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# Design Desk Critiques: Digital or Face-to-Face?

## Abstract

Internet tools are becoming a legitimate option for conducting design discussions in a global market, but architects are uncertain of how these tools may affect the discussions. The desk critique is an important kind of design discussion in both education and professional practice. This research is employing empirical methods to compare desk critiques. The independent variable in the study is the collaboration medium, which may be either a face-to-face environment or the Internet collaboration software. Pairs of student and instructor participate in sessions with each medium, and their interaction is recorded on videotape. The videotape content is transcribed into sequences of coded events to permit quantitative analysis. Although the research is incomplete, the preliminary results suggest that for some participants and under some circumstances the digital desk critiques are superior to the face-to-face desk critiques. The results of the research may lead to improved methods of conducting design discussion using the Internet.

## Resumen

*Las herramientas Internet se están convirtiendo en una opción legítima para las discusiones del diseño que conducen en un mercado global, pero los arquitectos tienen incertidumbre de cómo estas herramientas pueden afectar las discusiones. La crítica de escritorio es una clase importante de discusión del diseño en la educación y práctica del profesional. Esta investigación está empleando métodos empíricos para comparar críticas de escritorio. La variable independiente en el estudio es el medio de comunicación, que puede ser frente a frente o software Internet. Los pares estudiante-instructor participan en sesiones con cada medio, y su interacción se registra de en videocinta. El contenido de la videocinta se transcribe en secuencias de acontecimientos codificados para permitir el análisis cuantitativo. Aunque la investigación es incompleta, los resultados preliminares sugieren que para algunos participantes y bajo algunas circunstancias las críticas digitales sean superiores a las críticas frente a frente. Los resultados de la investigación pueden ayudar a producir métodos mejorados para conducir la discusión del diseño usando el Internet.*

## Introduction

As the practice of architecture becomes global in scope, Internet tools are becoming a legitimate option for conducting discussions in support of collaborative design. Although there has been some research directed toward the impact of Internet tools on collaborative design, very little research has attempted to determine rigorously the impact of new collaboration tools on design. Empirical research methods can provide evidence that is valid and verifiable.

One kind of collaborative interaction is the desk critique (or crit). Key to both architectural education and professional practice, the desk crit provides one-on-one interaction between a mentor and an apprentice, or an instructor and a student (Anthony 1991). Our research method is to observe the interaction between a student and an instructor during desk crits, using both face-to-face meetings and computer-mediated meetings. Our intention is to identify what makes a good desk crit in either situation and how the two situations influence the interaction between the participants. The results of the research may help designers to be more aware of the content and patterns that are desirable in design discussions and how to apply Internet collaboration tools to design. Our findings may also help software developers to improve Internet-based collaboration tools and to adapt them to better support design discussions.

The research is motivated by recognition of trends toward globalization throughout industry. Architectural practice must address a global market even as other industries expand their scope beyond regional and national limits. The Internet provides new opportunities by which architects can reach beyond a geographic region. Using e-mail, the Web and other information technologies, a design firm can expand market positions throughout a nation and across international boundaries. Communications and discussions can be made much more efficient by using Internet tools and eliminating some of the travel required for face-to-face meetings.

## Collaborative architectural design on the Internet

The use of the Internet in support of collaborative design in the form of *virtual design studios* has been widely studied. The concept may have its origin in experiments that allowed students in a design studio to share images using networked databases (Van

Bakergem 1990). Early experiments involved sharing files through File Transfer Protocol (FTP) and conversing through e-mail in the context of a digital design studio (Wojtowicz et al. 1993). More elaborate experiments have expanded the scope to multiple time zones and complex design teams, and explored additional technologies such as audio conferencing and shared whiteboards (Cheng et al. 1994). Other virtual design studios have employed dedicated cable video lines to provide high speed and intensive synchronous interaction (Vasquez and Trigo 1997). With the proliferation of the Web, virtual design studios can exploit very rich exchanges of information through Web sites that are built collectively. Web sites backed by databases have further expanded the richness and complexity of project information available to designers. One experiment used databases to store the changing state of designs and enable designers to “hand off” the project every eight hours to a new team in a new time zone (Kolarevic et al. 1998).

While early experiments in virtual design studios have focused upon exploiting existing technologies, other research has attempted to invent new technologies to support collaborative design. Web-PHIDIAS uses an argumentation approach to support and document design reasoning for collaborative projects (McCall 1999). A prototype software system has been developed to provide for annotating (or “redlining”) a 3D model that is shared over the Internet (Jung, Do and Gross 1999). The tool uses Virtual Reality Markup Language (VRML) as a representation format so that users can manipulate the view of the model interactively as perspective projections.

