The Media Space: a research project into the use of video as a design medium

by Steve Harrison and Scott Minneman

Xerox Palo Alto Research Center
The Media Space: a research project into the use of video as a design medium

by Steve Harrison and Scott Minneman

a technical report of the Xerox Palo Alto Research Center

We seek to improve design processes by enabling better communications within the design process.

The communication needs of designers are increasing as their projects become more complex and design teams become distributed; the communications solutions available to designers may have profound changes on the way design is practiced.

We believe that design is a social activity—the interactions of individuals within groups and the relation of groups to one another. Another way we express this point of view is to say design is the social construction of a technical reality.

Video—unlike text, drawings, and computing—delivers the experience of being and working together. It can take you somewhere else and somewhen else.

We have developed a collection of prototype electronic environments to enhance communications between designers. These workplaces are called "Media Spaces"—environments that support both real-time connection and the creation and management of video documents. Media Spaces are made of audio, video, and computing systems that connect designers across time and space.

We use these environments as the settings for case studies of existing practice in a variety of design domains. The analysis of these studies yields some insights into the nature of communications and documentation in design, in particular about the relation of public and private behavior in design.

Motivation

The study is motivated by two observations:

Observation One: design is a social activity, carried out among people working in a group.

This is most visible in the architecture of the drafting room; the continuous open space, the piles of drawings for all to see and share, and the work culture continuously promoting an awareness of the activity of design team members and the progress of the project. Usually, work goes on separately, designers drawing at their drafting tables. But it is open work, available for kibitzing or impromptu review and explanation. The people share the space and are part of the "team".

But not everyone works in the drafting room. What happens to design when people become cut off from each other by walls, miles, or time zones? How can designers work with other designers, with consulting engineers, their clients,
or contractors without being present? Design activities become discontinuous—fragmented by meetings, telephone calls, and presentations made across town (or half-way around the world). Frequently, this results in bureaucratization of process that stifles creative activity. The distances and discontinuities are increasing as we build more complex artifacts that are further removed from the offices of designers, clients, manufacturers, and suppliers.

**Question One: How can we do design at a distance?**

*The social nature of design is seldom so clear as when designers are hunched together over sheets of yellow tracing paper. While this scene is common in small design projects, opportunity for this kind of interaction is rare in larger and more complex projects.*
Observation Two: video will soon become a pervasive part of the communications network and more integrated into everyday office practice.

In trying to find a technological answer to the question posed from observation one, we explored existing uses and upcoming changes in telecommunications technology. Signs of this change are already visible:

- Phone companies and cable television networks are beginning to install fiber optic wiring and advanced switching services that can handle some kinds of video.

- Video and computing equipment are colliding into what is emerging as "desk-top video". Video equipment continues to get smaller, faster, and cheaper with more functionality. (Note the explosive development of VCRs.) Business equipment is getting "smarter" and more ubiquitous. Single person design offices can now afford a computer, even one used for CAD. Already, inexpensive pc's are combined with vcr's to create limited-distribution promotional videos.

- Teleconferencing, once the province of Fortune 500 companies, is rapidly getting more affordable. The technology for compressing a full-motion video signal is continually moving forward—sending better quality images over less-expensive lines. Instead of requiring special-purpose teleconferencing rooms, the equipment is compact enough to be put in any meeting room. Various compression technologies (such as DVI) are even beginning to show up as single chips that will be integrated into other equipment.

- Video is becoming more legitimate in the workplace. Video-based training systems are used in many large institutions to bring "reality" to instruction. Some companies distribute videotape annual reports, and management reports to far-flung employees now come as slickly-produced tapes.

What will design be like when video communication networks are as pervasive as the phone system? What form will change orders take if editing video recordings becomes as easy as word processing? What will the relation between clients, consultants, contractors, and designers be if they all appear to each other to be working together in one large studio created by video technology? Will the experience of designing change?

