# Interpersonalized Media: What's News?

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We are in the midst of a major change in the ways that we communicate. This change will affect many areas of our lives—the ways we are informed, educated, and entertained; the ways we interact with friends, organizations, and the world. New communication media are arising from the grass roots as personal computers become widespread and are interconnected. These media allow new possibilities for interactive, personalized communication, so I will call them interpersonalized media.

Already there are small-scale efforts to interconnect personal computers via telephone lines. There are several national personal-computer networks and many local computer "bulletin board" systems, five in the San Diego area alone. These developments will lead to such radically modified institutions as personalized news, classroomless education, and interactive soap operas. In this article, I will focus on the influence of these new media on the interchange of information that constitutes news.

**About the Author**

*Jim Levin is a cognitive scientist interested in the implications of computer-mediated communications for the people involved. He teaches in The Communications Program and pursues research in the Laboratory of Comparative Human Cognition at the University of California, San Diego.*

## Personalized News

Imagine your own personal news staff, preparing a report every day on only those topics that you have expressed interest in: political news concerning Ghana, reports of advances in alternate energy sources, sports news about certain teams, want ads for Volkswagen Rabbits for sale within fifty miles for less than $3000, etc. By the time you specified a fairly detailed news profile, you would probably be receiving a unique, personalized news report.

> If the current decrease in the cost of computation and data storage continues, a system for distributing personalized news will soon be economically feasible.

Is this concept of personalized news a notion for some distant time in the future? No. The requirements for such a system are quite minimal and well within current capability. A prototype for parts of such a system exists at the Artificial Intelligence Laboratory at Stanford University, where the daily Associated Press wire contents are stored by a computer, and users are notified of stories that match their specified news profile. The details of storing, indexing, and retrieving large amounts of text have been worked out well. (However, the retrieval techniques are not foolproof. One user at Stanford, interested in dolphin research, asked to see all stories containing the word "dolphin." He was then puzzled that he was being notified of all the Monday morning football-score summaries, until he noticed the stories had the scores for the Miami Dolphins!)

The barrier to such systems has been economic—the costs of storage, computation, and communication have been too high to challenge the existing mass-distributed media of television, radio, and newspaper news. However, the cost of all three factors is rapidly dropping, and if the current decreases continue, a system for distributing personalized news will soon be economically feasible. (See the economic analysis by Panko in reference 11 for first-class business mail, for instance.) This development is especially likely when the interactive information system is integrated into a broader system for entertainment, education, and commercial interactions.

## Electronic Mail

Electronic mail is an almost accidental development of interactive computer networks, but it may become the most significant use of computers in our everyday lives. It

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began as interactive users of large computers needed ways to communicate with other users. Initially, mechanisms were developed to allow one person to type text that immediately appeared on the terminal of another user. However, these communication mechanisms could be used only if the other person was using the computer system at the same time.

Computer-mail systems were the next development, through which one user could type an entire message, to be seen by the other user whenever he or she next used the system. Since then, computer-mail systems have grown in power (and thus in convenience of usage) until they are now used even by people unable or unwilling to use computers for programming.

In the few organizations where they have been available for general use, electronic-mail systems have become a major communication medium. They are assuming much of the load previously carried by written memos and telephone calls, and even some of the interaction previously carried out face to face. For example, I have been using an electronic-mail system at the University of California, San Diego (UCSD) called MSG (which will be described in more detail later). Over the course of the five days before I wrote this, I received fourteen messages on this system. Two of these were directed specifically to me; two had been written to another person with a copy sent to me. Two more were directed to me as a member of a defined group of nine people, all concerned with a particular problem. This ability to send messages to a defined group of people easily allows these mail systems to be used for *teleconferencing* (described later).

The remaining eight messages were addressed to a group called "all," a group consisting of all thirty-seven users of this computer system. We can say that such messages are posted on an *electronic bulletin board*. But such use also leads to a potential problem, especially for systems involving a large number of people—the widespread distribution of electronic junk mail.



