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### ABSTRACT

Computer Graphics has been a vector oriented high technology for interaction and its images have been those of a silent movie. Current trends toward raster scan in general are bringing together the previously disjoint communities of image processing, broadcast television and computer graphics. Present implementations in video format are making computer graphics ubiquitous. Jointly, these events are leading to broader definitions of man-machine interaction and more generalized applications of computer resources. The user community is growing to include people like: presidents of companies, housewives, six year old children.

In this light, this paper is about not throwing away the message with the medium while offering new technological opportunities for communication. In many regards the old fashioned book remains the best random access information resource we have, but new opportunities include: personalization, sound synchronization, spatial data access.

### INTRODUCTION

Currently, computer-assisted communication and information access is used at work. As such, it is rather easy to evaluate the powers of computational search and manipulation in terms of productivity and effectiveness, without great concern for the more subjective and subtle matters of human comforts and deeper meanings. However, as soon as such methods are used in the home, as leisure systems, or for personal reasons, users will become significantly more demanding of the qualities of interaction (1) and less tolerant of the previously justified discomforts of computer usage.

The book is a wonderful random access medium for information retrieval and perusal. It is inexpensive, portable, and offers the occasion for personalized landmarks like annotations and dog ears. While such observations can be construed as nostalgic or wishful thinking, their computer surrogates should not be dismissed out of hand. At first we may be limited to trying to copy the old, but ultimately the new and dynamic media of interactive information processing and communication will find their own formats for supreme usability. Such features are no longer a luxury but a necessity.

Combinations of telephone, television, and microprocessing are emerging in a number of different forms, in the service of the consumer. The impetus for these developments is large because consumers come in large numbers. We are beginning to see a number of technological innovations invented for the consumer, but creeping into the more institutional marketplace of information management. The optical video-disc is a specific example. It, along with others, will offer richer media for communication, on the one hand. But, on the other hand, it will precipitate consideration of the human qualities of the interface, previously limited for the most part to physical and video typewriters.