Question Two: How will design practice change as result of these new technologies?
Design

Our first observation is that design is fundamentally a social activity. The purpose and effect of this social activity is to establish and maintain a shared understanding among the participants. The communications between designers manifest the development of this understanding. Focusing on design as communication, rather than information processing or problem solving, has profound effects on both how to view design process and how design will change as communications technology changes. [1]

To answer the question of how design will change, we need a description of the social nature of design. By its nature, social process is messy and active, constantly evolving, interactive, and ill-defined. However, it can be characterized by a few phenomena. These phenomena are well served by the video medium.

Experience

To use objects is to experience them, so design is the creation of experiences. The creation of the experiences is done indirectly and suggestively, but almost always in visual and tactile terms. The confusion of the image with the thing itself is very powerful and is a fundamental tool in the creative repertoire of design. The experience of creating that experience — of constructing the intersection of dreams and reality — is done through drawings or models. It is through the images that we get back to the experience or try to convey some sense of it to others. So too with design process: video images of design activities

The unstructured activities of sketching and talking together help create a shared understanding among participants.
can afford us the immediate experience of the design process, regardless of time and space.

Ambiguous Communications

A critical component of creative interplay comes from ambiguous communications. Creating something new requires an ambiguous set of perceptions—otherwise only the previously understood comes into being. Pinning things down early in a design process runs counter to innovation at later stages. It squeezes out the element of surprise and restricts alternate interpretations. Design works in the tension between explicitness and implicitness; therefore, ambiguity is a common and healthy characteristic of communications in a design group.

Two kinds of ambiguous communications are fruitful: confusion between the symbol and its object, and multiple meanings for the same symbol. Ambiguity and misunderstanding lead to a colorful, exciting world. Any complete model of a design process must be capable of reflecting the uncertain, fanciful, and ambiguous states of our minds. Video is a transparent medium conveying the implicitness of nuance, gesture, and presence. [2,3]

Negotiation as Modus Operandi

The members of a design group represent various interests, and in the course of designing, they confer with each other to reconcile their interests. In this sense, designing can be understood as negotiation. In the early stages of a project, negotiation frequently involves decisions that affect the scope or direction of the work. In the later stages of a design project, participants usually are more aligned and the negotiation addresses details. Observation of designers in action reveals that virtually everything about a design problem is negotiable. Video is well suited to the sorts of interactions found in most free-wheeling negotiations. [3,4,5]

Enrollment of Participants

This research is aimed at the typical medium size design consultancy. Even the "individual designer" collaborates at various phases of a project with engineering consultants, clients, and suppliers. At various times throughout a project these participants function as a group.

Participants become part of a group and must maintain working relations within it. They do this by "buying into" the goals of a project. Enrollment has a quality of ownership, a personal investment in the emerging artifact. This personal investment results in each participant wanting the artifact to reflect the results of their negotiations. From our work, we have seen how people can act as belonging to a group through both real-time and recorded video interactions. [4,5]
The Failure of Computing

Computers have been promoted as a tool for doing design at a distance. After working with computers for many years, it has been our experience that computers poorly serve the social processes of design, and therefore lack the essential capability to serve a distributed group. CAD is a very useful documentation tool, but it has not proven itself equally useful as an open-ended design tool for architects. The visual and dynamic nature of design makes it particularly unsuited to textual or computational representation. The computational environment—like its progenitor, text—generally eliminates multiple meanings. In doing so, it creates a static set of ideas that leave little latitude for expression and interpretation.

This same requirement for precise specification also makes CAD hard to work on together. It works best when most rigorously structured along the functional lines of the design organization (body shop, electrical, mechanical, and assembly), and the conceptual hierarchy of the object (modules, assemblies, and parts). Within each one of these layers, only one person can "drive" at a time, preventing simultaneous interaction between designers on the same object. This partitioning also blocks access to the gestalt of a design—it must always be seen as the sum of its constituents. Losing the gestalt, in turn, blocks shared understanding and further distances designers from the project and each other.

