or learning value in doing so. In other classes that have used the CoWeb, such as a large computer programming class, the CoWeb is heavily used for preparing for exams and for exploring and discussing the solutions to past years’ solutions to homework assignments posted by the instructor. In CoOL Studio, the asynchronous collaboration opportunities provided by the system might have been used more heavily if they student had perceived their work to be more directly linked to others’ activities. For example, if the students had been more explicitly assigned specialist research roles and had to rely on each other for this information they might have used the system more heavily to share and discuss.

Fundamentally, CoOL Studio was aimed at creating a way to share information where students, teachers and critics could participate without requiring knowledge of special software and without requiring specialized hardware or high-speed computer or video connections. A simple measure of its success was the ability to recruit seven highly placed critics who were able to participate as their own schedules allowed. More fundamentally, it seems to point toward an alternative to the high-tech virtual design studio, where architecture schools can open up the discursive space of the design studios using simple tools that are tuned to the pedagogical goals of architecture.

Newer CoWebs utilizing features that make it considerably easier to structure the creation of content and the way interaction takes place within pages have been introduced in subsequent studio and lecture classes in architecture. We are currently using one in an undergraduate class that brings together over 160 students from different smaller studios. In addition to supporting studio work, the website is being used to support design-related discussions and informal activities aimed more directly at establishing a sense of community amongst participants. Most importantly, we are at this point taking advantage of the ease with which the environment can be structured to test a broader range of interaction styles between similar student groups.

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<sup>i</sup> Refinements in the software have further reduced the learning time.