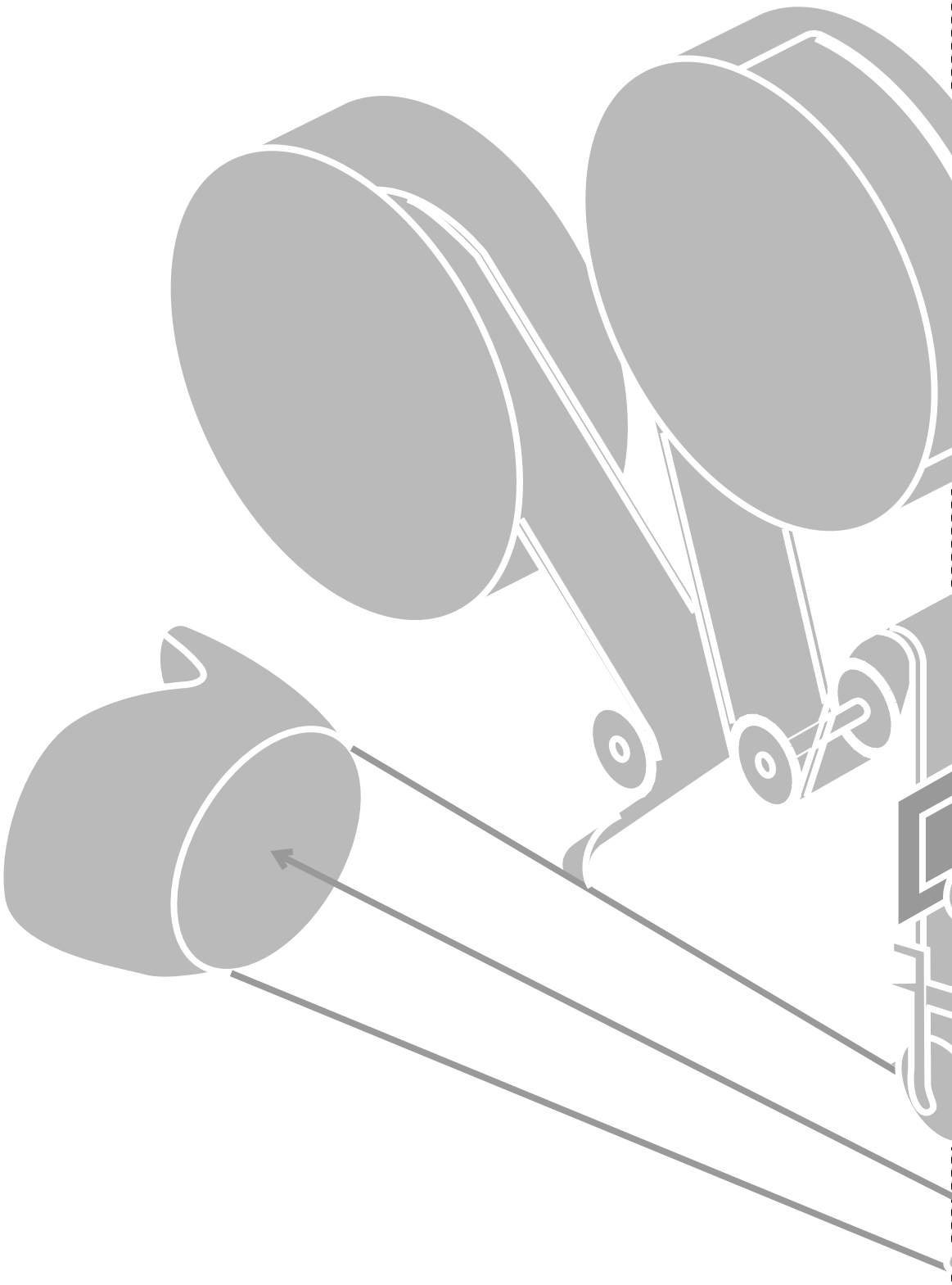

7

# MULTIMEDIA: THE DIGITAL REVOLUTION

# The Digital Revolution

In the beginning, there was the sign. The sign was spoken and sung. Then it was written, first as picture, then as word. Eventually the sign was printed. The ingenious coding system that was writing allowed ideas and feelings, descriptions and observations to be captured and preserved. The technology of printing liberated these written records from isolated libraries, allowing them to be communicated to thousands, then millions. They are the glue that binds our culture together.

As the scientific revolution took hold in the nineteenth century, we discovered methods to capture images and sounds technologically. Photography, then records and film, reproduced reality without the intervention of words. At least we thought they did. We accepted their representations as if they were real. In fact, they were simply a different set of codes. While far more verisimilitudinous than words, the images and sounds of cinema are still code systems—distillations of reality, sometimes distortions of it, always imaginations of it. That's why it is necessary to learn how to read a film.

Movies and their offspring have defined the twentieth century for us.

But now we find ourselves on the verge of a new phase in the history of media. The languages which we invented to represent reality are merging. Film is no longer separate from print. Books can include movies; movies, books. We call this synthesis "multimedia," or "new media." The technology offers tantalizing promise: instant and universal access to the world's knowledge and art, captured or produced with a versatile set of media tools. But it also brings with it some knotty challenges, both technical and ethical.

The Information Age is quite real. The microcomputer revolution of the 1980s has increased our access to and control over information a hundredfold. As that revolution matures over the next generation, information power will increase by another four or five magnitudes. Within our lifetimes, most of the world's knowledge will be available to many of the world's people instantaneously and at negligible cost. There is no turning back, nor is there any longer any doubt. We now know that we can index everything ever printed and that we can build networks to access this print universe in seconds rather than years. (Similar access to audio and video remains beyond current our capabilities, and we haven't yet thought seriously how to index images and sounds, but this will come, too.)

There is a memorable scene in Godard's *Les Carabiniers* (1963) in which the two soldiers return to their wives after the war with their booty. They have postcards of all the world's wonders which they proudly display, one at a time: the Eiffel Tower, the Great Pyramid, the Empire State Building, the Grand Canyon.… They think these images are deeds to the properties. We laugh at their naïveté as the pile of postcards mounts. The scene is an emblem of the information revolution: we now have the deeds to all the world's intellectual riches. But what will we do with this unimaginable wealth? Perhaps we are just as naïve as Godard's carabiniers: we have been given the keys to the virtual kingdom, but what about the reality that was once its subject?

As we noted in Chapter 1, the virtual world increasingly crowds out the natural world, and the very power that we now have to manipulate these once precious images and sounds devalues them, destroying our faith in their honesty and our appreciation of their art.

When the first edition of this book appeared in 1977, it may have seemed strange that an introduction to film included so much about print and electronic media. At the time, movies and print seemed to have little in common: they were both communication systems, true, but the similarity ended there. Now, as the technologies and distribution systems used to reproduce and disseminate the two converge, we can see how they fit together.

This has happened almost by accident. No one set out in 1960 to find a technological common denominator between books and movies. No Godard fan, noticing his fascination with the clash of words and images, decided to find the link between the two. Nor did a Truffaut aficionado, after having seen *Fahrenheit 451* or having read Truffaut's *Hitchcock*, dedicate years to discovering the technical common bond between the two media which that filmmaker/writer loved equally. The development of semiotics in the sixties and seventies was fortuitous, since it provided a single critical approach to both written language and filmed language, but semiotics was a way of thinking, not a science; there were no semiotics labs funded by governments to discover the basic building blocks of signification.

Rather, as you might expect, the technologies developed more or less independently and for mundane economic reasons. It was only after a decade of furious activity that it became clear that both types of expression, print and film, were going to share a common technology and that—therefore—it would be possible to do both at the same time in the same place. The common technology they now share is digitization.*

In the 1950s, computers were regarded simply as number-crunchers. (In 1952 IBM actually estimated that 18 computers would saturate the entire world market.) The machines of that day were programmed by feeding in decks of punched cards—a medium that dated from the 1890s; they required carefully engineered environments ("computer rooms"); and they were operated by specially trained engineers, who—like priests of old—were exclusively ordained to enter the sanctum sanctorum and approach the electronic oracle.

In the 1960s, it became clear that the CRT screen could provide a more efficient link between the machines and the people who operated them than the punched cards or the paper and magnetic tapes that had become common by that time. Indeed, the engineer at IBM who first thought to connect a television cathode ray tube to a computer may be considered the godfather of multimedia, for once that visual device became the basic input/output channel, the development of a visual metaphor for the logical control process became irresistible. This marriage of technologies was not preordained, and if punched cards and band printers had remained the input/output devices for digital computers, multimedia—to say nothing of the microcomputer appliance itself—might have remained a dream.

In the 1970s, when the development of word processors as basic business tools suggested that computers could be operated by ordinary laypeople, interest increased in a visual control metaphor—or "graphical user interface," as the jargon later tagged it. At the same time, filmmakers and audio technicians became intrigued with the exciting possibilities of applying this new tool to the manipulation of images and sounds. Filmmakers like James and John Whitney used mainframes to produce abstract images for their films as early as 1961. Musicians and audio artists became infatuated with the new Moog synthesizer in the late 1960s. The first digital audiotape recorder was offered for sale by the Lexicon company in 1971. By the late 1970s CBS had developed a machine for digital editing of videotape. The price? $1 million. (It is not known if any were sold. Today you can do a better job with a system that costs less than $3,000.) The elements of multimedia were evolving.

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* When you consider that digital technology is founded on quantization and binary number theory, which reduces numbers to their basic elements—1s and 0s—the comparison with contemporary physics's quest for quarks is not inappropriate.

Figure 7-1A. John and James Whitney pioneered computer-driven imagery in the 1960s. Here, frames from John Whitney's "Catalog" (1961). (*John Whitney © 1984. Used with permission. Frame enlargements.*)

Figure 7-1B. Jordan Belson's films don't use computer techniques but they do combine optical and mechanical effects with natural phenomena and many other experimental techniques to produce a rhythmic, abstract esthetic. These frames are from Belson's "Samadhi" (1967). (*Jordan Belson © 1989. Used with permission*. *Frame enlargements*.)

In December 1968 Douglas Engelbart, an employee of the Stanford Research Institute, demonstrated an effective graphical user interface, fulfilling a dream first outlined by physicist Vannevar Bush in his seminal 1946 essay "As We May Think." In the early 1970s researchers at Xerox's Palo Alto Research Center and elsewhere combined the graphics on the now ubiquitous CRT with a separate physical pointing device that they called a mouse. What may have appeared to Engelbart to be the end of a line of technological development now revealed itself as instead the beginning of a fertile and fascinating field of inquiry: the invention of a coherent visual and physical metaphor for the complex and subtle interaction between humans and their first true intellectual tools. Interface design rapidly became a subject of intense interest. It isn't often that a new basic and universal language system is invented.* The twentieth century has seen two: first film, now the graphical interface. As new systems of communication, it was only a matter of time before the languages of film and computers merged to give birth to multimedia.

Apple's Macintosh computer, introduced with great fanfare in January 1984, marked the long-anticipated birth of multimedia. As the first microcomputer to

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* Just in time, too, to revive the science of semiotics. By the time the Macintosh was born, the best film semioticians were either dead or writing popular novels. In the early 1980s, as Apple was beginning work on the Mac, the locus of semiotic creativity had shifted from Paris to Cupertino.

commercialize successfully the graphical interface developed at Xerox PARC years earlier, the machine and its software provided a platform sophisticated enough to support the development of new media during the next ten years.*

The company had been founded in 1977 by two young Californians, Steven Jobs and Stephen Wozniak. While Wozniak was regarded as the "techie," Jobs, the "business head," turned out to have the greater impact on the history of technology, for it was he who championed the Macintosh vision of the computer as an appliance, like a toaster, with an interface simple enough for anyone without technical training to operate.

