

DEVELOPING ASYNCHRONOUS COLLABORATIVE DESIGN ENVIRONMENTS: AN EXPERIMENTAL STUDY

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Abstract. Our interest is in the development of design environments that incorporate means for representing ill-structured design knowledge and processes for use in design education. This paper describes the experiment in developing the foundations for generating a new paradigm for digital design studios, allowing significant movement toward coordination and process design.

1. Introduction

This paper describes work in progress for developing design environments supporting collaborative design, one that is able to support a new pedagogical model of design education. We describe our experiment in developing an asynchronous collaborative design environment, in conjunction with running digital design studios in past few years. There are many issues involved in setting up a digital design studio. Rather than focusing on organizing digital design studios in architectural design curriculums, our interest is to develop advanced capabilities and means for representing ill-structured design knowledge and processes in web-based design environments for use in design education.

We believe that most efforts in developing digital design studios have several important weaknesses in support of design education. We are aware of most of the existing efforts to develop multi-user collaboration tools within web environments (Wojtcwicz, 1995; Kolarevic et.al., 2000; Maher et.al., 2000). While there has been a large number of digital design studios that address remote collaboration, studies on how to enhance effective coordination and process design in such a environment have been only a few. Most digital design studios tend to ignore process management issues, which limits experience in dealing with multiple design issues when conflicting conditions arise. Examples include how different building requirements may conflict and how designers interact to resolve the design problem. In this paper, we propose an alternative environment for representing and articulating design issues

supporting coordination and process design. Some of its details, benefits, current status and experiments are discussed.

2. An Experimental Study

2.1. STUDIO1999: COLLABORATION SUPPORT

We started up the Studio1999 by building a web server to provide online access to a persistent repository of CAD models. The contents of the web interface are composed of three schemes. The first scheme is designated for various project-specific design proposals. Each design proposal is linked with up-to-date design data, including design specifications, sketches, concept description, and 3D models. The other scheme is a bulletin board that provides a virtual space for collecting user feedback, discussion, and criticism for each design scheme. In this project, the students were engaged in re-design of elementary schools that had been completely rattled by the earthquake. Remote collaboration was undertaken with involvement of professional practitioners, schools agents and domestic residents. A shared whiteboard system and a message board are also provided for synchronous and asynchronous communication. The interface of this web site is shown Figure 1.

2.2. STUDIO2000: ACTIVE LEARNING SUPPORT

As compared to the Studio1999, the focus of the studio2000 was to develop an easy-to-use design environment supporting active learning. The environment has provided an online case library where analytical design cases could be dynamically posted and shared by the students. The design environment was used in conjunction with a design studio and an entry-level CAD course. The courses were organized by focusing here on three issues:

1. a means for structuring ill-defined information for use in design,
2. coordination of design work progress in multiple design groups, and
3. support for active learning.



Figure 1. An experimental study in the development of web-based design environments in Studio1999 (on the left) and Studio2000 (on the right)

3. Observations and Findings

While the asynchronous collaborative environment is described as a technical background, this paper also addresses the teaching experiment and our observations about the patterns of online behaviors for collaborative learning. From our observations and analysis of the online activities, we found that the digital design studios have long been hampered by several fundamental limitations of current web technologies:

1. Online activities restrict students into standard procedures, starting from uploading drawings, design review, online discussion, to question reply, and then the loop repeats. We argue that online activities are essential part of the design process. However, a strict order of online activities may hinder the opportunistic discovery of the proper information for rapid acquisition of design knowledge.
2. The students learn how to communicate or navigate design information but do not know how to coordinate when conflict arises. The qualitative information and the ill-structured design issues are embedded in the online discussion. The environments do not show how multiple design issues overlap and possibly conflict in multiple design documents. There has been no way to extract and articulate the design issues for use in design.
3. To overcome the barrier of collaborative design understanding, most of the design teams adopt the use of keywords that can be understood by all participants in communicating design ideas. We argue that it is unrealistic to enforce a finite set of keywords to construct interpretations and concepts of the design. Design language must be rich enough to support communication and shared understanding.

4. Learning to Design of the Design Process and Coordination

To address these limitations, we have proposed an alternative design environment for design education. An expanding set of system capabilities quickly arises include:

1. Separation of design process links from users' online activities and active web pages, allowing learning to design of the design process and coordination of various design issues;
2. Incorporating back-end database views into active web pages supporting personal broadcasting, dynamic aggregation of varied multimedia design information across architectural online courses tailored to support individual needs through different learning phases;
3. Dynamic extension of keywords for use in design using XML technology, capable of supporting shared understanding of high-level design actions.

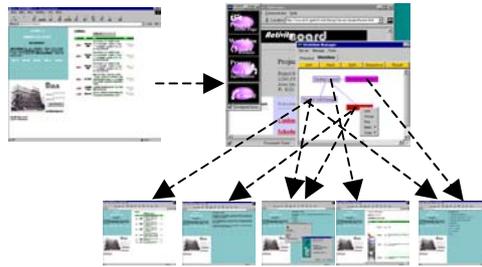


Figure 2: Separation of design process links from users' online activities and active web pages

This project is part of the DECADE project, a long-term project to develop the needed technologies supporting collaborative design. DECADE has included the definition and implementation of a process model and databases supporting it. It includes the development of a database system, a constraint/trigger structure and active database capabilities that manage interdependencies between design activities, and recently, support for coordination among users of the design environment.

References

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