## Research methodology precedents

The reports of virtual design studios have been largely descriptive. Very little work has applied rigorous empirical research methods. Studies in computer-supported collaborative work (CSCW) help to define the questions that must be addressed and have provided precedents for research methods.

Media richness theory suggests that communication media can be characterized in terms of “richness” and that richness influences media choice and communication process (Daft and Lengel 1984). Users prefer communication and collaboration media that are rich over those that are lean. A medium may be characterized as “rich” or “lean” based upon: a) the availability of instant feedback; b) the utilization of multiple cues such as body language to convey interpretations and feelings; c) the use of natural language rather than numbers to convey subtleties; and d) the ability to present individual tailored messages (personal focus). Face-to-face communication is the richest medium.

Interaction analysis is a way to collect data regarding the use of media in communication or collaboration (Jordan and Henderson 1995). The basic method is to stage situations in which people interact (such as solving a problem) and then observe the interaction. The sessions are videotaped. A team of researchers collectively watches the videotapes, commenting and generating interpretations of the interactions. In a further refinement of the analysis, the tapes are transcribed into coded segments. The coding for multiple sessions can then be analyzed statistically. The method has been applied to architectural collaborative design in a study of how pairs of students used Microsoft NetMeeting to solve a design problem (Al-Qawasmi et al. 1999). Videotapes have been used to analyze sessions of designers at work to reveal patterns in the content of design activities (Purcell et al. 1996).

Another relevant research precedent derives from software usability research. The most fundamental method in usability research is user testing, in which alternative software user interfaces are compared by observing how people use the software to solve a problem (Nielsen 1993). The time required to perform the task is a typical metric, as are the number of errors or the number of tasks accomplished. Several trials are conducted with different users to control for variability among users. The results of the trials are typically averaged to produce a composite rating. Although larger samples of participants can lead to more confidence in the results, very small samples (such as three to five participants) often provide very helpful results.

User testing has been adapted to address questions regarding the effectiveness of Computer-Aided Design software (Clayton, Fischer and Kunz 1998). This “Charrette Test Method” has been applied to compare a software-aided process for solving an integrated design problem to a manual process.

## Design methods

The question behind this research is whether Internet tools substantively alter the design process when compared to conventional face-to-face collaborative design. Published characterizations of the design process can serve to guide the observations and analysis.

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- Many researchers have speculated upon the patterns of cognition in the design process, whether in architectural design, product design, mechanical engineering, or another kind of design. Several characterizations of the design process have earned widespread recognition. Three high-level activities can be distinguished within the design process: analysis, in which the designer defines the problem, synthesis, in which the designer generates one or more solutions, and evaluation, in which the designer tests a solution against the criteria defined in analysis (Asimow 1962). Another insight is that design involves a combination of actions and reflective moments (Schön 1987). This theory of "reflection in action" has arisen from meticulous observation of designers at work and design instructors teaching students. Other researchers have ascribed great importance to the acts of drawing (Laseau 1989). The theory of graphic thinking suggests that design cognition cannot be separated from drawing.

## Point of departure

In most of the previous experiments, the participants are peers. The collaboration is among three or more students, all who are acting as architectural designers. The experiments have a relatively extended duration of several days or weeks and involve several sessions of interaction. These characteristics are descriptive of the interaction within an architectural design team over the course of a project. However, interaction in architectural design may also involve participants who are not peers; an architect may interact with a consulting engineer, or an architect may interact with a client. Our research differs from related projects by focusing upon the interaction between an instructor and a student in a single session. The scenario behind the research is analogous to a discussion between a chief designer and a junior designer.

This research is further focused upon existing, commercially available software tools. Microsoft NetMeeting is being used as a collaboration support tool for designers. The software provides the following "channels" for communication:

1. File transfer. Participants can copy files across the network.
2. Chat. Participants can exchange typed messages nearly instantaneously.
3. Video. When using a computer equipped with an Internet video camera, NetMeeting users can share real-time motion imagery, although at a low frame rate and resolution.
4. Audio. NetMeeting provides Internet-based telephony.
5. Whiteboard. Participants can sketch on the same virtual surface at the same time.
6. Application sharing. Participants can share a compliant program, such as AutoCAD 2000, so that any participant can take control of the same instance of the program and issue commands. All participants can see the program even while others are issuing commands.

Our research methods are more rigorous than those used in most architectural research. Rather than informal observation, we are using careful protocol studies using videotapes of multiple sessions and controls for user variability. The analysis of observations includes study of the graphic artifacts and the patterns of design activities that are documented by the videotapes.