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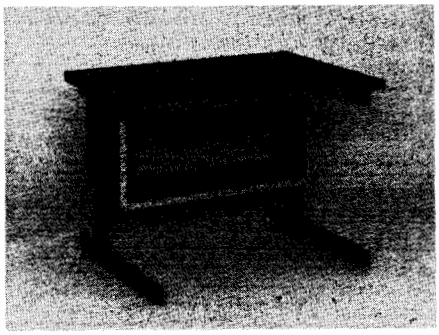

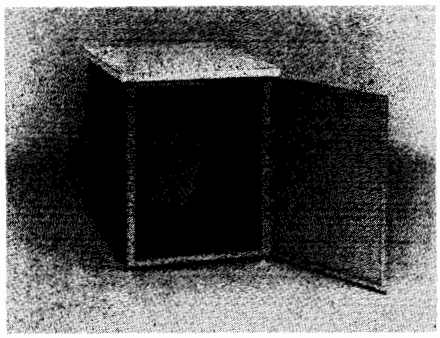

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One unexpected property of text teleconferences is the tendency for multiple streams of conversation to form and flow in parallel.

### Electronic Bulletin Boards

The use of electronic bulletin boards has already spread through the personal-computing community. A student of mine, Mary Loughran, discovered five electronic bulletin-board systems in operation in the San Diego area as of June 1979; two local "nodes" of nationwide bulletin-board systems, and three systems set up by individuals.

### Electronic Junk Mail

The problem of electronic junk mail is a major issue for these bulletin-board systems, one that becomes critical for a widespread electronic-mail system. People get upset if they get a lot of junk mail. Fortunately, personal computers give us a direct way to deal with this problem—we can design and use electronic junk-mail "filters," programs that preprocess our electronic mail and systematically discard recognized junk mail. For example, if every message I have ever received from Bill Smith has not been worth reading, I can program my mail filter to automatically discard any messages from him.

As such junk-mail filters become widely used, general announcements (advertisements) will become more sophisticated, so that announcements are targeted only to people that are genuinely interested in them (or else are disguised as interesting messages). We can predict several rounds of action and counteraction like this within an electronic-mail system—beyond that, the system is likely to evolve into novel, currently unpredictable forms.

### Teleconferences

Another mode of electronic interaction is the *teleconference*, which draws an analogy to more conventional, face-to-face meetings. Early computer teleconferencing systems had a chairman who assigned the floor to a speaker (who was then allowed to type in text that everyone else in the teleconference saw, until either he or she relinquished the floor or the chairman reclaimed it).

However, it was soon discovered that this new medium does not require a "floor" since many people can enter text simultaneously. More important, the participants do not even have to be simultaneously involved—the "tele-" aspect was then extended to mean "remote in time" as well as "remote in space." In this way, the non-real-time teleconference was born.

You may ask, "Why bother with computer-text conferences if you can just arrange a meeting or even a conference phone call?" First of all, anyone who has tried to arrange a meeting time for even a small number of busy people knows how difficult it is to find a common free time. This problem is aggravated by differing time zones; in arranging a conference telephone call that includes people from both the east coast and the west coast of the United States, you have only four hours during which both sets of people are normally available during the working day. Between London and Los Angeles there is only a one-hour window, and for much of the world there is no overlap at all.

Even when there is a considerable overlap, even a normal two-person phone call is not easy to conduct. You call the other person; she is in a meeting, so you leave a message; she returns the call an hour later only to find that you are in a meeting, and so on. I have gone as many as five rounds like this to establish communication, even when I have known I was not getting a "tele-runaround." In addition, the interruption of another phone call is amazingly disruptive—have you ever been able to finish a coherent thought when your phone rings?

But you might wonder, "Isn't a non-real-time teleconference a stilted, artificial, and ineffective way of conducting discussion or decision making?" The answer to this seems to be (1) yes, at the start, and (2) no, not after the participants acquire some experience with this new medium. A number of transcripts from different types of text teleconferences that seemed to work for the participants quite smoothly and effectively are

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recorded in the book *Network Nation: Human Communication via Computer* by Hiltz and Turoff. [*See the review by Glen Taylor on page 136 of this issue*....RSS]

Isn't spontaneity lost without real-time interaction? My experience with text teleconferences over several years has been that spontaneity is just as possible as in face-to-face meetings (and just as problematic—in how many meetings have you felt free to be spontaneous in your participation?).

