Observations on the Effect of Digital Medium on Architectural Design Education

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Abstract
Design communication is central to student learning in architectural education. A unique design studio course was offered during the fall of 1997 at Miami University to upper level undergraduate students where the use of digital media technologies for design communication was a central theme; this course was offered again in the fall of 1998. Students interacted with professional architects in the industry face-to-face and on the web. The nature of these interactions, the representation strategies incorporated in design communication, and some observations on their strengths, pitfalls, and effects on student learning will be discussed.

Introduction

One of the significant changes that the higher education has undergone over the past decade is the increased use of technology for instruction and related educational activities. Architecture is no exception. Due to the developments in digital technologies powerful visualization and collaboration tools have now become available at an affordable cost and are rapidly gaining in popularity among architects in academia as well as the industry. This has resulted in a trend where computers increasingly dominate the design communication processes.

For the purposes of this discussion, "design communication" can be interpreted as externalizing thoughts into some visual form such as sketches or physical models for the purposes of (i) seeing: to verify what an idea may be like, (ii) showing: to present idea/s to clients, consultants etc, and (iii) seeking: for soliciting input from peers, experts. Traditional design education involves student designers *showing* their work in order to *seek* the input of expert reviewers. Reviewers first need to *see* what the designer is proposing and, in turn, *show* how it could be improved.

The Opportunity

Collaboration is one of the major promises of the emerging information technologies. The idea is that information represented digitally on the Internet allows for a greater access never possible before. A wide range of individuals from the profession and industry can then share their expertise to help students make better decisions. The

compelling nature of this promise has caused several disciplines to utilize this medium for collaboration, from business to engineering and medicine, for example. Being situated in a rural setting, we wanted to explore the opportunity to engage our students with architects involved in professional practice who typically tend to be concentrated in urban areas.

The Challenge of Design Communication using Digital Media:
Traditionally, for design communication, architects depended on sketches (from cocktail napkins to meticulously maintained sketch books), drawings (often as large as 36" X 24", sometime more), physical models (made of chipboard, plaster, wood, metal, etc.), writing, and verbal discourse. The first level of the challenge is to find ways of capturing these multiple representations in a meaningful and coherent manner in digital format. The second, creating a presentation using them so that it can delivered asynchronously over the Internet.

Methodology for Delivery
In the design studios taught by the author during fall 1997 and fall 1998, sophisticated 3D modeling, rendering, and imaging software on high-end desktop computers (from here on referred to as a CAD system) were utilized for design development and communication. In addition, sketches were incorporated especially during early stages of design. As discussed by Lansdown[2] and Scrivner[5] sketching offers better support during early stages of design over the current CAD systems.

Face-to-face Communication

Figure 1. An example of a "design communication" process used during fall 1997.

During fall 1997, the students were required to generate architectural drawings, photo-realistic images of interior and exterior spaces, and templates for building chipboard models from the 3-D CAD models of their design solutions. Various local expert critics from the industry (architectural firms in Cincinnati) and academia (senior faculty colleagues) were present at these reviews and interacted with the students face-to-face. Students met these reviewers periodically over the semester in a classroom setting to present (*show*) their design solutions using large drawings (plotted from CAD models),

sketches, models, and verbal discourse (*seek*). The reviewers often gave feedback by verbal commentary using gestures and body language often pointing at the drawings or models and sometimes used sketches to clarify their suggestions (*show*).

Web-based Design Communication

Fall 1998 students of this course were required to use computers as a primary medium of design development (as before) and the Internet as the primary source of design communication. Students built web sites of their project presentations consisting of images of architectural drawings, photo-realistic images of interior exterior spaces generated directly from the 3-D CAD models, and scanned images of sketches and photographs of the physical models. Additionally, these web pages also incorporated the following:

- QTVR based movies showing walk-though experiences generated directly from 3-D CAD models
- Java scripted rollover images that juxtaposition various images, for example, sections over plans etc.
- Brief text description of the proposed project.