Computers also fail designers because communications through them are unrealistically bureaucratic. The cost of the seemingly infinite malleability of computing is regimented compartmentalization. To make effective use of computers, the communications must reflect the same compartmentalization. The collective activity of design cannot be experienced through computers; things cannot be said ambiguously through computers; positions cannot be negotiated through computers; and people remain estranged from, not engaged with, the group through computers. The fluid and shifting relationships between people that are so clear when pencils and hands dart across sketches are lost on PERT charts and CAD drawings.

The Promise of Video

One answer to the first question, "How can we do design at a distance?" is video. It can change the nature of work by:

- connecting across space. People and places can be brought into the design studio enlarging it to the limits of the electronic network.
- connecting across time. People who must be in two places at once can be brought into the design studio through recording. Events can be re-experienced.

Some Current Uses of Video

A survey of current uses in the profession today reveals that the properties of video have not gone unnoticed in the profession; video has already found a place as a documentation and presentation tool. Almost all of this is the result of availability of high-quality portable recorders ("camcorders") that permit designers to "do it themselves." They can:
Document Existing Conditions

Especially useful for modifications to existing products, video can show the reality of actual product performance. It can take back to the office the play of sunlight across a well-finished contour or wheels that unnervingly leave the ground. Designers can use these records as a jumping off point in their work, rather than making up how real products behave in the real world.

Survey Users

As a data collection tool, video may be used to show how people work and live. Usually, this data is then distilled as part of the analysis and is not delivered as part of the final report. Most of this use has been to collect documentation on special cases, where access is otherwise restricted, such as in-field focus groups. Not only does it provide user input "on their own turf", it also delivers the context of their comments. It can even provide a detailed, visceral record of how people use existing artifacts.
Document the Manufacturing Process

Using video to observe the manufacturing process can preserve techniques and skills that may be integral to the qualities of the finished product. This record is useful for coordinating design intent with final product, for improving manufacturing processes, and for educating designers. The major limitation in this use has been the potential to upset the often-fragile working relations at the manufacturing site.

Making Client Presentations

One last use, presentation and promotion, is commonly employed by design professionals. However, the technology has generally not been under the control of designers directly, but instead turned over to video professionals who bring the persuasive illusory power of video to create slick client presentations and video "brochures". High production values, derived from broadcast and advertising, require high capital investments and special skills.
Some Future Uses of Video

We can already see some of the first uses of the next generation of technology (videodisc and hypertext systems, desktop tape editing stations, and inexpensive "smart" VCRs and TVs) and its impact on design. The next generation will include:

- product literature libraries. Using robust hypermedia systems, product literature would be available that showed form, function, and maintenance that is cross-referenced and automatically updated. It would be possible to answer the question, "What is it like to use this valve?"

- simulate the experience of environments. Combining drawings, models, computer graphics, personal presentation, and libraries of images, video could provide for more convincing environmental simulations.

- document the design process and connect participants. This has been the main focus of our research and development efforts creating a prototype distributed design environment called the Media Space.

The Media Space

So, what will practice be like when there is a ubiquitous video environment? To explore that question, we built a demonstration design environment which we call "Media Space". We use it everyday as part of our work space and as the test bed for our studies of design communications.

What is a Media Space?

It is a system that integrates video, audio, and computer technologies, allowing individuals and groups to create environments that span physically and temporally disjoint places, events, and realities. It is also a way of working—of being "media aware"—that brings the illusionary power of media into everyday work.

No, Really, What is a Media Space?

