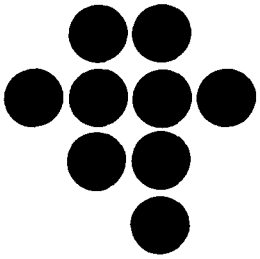

COMMUNICATIONS
FORUM

MULTIMEDIA WORKSTATIONS

November 9, 1989

Seminar Notes

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

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Andrew Lippman, MIT

Michael Liebhold, Advanced Technology Group

David Backer, Fluent Machines

Mark Laff, IBM

Antonio J. Botelho, Rapporteur

Andrew **Lippman**, MIT, opened this session of the forum by saying that people in academia and in government (specifically DARPA) have been working in the area of multimedia workstation for over 15 years. Recent interest in HDTV has brought renewed attention to the area. TV and computers are about to merge. There are more reasons to have a computer in a TV than the other way around. Today the TV in the home has a computing component with the VCR, but it remains analogue and the viewer still does not control the storage media. The underside of the story is the addition of video to the workstation. Experiences of integrating computer with videodisc started back in 1976. Nowadays, in 1989 where is the great multimedia infusion in the workstation we should have seen?

In the last ten years we can identify two gating functions that may have acted as inhibitors. One is the technology; videodisc was too big and had compatibility problems. The second is the lack of imagination. We do not know how to interact with things that are moving; we have neither the technology nor the language for doing so; we do not know how to deal with interaction in video. The situation today is that the technology has advanced to the point (HDTV, CDI) to be introduced to the public.

The first speaker was Mark **Laff**, of the User Interface Institute, at the IBM Thomas Watson Research Center. **Laff** said that his talk would be about his work with the Interactive Media Project at IBM: User Interface Issues in Multimedia in Workstation.

Many years ago multimedia efforts were slides, multiple screen movies, special effects with polarized filters etc. Today one of the key problems that the new multimedia computer capability has introduced is the information transfer issue - communicating the content to the end user. The new multimedia capability enables a broader communication channel which deserves better understanding.

Laff explained that one approach this study is a set of design guidelines - what works and what does not. The objective is to understand multimedia as a grammar, just as people have done with film. Some of the features of that language taken from film are cuts and dissolves, which the author uses to convey different ideas, for example different time frames. However, guidelines alone are not enough to create a good multimedia, for there are many situations in which design guidelines do not guarantee good designs. Some techniques that have been tried are music and moving image, to appeal to memories and emotions; and storytelling, to put the viewer in the story. A storytelling technique would be very effective in conveying the essence of a design.

Laff explained that the project has been trying out these techniques in real life situations as a test. One experiment is the research information kiosk and another, the computer science electronic magazine. Both experiments are packed in a touch screen videodisc-based electronic system in the research center lobby. The goal is to deliver this system to everyone's desk in the center. The technology is four year old IBM InfoWindow technology, the images are still poor but will get better.

Next **Laff** showed a short videotape of the system in action. One function of the system is a map of the building through which a visitor can locate people's offices in individual floor plans. The system also helps locate other services in the building such as copiers, cashier, cafeteria, medical department. Other information offered is a map of how to drive to local airports, that can be printed out. For people browsing there is also an online calendar with talks and conferences taking place and information about IBM in general, IBM research and different programs in computer science research.

The other experiment is the electronic magazine, based on laserdisc in contrast with the graphics-electronic kiosk. One effort to be tried in the future is to add video on the laserdisc to other segments such as the driving directions. In the electronic magazine the user presses a button to find out all the locations for IBM research worldwide, and then presses a video button which introduces a video segment on the research at that location. There is also an abstract of the video article and a reference bibliography. The goal is to put out the video magazine several times a year and to use the articles in it as an experiment. All the video segments in the disc are produced internally.

Laff concluded that one thing it has been learned is that if software is hard, then interactive video is one thousand times harder to produce and control. A second issue is provide tools that lower the technological boundary to producing these videos, less expensive equipment which requires less specialized knowledge to operate. This is important because one of the main goals is to offer the possibility of people being capable of authoring multimedia on their desk. It is chiefly an user interface issue. In order to

convey some of the problems of producing video, **Laff** showed a small segment, using the storytelling technique, of himself producing a video with professional equipment. He indicated that editing is very time consuming and involves many different steps. A computer with the right user interface could be helpful in this phase.

Laff summarized his presentation by stating that his research group at IBM has been interested in three main issues: 1- work in the medium to understand what the design guidelines are; 2- develop tools for making it easier to work in the medium; and 3- user interface studies to discover what works and what does not.

The next speaker was Michael **Liebhold**, manager of hypermedia research with the Advanced Technology Group, Apple Computer. **Liebhold** presentation was on the multimedia workstation in the context of the evolving technology of the future, distributed computing and high speed networks.

