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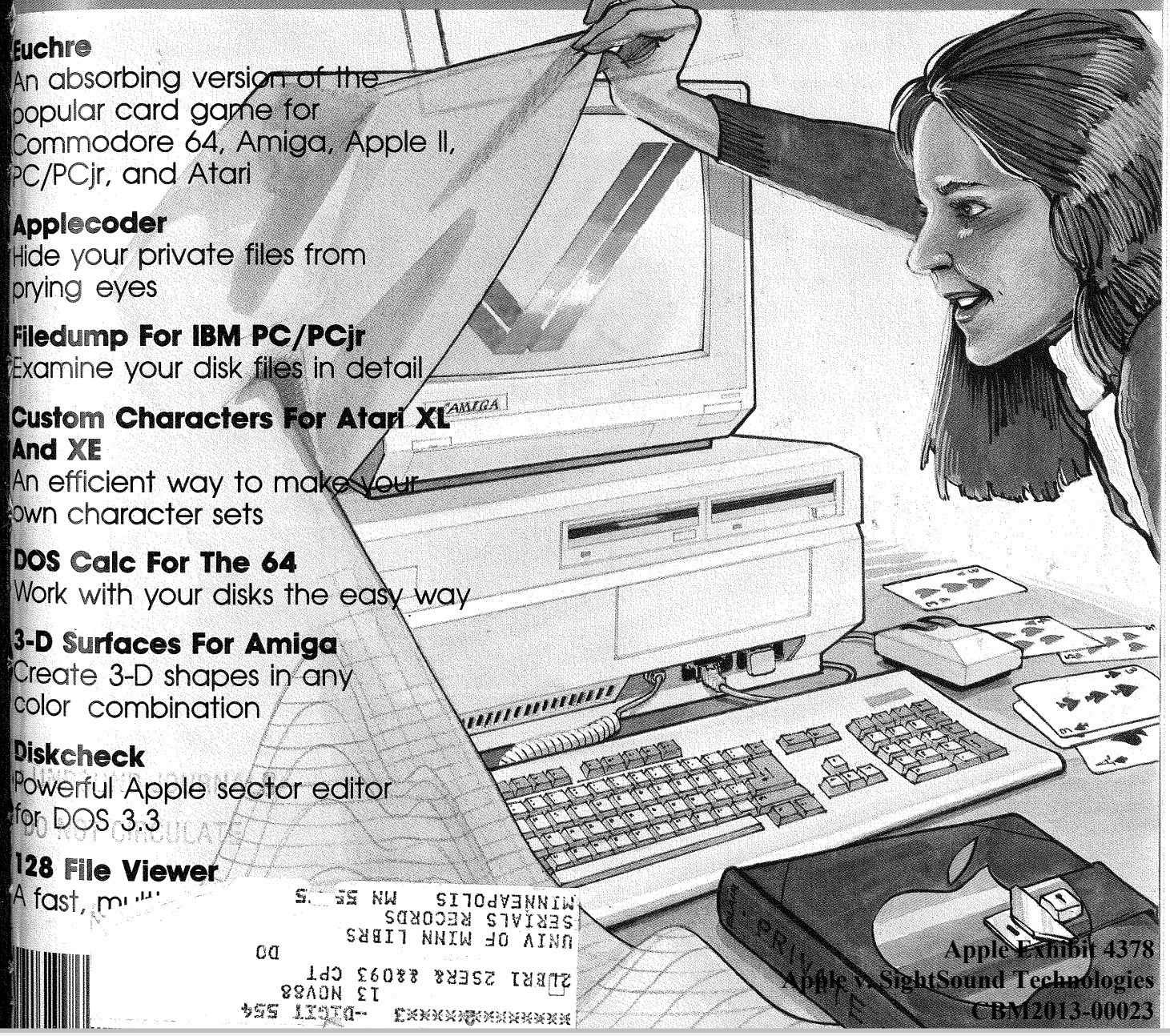

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Editor's Notes

As microprocessors, computer chips, become increasingly a fact of modern life—stamped into everything from coffeemakers to greeting cards—we can expect the things around us to grow ever smarter and, consequently, more useful. Madison Avenue seems to follow a predictable pattern when describing the various levels of appliance intelligence. It's most obvious with communications appliances like stereos and TVs. What was just a radio suddenly becomes a *digital* radio. A year or two later, and some additional RAM and ROM chips, and it's *computerized* (or *microprocessor controlled*). Eventually, when the device is finally more computer than radio, it's called *programmable*.