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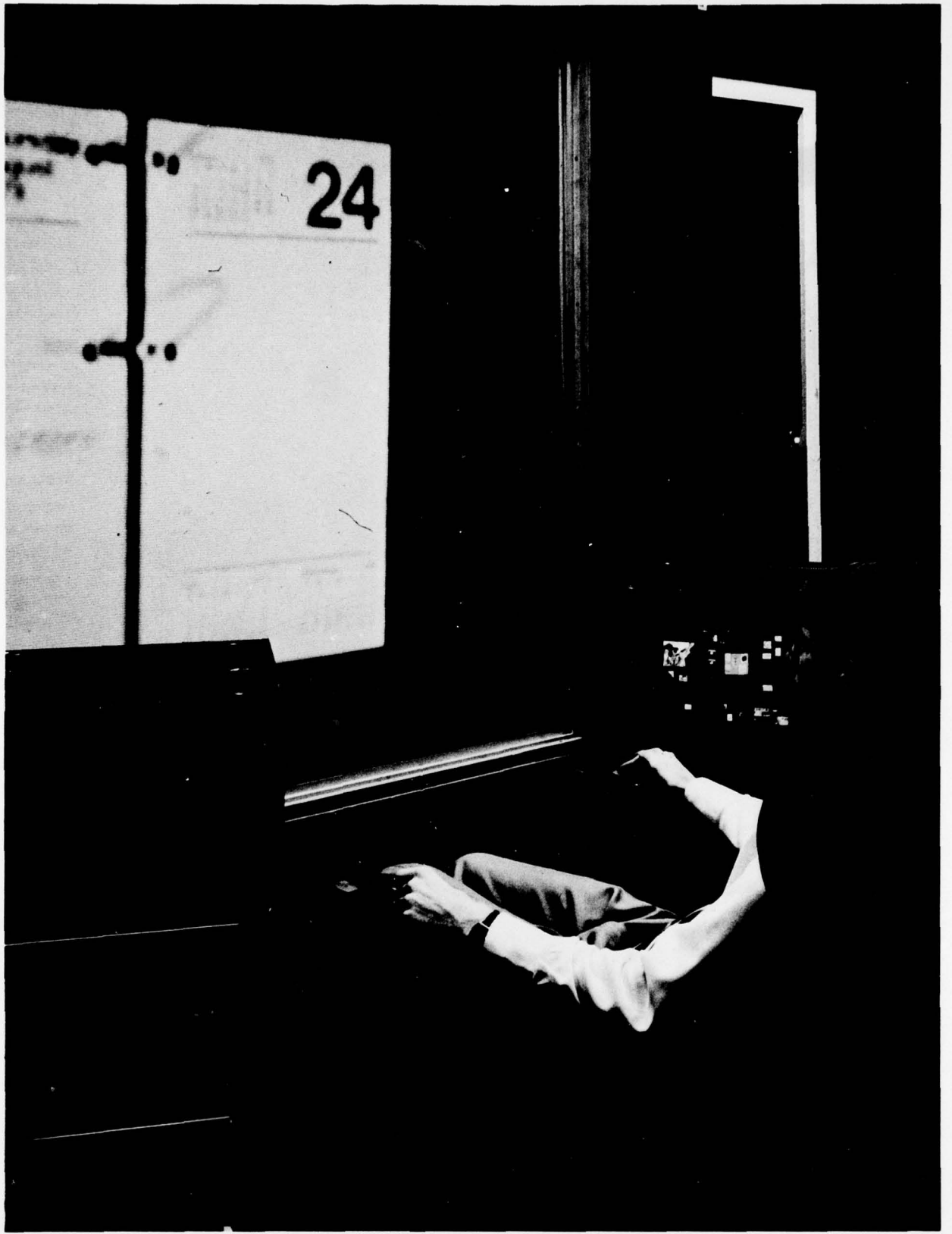
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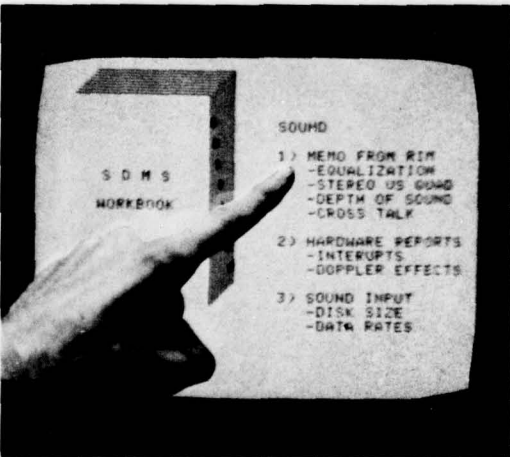
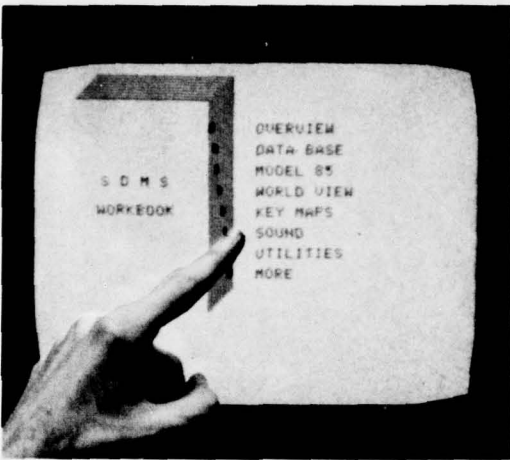
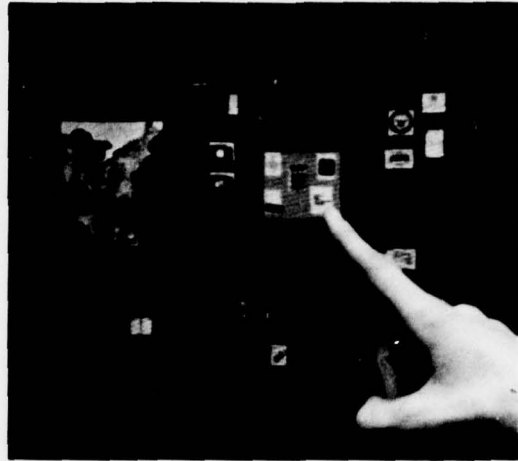
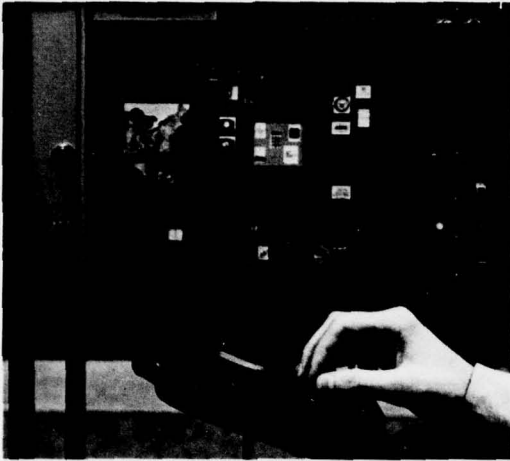
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In this light, this paper is about not throwing away the message with the medium while offering new technological opportunities for communication. In many regards the old fashioned book remains the best random access information resource we have, but new opportunities include: personalization, sound synchronization, spatial data access.