Liebhold stated that he assumes the multimedia computer as a desktop supercomputer, a standard platform with high resolution display and interactive graphics capability. The platform should be able to process many types of video: from 64k video running on ISDN telephone lines to 1.5M video running off CD-ROM or SCSI hard disk to 22-50M video for broadcasting to 50-100M for HDTV. The problem for Apple is additionally complex because the scan rate of the video display of its workstations is not very compatible with the NSTC rate.

One of the fundamental assumptions underlying future developments in this area is a dramatic transformation of mass storage from optical storage in CD-ROM towards high capacity read and write disks. Future erasable optical discs will have much better data transfer rate, crucial for video than current CD-ROMs. Another major transformations is from a static to a cinematic computing environment. This means that the screen display will feel and look like a very good interactive television. Still another dramatic change will be in the way we view information: from linear to hyperknowledge. Now we have the ability to create hypertext with the capability of getting further and further information, for example, from footnotes or annotations that can be text, cinematic or acoustic. There ia also the emerging capability for having annotated cinema, the ability of having a piece of video that is annotated by hyperlinks. As you are watching the show you can stop and click on a piece of video and have a reference pop up.

Next **Liebhold** remarked that a final important transformation is made capable by evolutions in mass storage capacity and network linkages is that the computer environment has changed from a data-impoverished environment to a data-rich environment. Today you can put the entire census of the United States in a CD-ROM.

Liebhold said that all this compels a multimedia document editing environment to bring together this diverse range of data types. One factor here is that multimedia data is temporal data, so you have to have the ability to time, synchronize and choreograph data chunks. There are different memory bandwidth requirements, different user interface and

output requirements for different data types. Apple is evaluating at the video post production process of editing. By the way, the McIntosh is becoming increasingly popular as an editing control machine with system integrators in this area. User interface issues are really crucial. Montage style editing projects have been developed at MIT (using "micons") as well as at Lucasfilm. There are still a lot of problems to be solved in this area: resolution, pictorial representation of sound, etc.

Some of the new applications of this new multimedia are educational hypermedia (electronic books, video manuals, simulated laboratories) , reference and training business and design simulations (Harvard Business Case), numeric simulations, scientific visualization and data analysis, interactive movies, and architectural visualization and design. For some of these the consumer market will not happen very soon, but they already have niche high-end applications. A problem is that you do not know what is going to happen with the hypermedia user interface if you do not have a way to discriminate interactions before you plunge into an hypermedia interaction. Take the case of a satellite view of a city and think about how much data and reality represented there and you realize that you clearly want to filter that data before you interact with it.

Liebhold remarked that another major transformation in the multimedia platform is the network. There is ISDN "around the corner" (ten years after announcement) and shortly on its heels broadband capabilities, which allows for media transmission with great transfer rates. Broadband transport new people have been excited about running HDTV, but the problem is that HDTV is the most political technical issue in the world today,

indicating that there will not be much of a convergence in the near future. HDTV will probably demand a complete transformation of the entire image production infrastructure, and very few groups in the world today will be able to afford it. Another interesting development is 1.5 megabit video that runs off a compact disk, coming from the codec technology developed by the telecommunications industry. The advantage of this video in the broadband network is that you can have abundant signal. Consumers would rather have abundant resources, lots of videos files to seek and retrieve, than a couple of master big high resolution pictures. Perhaps in the 21st century we will have lots of HDTV on demand.

Liebhold concluded by saying that the US already has a lot of fiber optics running, called DS3, that by 1991-1992 telephone companies will roll out 45 megabits service called SMDS switch multi-megabit data service.

The next speaker was David **Backer**, VP of engineering, Fluent Machines.
Backer's presentation premise was that the public will see in the next two years PC workstations design-centered on multimedia as part of the mainstream commercial environment. Multimedia here means the integration of video and high quality audio as standard data types along with the familiar text and graphics.

Backer began his presentation by describing the evolution of workstations with the help of a series of videotapes produced by the ACMA on the history of the personal workstation. In the research arena he noted that we can trace the evolution from

Vannevar Bush's "memex" concept to J. C. R. Licklider's "procognitive system" to Alan Kay's work at Xerox PARC on the Altos computer and the Dynabook. In the commercial arena, he pointed out that efforts run from Apollo "5M" machines to Apple's graphical interface to NEXT's object-oriented programming tools in the commercial arena.

Backer next spoke about recent multimedia developments in both commercial and research worlds. In the latter there is the MIT Architecture Machine Group, the Media Laboratory and Project Athena. In these groups there are several projects such as SDMS, the Movie Map and the Movie Manual. The key here is the integration of all types of media: text, graphics, sound, video in a highly interactive environment. Another important person in this area is Ted Nelson, who coined the terms hypertext and hypermedia back in the 1960s, the founder of the idea on non-linear writing and thinking and the ways of associating links between documents and parts of documents. In the commercial world there are a number of big names putting a lot of money in multimedia. There is Philips/ Sony/ Matsushita efforts in CDI-I and now working with full-motion video; there is also Intel's RCA-purchased DVI and IBM's Infowindow and AVC computer. In this group it is hard to sum up all of Apple's activities but certainly the introduction of Hypercard is a significant one. In the software arena, there is Microsoft's commitment to software tools and multimedia titles. In Japan, Fujitsu is producing the FM Towns PC, which is a PC with a built-in CD-ROM drive; and NEC's PC Engine. The common result here is that digital multimedia is about to happen in the PC now.