## Experimental design

This research compares face-to-face desk crits to digital desk crits by observing designers acting in multiple design sessions. The research method combines the Charrette Test Method with interaction analysis. The independent variable in the study is the collaboration medium, which may be either a conventional face-to-face environment or Internet collaboration software. Pairs of student and instructor participate in two sessions for each pair, one with each medium. Their interaction is recorded on videotape and the artifacts of the interaction are collected. The videotapes are analyzed to distinguish time segments and are coded according to categories of activity. Both qualitative analysis and quantitative analysis are used. The coding is then aggregated and studied using statistical methods to uncover patterns and correlations. The statistical data is then further analyzed to reach conclusions regarding causal relations. Finally, a survey of the participants collects qualitative impressions of the experience that can be further analyzed and provide indications of reliability.

The participants in the study include four Professors in the College of Architecture and 20 undergraduate students. Each pair of instructor and student participates in each of a face-to-face desk crit and a digital desk crit. All sessions are part of regular class activities in design studios. The face-to-face desk crit takes place at a student's desk and employs a drafting board, pens, and paper. An overhead video camera records the artifacts on the draawing board while an eye-level camera records personal attention. The digital desk crits are conducted using computers and Microsoft NetMeeting so that the student and the instructor are in separate rooms. The participants have available not only NetMeeting,

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but also AutoCAD 2000 employed in a shared application mode. The sessions are recorded using a scan converter that feeds the display signal to both the monitor and a video cassette recorder.

## Hypotheses

Our working hypothesis is that the digital desk crits will be in large part similar to face-to-face desk crits. Each approach will have strengths and weaknesses. The research has been designed to test several more detailed hypotheses:

**1. The computer technology will be less effective than manual methods in supporting graphic thinking and graphic communication.** Most architects and instructors argue that hand sketching can better support creative activities in design. This research is producing examples of graphic output from either medium to enable comparison. 3D computer graphics may prove superior to hand sketching among students and instructors who are skilled with computer tools.

**2. Substantially more time will be required to manage a computer supported desk crit than is required to manage a face-to-face meeting.** By examining the videotape records, it should be possible to differentiate between time spent discussing actual design issues and time spent collecting materials, negotiating the agenda and dealing with the apparatus.

**3. The computer technology will be less effective in achieving a shared understanding than a face-to-face meeting.** By studying how rapidly the participants move from one topic to the next, it may be possible to determine how rapidly understanding is achieved. Due to the diversity of channels, the power of the whiteboard, and an ability to create an audit trail of the discussions, it is possible that the evidence may contradict this hypothesis.

**4. The digital desk crits will produce more complete documentation that can be applied to project refinement.** On the surface, the digital desk crits appear to produce more thorough and usable documentation than face-to-face desk crits.

**5. The computer-based desk crits will be no less or more productive than the face-to-face desk crit.** The software will support consideration of the same number of design issues as the face-to-face desk crits. By examining the videotapes, the results of the crits, and the subjective surveys, it should be possible to achieve a general, although imprecise, indication of overall productivity.

**6. The computer-based desk crit will be less enjoyable.** Experience using computer tools suggests that there is inevitable frustration and cognitive load associated with interacting with a computer. However, for some people Web-based chat rooms and rapid e-mail exchanges are very seductive and satisfying. The follow-up survey addresses this issue and will provide statistical evidence.

## Conclusions

Although trials are still being conducted, some tentative conclusions can be offered. Instructors and students find it easy to learn NetMeeting and adapt it to desk crits. Training and practice leads to more focused discussions and fewer distractions caused by the computer systems. The whiteboard appears to be a very effective tool for grounding design discussions. The video channel is unsatisfactory due to performance problems, but may also be less useful than other channels. Video does not seem to be important in that even face-to-face desk crits appear to make little use of eye contact and visual attention upon the other person. Although the audio channel appears to be very effective in allowing users to draw while they talk, use of the chat channel produces better documentation. In general, the documentation produced by the digital desk crits is more extensive and better organized than the documentation produced by the face-to-face desk crits.

It is unclear whether face-to-face desk crits are better than digital ones and vice versa. This is significant. If there is no strong difference between the media, then the digital media should be considered superior for many applications due to reduced travel costs and the potential for more frequent sessions.

Desk crits themselves seem to be less structured than one might assume from design methods theory. Checklists or special software could guide the desk crit process and provide more consistently high quality.

The research is significant to innovative design education that allows faculty and students to be geographically distributed. It should also be of interest to practitioners who are considering the use of Internet technology for discussions with clients, among consultants, or with employees at remote locations.