In a physical sense, cameras and monitors are placed near drafting tables, desks, conference tables, CAD stations, diazo printers, and coffee pots—wherever people gather at work. The cameras and monitors are linked to each other and to recorders and videodisc players that provide a library of interactions that can be retrieved as an integral part of routine work. These local area audio and video networks can be connected together in remote point-to-point configurations. Subsets of the larger group can then connect themselves together to form project teams that are in the same virtual room or out to a remote location like a job site.
The video can be used as an open window from one space to another and, by using recordings (both videotape and videodisc), from one time to another. Instead of physically relocating, virtual groups can be formed by reconfiguring the electronic connections between offices. Video images keep the participants in touch with others who are absent—temporally, physically, or both. Media Space defies walls and clocks.

Coordination of the connections is accomplished using the networks of computers that are already in the workplace for word processing, accounting, project management, and CAD. In addition to controlling access to devices, they are used to organize the video records of the design activity, index and access the recorded material being collected and viewed, collect data about how the material is accessed, and provide groups with the ability to mark their activity (flagging places in their process they or others might want to revisit).

Combining recording and real-time connection has a great systemic synergy: adding a recording capability to real-time connection is cheap and provides a useful journaling service to users, and having retrievable recording makes real-time connection much more than a “picturephone”. For example, we frequently use this facility in our everyday work to record meetings that someone else might have a peripheral interest in. By watching snippets of the recordings, the absent individual can stay apprised of an activity without a big time investment. [6]
Case Studies

What happens when designers actually work in a Media Space? We study actual design projects set in the Media Space, openly intervening in their communications. The methodology is a kind of participatory observation. The means of communication are visible to the participants and under their control. For example, wherever possible, the participants are responsible for pointing their own cameras. Recordings of the actual communications form the basis of the research data. The case studies and technological explorations are closely coupled, each informing the direction and scope of the other.

These case studies, along with other ones of designers in different disciplines, have been reported in more detail elsewhere.

House Addition Design Project

A small architectural design project was tracked from conception through building occupancy using video to record the project. The recordings depict aspects of a design process that are nearly invisible in computation-based records and demonstrate the possibility for using video to provide connection within a design group. Designers and client used video recordings to track design decisions made in their absence. [7]

The Office Design Project

Using the Media Space to simulate regionally distributed offices, we had three architects collaborate on a design project. Using video, the architects worked the design to completion without meeting face-to-face. [4]

Careful consideration was given to simulate a real design project. The designers were given a program by a client. Developing the design in a two-day charrette, the project, a conceptual design for a new kind of office, was then presented to the client.

The program, the introductions of participants to each other, and the presentation by the designers to their client were delivered through videotapes and videodiscs. The Media Space provided live video connection during the charrette so they could talk and draw together from their separate offices. Besides simulating a high-bandwidth connection between the architects' offices, it provided a shared videodisc library of their reference material, paper prints of the real-time and video disc images, and recordings of all their interactions. The recordings of the deliberations in the charrette were edited to form the core of their presentation to their client.

The three designers were able to design effectively in this electronic workplace and they felt the artifact that they designed was constructively influenced by working in a video-based environment. A few phenomena of note were:

• when the designers started the charrette, they behaved as though they knew one another,
having become acquainted with each other only through videotaped interviews;

- the designers learned to operate in Media Space without much training;

- the designers were focused on the design task while working in the Media Space;

- design history became design rationale—the design was described to the client in terms of the process of its creation by showing videotapes from the charrette in their presentation;

- the client became engaged with the experience of the design process through videotape replay; and

- the designers expressed some preference for electronically mediated relations over face-to-face relations since it permitted them to draw together from the privacy and convenience of their own drafting table and to be visible and active in the group while working privately.

Three particular qualities of a Media Space were observed that create and sustain social relationships in a design group: extended awareness of other members of the group, image-based familiarity, and the representation of process. [5]

In this charrette, three architects work together in separate locations, meeting only through video. The Media Space also provides a shared library of video scenes, a log of events to aid in retrieving recordings, and hardcopy images. The recordings of the work are both a journal that they use in their design work and one that we use in our design research.
Design Communications Workshops

A series of workshops with industrial engineering designers explored issues surrounding training of designers to make effective use of media in complex work group settings. The workshop simulated the product planning process within a manufacturing company with the participants playing roles in the company's marketing, engineering, and manufacturing divisions. Each division had to communicate with the other two, resolving ambiguous project roles and goals, and negotiating design decisions.