This has led to Fluent Machines' plans, which is skipping the lab phase given the amount of research and information already known about multimedia and the commercial projects already out there. **Backer** believes that there are three keys to a successful multimedia workstation in the 1990s. The first is a fully integrated system architecture, that includes the PC and digital multimedia peripherals. The standard technologies that make it possible are out there. The key here is real time acquisition and storage and manipulation at the desktop. The system software has to be a really integrated development environment for both software developers and end users. This requires a very powerful object-oriented development environment and database storage facility. Finally, the user interface has to be a high resolution windowing environment, probably with movie icons. The second is integration with standards. These standards have to be supportive of the commercial PC industry, that is compatibility with current applications. There has to be compatibility with international video formats and computer standards for compression. There also has to be integration at an international level of manufacturing and distributing channels.

The third and final key is the availability of applications. It includes both standard packages as well as new multimedia applications, often drawn from the videodisc model, like training, on-line computer help, electronic product catalogues, multimedia mail and databases for advertising. In addition, the basis for this is strategic partnerships with content providers or applications developers.

Backer summed up saying that Fluent Machines is trying to shape its multimedia workstation product with all of these guidelines in mind and it is engaging other developers of hardware and software to support these concepts in their products. It expects to become a significant player in the multimedia workstation environment in the 1990s.

Question & Answer

The first question in the discussion was what would the price point for this type of workstation be. **Liebhold's** said that there is no simple answer, but rather the price depended on the level of functionality required. Cheap workstation will not happen in the next few years. The alleged convergence between the computer and the consumer electronics market is not happening in the predicted way for the fundamental reason that even in the home the computer and the TV set will probably not going to be the same device. There will be different devices with different functionalities and different economics. The price of multimedia workstations will ramp down slowly. **Backer** speculated that it is likely that the price will be in the range of the average workstation.

The next comment was that the technology will be closely related to the quality of software and asked what are companies are doing about supporting software developers. **Backer** argued that there has to be a multitrack strategy for both end users and software developers. For the end user there has to be editor packages that allows for free manipulation of different media types and incorporation into different document types.

At the software development level there has to be robust development environment. **Liebhold** commented that all sorts of people are publishing this software and remarked that Apple is also building multimedia authoring tools for end users. Hypercard allows children to develop very sophisticated multimedia. Apple is also developing new software development tools and supporting existing products, such as the McIntosh-based sound and graphic editors. **Backer** remarked that a bundled software environment will be very important for the development of a large multimedia workstation market.

The next question addressed the issue of picture quality for the consumer market in relation to compressed video. **Backer** said that it will be important but not the only axis of measurement, because people working will perceive video differently from the way when they watch TV. **Liebhold** added that most of the stuff out there is above the low threshold of video quality acceptable to the public. **Lippman** commented that the quality of compressed video is a function of the technology or the bandwidth available. Often people refer to very short portable bandwidth, which is not valuable for computer compressed images. What has to be considered is how picture quality can improve with technology as it scales and how will it improve with bandwidth. Today there is magnetic disc which is also portable equivalent to the CD and gives a better picture quality.
Another question was about intellectual property issues and freedom of information rights in the new decentralized multimedia environment. **Liebhold** replied that right now, negotiation is a very time consuming process because people who own photo libraries have never given much thought about digital reproduction. Perhaps first we should use public data. Possible sources of media that has been untapped so far are public archives

and scientific institutions, such as Landsat images. Intellectual property is a difficult issue - yet, the Library of Congress has no notion what to do about that.

The final comment was that the multimedia revolution will cause problems because people will spend more time deciding what to incorporate in terms of the different media to enhance documents rather than actually worrying about content. Two examples where multimedia has failed are voice mail, it competes unfavorably with e- mail; and books. It is hard to figure out what information people are willing to pay money to have in their computers. In contrast, cases were media have succeeded have usually involved associating the content with the signal. The real breakthroughs will come from new silicon and new operating systems. **Liebhold** reply was that everybody at Apple uses voice mail effectively, it is a question of implementation. He also mentioned that there is silicon implementation coming from a number of vendors based on the J.P.E.G. standard that allows you to take a very high resolution bit-mapped color display and compress it and pack it into a disk. There is also lots of people working on the CCITT video codec. At Apple an interesting experience that seems to have made sense has been to put together a music catalogue in hypermedia format. A paper back book is hard to replace, thus the goal should not be to replace a paper media but rather add the new modalities of audio, video and graphics as appropriate.