View of the Media Room as used in the Spatial Data-Management System. The world view of Dataland is to the user's right. Note the arms of the chair are each equipped with joystick and touch sensitive pad (the right one of which is being used to flip the pages of the calendar).



Top left: close-up of joystick control. Middle and bottom left: a touch sensitive index of SDMS Workbook. Right top, middle and bottom: using a touch sensitive world view to move from book to museum map, to the Southeast.

### THE PAGE AS A SYNTACTIC CHUNK

Scrolling text on a computer terminal is so commonplace that it may be alarming to question it. But really it is rather dreadful. Most of the time it cannot be read when moving. Almost all of the time it gives the user absolutely no sense of where he or she is vis-a-vis some whole.

We take for granted the semantic constructs of grammar. A sentence carries a statement or question and a paragraph can be said to develop or support an idea. One way or another, chapters, subsections, paragraphs and sentences can be seen as descending, semantic boundaries.

But there are also syntactic boundaries tied to the medium of presentation more than to the information content. The page is an excellent example. The ideas in a letter or a book clearly do not fall on page boundaries. But one remembers a three page love letter or nine hundred page novel partly as such. A recent directive from the National Science Foundation has limited proposals to fifteen pages.

Unanswered questions about computer media include: are there similar chunks? what purposes do they serve? what use does the sense of place serve? are there meaningful gestalts? The purpose of this paper, accompanied by video tapes and verbal presentation at the IEEE meeting on communications, is not to answer these questions, but to pose them as serious issues.



### PAGES WITHOUT PAPER

The optical videodisc illustrated below is a particularly new and important medium for information dissemination. The page counterpart is a frame, of which 54,000 are available today, on a randomly accessible basis, at very low cost. In the computer community 54,000 or 54K is an insignificant number when measuring, for example, bits, bytes, or words of memory. But 54,000 slides or 54,000 pages is quite a different matter. A PhD student of Art History does not encounter 54,000 art slides in his or her education, probably career. 54,000 pages is more than the Encyclopedia Britanica with all its annual updates.

The pictures on the following page are taken from a student thesis (2). As illustrated, the text is almost print quality, does not scintillate, and has all the letter size and spacing variables common to printing. In addition, with the small overhead of animation, pages are flipped from the upper right to the lower left. On the previous color page, user interaction is illustrated as an actual finger flipping gesture on a touch sensitive pad embedded in the arm of a leather easychair.