One property of text teleconferences that is unexpected (and a bit disconcerting at first encounter) is the tendency for multiple streams or threads of conversation to form and flow in parallel. Multiple streams are disruptive in a face-to-face meeting, but are easily accommodated by many text-teleconferencing systems. In my experience, a new conversational thread does not appear out of the blue, but instead starts as a response to a message that branches from the main, continuing stream. Some participants follow the main stream; others follow the new branch. Many participants follow both, especially in non-real-time conferences where the urgency of real time is lacking.

## Open News Networks: Being Your Own Editor and Reporter

We can now return to the general issues concerning the effect of new interpersonalized media on the ways that we exchange information. I started out with a discussion of personalized news. In effect, personalized news allows everyone to become his or her own news editor, since each person specifies which items he or she wants to see from the much larger pool of information.

Once editorial capability has become distributed, the restrictions on input and on transmission of information can be relaxed. Broadcast media structurally require strong central control of information, since the same few items are sent out to a large audience. Such restrictions are not needed for "narrowcast" media like personal letters, phone calls, personal conversation, or interpersonalized media.

Everyone can thus serve as a reporter of whatever he or she defines to be news and then act as editor, again defining the small part of a vast information pool which is considered news. The structure of information flow can change from the current "hourglass" form to that of an open network; the constriction in flow can be removed.

## What Is News?

The kinds of changes discussed here may have a major impact on the ways we circulate information about the world. The general notion of what constitutes news will be challenged. Currently, "news" is information that is sufficiently interesting to a broad enough section of an audience to be judged worthy of being broadcast or otherwise disseminated by a commercial or governmental organization.

If a Little League baseball team in Peoria, Illinois, wins a local championship, that is generally not news for a San Diego, California, newspaper. However, if your nephew is playing on that team, then the result of the game *is* news to you (even if you live in San Diego). If you personalize the information you receive, then you are redefining what is news. Thus, news as information of general interest to a broad audience is replaced by news as information of specific interest to each particular individual.

There will still remain a role for news mediators in an open information network. Given a complex world and a large body of information about it, people will still depend on other people to collect, evaluate, and condense information. I will return to this issue of mediators after I consider a more general way to view these interactive information networks.

## Mixed-Intelligence Information Networks

The examples we have explored of new forms of news networks are particular cases of general systems for sending and receiving information. You can picture yourself as part of a vast network, branches going in all directions, with you at one of the many places where branches converge, a *node* of the net. Each of the branches entering and leaving your node represents a way in which you receive and transmit information: by television, by newspaper, by phone call, or by word of mouth. The

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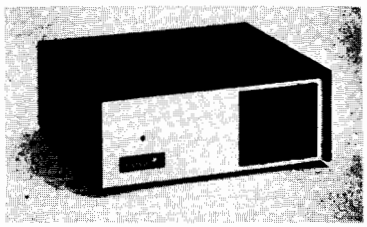

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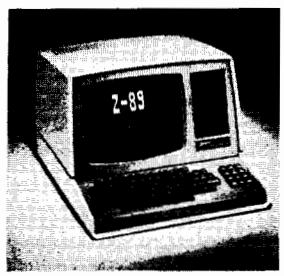


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possibilities discussed above are steps toward a *mixed-intelligence information network*, where some of the nodes are human (as in our current information networks) and some of the nodes are computers.

Let us look at the simplest case, in which you and your personal computer are sending and receiving electronic mail from a friend (and her personal computer). You type a message; your personal computer transmits it, placing a telephone call to your friend's personal computer (trying repeatedly if the line is busy). Your friend reads the message the next time she checks her mail, perhaps entering a reply message to be sent back to you. This network has four nodes: two human nodes and two computer nodes. By expanding the number of people involved, we can develop much more complex mixed-intelligence networks for sending and receiving information.