Although there's considerable imprecision and variability in the use of these terms, there *is* a profound change taking place.

You can see it happening now with television sets. A year ago we were introduced to the first "digital" TV. All this amounted to was "picture within picture": You could cause a frame to appear on the screen holding an image that differed from the larger, normal TV image. Now, however, newer "digital" TVs use special sampling techniques to improve picture quality by creating more lines than were originally broadcast. In other words, the TV is smart enough to infer what would have been sent if the TV studio or videotape were transmitting roughly twice as much picture as either is currently able to. The result is a sharper, more detailed picture, and you cannot see the fine horizontal lines which are visible on most TV images.

With this we have moved closer to high-definition, theater-quality home entertainment. However, there is a clear line of progress yet to come, from these early steps to the ultimate TV. For one thing, even intelligently enhanced images are not, themselves, digital. To see why, we need to briefly define the important distinction between analog and digital.

There are only two ways to transmit, store, or manipulate information: analogously or digitally. Analog information is an *imitation*, where digital information is a *numeric code*. Cavemen used both forms: If an advance scout needed to tell the hunting party that he saw two elephants, he could either imitate them by sketching two elephant figures on a tree, or simply poke two sticks into the ground. (Digital, being a code, depends on a prior agreement—for instance, that sticks in the ground represent elephants.)

But an even more fundamental distinction between digital and analog rests on whether the information is continuous or separated into abrupt steps. Again, this can be seen in the earliest cave paintings: A drawing of an elephant is a unit, a whole unto itself, sometimes even drawn with a continuous single line. A series of straight lines, however, perhaps representing a herd of elephants, is discontinuous, separated into symbols, and bears no real resemblance to the thing it communicates. Thus, when you call someone on the telephone, the rise and fall of your words is reproduced, imitated by the little speaker in the earpiece of the telephone on the other end. The information is continuous, a flow of sound. Were you to communicate via smoke signals or Morse code, the information would be broken into distinct steps or pulses and would bear no resemblance to the spoken word. In the modern sense of the term, digital communication means frequently sampling a continually varying event to reduce it to a series of numbers. The numbers, then, can be easily stored or transmitted. They are also easy to manipulate: To make a louder sound, just multiply the numbers.

Nevertheless, analog has been the primary method of communication for most of man's history simply because it's generally easier to accomplish without computer assistance. For example, the traditional phonograph record is made by a little needle which vibrates a pathway into soft vinyl. When recording a trumpet, the needle digs a vinyl pathway which is a direct imitation of the vibrations in the air caused by the trumpet. Then, when you want to listen to it, the needle on your record player sends the same vibrations to your speaker, which, in turn, vibrates the air as the trumpet originally did. All the way along, from Doc Severinsen's horn to your ear, the information is passed in the form of various analogies to the vibrations of air we recognize as the sound of a trumpet.

To digitize this sound requires enormous amounts of computer power, and it was only a few years ago, with advances in microprocessing, that digital music, in the form of the compact disc, became possible. Whereas analog is easy (the needle and vinyl and speakers transmit vibrations to each other pretty much unassisted), digital requires that the sound be turned into a code, into numbers to be stored on the disc. Then, in order for you to listen to it, those numbers have to be translated back into vibrations by a compact disc player through a process known as digital-to-analog conversion. And to get accurate sound, you need lots of numbers: 44,000 per second. A single minute of music on a compact disc requires more than 2.5 million numbers.

A video event requires far more information than audio. So we can expect to wait years before TV images are thoroughly digitized all through the chain from network camera to home TV screen. Some few studios are just now beginning to add digital capabilities, but the cost is as yet far beyond the consumer market. As usual, the consumer must wait for lower chip costs and higher chip speeds before the manifest benefits of digital TV will be everywhere available.