Before the introduction of the Mac, Apple had manufactured machines, like the rest of the nascent microcomputer industry, which required a significant amount of technical expertise to operate. Their success until that time had been due to two factors: the feisty and romantic image they had projected, and the lucky accident that two other young men, Dan Bricklin and Bob Frankston, based in Cambridge, Massachusetts, had written a program called "VisiCalc," which ran only on the Apple II computer. VisiCalc was introduced to the market in 1979, shortly after the machine debuted. Thousands of young MBAs, heady with the financial dreams of the 1980s, rushed out to buy Apples to run this new "spreadsheet" program, a business planning tool.†

The first Macintoshes shipped in 1984 with a painting program as well as word-processing software. Immediately, users could draw on their screens as well as type. Perhaps just as important, the graphic power of the machine was applied to texts as well as images. Writers could actually choose their own fonts and type styles! This was a major advance over the crude representations of the dot-matrix character-based screens of that time. (See Figure 6-3.) The heretofore arcane concerns of publishers and printers—fonts, leading, point sizes, kerning—quickly became common knowledge for a new generation of assistants and middle managers. This social and esthetic sea-change had been foreshadowed in the 1970s when ubiquitous cheap photocopiers allowed almost anyone to be a publisher. Now the Macintosh let anyone design layouts and set type, too.

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* Xerox itself had attempted to sell a machine with a graphical interface several years earlier, but the "Star" was ahead of its time and overpriced, as was Apple's own Lisa, which predated the Macintosh by a year.

† While Jobs and Wozniak are likely to be remembered in history books for quite a while, throughout the late 1980s and 1990s their competitor and nemesis, Bill Gates, founder of Microsoft, held center stage. Gates had written the first version of Basic for the new microcomputer of the mid-1970s, but his remarkable business success was built on products that were imitations. Seldom a pioneer, Microsoft built its dominating position in the microcomputer industry by applying superior business acumen to ideas and products developed by innovators like Apple, Digital Research Inc., Adobe, and Lotus.

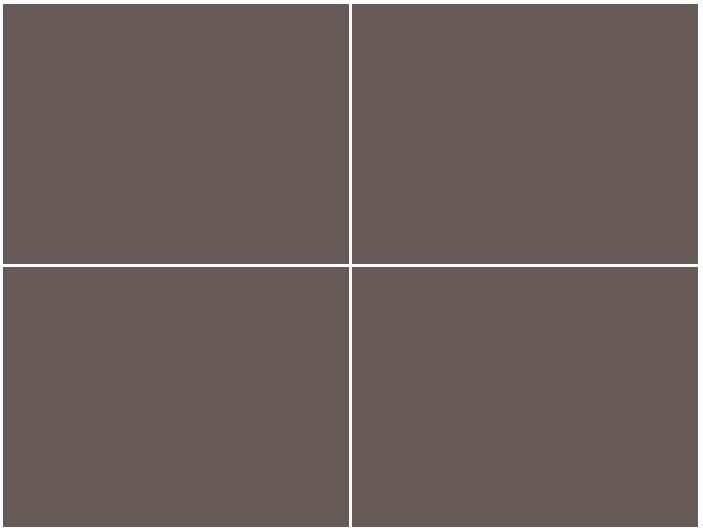

Figure 7-2. The "1984" commercial introducing the Macintosh aired just once during the Super Bowl, January 24, 1984. Ridley Scott directed. (*Courtesy Apple Computer, Inc. Frame enlargements*.)

The "consumer" celebrated in the fifties and sixties was yielding to the "user" of the eighties and nineties. The consumer had been a passive and dutiful partner for the great industrial producers of the first half of the twentieth century; the user was to become an active, independent, and demanding client for the service providers of the next century. Little did we know, as we marched in the streets in the sixties chanting "Power to the People!," that the power would indeed be granted—but in the arts and communications, rather than in politics and economics.

This relationship between the counterculture of the sixties and the microcomputer culture of the eighties is curious but undeniable. Apple understood it early on, and profited by that understanding. The famous Super Bowl commercial that introduced the Macintosh as "the computer for the rest of us" in January 1984 traded heavily on the residue of countercultural yearnings.

Separately from the cultural mystique that it acquired, the microcomputer was also "revolutionary" in the purest sense of the term, since its historical progress is measured geometrically rather than arithmetically. "Moore's Law" suggests that chip density (and by extension computing power) per dollar doubles every 18 months. Gordon Moore, one of the founders of Intel, the dominant chip manufacturer, offered this rule of thumb early on. The history of the microcomputer over the past twenty years bears uncanny witness to its truth. The machine I bought in March 1994 ran 200 times faster than the machine I bought in April 1981, had 200 times the storage capacity, and cost about the same. Those figures are almost exactly what Moore's Law would have predicted. Adjust for inflation, and performance doubles yet again.

This isn't just computer jock talk. Numerically, the information revolution of the 1980s accomplished in fewer than ten years what took the transportation revolution 100 years to achieve before it ended in the 1960s. Put another way, if transportation power had developed at the same speed as information power in the 1980s, the five-hour flight from New York to Los Angeles would now take about a minute and a half. These numbers are so profound that we can only surmise what the cultural and social effects will be. Bob Dylan's phrase from the sixties comes to mind:

> … something is happening here
> But you don't know what it is
> Do you, Mr. Jones?*

While the burgeoning microcomputer industry led the way in the office, the consumer electronics industry took advantage of the microchip revolution in the home.

At the end of the 1970s, people saw movies in theaters, listened to music on records, watched one of the four national television networks (actually getting up out of their chairs to change channels on occasion), used telephones with wires tethering them to the wall, and, if they were so inclined, corresponded with each other using pens, pencils, typewriters, paper, and the U.S. Postal Service.

By the early 1990s, these same folks saw movies mainly at home on videotape, listened to digital music on Compact Discs (more often walking in the street than sitting at home), had their choice of 40 or more cable channels from which to choose (and channel-surfed without leaving their chairs), made telephone calls in their cars or walking around, and, if they were so inclined, corresponded with each other via fax or electronic mail.

A few years later, they could also, if they so chose, buy a camcorder that would let them shoot videotape of near-professional quality. They could install a home theatre with a screen almost as large as the ones at the local sixplex (and with a sound system that was markedly better). They could watch videodiscs, skipping, browsing, freezing, and skimming as they might with a book; install their very own satellite dish; or buy a computer for the kids to play with that had the power of a 1980s IBM mainframe.

Increasingly they chose this last alternative, often for the sake of the children. By 1990, computer literacy was a prerequisite for admission to many colleges and universities. By 1994, nearly 40 percent of American homes had microcomputers and the stage was set for multimedia to weave together most of the technological strands we have just enumerated.

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* "Ballad of a Thin Man," © 1965 by M. Witmark & Sons. Reprinted by permission.

"You say you want a revolution...." Digitization and computerization completed the profound shift in our cultural architecture that had begun in Edison's labs a century earlier. As the Information Age became a reality and knowledge joined labor and capital in the social equation, ideology couldn't keep up. It is more than coincidental that the rise of the microchip accompanied the end of the Cold War, a conjunction that Mikhail Gorbachev himself once pointed out.

Despite the exponential speed of the digital revolution in the eighties, it took more than twelve years after the introduction of the CD-ROM in 1985 before multimedia became a marketable product. The reason? Digitized images and sounds, not to mention movies, made extraordinary demands on processor speed, storage capacity, and communication bandwidth. The digital text for this book, fully formatted, amounts to about 2.5 megabytes. The black-and-white images and diagrams that appear in the book take up an additional 90 megabytes on the DVD-ROM version (although they appear on the disc at greatly reduced resolution; the book versions occupy 750 megabytes). The additional illustrations, color, animation, programming, texts, and movies fill up most of the remaining 4,300 megabytes. In other words, the fully formatted text of *How To Read a Film* occupies less than one-tenth of 1 percent of the disc space required for the multimedia version, while the images and sounds which merely illustrate it consume more than 1,000 times as much real estate.

Some other numbers to think about:

- The standard computer screen of the mid-nineties, when multimedia came of age, measured 640 by 480 pixels. If each pixel in a full-screen image was either black or white, 38,400 bytes would be necessary to describe that image.* However, if you have a standard VGA color screen, with a palette of 16 colors, multiply that number by 4; if you have a basic Internet machine with a palette of 256 colors, multiply it by 8; and if you want color approaching the quality of film or television, multiply it by 24. All of a sudden, a single screen occupies nearly a megabyte of storage. You see the disparity: you can store an entire book—or a single decent color image. A picture may be worth a thousand words, but should it cost 150,000? This is not a good deal.

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* In the world of microcomputers, a byte is a unit of measurement equal to 8 bits. A bit is a single value, either 1 or 0. The word "bit" is derived from "BInary digiT." If a bit is a letter, then a byte is a word. There is a lot of confusion about bits and bytes, megabits and megabytes, gigabits and gigabytes, most of it stemming from the application of the decimal prefixes (kilo, mega, giga) to a binary system. For example, a kilobit is not 1,000 bits but 1,024 bits ($2^{10}$). For more detail on this and other digital issues see my *Dictionary of New Media.*

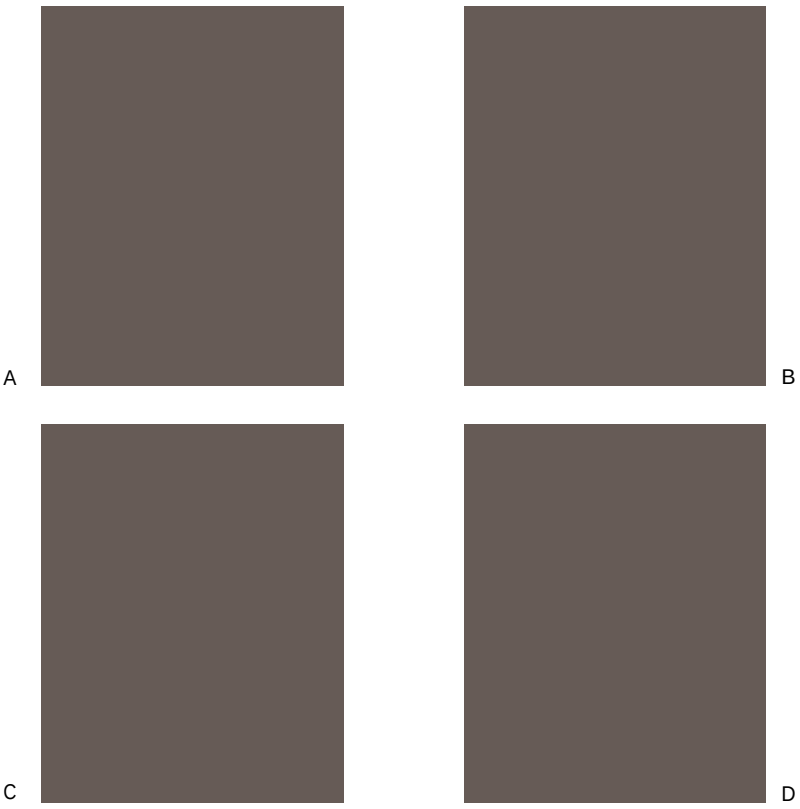
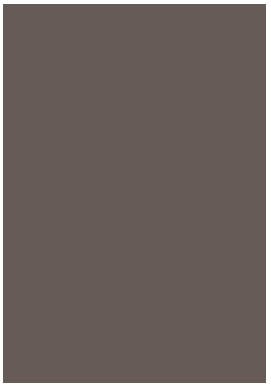



Figure 7-3. REMOTES.
(A) Warner-Amex Cable's Qube III cable television "keypad." Introduced in 1977, Qube was the early harbinger of the interactive cable market of the next century. It would have allowed the cable television viewer to select a large variety of programming channels—some of which incurred per-hour charges—and also to "talk back" to the cablecasting network. The technology wasn't ready and the experiment failed. But the keypad remote control changed our experience of the medium in the eighties.

(B) By the nineties, the remote was ubiquitous, not only for television equipment but for audio and other devices, as well. These are the remotes the Monaco family—two adults, three teenagers—used in a small city apartment. The first three at the top (cable box, VCR, and TV) had to be employed as a troika to operate the living room equipment. The largest and smallest in the collection are the Laserdisc player and the Hi-8 camera, respectively. The space in the middle is reserved for the stereo remote: we seem to have lost it. (Not shown: the DVD-Video remote; it's boring.)

(C) We use these remotes in the country for three televisions, two stereos, and an old VCR. Note the wire on the VCR remote, vintage 1984. It is the only one of the complete set of fourteen that never gets lost.

(D) These are the remotes accumulated so far by the Plumlee family—two adults, one two-year-old. Note Anna's toy remote (lower right). By the time she is old enough to channel surf, she'll have the technique down cold.