The workshop focused on the use of video to support the interactions within and among the company's divisions. As with the Office Design Video Project, the communications between the designers were carefully structured and the effects identified. The study investigated the way small groups of designers behaved when working together, and the suitability of video to substitute for the physical setting for that behavior.

The groups sent video "memos" to each other. They were quickly made using camcorders and vcr's. The memos conveyed some sense of the degree of agreement on various points and overall intention within a group. Groups began to get a sense of all the members of the project and understand how they "fit" within the development of it. Video memos also allowed distant designers to "get inside" and point at specific problems they were having; they could show what was wrong and how they proposed to solve it by pointing and talking, just as if they had brought the machinery into the design studio.

Groups of designers play the roles of Marketing, Manufacturing, and Engineering in a small manufacturing business. Over the course of an afternoon, the groups must interact in order to complete their assigned tasks. They communicate by sending an emissary, written or drawn messages, or videotape recordings to each other. Each group also prepares and circulates a videotape status report at hourly intervals.
Control of the communications technology was vital to the functioning of the groups and to individual effectiveness within a group. Some participants preferred to remain "off-camera", but found that they could positively change their relations within the group if they could control the "story" that emerged by being responsible for pointing the camera and selecting images. In addition, some participants became aware of the effect of their own appearance, speech, and other forms of personal presence on the interactions in design development. The workshops helped train them in skills of effective presence and distribution of their working image. [8]
Observations About Video as a Medium for Design

The Media Space is more than the technology. It is a way of working using electronic technology to warp time and space, to bring the illusions of film, radio, and television into everyday work settings. It is believing that an emphasis on communications will extend the common experience of the group, thereby improving both the process of design and the design of buildings. The research suggests that video can:

- document the design process. By recording design activities and indexing the recordings in coordination with the development of the design, a usable design history can be kept that maintains design rationale.

- connect participants. Project teams can be sustained over distances and across organizational lines through live video images. Designers, clients, consultants, and contractors can work in an extended design studio for the duration of a project through the use of cameras and monitors.

In addition to formulating specific technology development recommendations, the research has uncovered some particular observations about video in design:

- The medium retains many of the vital qualities of face-to-face interaction (ambiguity, negotiation, visual communication) that are lacking in computers.

- The necessary facility to both use and act effectively in video can be acquired quickly by designers and integrated into work practice.

- The use of real-time video connection can result in an intense task focus.

- Some people resist being recorded on video and do not cooperate in its use; of these, some lose their resistance if they see that video is under their control and can serve them. This may require development of additional skills.

The effect of all this is that backstage is brought onstage. Video tends to diminish the distinction between public and private. By making it more convenient to capture and replay casual elements of design activity to improve design process, formerly private activity is given public display. Standard forms of interpersonal relations change when the answer to "Why is this so?" is a video recording of the design process. The significance of individual roles diminish with a concommitant rise in the importance of being part of the action. [9]

As a process representation, video carries the content of the work process, references to the design documents and other artifacts (at times becoming an artifact itself), and the social process between the designers. In video form, all these separate kinds of actions are represented together without distinction, in marked contrast with the highly regimented symbolic representations of computerized project management systems.

If this vision of the design practice comes to be, then the nature of design documents, manufacturing observation, project participation, and the relations with other designers will be changed. The settings and rituals of design will change. The issue is message of the medium—the medium's effect on individuals and the way they work together. [10,11]

Ideally, the preceding should have been presented in video form. The experience of the video itself would have conveyed the force of the arguments we're making in a direct visceral way that the process of reading ultimately cannot.
References