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### ASCII TEXT DISPLAY

This is a page of ASCII text displayed by the new 85 font system. The font master is stored "off screen" starting at page 0 of the extended memory. As the ASCII text is parsed, each character is "moved", via the microcode, to the appropriate spot in the currently visible space.

The fonts are two bits per pixel. Associated with each font is a location table giving its coordinates on the invisible read-image. Also with the font is a one dimensional kerning table. The kerning table is stored in program memory during the formatting phase of display.

The page is flipped by scratching

the appropriate direction on a touch-sensitive joy-pad. A "page" actually consists of two pages of characters, one occupying the low order two bits (of the 8 bit per pixel display image) and the other occupying the next two bits. By scratching the color matrix, display is switched from one page to the next.

The fonts are a template associated with a high-order four bits of location table. By modifying the coordinates on the invisible read-image. Also with the font are one dimensional kerning table and kerning table is stored in program memory during the formatting phase of display.

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## TALKING PAGES

In the same way that it will become difficult to buy a calculator or television that does not tell time, it is this author's feeling that it soon will become difficult to buy machines that do not talk. The recent introduction of the toy 'Speak & Spell' is a marvelous example of sound synch display.\* Applied to the more general concept of books without pages, two particular applications are being examined at this time: mode and medium switching, spatial sound.

It is a common programming practice to assume a mode and medium of presentation for particular data. This is especially true in computer graphics, wherein the database is frequently polluted by the "line" construct of drawing practice. It is also true for text. However, there are many reasons to wish for switching between media, with the same information. For example, it is hard to browse through sound. At the same time, one can imagine addressing a piece of equipment with hands and eyes, wishing for the assembly instructions to be spoken, one by one.

The spatiality of sound is more adventure-some. Here we are suggesting a cocktail party effect, where quadraphonic or octaphonic sound systems produce spatially localized sound. A proposed example is for verbal annotations to be placed on a page, in specific places, by a specific reader. Return to these annotations is achieved by a kind of Flatland where the user can roam about the surface, listening to all the sounds in parallel, but properly attenuated as a function of their distance. How many times have you overheard your own name at a cocktail party?

\* The technological achievement of this particular device is remarkable and well acclaimed. In the context of this paper, it has an additional property which is so obvious we tend to overlook it. That is: portability. The unit and its batteries are small and light enough to curl up with in bed, take on airplanes or in cars, and to put on a shelf!

## PERSONALIZED PAGES

As computational resources increase in power and decrease in cost, we hear more and more about the so-called "personal computer." This is an unfortunate name, given the true thrust of the movement at this time. The computers about which people are talking are not really personal and in no sense personalized (3). Instead, they are available at sufficiently low cost so as not to have to share them.

Personalization comes in two flavors. The easiest form of personalization to achieve is that of variety. If the choices are large enough, individual selection can be seen as a mild form of personalization: print in preferred type fonts, right handed versus left handed, and the like. At the other extreme, the most difficult to achieve, is personalization that comes from knowing. Human-to-human discourse enjoys a wide range of abbreviations and subtleties gained through familiarity, shared metaphors, and the complicated mechanisms of inference making.

There are some middle-ground examples that begin to illustrate a kind of Z-axis for books without pages. Early implementations of our Spatial Data Management System (SDMS) (4,5) were a laminar of "pages." More information or elaborations were gained by literally flying through words or pictures. Their expansions can be made very personal and invoked implicitly. A simple example in a text processing application is the automatic expansion of acronyms that one does not know or has forgotten since last reading.

A slightly more ambitious example of a personalized page can be derived from work currently being done on "personalized movies." These are movies whose apparent content, form and medium is the intersection of a set of resources and a model of the user contained in a computerized playback system. A cookbook created this way is an exemplar: Consider the proverbial instruction "cook until done." (6) This is meaningful to the experienced chef. A less qualified cook may need to know the time and temperature; a beginner may need to be reminded to preheat the oven, and to place the dish on the center rack. Revisiting this recipe, the fast learning tyro may need only a reminder of the oven heat, whereas a forgetful expert may need to be reminded of all of the steps again, but in brief form.