The latest home video recorders do have enough memory to capture a single still image and display it, rock steady, as a freeze frame. We can also expect digital signal enhancement for VCRs soon. But the most dramatic changes will come in the next stage, the *computerization* phase. At that point, the home television will start to make some decisions all by itself.

To get a hint of what's possible, we can look at a couple of recent developments in the satellite TV world: constant database broadcasting and intelligent receivers.

There's now a service which acts like a smart *TV Guide*. You interact with it when you tune it in. You can request a list of sports events only, or reviews of

all of tonight's movies. In other words, it works like a typical computer database where the user is able to search and filter the information, to tailor it to his or her needs or tastes.

In a related development, if you want to watch scrambled satellite broadcasts like HBO, you purchase a "descrambler," a unit that looks something like a hi-fi receiver, but which is really a sophisticated computer in disguise. You plug it in between your satellite dish and your TV and it mostly just passes the pictures and sound right through. It sits there and does nothing more than pretend it's just a wire, since most satellite signals are unscrambled. But when you change to HBO, it recognizes the scrambling and blanks out the picture with the message "No Subscription."

If you choose to subscribe, you can call HBO directly and give them your credit card number and the serial number of your descrambler. Within 30 minutes, the HBO movies are coming through the descrambler. What's startling about this, and also predictive, is that HBO turns on your particular descrambler from its central offices *via the satellite signal* which is beaming all across the country. Within that signal, for a brief time, is a special message to your individual descrambler. This facility for pinpoint targeting is also now giving rise to pay-per-view services and individualized messages sent between the normal pictures.

And there is a lot of space between the normal pictures. The vertical blank interrupt, that black line you see if your picture rolls, can contain considerable additional information. Bilingual or captioned movies; stereo audio; teletext and other printed data; and dozens of other kinds of communications can fit in that extra space. But none of this would have been possible without the advent of computers and their capacity for blazingly fast digital manipulation.

One major byproduct of computerization is increased personalization, increased interactivity with the appliances around us. We can expect to see TV sets which will allow us to customize them to a degree previously impossible. Not only will we be able to establish passwords for channels considered inappropriate for younger members of the family, but we'll also be able to tell the TV to always turn to our favorite news broadcast, or even to recognize and record any W. C. Fields movies.

Further, the media itself can become more personalized. There can be more shows on less popular topics; more foreign movies; more special interest broadcasts—all because a small audience can support such narrowcasting through pay-per-view.

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Editorial offices:	324 West Wendover Avenue Suite 200 Greensboro, NC 27408 USA
Corporate offices:	825 7th Avenue New York, NY 10019 212-265-8360
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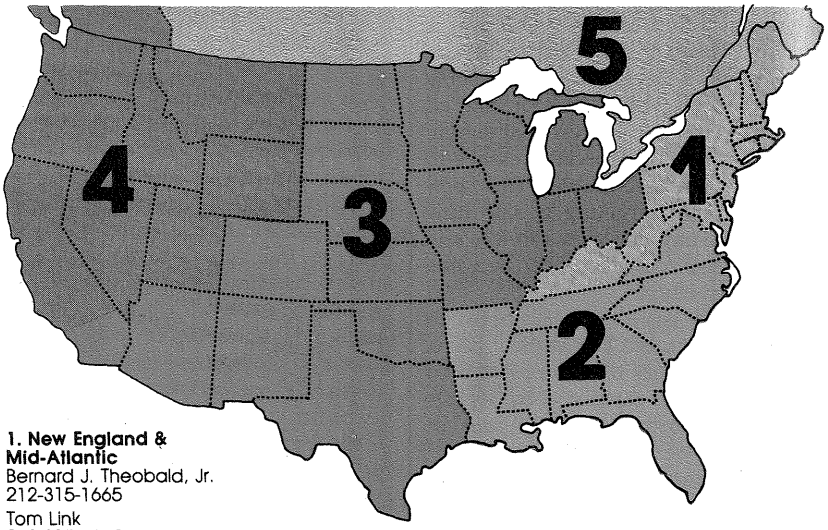

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