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E

Figure 7-3. MORE REMOTES.
(E) A "Remote Possibility," as envisioned by Jeff MacGregor for *The New York Times*, October 16, 1994. *(Copyright 1994 by the New York Times Company. Reprinted by permission.)*
(F) The remote reduced to its basic elements.

- Now, make that still color image move. Don't even think about 24 frames per second. Try 12—it will almost work. Now you need more than 11 megabytes for each second of jerky movie that you show. A CD-ROM, with its gargantuan storage capacity of 650 megabytes, could hold a minute of film (well, not quite). This is also not a good deal. The old analog world never looked so good. (Maybe this digital thing is a bad idea.)
- Finally, assuming that you can find some way to lick the storage problem, remember that you will have to transfer 11 megabytes per second from disc to CPU to screen in order to show your 12-frames-per-second "movie," while the standard transfer rate of CD-ROMs in the late 1980s was 150,000 bytes per second.*

You now have some idea of the technical challenges that confronted the digital video pioneers! The solutions they worked out for this seemingly insurmountable problem are ingenious and instructive. For the most part, they were not initially hardware-based. Building chips that could process this amount of information quickly enough and at a reasonable price would have solved only half the prob-

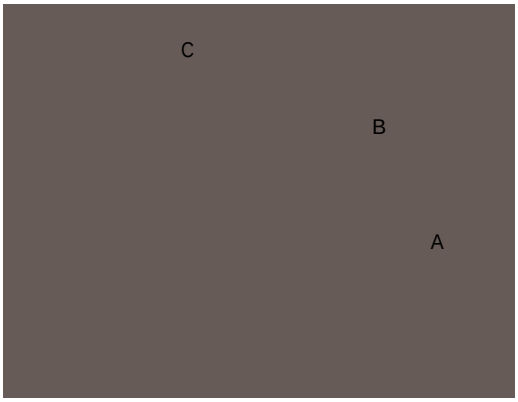


Figure 7-4. STORAGE TECHNOLOGY. (A) The punched card that made IBM successful (1929) held eighty characters on 24 square inches. (B) The 8-inch floppy disk (1971) held 128,000 characters on 50 square inches. (C) The DVD (1997) holds more than 4 billion characters on less than 20 square inches. (D) The singing ring from *The Time Machine* (802,701 AD) holds … a little bit less, but requires no player, except Yvette Mimieux or Rod Taylor.


lem, since the storage demands were just as astronomical as the demands on the processors. Separate Digital Signal Processor chips (DSPs) are useful—even necessary—but the first stage of multimedia was made possible by software that uses purely mathematical techniques that are as beautiful as they are effective.*

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* The calculations: 640 x 480 pixels x 1 bit per pixel = 307,200 bits. 307,200 bits / 8 bits per byte = 38,400 bytes. Four bits of color information yields 16 possible colors (2 to the fourth power). Twenty-four bits of color information yields more than 16 million colors (2 to the 24th power). This is the current standard for realistic digital color. 38,400 x 24 = 921,600 bytes. 921,600 bytes per screen x 12 frames per second = 11,059,200 bytes per second.

* By 1996, a decade after CD-ROM had been introduced, manufacturers could produce 24X players at a reasonable cost. (Their transfer rate was twenty-four times the original 150,000 bytes per second.) These machines could handle the raw transfer rates necessary for video as described above, but by this time the compression routines were well established, and necessary for the still greater ambitions of DVD.

| Decimal | Binary | Hexadecimal |
|---|---|---|
| 0 | 0 0 0 0 | 0 |
| 1 | 0 0 0 1 | 1 |
| 2 | 0 0 1 0 | 2 |
| 3 | 0 0 1 1 | 3 |
| 4 | 0 1 0 0 | 4 |
| 5 | 0 1 0 1 | 5 |
| 6 | 0 1 1 0 | 6 |
| 7 | 0 1 1 1 | 7 |
| 8 | 1 0 0 0 | 8 |
| 9 | 1 0 0 1 | 9 |
| 10 | 1 0 1 0 | A |
| 11 | 1 0 1 1 | B |
| 12 | 1 1 0 0 | C |
| 13 | 1 1 0 1 | D |
| 14 | 1 1 1 0 | E |
| 15 | 1 1 1 1 | F |

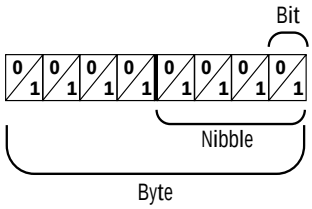


Figure 7-5. DIGITAL CODING. Computer coding is an inventive combination of binary (base 2), hexadecimal (base 16) and decimal (base 10) numbering systems. The theory begins with a binary system, since each circuit can exhibit one of only two states—on or off, 1 or 0. While a binary number system is easy for machines, it is difficult for human beings. By the 1980s, the industry had settled on a standard system which combined binary "bits" (for Binary digITS) into groups of eight, called a byte. Each half of the byte (a nibble) can represent a number up to 16 ($2^4$) so numbers can easily be represented in hexadecimal notation (where the letters A through F stand for the digits we don't have in the Arabic decimal system). The eight-bit byte permits 256 possible values ($2^8$) which is a limit sufficient to encode all the letters of the Roman alphabet, both upper- and lower-case, punctuation, numbers, accents, and accented letters.

Although they are too complex to detail here, suffice it to say that these algorithms compress the amount of data required to store and display an image (or that succession of images known as a movie) by recording the difference between successive pixels or frames rather than the individual values of each pixel in each frame. For example, a still image with a large background of a single color would take much less room to store than the same image with a multicolored, variegated background. It is the number of changes that count, not the number of pixels. Similarly, a movie that is slow moving with few cuts requires far less storage than a quickly changing scene with numerous cuts. Only the differences between frames are recorded, not the complete data for each frame. The compression of each still image is known as "spatial compression;" the compression of succeeding frames is called "temporal compression." Both sets of algorithms are necessary to produce economically viable digital video.

These compression techniques can easily reduce storage for a still image by a factor of 10 and storage for a moving image by a factor of 100. So we are back within the limits prescribed by the capacities of current hardware. The main standard for still image compression is known as JPEG (for the group that designed it,

the Joint Photographic Experts Group) while the main standard for movies is called MPEG (for Motion Picture Experts Group). The DVD specification is based on MPEG-2 and provides for full-screen, full-motion video. There are many other schemes in use as well. (Oh, yes. There is also a very simple way to reduce the amount of data necessary for a digital movie: reduce the size of the image. That's why most digital movie windows on early multimedia CD-ROMs looked like large postage stamps.)

Although the Voyager Company had demonstrated the possibilities of multimedia as early as 1989 with their release of Robert Winter's *CD Companion to Beethoven's Ninth*, multimedia did not begin to become a market reality until June 1991, when Apple introduced their software technology for movies known as QuickTime. (Microsoft followed with Video for Windows the next year.) QuickTime was designed as an architecture to support all media types, time-based or not.

One of its aims was to provide a platform-independent technology so that moving images could be shown at the best quality that the hardware on which they were run was capable. As successive versions of the software were issued the architecture supported more features (text, interactivity), more codecs (compression algorithms), and adaptations for use on the Internet (streaming, variable transmission rates).

With QuickTime, new media producers had their first effective tool for integrating audio and video in a text environment, but they were still constrained by the hardware. Their delivery media, the CD-ROM and the Internet, were both limited. CD-ROM was based on technology that was devised in the late 1970s, while Internet transmission was hampered by low modem speeds. DVD, the successor to the CD and designed to have sufficient capacity and speed for digital video, was not marketed until 1997,* while high-speed cable modems and DSL Internet connections did not become widespread until the turn of the century.

Developed jointly by Philips and Sony, the laser-based CD was introduced as an audio medium in 1982. Within six years it dominated the recording business, one of the great success stories of twentieth-century consumer electronics mar-

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* As an analog medium Laserdiscs weren't a serious candidate. Philips's other optical disc technology languished throughout the 1980s, adopted only by a coterie of several hundred thousand movie aficionados for their superior resolution and control. As videotape crested, Laserdiscs finally reached the one-million penetration level in the U.S. in early 1991. The so-called RCA rule declares that a consumer product doesn't provide a real market until the installed base reaches one million. Sure enough, just as the Laserdiscs approached that level, the software moved out of the specialty stores and into the video chains.

In the mid-1990s, the VCD format ("Video CD") provided up to 74 minutes of video on a standard CD, compressed with MPEG-1. The medium was popular in Asia—especially for pirated movies—but was not successful elsewhere.

Figure 7-6. One of the first QuickTimes, this team cheer was included on Apple's first demo disk. (*Courtesy Apple Computer, Inc. Frame enlargements*.)

keting. The success of the CD in the audio market brought prices down rapidly, making this physical medium even more attractive for the computer industry which in 1985 adopted CD-ROM as the storage technology of the future.

Ironically, Sony, like Philips, had little success in the multimedia market. During the early 1990s the company brought out at least four versions of a portable CD-ROM player, but neither the Data Discman (in several incarnations), the Bookman, nor the MMCD player was accepted by the public. Success would come, but not until the next generation: DVD.

The audio CD succeeded so quickly because Sony and Philips controlled the technology: a single uniform standard was adopted by all manufacturers. Conversely, until the advent of DVD, CD multimedia development was slowed by a multiplicity of approaches. In addition to the Apple Macintosh and Microsoft MPC formats and Sony's efforts, the list of erstwhile contenders included Philips's CD-I (introduced in 1991), Commodore's CDTV, Tandy's VIS, IBM's Ultimedia, and the game machines of Sega, Nintendo, Sony, and 3DO. Except for CD-I, all were nonstarters. Like its imitators, CD-I discs played on an attachment to the television set (priced at about $600 at introduction) controlled by a remote joystick that lacked a keyboard. CD-I was hampered by two major limitations: the poor resolution of the television screen combined with the lack of a keyboard meant that very little could be done with text. CD-I turned out to be little more than a playback medium for still images. The base technology simply hadn't the muscle to support effective video. Although hundreds of companies rushed to market in the early 1990s with CD-ROM-based products (many of them quite ingenious), multimedia remained more a dream than a reality. By 1995 most of the early multimedia producers were out of business. The only successful CD-ROM genres were games and text-centric products like encyclopedias and reference works. Indeed, by 1994 more encyclopedias were sold on disc than in traditional book form.

The original specification for the CD aimed for a product that could deliver more than an hour of digital audio, uncompressed. DVD was designed to have the

Figure 7-7. Voyager's landmark *Beethoven* disc (1989) marked the start of the multimedia market.

capacity to deliver a standard two-hour feature film on a similar-sized disc. By using a laser with a shorter wavelength engineers were able to fit almost seven times as many bits on the same disc, but as we have seen that is not nearly enough capacity for raw video.* Compression technology was necessary for a viable product. Here's where it gets interesting.

Compression algorithms come in two flavors, "lossy" and "nonlossy." As their names imply, nonlossy compression faithfully reproduces every digital value captured from the original, while lossy compression does not: it approximates some values. Furthermore, the very nature of digitization itself implies a loss of values. No matter how high the sampling rate, theoretically values in between the steps are lost. There are still audiophiles who complain about the "coldness" of CD reproduction, preferring the old-fashioned analog vinyl disks, despite their fragility.

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* To return to our earlier equations: 921,600 bytes per screen x 30 frames per second = 27.7 million bytes per second of uncompressed video. 4.7 billion bytes (the capacity of a single layer DVD) / 27.7 million bytes = 170 seconds, or less than 3 minutes of uncompressed video. DVD-Video compression routinely achieves greater than 100:1 ratios, boosting the capacity of a single layer so that there is plenty of room for an entire feature film. (Note: these numbers are simplified. In practice, it's more complicated.) Moreover, the specification allows for double-layer and double-sided discs, so the ultimate capacity exceeds 18 billion bytes.