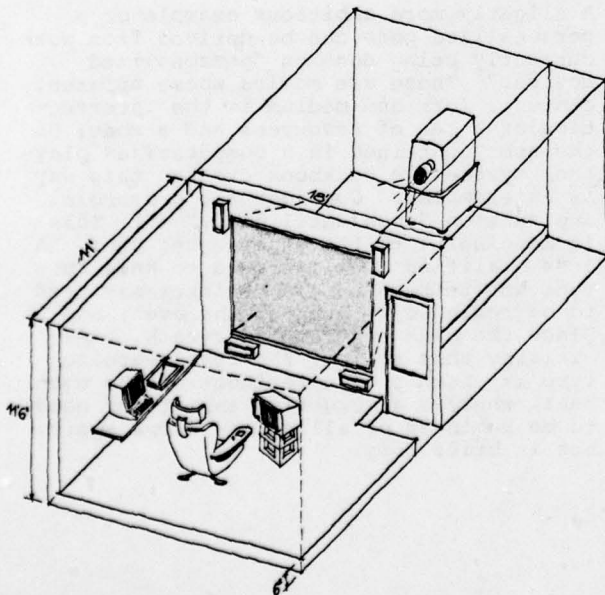
Likewise, information in a book may be transmitted as a function of previous knowledge and experience with the material, the number of times that the knowledge has been similarly accessed, etc. And it may be expressed in a form suitable both to the particular subject matter and the particular user. With the wide variety of modes and media presently becoming available, the range of this communication is extensive.

#### PAGES WITH PLACES

In the bottom right hand drawer of my desk can be found an orange sheet of paper in a red Pendaflex folder near the back, labeled "hardware." In that sentence, the label "hardware" is the least significant cue to finding data. The most significant cues are spatial.

As human beings we have a deep-rooted and fine-tuned perceptual mechanism for space. While some people enjoy a more developed sense of place and visual thinking, even the lowest common denominator of human abilities is a fabulous navigational aid and information retrieval mechanism. The management of our own desk tops, kitchen closets and book shelves are but a few examples of "data" accessed by where it is, versus what it is.

The Spatial Data Management System, SDMS (7,8), is one attempt at incorporating spatiality into the process of information retrieval. The basic structure of the system includes an "infinite" two dimensional surface called Dataland, upon which data are placed, in a variety of forms, sometimes in neighborhoods, frequently with landmarks. Such data is accessed by "flying" to it, where movement in X and Y is traversal over this fictitious country, and X is a helicoptering effect that affords greater or less resolution as a function of distance from the surface. Perusal or "reading the book" can be seen as landing, but in this case on data types which include more than surrogate pages: animation, sound, movies, slides, and the like.



#### BOOKS IN WHICH WE MIGHT LIVE

SDMS has the added theme of the human interface. The terminal is itself a room, currently equipped with floor to ceiling display (twice as large as the one illustrated), octaphonic sound, position sensing devices for body and arm movements, and soon to get a formidable eye tracking system and continuous speech recognizer. This gaggle of equipment is assembled with the idea of going to the fullest extreme of human interfacing, leaving no channel untapped and no mode or medium of presentation unused. We propose that later one can retrench from such hyperbole, evaluating the effectiveness of one method or another, but that the human interface can no longer be ameliorated by baby stepping with small incremental changes.

The Media Room (9) is a place. The user is not perched in front of a small black and white window (polluted by fan noise). Instead, the user is invited to engage with human size displays, arm wave, or rest back and listen. At first thought one can imagine a circus or world's fair. But more like books without pages, one can envisage a universal encyclopedia that takes you to Patagonia, sings *Così fan Tutti*, animates the preparation of *Coulbiac*, or monitors the progress of herpes zoster.

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