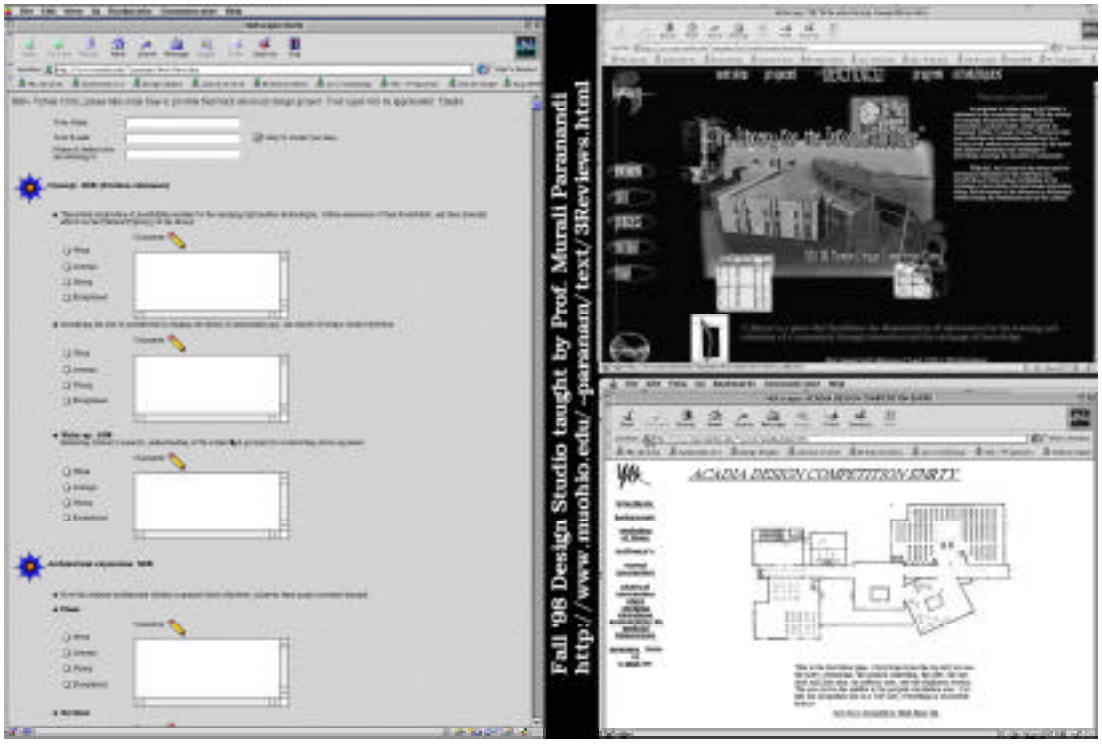

Figure 2. An example of "online design review" during fall 1998.

Reviewers interacted with the students through face-to-face critiques as well as virtual critiques over the Internet. As seen on the right side of the illustration (figure 2), designers posted their design work online to *show* it to the reviewers to *seek* feedback. The expert reviewers (practicing architects from Boston, Seattle, and Kansas City)

browse (*see*) the designers work online and provided feedback by filling and e-mailing a form (*show*).

Benefits of Incorporating Digital Media and Internet in the Design Education:
The major attraction of computers in design education[3] is that of accuracy (geometric), opportunities for iterative exploration (studying variations of a theme), and multiple representation (from a single 3D model several drawings can be generated). Our experiences have confirmed this.

The most notable aspect of the incorporation of the internet in our context is that the expert reviewers did not need to be on site. They could participate from anywhere in the country or the world with an internet connection.

Concerns associated with the Incorporation of Digital Media and Distance Education in the Design Studio:
Our observations of the limitations of digital media technologies are identified below:

i. Lack of simultaneity:
Even the most powerful desktop computers can, at most, support two screens at a time. This is significant in that you may look at just one screen at a time. For example, you can look at a screen that displays a first floor plan, another screen that displays the second, and so on. There is not a way to see them all at once unless they are shrunk.

ii. Physical limitation of size of display:
Often architects use very large size sheets of paper (36”X24” or larger) for generating architectural drawings. Unless one uses a projector, the size of the computer generated image is limited by the screen size of the computer, which is often very small (around 17”). Design decision making demands a holistic picture of the idea under consideration, which requires being able to *see* several drawings at the same time.

iii. Skills requirement for participation:
How one interacts with what is displayed on the computer screen requires familiarity with the software and hardware system in question. Traditionally, architects are trained to use a pencil or a marker to draw on top of a drawing or a separate piece of paper. Conceivably, in the future, with computers integrated into architects’ training, this may not be an issue. However, at the present time, it is a significant reality that we need to take into account.

iv. Misleading representation:
Lack of accommodation for certain vital information in computer representation could be misleading. For example, most computers do not take the physics of light into account when generating images of a 3D scene. Therefore, most photo-realistic images do not necessarily represent the reality of the situation.

v. Lack of tangibility:
Physical models can be touched, held in the hand, pointed at, and quickly added on to. Technology interferes with doing this digitally!

vi. Lack of accommodation for gestures, body language:
Gestures and body language are important part of design communication. Asynchronous communication over the internet does not allow this.

In our experience the expert feedback online was text based. This imposes an additional burden on the expert to be succinct and be very clear about the portions of the design aspects and spaces he/she is referring to. Regardless, this non-graphic mode of communication could be at times ambiguous from student's point of view. Gross's[1] work utilizing VRML and Java technologies offers promise in addressing the expert feedback (*seek*) issues. Richens and Trinder[4] work at the University of Cambridge using game software (Quake II) for 3D presentation of the emerging building design appears promising in addressing the issues of *seeing* and *showing*.

Conclusions
Of the differences in student learning experiences of design communication with digital media compared to traditional architectural methods, the following seem to be most notable and their effect is debatable:

1) Students need to learn more technical skills necessary for creating digital presentations that may not have a long-term value. i.e., the specific techniques learned can become obsolete quickly.
2) CAD systems impose several limitations on the designer, which the student needs to conquer. In other words, CAD systems do not do what you ask them to do but what you tell them to do. This process forces the student to understand the thought processes that go into design and contribute to a better understanding of the problem.

Based on our experiences, we are encouraged by the potential offered by the web–based design communication. In future courses, we would like to incorporate the following to deal with some of the limitations.

- Supplemental drawings (downloadable and printable across the Internet) to go with web presentations.
- Periodic face-to-face conferences
- Incorporating text descriptors for presentation and for critiques.

Bibliographic Information

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