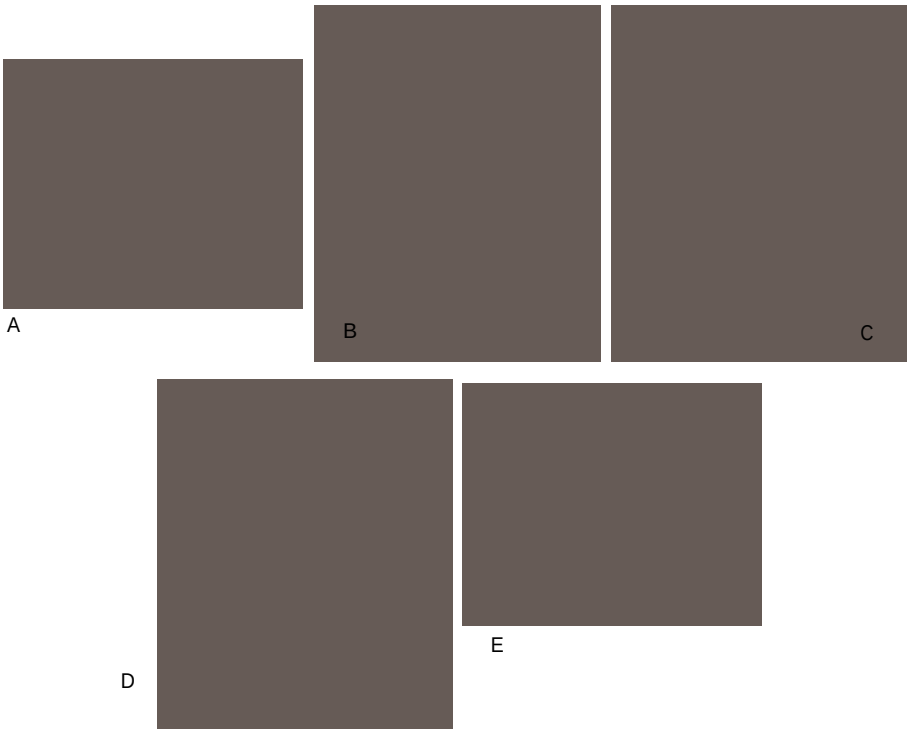


Figure 7-8. THE BOOK "FORM FACTOR." The form that an old-fashioned book takes has been an alluring metaphor for microcomputer designers ever since the visionaries at Xerox PARC first described the ideal "Dynabook" in the early seventies. Sony introduced the Typecorder (A) in 1981, arguably the first laptop computer. It did nothing but word processing with a four-line LCD screen. The typing was recorded on a common microcassette. It worked, but it gained no position in the market, and was quickly superseded by the Radio Shack 100, which had a full operating system. Sony introduced the ingenious Data Discman (B) ten years later. Based on a 3-inch CD disc enclosed in a plastic case and looking like a fat magnetic diskette, the Data Discman (and its successor the Bookman) could store several hundred megabytes of text and display it on a small screen. It was about the size of a large paperback. Sony kept its record of failure in the computer business intact: the Discman didn't catch on.

After years of lagging in the portable computer market, Apple enjoyed huge success with its Powerbook (C), introduced in October 1991. A leading example of sensible ergonomic design, the Powerbook quickly became the status symbol among Hollywood players and others. Barry Diller credited his conversion to digitalism to the Powerbook. Apple was less immediately successful with the Newton (D), its first Personal Digital Assistant, introduced in 1993. Yet PDAs like the Palm Pilot eventually became almost as common as the calculator or cellular phone. As a dedicated communicator and note taker, the Newton marked the beginning of the breakup of individual computer functions on dedicated devices. It had been foreshadowed eleven years earlier by the IXO Telecomputer (E), a tiny device with an even tinier screen that communicated over telephone lines at 300 baud. An interesting idea, far ahead of its time, the IXO failed quickly, superseded by the ubiquitous pager. (*JM*.)

Because it depends on heavy, lossy compression, the DVD format established as a standard late in 1995 for the next generation of optical disc technology compounded these esthetic problems. Most consumers marvel at the picture quality of DVD-Videos. Indeed, the resolution and color fidelity are both far superior to the VHS tape with which a DVD-Video disc is usually compared. The DVD-Video launch was one of the most successful introductions of a consumer electronics product in history.

But, just as CD sound is cold and lifeless for audiophiles, so the digital image is too clean and airless for some videophiles; they continue to prefer analog Laserdisc. As Robert Browning put it, "What's come to perfection perishes."

The problem is ethical as well as esthetic: most of the frames in a DVD-Video simply aren't there; they haven't been recorded. And most of the pixels in the frames that do exist also aren't present. You don't get 100:1 compression for nothing. Filmmakers may very well prefer DVD-Video to VHS for its clarity while at the same time reserving the right to criticize the medium for its supercilious attitude toward fidelity. But then, they are all copies, aren't they?

The fully digital image also presents challenges to distributors. Because copies are exact and there is no generation loss, DVDs present serious piracy problems. Once movies are digitized they are just as easy to duplicate and transmit as digital text. It's only a question of bandwidth.

Yet the call of the digital siren was irresistible to the hardware companies. The MPEG-2 algorithm was adopted by the floundering consumer satellite television industry for its digital second-generation product in the mid-1990s and proved successful. By 1998 the consumer electronics market was flooded with digital cameras, both still and video, and film-based photography was under siege. Sony had tried to market a digital still camera called Mavica as early as 1989. In 1992 Kodak had introduced the Photo CD format to deliver film-based photos digitally. Both had languished. Now, the time was right. From the moment DVD-Video was introduced in April 1997 analog was dead—at least in marketing terms.

## The Myth of Multimedia

Considering the formidable technical hurdles involved in digitization, the disorganized marketplace, and serious issues of quality, the seasoned cinephile may be excused for reacting cynically to the multimedia hype of the nineties. Artists have been combining text, images, and sounds since the invention of movies. Edison was the first multimedia artist, and film is the first multimedium. Digitizing the images and sounds gives the viewer a real measure of control over them, which is

a useful advance, but didn't the Laserdisc (still an analog device) accomplish much the same end?

From a strictly cinematic point of view, it does. If our aim is simply to control the experience of watching movies, a fully computerized laserdisc (or DVD) player is a decent solution to the problem. Moreover, the existence of a multimedia industry is not going to change the way filmmakers make films in any significant way. As producer Joe Medjuck has pointed out, the artistic strength of Hollywood (and by extension most filmmakers) is linear narrative, which is directly contrary to the interactivity that is the soul of multimedia. Filmmakers tell stories: "First this happens, then this happens, then…." Random access to the parts of a movie can destroy its rhythms, its reasons for being.

From a publisher's point of view, however, the advent of multimedia is a historic event nearly equal to the invention of movable type. For the first time, all media become available to the publisher. Books have always had illustrations. Sometimes a picture *is* worth a thousand words. Moving pictures, then, should be worth 24,000 words per second.

In the 1970s at Xerox PARC, scientist Alan Kay, one of the key figures in the microcomputer revolution, developed a model for the computer of the future that he called the Dynabook. (Remember, this was before there was such a thing as a microcomputer.) Kay envisioned a hand-held computer that had much the same "look and feel" as the book you are now holding (assuming you are reading the book version of *How To Read a Film*). He understood the value of this ancient information format and assumed quite rightly that, as the computer people learned to say years later, "if it ain't broke, don't fix it." Multimedia is an important step in fulfilling the promise of the Dynabook. All that remains is to make it portable, and flexible … and much faster (and, while we're at it, let's quadruple the resolution).

In a sense, the format is misnamed. Since the main advantage of "multimedia" is that it unifies the various publishing media we have developed over the past hundred years, perhaps "unimedium" would be a better name. This would focus our attention on the job at hand: to produce a unified experience, communicating thoughts and feelings, using whichever information formats work best.

More important, the real value of the format known as multimedia has much less to do with the combination of media for which it is named than it does with its coding system. Another better name for the format would be "digital book." While, as we have seen, digitization creates some serious problems for multimedia movies, it is no less than deliriously liberating for text. The advantages are several, and they are real.

The most important is the ease with which digital text can be retrieved. Most printed nonfiction books have indexes, but digital text allows for "fulltext indexing," which means that every word is retrievable, and this is nearly as useful with

Figure 7-9. At the Digital World multimedia show in 1991, Voyager employees were identified by their contrarian tee-shirts. (This was the show at which Apple introduced QuickTime.) (*Courtesy Colin Holgate, Voyager.*)

fiction as with nonfiction. If the concept of the digital book is extended to the digital library, this unlimited and easy access method becomes a formidable intellectual tool. Commercial electronic indexing was pioneered in the late sixties and early seventies by companies such as Dialog and Lexis long before the CD-ROM and multimedia developments of the nineties. These online databases continue to perform a central function in the world of digital books, even now that they have been joined by "portable" databases on CD-ROM. Even a jukebox full of dozens of CD-ROMs can't approach the capacity of centralized databases, which is one of the reasons online technology will continue to play a role in multimedia publishing. The World Wide Web would be an impenetrable thicket of data were it not for the search engines that drive it.

Fulltext indexing also allows for the electronic variant of cross-referencing that has come to be known as hypertext. In a hypertext document, the user controls the flow of the narrative logic, expanding or contracting the level of detail, going off on tangents at will, or outlining the subject of discussion. With its ubiquitous pointers to relevant information and illustrations, hypertext provides a level of control over the text experience unmatched in print. Hypertext fulfills the dreams of authors who are fond of footnotes* (and parentheses) as well as the venerable editors of text commentaries like the Shakespeare Variorum and biblical concordances who had felt the need for a third dimension of textual narrative. Now they have it.

Digital text also offers the reader new control over the experience—a new degree of ownership of the text as well as the book in which it is housed. Digital text is easily copied and moved, sorted and modified. While this is of considerable

* Still an effective way to give text a third dimension.

Figure 7-10. The Oxford English Dictionary, one of the world's great publishing enterprises, in its traditional 20-volume book form and on CD. The CD-ROM is easily updatable as well as being easier to search and almost infinitely cheaper to manufacture. (*Courtesy Oxford University Press*.)

benefit to the reader, it poses some serious and interesting problems for the publisher, which we'll discuss shortly.

Digital text still suffers from a lack of screen resolution, and given the choice, a printed book is still the best way to experience a text. With a digital book you can't make marginal notes as easily, turn down the corners of pages, or mark the text as flexibly, but those problems will be solved as we approach the Dynabook, and the control and searchability of the digital book can make up for the rigid linearity of the physical experience.

Perhaps the most valuable feature of digital text from a publisher's point of view is also its most mundane: its price. The cost of producing CDs or even magnetic diskettes is insignificant when compared to the cost of producing even the simplest of books. Moreover, discs—unlike books—can be produced pretty much on demand. It is not necessary to invest in large inventories. Most readers are unaware of the economics of book production, but publishers constantly must confront this painful dilemma.

Most of the cost in printing is front loaded. It takes more time and effort to set up the presses for a print run than it does to do the actual printing. Thus, it is uneconomical to print just a few copies. Publishers are forced under the current technology to print a sufficient number of copies so that the large costs involved in setup can be amortized in such a way that the unit cost is reasonable. More than one publishing house has been destroyed by maintaining excessive invento-

ries, the result of overly ambitious press runs set to make the numbers work rather than serve the market.

The setup cost for a printing of CDs or DVDs is negligible when compared to traditional book printing setup costs. For example, a twenty-volume large-format encyclopedia that might require printing a minimum of a thousand book copies at $150 per set (because if fewer copies were printed the unit cost would be too high) can be produced on a single CD-ROM in a much smaller edition for $1 or $2 per copy. Instead of an investment of $150,000 the publisher needs to spend perhaps $1,500. All kinds of publishing ventures that were uneconomical in print form become possible on disc, greatly expanding the range of publishing.*

Indeed, the low cost of digital publishing means that highly capitalized professional organizations may no longer dominate. Electronically sophisticated authors now command the publishing power once reserved to the established publishing houses. With a few hundred dollars worth of software, an author can produce a fully formatted book, replete with illustrations (in color, and in motion). With access to the Internet he or she can make the "book" available to millions, worldwide, instantaneously: a kind of "virtual publishing." What such a cyberauthor can't do better than a commercial publishing house is market this work. For some types of publishing—academic, special interest, private—this may not matter.

It is also not yet clear that universal access to publishing channels is entirely positive. Take it to its logical conclusion: if everything is published, then nothing is focused. The arduous process of production and distribution that pertained for three hundred years provided a filter that, on the face of it, worked. Imagine if there were a thousand times—a hundred thousand times—as many texts to deal with. The great bane of the Internet is logorrhea. We will have to find a new way to separate the wheat from the chaff. While the job of publishing may be increasingly irrelevant, the importance of editing grows each day. The search engines are a start, but much more sophisticated tools are necessary.

There is another aspect to this new world of virtual publishing that needs to be examined. As we noted earlier, because the reader now has such a command of the author's text, the traditional concept of copyright comes into question. Digital publishing is so easy that it leads us beyond traditional self-publishing to what we might call republishing or repurposing. College teachers who succumbed twenty years ago to the siren call of the photocopier, producing limited editions of other people's texts for classroom use have been joined by the rest of us, who can now whip together a little multimedia wedding invitation, for example, from a few

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* It's true that "prepress" costs for multimedia CDs and DVDs can be very high: software development is much more expensive than traditional typesetting and book design. But these costs will drop quickly as publishers learn how to deal effectively with this new format.

rivverun, past Eve and Adam's, from swerve of shore to bend of bay, brings us by a commodius vicus of recirculation back to Howth Castle and Environs.

Figure 7-11. On top, text in the Palatino typeface reproduced at a computer screen standard of 72 pixels per inch. Below, the same text as it appears in a book at approximately 2600 dots per inch. (Set 12 points on 14-point leading.)

lines of Gerard Manley Hopkins, a little Lohengrin, and perhaps a David Hockney for the background.

The legal doctrine of copyright has traditionally protected not ideas, but their expression. Because it brings all texts, images, and sounds into a uniform environment, digitization makes it a simple matter not only to reproduce those copyrightable objects with little or no cost barrier, but also to modify them in such a way as to meet the letter of the law, if not its spirit. When does a quotation become plagiarism? When does plagiarism become an homage, a new work of art? These questions have been with us for a long time, but they gain added urgency in the digital age. Aside from laws dealing with physical property, the ownership of intellectual property is a relatively new concept, with its roots in the nineteenth century. It may not last through the twenty-first century.

Sampling—the reuse of other people's music—first became common in the 1980s when professionals gained access to digital editing equipment. By the late 1990s. the availability of cheap CD recorders meant that every high-school kid could dub his own "mix." The development of audio compression formats for the Internet like MP3 made every hard disk a potential pirate jukebox.* By 1999, the music industry was in the throes of a revolution: it wasn't just the threat of universal piracy; it was also that musicians could now sell directly to listeners. What had happened slowly in the print world was now spreading at Internet speed through the music world. It is only a matter of time before this is an issue in video as well.

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* If audiophiles think poorly of uncompressed CD, they have nothing but contempt for the lossy compression of MP3. But the vast majority of Internet music hobbyists couldn't care less. After all, the popular music they trade is usually produced with electronic instruments of the same level of quality. We're not talking Stradivarius here—or even Zildjian vs Sabian cymbals.

Expect the next edition of your word-processing software to come with a translator that will modify the borrowed text you select just enough so that no one will be able to identify where it came from. Expect the next edition of your multimedia authoring tool to do the same for movies. You can already buy font design programs that perform a similar function with typefaces. Altsys Fontographer allows you not only to apply slight modifications to a font in seconds, but also to merge two separate and distinct faces. If you combine Hermann Zapf's influential and resonant Palatino with Frederick Goudy's obstreperous Old Style, what do you owe to the designers and producers?

Probably nothing. Current U.S. copyright law is unclear on the copyright status of typeface designs. Since the Copyright Act of 1976, Congress has chosen to "defer" protection of typeface designs. In other words, it has decided not to decide whether these creative enterprises are "works of authorship" and therefore copyrightable. The crux of the matter is whether the design can exist separately from the utility of the product. If it cannot, the Act of 1976 declares, it is not protectable.* This leads to an esthetic paradox that would have bemused architect Louis Sullivan, who insisted in the last century that "form follows function." If you abide by that dictum perfectly, you can't separate the design from the article, so you own no intellectual property rights—according to the Congress of the United States. You've reached design nirvana—and copyright hell.

But clearly you've appropriated other people's work. Just as clearly, your own input has been minimal. Morally, you've transgressed, even if you are not legally liable. Now suppose you spend a certain amount of time, effort, and talent modifying the new typeface. At what point does it become your own work? At what point—if any—is it no longer a plagiarism?

This curious situation is not an isolated anomaly. In 1991, in *Feist Publications v Rural Telephone Service Co., Inc.*, a case with similar implications for the information industry, the U.S. Supreme Court ruled that a factual database that was complete and organized alphabetically, such as a telephone directory, was not protectable under copyright law. The Court decided that it was the editorial labor involved in editing down a complete database that formed the "work of authorship," which was therefore protectable.

Both of these legal rulings would have worked well enough in the mechanical past: type designers made livings because their foundries sold expensive bronze matrixes; the value in any printed list was not that it was comprehensive but that it had been edited down to manageable size. But neither ruling serves us well in

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* "The design of a useful article … shall be considered a pictorial, graphic, or sculptural work only if, and only to the extent that, such design incorporates pictorial, graphic, or sculptural features that can be identified separately from, and are capable of existing independently of, the utilitarian aspects of the article." [17 U.S.C. Sec. 101.]

Figure 7-12. With hindsight, the merger of text, images, and sounds was irresistible. Jean-Luc Godard used the technology available in his time. These four shots from *Le Gai Savoir* (1969), combine drawings, print, ads, cartoons, handwriting, and symbols. (*l'Avant-Scène. Frame enlargements.*)

the digital age when fonts are made of infinitely replicatable bits and bytes, and complete databases are the goal, not the bane, of listmakers.

Typefaces are relatively simple intellectual properties, but the same patterns apply to texts, images, and movies. Indeed, the film industry has more experience than any other in handling complex intellectual property rights issues. Film is, of course, a collaborative medium, and any industry lawyer is familiar with the knotty problems of competing claims as to who owns what. Dozens of major contributors can lay claim to various pieces of the intellectual property that is a movie, from the author of the original source material to dozens of filmmakers and actors to numerous distributors in numerous markets. The trouble is that there is little logic to Hollywood rights law, and so the new multimedia industry will have to work out reasonable guidelines without the help of its predecessor.

In the end, if the copyright system is going to survive, it may only be because we apply prodigious amounts of digital processing power to the task of allocating percentages among the hundreds of individuals and companies that may contribute in some way to a multimedia production. The model would be music royalty organizations like ASCAP and BMI, or the British library Public Lending Rights program, that apportion certain amounts of revenue to authors by formula. The only other alternative is to abandon the idea of copyright altogether and return to the system that pertained until the nineteenth century in which the value of a work of art was vested in its physical manifestation, not its abstract intellectual form. In the new world of virtual publishing, where every author is a publisher,

this might be conceivable. There's only one problem: so much of intellectual work in the digital age simply has no physical manifestation.

As we watch this new medium struggling to be born—the synthesis of 500 years of print, 150 years of photography, and 100 years of audio recording and movies—we are struck with the contradictions:

- ❏ It has less to do with the new medium of movies than with the old medium of print.
- ❏ That image, sounds, and print are digitized is more important than that they are combined.
- ❏ While digitization vastly increases our control over these media, it also—for the time being—reduces them to abstractions with notably less quality than their analog predecessors.
- ❏ The major advantages of digitization—instant access to information and its comprehensive indexation—have more to do with the rise of networks and their databases than with the combination of media.
- ❏ While digitization vastly increases a reader's power and facility, it poses serious challenges to the concept of copyright on which our current system of authorship is based.

Yet we can sense the rightness of multimedia: this is where we have been headed for hundreds of years. If Sir Walter Scott could have added slide shows to his novels, he would have. If Charles Dickens could have personally narrated his remarkable stories, he would have (and did, to a certain extent, in his lucrative lecture tours). If Daniel Defoe could have included an interactive database of historical statistics with *Journal of the Plague Year*, he would have. If Georges Méliès could have allowed his viewers to interact with *Voyage to the Moon*, he would have. If George Bernard Shaw could have included ancillary texts with *Candida* or *Man and Superman*, he would have (and did, in the published versions of his plays). If Preston Sturges could have spunoff his films as television series, he would have. If Jean-Luc Godard could have written a book that was also a movie, he would have. If François Truffaut could have shot a movie that was also a book, he would have, too.

Text and images and sounds have been separated for hundreds of years only because technology has lagged behind our imaginations. Now it has caught up, and they are united, as they were meant to be: for better, for worse, in sickness and in health.…

# The Myth of Virtual Reality

There is always a struggle between the artist's aims and the limits of the available technology. But now that the digital revolution is well on the way to providing a common coding system for all forms of media, the tension between desire and capability is yielding to a new controlling dialectic: between ethics and esthetics. This historical development in our intellectual history is not unlike psychologist Erik Erikson's famous dialectics of personal growth. In this case, we reverse the classic biologists' saying: now, "phylogeny recapitulates ontogeny"—the development of the group echoes the development of the individual.

Once images, sounds, and texts are digitized, all things are possible. The struggle between what we want our media to do for us and what they are capable of doing has ended. Or, at least, the struggle is pointless. In the analog world there were strict limits: you could only make a piece of wood or a violin do what it was capable of doing. In the digital world, there are no physical limits: it's only a question of storage capacity, processor speed, and communication bandwidth.* The digital revolution is completing the intellectual revolution that began thousands of years ago when someone first put paint to stone. Cave paintings, like all art since, sought to distill the natural world, to abstract it, to make of it an idea. Now we have no physical barriers between us and the idea.

This new power is intoxicating, but like all power it brings with it the necessity for a strong ethical structure. Godard was fond of quoting Lenin's dictum: ethics is the esthetics of the future. They were both right, but in ways they could not have foreseen. Now that there are no insurmountable technical limits, now that we can make our artistic medium do everything we want, we need to understand the moral limits much better than we have before. In a way, all artists have been adolescents until now, under the thumb of parental technologies. Now they must take on the moral responsibilities of adulthood.

Before we investigate those responsibilities in more detail, we should look at the current business context of virtual reality. Like "multimedia" and "cyberspace,"

* Yes, this is a bit of hyperbole, but not much. For the purposes of discussion, let's assume that all the world's texts amount to 100 terabytes (100 million books averaging a megabyte each). Today, you can carry 18 gigabytes in your pocket. (This is the capacity of a two-sided double-layer DVD.) In the past twenty years we have increased storage density by five magnitudes. 100 terabytes equal 100,000 gigabytes. To carry all the world's written knowledge in your pocket, we will need to increase storage density by another five magnitudes. We're halfway there. Perhaps some compromises will have to be made: you may need two or three pockets, or you may have to plug into the Internet for some of it.

"virtual reality" has been one of the catchphrases of the digital revolution. In its narrowest commercial sense, virtual reality intends to apply digital technology to computer games and entertainment to increase the apparent reality of the experience by making it both more verisimilitudinous and more fully interactive. Instead of choosing which room to enter by typing on a keyboard or clicking a mouse, you physically turn left or right: all the fun of walking with none of the aerobic consequences.

Virtual-reality techniques vary in both attitude and ambition. As the century came to a close, virtual-reality engineers and producers were reliving the artistic dialectic that characterized the birth of film a hundred years ago: should the technology be used to reproduce reality or replace it, to capture the world or to invent a new one? It's Lumière versus Méliès all over again, but with a special twist this time, for digital records don't betray their sources. Méliès's fantasies were clearly different from the Lumières' realities. Digital imagery has reached a level of mathematical abstraction that now makes the one indistinguishable from the other. Interestingly, the traditional realists seem to gain more from the new technology than the fantasists: "Telepresence," the application of virtual-reality techniques to reproduce a distant place, will yield significant scientific dividends as machines will go "where no man has gone before."

These classic differences in attitude are accompanied by differences in ambition. At one extreme lies "fully immersive" virtual reality, which attempts a full range of sensory impression, including three-dimensional video, full-range audio, and touch. At the other end of the scale we find basic, yet elegant, applications that simply allow us to control our point of view of standard images.

One of the earliest examples of telepresence was the popularity of "webcams" in the early days of the web: cameras that transmitted live images of the weather or someone's bedroom. The most ingenious of the early webcams was the Telegarden project at the University of Southern California (1995). Web surfers who became members of the project could send commands to operate a robot to plant seeds, water, or fertilize a real garden that had been planted in the Telegarden lab. Anyone could tune in at any time to see how the garden was progressing. The next year NBC installed a number of webcams at more than a dozen venues for the Atlanta Olympic games. The television coverage was so tightly edited (and usually delayed) that the website (operated in conjunction with IBM) became the best way for sports fans to view the contests. In 1997 the landing of the Mars Pathfinder probe drew a record 45 million visits to the Jet Propulsion Laboratory website to view live images from another planet. These early experiments suggest some of the possibilities for telepresence.

As a consumer product, virtual reality means to exploit multisensory perception to increase our involvement. But we mean to take virtual reality in its

Figure 7-13. In the broader sense of the term, virtual reality existed a long time before we gave a name to it. Perhaps the assassination of John Kennedy in November 1963 marked a turning point. The nation was united in a television drama. Here, Jack Ruby shoots Lee Harvey Oswald, live. (*Courtesy Photofest*.)

broader sense here: as the technological movement toward increased verisimilitude and interactivity that is closely associated with multimedia.

In either sense of the term, virtual reality simply extends a theme that has been part of film history since the beginning. In the early years of this century, movie travelogues provided virtual journeys for homebound would-be travelers. As we've seen, filmmakers have been experimenting with larger screens, 3-D, and stereo sound since the twenties. In 1953, *This Is Cinerama* took us on a collective rollercoaster ride that is still the model for experiential cinema. As a technique to increase verisimilitude, virtual reality continues this tradition. The difference is in its interactivity, the degree of control over the experience that it provides to the viewer.

Here the technology may miss the point. At the 1964–65 New York World's Fair, viewers at the Czechoslovak pavilion could vote to determine plot developments in the movie they were watching. In the late sixties and early seventies, several stage drama experiments offered audiences erstwhile control. The technique did not catch on, for obvious reasons. The National Lampoon satirized audience control with lethal effect in a mid-1970s skit. In their version of *Waiting for Godot*, the always imminent guest shows up only thirty seconds after the play begins. He and Didi and Gogo briefly discuss where to eat. (As I remember it, they decided on Chinese.)

As a technique applied to games rather than cinema, virtual reality shows more promise. The essence of a computer game is its interactivity, so the increased verisimilitude offered by virtual reality is useful to enhance the experience. The basic concept of a dungeons-and-dragons game is a multithreaded matrix of plots, while a battle game depends for its effect on the adrenaline-boosting rhythm of

Figure 7-14. Telepresence is one of the faces of virtual reality. Here, a demonstration of carpal tunnel surgical technique shows how the technology permits less invasive surgery. The inset shows the image the surgeon sees.
(*Courtesy 3M Health Care. Frame enlargement.*)

challenges. In both cases, virtual reality enhances the effect. But perhaps its greatest value is with that class of games that duplicate experience, such as flight simulators. Indeed, simulators are less games than they are prototypes for virtual reality experience, and their great promise is educational. Perhaps we are not quite ready yet to trust the training of our surgeons to a virtual-reality lab, but numerous other crafts and techniques can benefit from the simulator approach that has served airline pilots well for many years. Now that these devices have been digitized, we all have access to them. Indeed, the first successes of virtual reality (apart from games) have been in the "how to" business, with CAD programs that allow us to envision—albeit roughly—how the new deck will look if we build it the way we've designed it.

Both key elements of virtual reality—verisimilitude and interactivity—lead to ethical questions.

Digital images and sounds are more true to life only when judged in their own context. No computer screen commercially available today comes close to the resolution of properly projected 35 mm film, to say nothing of superfilm technologies like Showscan and Imax. (Similarly, no electronic screen can match the quality of a well-printed book.) And while the CD has made digital sound the new standard, some audiophiles still prefer the older analog technology, as we have already noted. Are they simply esthetic Luddites?

The acuity of a digitally reproduced sound or image depends on two mathematical factors: the number of samples and the precision—or depth—of each sample. For moving pictures, add a third factor: the frame rate. Theoretically, to match the accuracy of analog reproduction, digital sampling rates would need to approach infinity. Luckily this is not the case in practice. As we have seen in Chapter 2, the invention of film itself depended on limitations of human perception. We only need to exceed those limitations by a measurable margin for error. Moreover, analog techniques of reproduction are themselves far from perfect.

Figure 7-15. FULLY IMMERSIVE VR. A woman playing Cybertron finds herself ensconced in the middle of a gyroscope which, combined with a head-mounted video display and a 4-channel audio system, attacks most of her senses. The system weighed 750 pounds and required 80 square feet of floor space. Not for couch potatoes! (*Courtesy Straylight Corp.*)

Digital models need only match or exceed their analog predecessors—for the time being.

The problem is that they don't, yet. While it is arguable that the audio CD standard is close enough, and it is likely that the 16 million colors available on a high-end computer video driver are sufficiently precise, the resolution of the screen, and the prodigious compromises necessary to store motion pictures still impose significant limitations, despite rapid advances in compression technology.

In the sixties, the story goes, Ingmar Bergman suffered from guilt over the inherent dishonesty of his chosen medium. Bergman brooded over the fact that more than 50 percent of the time his audience was watching a perfectly blank screen. Imagine his distress when confronted with digital imagery, which compounds that singular trick of the movies a thousandfold!

The interactive element of virtual reality presents an additional ethical problem. As we involve the viewer-turned-user in the artistic decision-making process we may abrogate the responsibility of authorship. The very richness of the virtual-reality multimedia environment can be misleading. The more we attempt to duplicate reality, the more freedom we create for the user to manipulate and control this environment, the farther away we seem to get from the point of it all. The closer we come to the full reproduction of reality, the more we lose the dialectic between art and its subject. The term "virtual reality" is, after all, an oxymoron. In physics, what is real is real, what is virtual is not real. The result is that, like David Bowman at the end of *2001*, virtual reality users find themselves in a cage—a beautiful cage, but all the more constricting just because it appears to be open.

Figure 7-16. QuickTime VR, introduced by Apple in 1995, turned movies inside out. Here, the artist gives you the space or the object, and you choose how to view it. If movies are paintings, QuickTime VR is both architecture and sculpture. These frames are from the "Balcony" QTVR, the first released demo of the technology. Thirty-three stills were stitched together into a continuous panorama which the user can navigate at will (*Courtesy Apple Computer, Inc.*)

The comparison with the drug experience is apt. As The Beatles put it:

> Nothing is real
> And nothing to get hung about.…*

We've already noted the parallels between psychoactive chemicals and our traditional plug-in drugs. Fully immersive virtual reality is the electronic superdrug. "Strawberry fields forever."

While the philosophy of virtual reality raises these ethical questions, on a more practical level, certain virtual-reality technologies show immediate promise—and in a way we might not have expected.

Apple's QuickTime VR is one of these. Previewed at the Digital World show in June 1994, three years after the debut of the original QuickTime, QTVR and its competitors turn that movie technology on its head. Using the same underlying algorithms that approximate movies in a digital environment, VR permits the user to change point of view, to tour a space at will. The movement of the mouse determines the camera's point of view, and a click of the mouse controls the position of the camera. Panoramic still photographs taken at one or more locations in the subject space are stored on disc. QuickTime VR processes these complete but distorted records to present a properly proportioned still image from the point of view the user has chosen. Users can zoom and pan as they like. If more than one position in the space has been recorded, users can move from point to point. If no 360° panoramic record exists, a separate VR preprocessor will create one from a

* "Strawberry Fields Forever," copyright 1967, Northern Songs Ltd. Reprinted with permission.

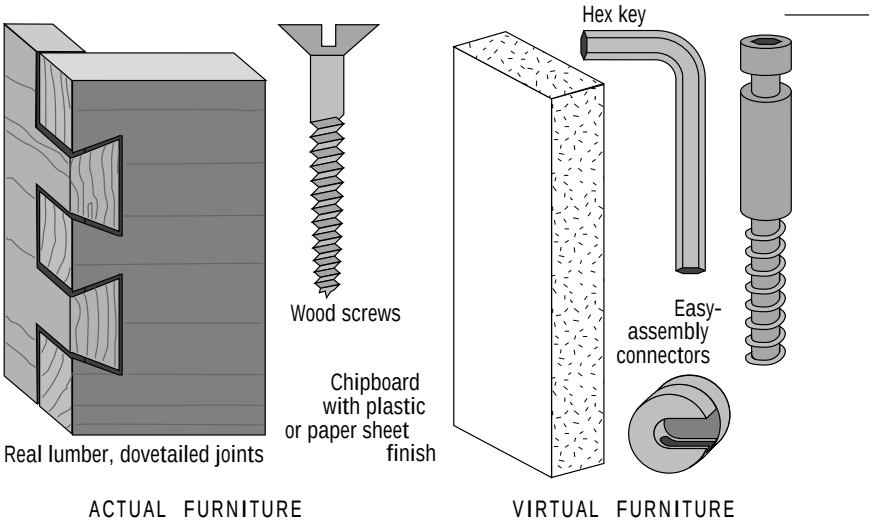


Figure 7-17. VIRTUAL FURNITURE. While we might easily assume that virtual reality is a product of developing technology, perhaps there are underlying economic motivations: in an overcrowded world, there isn't enough real reality to go around, so many of us are going to have to make do with synthetic reality. Much the same has happened to furniture in the last 35 years. For many centuries, the world over, furniture was constructed of lumber joined mechanically—rabbet, mortise and tenon, dovetails—and glued. The industrial revolution brought the metal screw to replace the peg, but the basic philosophy of joinery didn't change. That tradition has been superseded in recent years by a method of construction that relies on imitation wood and shifts the burden of construction from the carpenter to the user who—just as in VR entertainment—is provided with an ingenious technology that makes the work of construction appear easier, even though it isn't. The result is a virtual product that appears to meet our criteria—but has an exceedingly short lifespan. Perhaps the same will prove true with VR media.

series of rough stills. The technology also allows the user to track around an object—the reverse of panning around a space.

Now this is hardly the stuff that virtual-reality visionaries dream of. There is no attempt to overwhelm the senses; the user remains in control. The genius of the QuickTime VR technology is in its simplicity. It elegantly and intuitively capitalizes on the singular advantage that digital films have over their analog predecessors: the ability to approximate new images by interpolating old ones, which is the heritage of the compression techniques that had to be developed to deal with the formidable numerical requirements of digital cinema. QuickTime VR is the latest example of a classic pattern in the arts: the limitations of the medium yield its essential utility. The main disadvantage of digital movies has become the engine of a new technology.

Of course, this new technology is not movies; "stillies" might be a better term. It creates a place, not a narrative. It denies both mise-en-scène and montage. It

replaces rhythm with atmosphere and character with environment. But as it matures it will serve some of the same needs that film has served. In their own way, "stillies" will take us to other people's worlds just as the movies have done. What this elegantly simple technology will not do is confuse those worlds with our own.

## The Myth of Cyberspace

The early visionaries of the digital revolution were almost as fascinated by the communications possibilities of the new technology as they were by its capacity to reproduce reality and fuse together multiple media. At the same time that the microcomputer decentralized power in the office, liberating individual workers from the haughty priests of technology in the computer room, new communications techniques were adapting the telephone network to connect millions of these personal intellectual tools with each other and with centralized databases.

Dialog, the first major online database, opened for business in 1965. It was originally designed by Lockheed as a tool for the space program. Lexis, the first comprehensive professional database, put an entire law library online in 1973. Arpanet, the predecessor to the network of networks that later became known as the Internet, went online in 1969. The British Prestel system opened in 1976, demonstrating that online computer information networks could be useful to consumers as well as professionals. Prestel was never a commercial success, but its television-based cousins, Ceefax and Oracle, became part of British life in the 1980s. The French Minitel system, more technically sophisticated than Prestel, became an integral part of French culture beginning in 1985.

The Minitel system differed radically from its predecessors (with the exception of Arpanet) in that it was a distributed system. Instead of linking tens of thousands of users to one central host computer, it provided a switching network to link them to thousands of smaller, independent hosts. One of the salubrious advantages of this architecture was that it decentralized the costs of development and operations. Thousands of Minitel services quickly sprang up. Many of them hosted chat sessions. In an age before email this new form of instant messaging was all the more unique. The online databases were useful, but that a database was online was important mainly if it was too large or too frequently updated to be effective resident on a local disk.

Communication, as quickly became evident, was the real soul of an online system. Chat proved to be a genuinely new form of human interaction, as a single individual could hold multiple simultaneous separate private conversations. It was a realtime equivalent of old-fashioned written correspondence, but the

Figure 7-18. This is a late model of the French Minitel, first introduced in 1981. To save space, the keyboard folds up. The design goal was to occupy a smaller "footprint" than a telephone directory. (*JM*)

instantaneous speed combined with the anonymity of typed messages and access to tens of thousands of strangers the world over quickly proved to be an addictive combination. By the late 1980s. the Minitel had been institutionalized in France: thousands of everyday products listed their Minitel numbers as marketers found a new way to build a direct path to their customers. Minitel served as a clear model for the development of the Internet and the World Wide Web: all the elements were there. It worked so well, in fact, that Internet services grew very slowly in France in the 1990s: consumers were satisfied with the older, simpler, and more convenient system.

While Minitel was succeeding during the 1980s, a number of similar American experiments failed, mainly due to misunderstanding of the market for such services. Some, such as Knight-Ridder's and Times-Mirror's experiments, chose to broadcast on television, confusing the medium with its sobriquet, videotext.* Not only did this impose a centralized authority on what was meant to be a one-to-one communications medium, it also suffered from the inability of the average television screen to reproduce text. Others, like IBM's and Sears's Prodigy, relied on an outdated network model (again, the massive central host, although this time with subsidiary masters), and a graphics system that was equally out of date. NAPLPS, the North American Presentation Level Protocol Standard, had been devised in the early 1980s as the U.S.'s and Canada's answer to Britain's pioneer-

Figure 7-19. Microsoft's *Cinemania* CD-ROM, first published in 1992, was one of the early examples of a multimedia reference work. The keyword indexing is just as valuable as the pictures and sounds.

ing Prestel graphics language and Minitel's Teletel protocol. Prodigy adopted NAPLPS just two years before much more sophisticated graphical user interfaces became ubiquitous on the nation's microcomputers.

The brief history of online graphics is quite interesting. An engineer for the British Post Office named Sam Fedida had come up with the basic concept of Prestel in the early 1970s. The aim was to produce an online system for consumers. From the beginning, basic graphics were to be a part of the service—this at a time when microcomputers didn't exist and time-sharing terminals, their equiva-

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* Although a number of terms were in use in the early 1980s as the industry was being formed, English-speakers eventually settled on "videotext" to describe the telephone-based systems like Prestel and Minitel, and "teletext" to describe the video-based systems like Ceefax and Oracle. Of course, it should have been the reverse. Later, videotext lost its final "t." The remaining stub reminded one of disposable paper products—not a felicitous analogy. By the way, the U.S. tried teletext too, with an equal lack of success. Here, the problem was much simpler. In the U.K., where the medium succeeded, all television sets were manufactured with teletext decoders; in the U.S., they were not.

Figure 7-20. Reference works on the Web, such as the Internet Movie Database (www.IMDB.com), offer less bandwidth and independence than CDs, but are capable of being instantly and continuously updated.

lent at that time, were strictly character-based. The Prestel—and later Minitel—graphics character sets were ingenious solutions to the problem of transmitting graphics over telephone lines. (They used the upper-ASCII character set to produce elements for a mosaic graphics format.) The basic colors and shapes greatly added to the effectiveness of the display of characters and simple drawings without attempting the then-arduous task of re-creating photographic imagery.

NAPLPS, ambitiously, attempted to extend the idea to more complex vector graphics. The ambition proved hubristic, as pixel-based graphical user interfaces like the Macintosh quickly established themselves. The engineers at Prodigy (the only ongoing system ever to use NAPLPS), focusing paternally on the graphic responsibilities of the central host computer, had ignored the revolution going on around them. As microcomputers spread, increasing the general wealth of computing power a millionfold, there was no longer any need for NAPLPS—or IBM's mainframes, for that matter.

Although it was not a financial success, Prodigy nevertheless accumulated some two million users during the five years after its introduction in 1988. At the

same time in the U.S., Compuserve, the stodgy but profitable online system that had been adopted by the computer industry as its own forum, and America Online, a creative startup, had accumulated three million others between them. By 1993, as microcomputers became easier to use, the online industry dominated the business pages as the "Information Superhighway" had become part of the Clinton administration's national strategy. The "industry in search of a business," as online was known throughout the eighties, had finally found one. As the Internet began its rapid rise, AOL successfully made the transition from a proprietary service. By 1996 AOL was approaching 10 million members and expanding into Europe. In 1997 AOL acquired Compuserve, boosting its audience past 12 million. By the end of the century it was pushing 20 million.

Compuserve had been entirely character-based since it's debut in the late 1970s. AOL stole the lead by integrating client-based graphic elements, updates to which were downloaded and stored locally whenever a user logged on to the network. Pioneer online users in the early 1990s constantly bemoaned the time lost waiting for AOL graphics to arrive. (At about the same time, Compuserve developed the GIF format, a compression algorithm for photos that became ubiquitous.) By the time the Internet started to mushroom in 1995, PCs were powerful enough and modems were fast enough so that graphic elements could be downloaded as needed. It was no longer necessary to store them in advance. World Wide Web pioneers constantly bemoaned the time lost waiting for these graphics, too. At the turn of the century, the industry was still a wild frontier, and the early settlers put up with conditions that would have been unacceptable to their more civilized cousins back east. No other medium established itself so quickly: and no other medium offered so little control to publishers and producers. Imagine television in the early 1950s if every set received the broadcast signal differently, and sometimes not at all. Because so much depends on the browser software, that's still the case with the World Wide Web.

The large, centralized commercial networks like AOL took as their architectural model the television networks of the previous media age. Intending to be general public services, they tried to be all things to all people but quickly felt the weight of this responsibility. Entertainment may be something that we share communally, but information—the heart of these services—is profoundly private. Each of us has different requirements. The model should have been magazine publishing, not broadcast television. In France, it was, partly by accident. For political reasons, the French government had decreed at the beginning that all Minitel services were to be operated by existing print publishers. As a result, many of the early services followed the special-interest model of their print progenitors, and quickly found committed audiences. Service operators in the U.S. had to learn this the hard way.

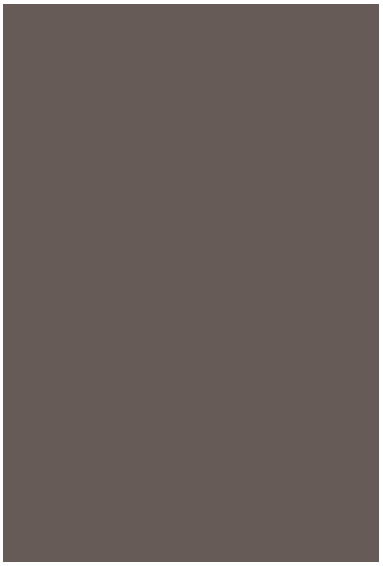

Figure 7-21. With a rare display of wit, The *New York Times* ran this graph to accompany a serious story on the growth of the Internet at the beginning of net mania. May 15, 1994. *(Copyright 1994 by the New York Times Company. Reprinted by permission.)*

Partly as a response to this need, by 1994 the Internet had become the online focus of attention in the press. Descendent of the Defense Department's Arpanet, the Internet provided a massive network of interconnected host computers around the world, and therefore what appeared to be a perfect path to an infinite variety of special-interest services. What's more, it was "free," since the government and the universities were still contributing to its upkeep.* This transition happened more quickly than anyone familiar with the long history of the Internet could have forecast. Like fax before it, the Net was a technology with more than a twenty-year history behind it when it took off. Most observers credited its metamorphosis from a network of government, scientific, and military networks to an international commercial online medium of unprecedented power to the development of the technology known as the "World Wide Web."

Tim Berners-Lee, an Englishman working at the European Center for Particle Physics ("CERN") in Switzerland first suggested the concept of the World Wide Web in 1989 and developed the basic hypertext technology in 1990. It was based on work he had done as early as 1980. The idea of hypertext linking was not new; but the ambition of linking to anywhere on the Internet had profound implica-

* This is one of the more remarkable aspects of Internet history. The government no longer supports the network, but the transition has been seamless and economically painless. The commercial opportunities appear to be so vast, that the telecommunications companies have been more than willing to invest tens of billions to develop the necessary communications infrastructure.

tions. Imagine a library where any book—indeed any page in any book—appears instantly in front of you whenever you think to request it. Now imagine that that page is always from the latest edition, and that it can be illustrated with audio and video as well as with still pictures (and those illustrations do not have to reside on the page; they can exist anywhere). That is the vision of the World Wide Web.

For the first few years, the World Wide Web was mainly a European project—not surprising, since online development had been dominated by French and British projects, while Americans lagged far behind. Then, in September 1993, the National Center for Supercomputing Applications ("NCSA") at the University of Illinois/Urbana-Champaign, released Mosaic, the first fully functional browser (or client software) for the Web. (Marc Andreessen, then a student in his early twenties, is generally given credit for Mosaic.) Within months, interest in the Web exploded, magnifying Internet mania tenfold. In January 1993 1.3 million machines were connected to the Internet; by January, 1996, that number had mushroomed to 9.5 million. Eighteen months after that it had more than doubled to 19.5 million. By July 1999 the count was 56 million.*

By mid-1994 hundreds of American corporations had opened "Web sites"; a year later, thousands had. Most of these sites were devoted to marketing information and advertising—anathema to Internet "netizens" just a few months earlier. By mid-1995 no commercial movie opened in the U.S. without its associated Web site. In August 1995 Netscape—the company founded 16 months earlier by Marc Andreessen and Silicon Valley entrepreneur Jim Clark—went public in the most successful initial offering in history until that time. Wall Street valued the company at $2.9 billion.† Internet stock mania had begun.

The established media rushed to find a foothold on the Web. Rupert Murdoch's News Corp. took a $2 billion investment from MCI with an Internet fillip. NBC made a deal with Microsoft. By 1996 no major newspaper or television network was without a presence on the World Wide Web. More important, one hundred thousand Web sites had bloomed around the world (as of January 1996), the vast majority operated not by the media giants of broadcasting or print but by individuals, small companies, and public organizations.

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* Network Wizards, Inc. See WWW.NW.com for current numbers and other useful data on the Web. While you're at it, check out original historical documents at the World Wide Web Consortium (now operated by MIT in association with INRIA) at WWW.W3.org, and NCSA documents at WWW.NCSA.edu.

† After a battle royal with Microsoft for control of the browser market the company was acquired by AOL in November 1998. The announced price was about $4 billion in AOL stock. This was not a very good return on investment for Netscape stockholders. However, by the time the deal was concluded less than four months later, the AOL stock was worth $10 billion to Netscape shareholders.

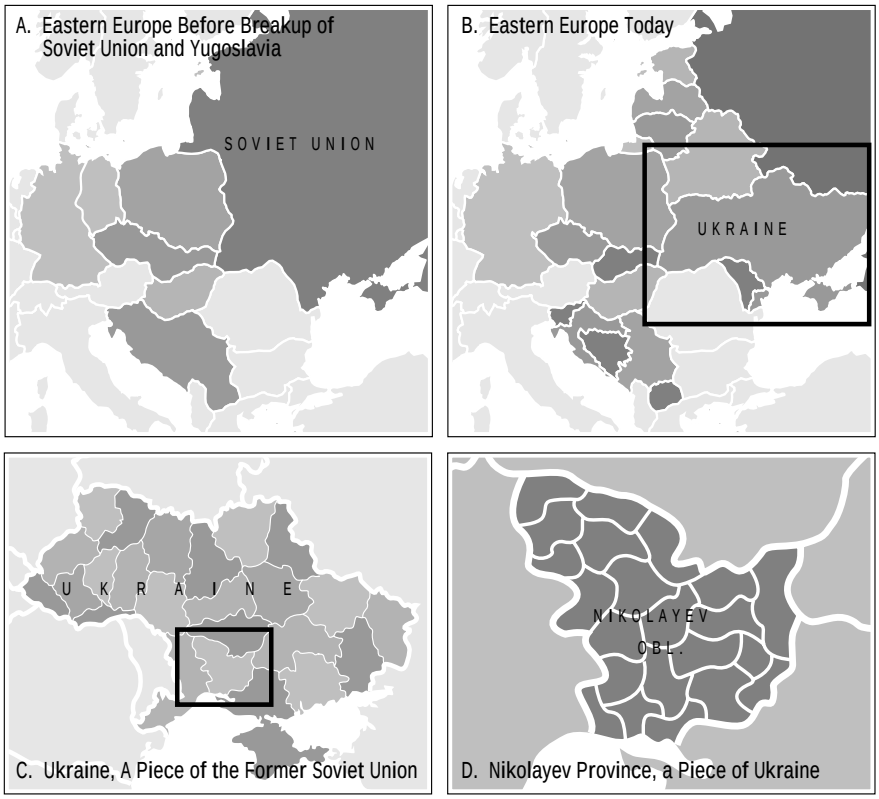


Figure 7-22. POLITICAL FRACTALIZATION. The disintegration of national structures in Eastern Europe in the nineties revealed the political fractalization that created them in the first place. Just as fractal mathematics are used to build complex figures out of small designs, so, in reverse order, larger political units break down into smaller and smaller components until neighbor takes up arms against neighbor.

Search engine companies proved to be almost as valuable as Netscape, the browser company. When Yahoo went public in 1996 they were valued at $300 million. This may not seem like a lot in Internet dollars, but—remember—there were fewer than 30 employees at the time. Because of the vast amount of material available on the Internet, the search engines, which indexed and sorted the world's websites, served as unofficial entry points. As such, they quickly garnered much of the advertising revenue that soon began to flow. By 1998 such magnet sites had been dubbed "portals" and the established media companies rushed to acquire them. In the next 18 months Disney bought Infoseek; Excite was acquired by @Home (with AT&T behind them); Lycos was the target of Barry Diller's USA Networks (although the deal fell through).

By late 1998 it was clear that the Web had established itself not only as major market, but also as the virtual engine of the economy. Priceline, a startup that sold discount airline tickets, had a market value in excess of the total for the top airlines, for example. Although the web was seriously cutting into the limited pie of consumer entertainment time, it had not yet found its share of consumer entertainment dollars. That was about to change. By 1998 every high-school and college student who had the bandwidth (and most did: bandwidth was a major recruiting point for colleges and universities after 1995) was into acquiring and trading MP3 music files. This audio compression technology pointed the way to a media universe where copyright was going to be about as valuable as the paper it was written on. Piracy, a nagging problem for music and video distributors since the late 1970s, was now about to become the norm rather than the exception, thanks to the digitization of the media and the increasing bandwidth of Internet connections.

In just five years the phenomenon of the World Wide Web had had a significant impact on the information industry, advertising, and the entertainment business. But these effects were dwarfed by the Web's potential for "e-commerce." This vast collection of digital ganglia had quickly altered the commercial value of intellectual property. At the turn of the century, with its lure of efficient markets and simplified sales channels, the Web was poised to change the basic way we do business with each other.

You say you want a revolution?

## "What Is to be Done?"

In 1980, the second edition of *How To Read a Film* concluded with a note on democracy in the media which observed that, while new technology had extended our power to create media, distribution of print, film, and television was still concentrated in a relatively small number of hands:

> The pervasion of the media has been a common theme in science fiction ever since George Orwell's vision of *1984*: "The instrument, the telescreen, could be dimmed but there was no way of shutting it off completely." But the facts bear repeating: what we still choose to call "reality" is now largely determined for us. It is not only that someone else is telling our stories—it's also the kinds of stories they're telling.

We then suggested that the channels of distribution were about to broaden, too, and listed a litany of imminent technologies from electronic mail to video on demand, from online data services to fiber optic cable, from direct-to-home satellite broadcasting to computers in every home. Many of these innovations are now

part of our daily lives. Others are still on the horizon. But one thing is clear: the digital revolution has radically altered the way we deal with reality—no matter who determines it.

My children, who were born after *How To Read a Film* first appeared and who largely grew up before I got around to the third edition, have enjoyed a wealth of media unknown before 1980. They are prodigious consumers of television, video, CDs, computer games, software, and theatrical movies, and—perhaps surprisingly, considering the wealth of new media—are not unfamiliar with the printed word. I may complain at the dinner table about our familial addiction to television (they may dim the telescreen, but there is no way they will shut it off completely), but they may be just as well read as their parents were at their age.

More important than the vast quantities of media they consume is the equally remarkable quantity they produce. They have at their disposal a range of software tools that would have astonished any professional writer, filmmaker, or painter twenty years ago. From the time they were six, they spent almost as much time actively creating as passively consuming.* Shortly after they discovered HyperCard, they began a series of illustrated stories. When Apple added sound to the software, so did they. To them this wasn't multimedia; it was fun.

The Orwellian year has come and gone. (We've forgotten who won the Super Bowl, but we remember the commercial.) The warnings about control of the media seem less pointed than they did fifteen years ago. We are now, most of us, so intoxicated with our new power to produce and to distribute media (media of all sorts: multi, uni, ulti, hyper, visual, textual, and traditional) that we could care less who owns the old-fashioned media. A. J. Liebling, the great press critic, noted almost forty years ago that "freedom of the press belongs to those who own one." We are now nearly at the point where we all own one—and a film lab, and a recording studio.

More important, the significant increase in distribution bandwidth during the eighties and nineties resulted in a political equilibrium in the media that is as frustrating as it is welcome. Most points of view get heard. Most people have an acquaintance with the issues of the day. No social or political problem is left untreated in telefilms or talkshows. Most new ideas find their way to the public forum quickly and efficiently. It is no longer us against them. It is them against them. The political and social dialectic has evaporated under the incessant and copious bombardment of more channels, more technologies, more media.

Alain Tanner forecast this state of affairs a long time ago in *Au Milieu du Monde* (1974):

---

* Lest you dismiss this as just a father's boast, I should admit the near balance was only possible because they worked on the computer at the same time that they watched television.

> We are in an age of normalization, where exchange is permitted, and nothing changes.

We have democratized the media more quickly and more thoroughly than we ever dared hope. Now we have the power. Do we know how to use it?

Raymond Williams observed in *Communications* (1976):

> In societies like Britain and the United States, more drama is watched in a week or a weekend by the majority of viewers, than would have been watched in a year, or in some cases a lifetime in any previous historical period. It is not uncommon for the majority of viewers to see, regularly, as much as two or three hours of drama, of various kinds, every day. The implications of this have scarcely begun to be considered. It is clearly one of the unique characteristics of advanced industrial societies that drama as an experience is now an intrinsic part of everyday life, at a quantitative level which is so very much greater than any precedent as to seem a fundamental qualitative change.

Of course the numbers have changed since Williams wrote. "Two to three hours" now seems like a frugal budget, and to the experience of broadcast drama we must add news-as-entertainment, video games, tapes and discs, multimedia, and Internet mail, newsgroups, mailing lists, and the Web.

And one implication, at least, is beginning to become clear: we are losing our grounding in reality. We are well on our way to David Bowman's fearful cage. Someone points out that highways are noisy, so we build walls around them, oblivious to the fact that we cut ourselves off visually and morally from our surroundings. We discover that asbestos is carcinogenic, so we spend billions removing it from every public building, without even thinking to calculate the danger (or lack of it) of leaving it quietly in place. We rewrite history so that it won't be offensive. We pay lip service to certain social and political problems we identified more than thirty years ago, but little has changed.

We have the words of science, but not the scientific spirit. We have the rhetoric of commitment, but not the will to act. We are as a society at all times Politically Correct, without paying much heed to the consequences of the loss of a sense of balance—or a sense of humor.

We have, to a large extent, as Raymond Williams intimated, given ourselves over to the fictions and quasi-fictions of the media. And the people who make media are no smarter than we are. Our films and television are technically proficient, relevant, democratic—and dull. Our new technologies are theoretically exciting, but "You say you want a revolution?" There are no revolutions anymore. The culture has been homogenized, and the balance is every bit as problematic as the imbalance we once strove to overcome.

"What is to be done?" We cannot stop the juggernaut that is the contemporary media. It will continue to saturate our lives. New modes of discourse, because

they insist that the reader become an active participant in the process, may give us opportunities to find our roots again. But ethics is the esthetics of the future. We must focus on the uses to which our talents and technologies are put. It is no longer sufficient to know how to read a film. Now we must also understand, in a profound way, how to *use* a film.

[Please choose an ending.]

# 1

And most important, we need to remember that there is still a vestige of reality beyond film, beyond media, beyond multimedia.

In this, we have a guide. Writing in *The New Yorker* in the autumn of 1947 at about the same time George Orwell was sketching his dark vision of the future, essayist E. B. White extrapolated a world of media uncannily like our own. "Preposterous Parables: The Decline of Sport" drolly suggests a nation "in the third decade of the supersonic age" obsessed with games, besieged by loud and multifarious media, and laced breathless with superhighways (the concrete kind).

Because of the fever, "records fell like ripe apples on a windy day," he notes. "Customs and manners changed, and the five-day business week was reduced to four days, then to three, to give everyone a better chance to memorize the scores." In this world, as in our own, no one is content to take in one event at a time, "and thanks to the magic of radio and television nobody had to." What they don't see on the field, they watch on the video scoreboard, or listen to on implanted radios, or watch on pocket televisions. Like the postsurrealist fantasies of artist Bruce McCall, White's parable finds warm comfort in mild absurdity.

As it turns out, this media bubble is about to burst. In White's dream, the Midwest's classic Dust Bowl game of 1975, when a football player is shot by a disgruntled spectator, marks the turning point, beginning a chain of other disasters in the stadiums and on the highways. "All in all, the afternoon of sport cost 20,003 lives. A record," White reports.

> From that day on, sport waned. Through long, noncompetitive Saturday afternoons, the stadia slumbered. Even the parkways fell into disuse as motorists rediscovered the charms of old, twisty roads that led through main streets and past barnyards, with their mild congestions and pleasant smells. It's time for us to hit those twisty roads again.

Figure 7-23. David Bowman's virtual cage at the conclusion to *2001: A Space Odyssey*. (*Frame enlargement*.)

## 2

And most important, we need to remember that there is still a vestige of reality beyond film, beyond media, beyond multimedia.

In this, we have a teacher. Gertrude Stein, a founder of the modern movement and cogent observer of it, made it clear that “Rose is a rose is a rose is a rose.” (She would have found Chapter 3 tedious, perhaps.) For Stein, poetry isn’t what gets lost in translation, it is “really loving the name of anything.” She is as well remembered for her Paris salon as for her literary art, and rightly so, for everyday life was as important to her as literature. Like so many of her colleagues and friends at the time, from Picasso to Hemingway, her life was a work of art—a separate autobiography. In the Renaissance, the Italian word for this quality was “sprezzatura,” a kind of impatience with raw, unformed existence. Stein knew the proper balance between art and life.

We have spent seven chapters investigating the former. Gertrude Stein had the answer to the latter. In one of the great exit lines in history, she exclaimed on her deathbed:

> What is the answer?

A few moments passed before she concluded:

> What is the question!

That was the answer. Then she was gone.

Figure 7-24. Details from the Main Rotunda of the Lascaux cave paintings, Dordogne, France circa 15,000 BC: very real images, shadows from a pre-Platonic time that bring us back to the beginning. (*Bettman Archives/UPI*.)

## 3

And most important, we need to remember that there is still a vestige of reality beyond film, beyond media, beyond multimedia.

In this, we have a model. At the height of his career, William Shakespeare quit the playwrighting business to return to his home town. His last play, *The Tempest*, was a conscious envoi to the audiences that had filled the Globe for more than twenty years. It was about theater, his medium, but it is not a celebration so much as an escape. There is a real world outside the theatrical island of the play, and the aim of *The Tempest* and of Prospero (and of Shakespeare, we may infer) is to leave the magic behind and return to that reality. At the end, Prospero asks our leave:

> Now my charms are all o’erthrown,
> And what strength I have’s mine own,
> Which is most faint.
> * * *
> Gentle breath of yours my sails
> Must fill, or else my project fails,
> Which was to please. Now I want
> Spirits to enforce, art to enchant;
> And my ending is despair
> Unless I be reliev’d by prayer,
> Which pierces so that it assaults
> Mercy itself and frees all faults.
> As you from crimes would pardon’d be,
> Let your indulgence set me free.
>
> *Exit.*