## Dispatcher Mediators

Imagine that you want to send a message to all people who are interested in a certain topic, but you do not know who they are. You can broadcast a general message to everyone and let everyone decide whether he or she is interested, but that would be extremely expensive. Instead, you can send the message to a single person who keeps a list of people interested in the topic and ask that person to send the message on to the appropriate people. This single person can thus serve as a *dispatcher*, mediating the distribution of messages.

If a human dispatcher grows tired of forwarding the same kinds of messages to the same list of people, he can program his personal computer to automatically distribute these well-defined group messages. Thus, both human and computer dispatchers are likely to emerge in interactive information networks, with computers handling the routine cases and humans called upon to handle difficult cases.

A dispatcher lowers the cost of reaching a desired audience, raising the efficiency of the whole network. The dispatcher can then charge for the service provided according to the amount saved. Therefore, dispatchers will have incentive to develop accurate knowledge of which nodes in the net are interested in receiving what information.

## Standing Answers

In any information network, people come to have different kinds of knowledge. Experts in different areas emerge, and others go to these experts to ask questions in the area of expertise. Expert advice can be expensive, as anyone who has gone to an auto mechanic lately can testify. One function of this high cost is to control access, so that the experts are not overwhelmed by demands on their time. (Another function is to make the experts rich.) In situations where the cost of accessing experts is kept low (as in Great Britain's system of socialized medicine), other kinds of barriers arise (difficulty in getting appointments, long waits in office waiting rooms, and other problems).

How can access to expert knowledge be handled in mixed-intelligence networks? Say that you are an expert member of such a system, on the topic of backpacking in San Diego County. You receive questions from all over, which you answer for a small fee. After a while, since you give good answers, questions pour in. Worse, most of the questions are the same. You get tired of answering the same old questions again and again and again.

What can you do? You can program your personal computer to scan through the incoming messages. Any that the computer can identify as a "standard" question, it answers with your "standard" answer. You have thus specified a *standing answer*, which is to be given to any incoming question matching your specification for the standing answer.

Slowly, you build up a computer data base of your specialized knowledge that is readily available to other people. You can easily add new information and remove incorrect or obsolete information. Questions that do not fit any standard pattern are automatically passed on for your expert human judgment, and any question that even *you*, the expert, cannot handle can be forwarded to another expert.

From the point of view of the question, it bounces around the network, with each node it visits attempting to answer it. Both computer and human nodes in this net can easily face the possibility of being unable to handle a question, since it is easy to pass the

question on to some other node if the current node cannot answer it.

To keep the network from filling up with unanswerable questions, any question that is unanswered after traversing enough nodes can be sent back to the asker with the answer of "unknown." In fact, if a small "handling charge" is added to a question at each step, then the asker can specify exactly how hard the system as a whole should work in trying to answer a question by specifying a maximum cost for a question. A question judged by the asker to be unimportant would either be answered in the first few steps or returned unanswered, while an important question would keep circulating on to new experts for consideration.

Any question can be answered differently by different experts. A mixed-intelligence information network easily handles this kind of conflict by sending *all* answers back to the asker.

The asker may not want to deal with multiple conflicting answers. This situation provides for another kind of mediator in these interactive networks: one that collects divergent answers to a question and selects one. This "sifter" role is similar to that played by editors and other gatekeepers in the current mass-media systems. The flexibility of these new interpersonalized media is illustrated here by the fact that a person can choose to have his or her answers edited or not, and can directly select the mediator.

> If a given piece of expertise is in great demand, then it will spread through the network, becoming common knowledge.

## Standing Questions

We started this exploration of interactive information systems by considering the possibilities for personalized news. I discussed the possibility for each person to specify his or her own "news filter." A more active way to view this personalization is that each participant in a mixed-intelligence network can formulate *standing questions*. These questions can reside in one or more of the nodes of the net, and any information arriving at that node which answers the standing question will be sent to the asker. For example, you might set up as a standing question, "What is the score of the most recent Pittsburgh Steelers' football game?" or "Has Fermat's Last Theorem been proven?" or "What will the weather be tomorrow?" Whenever the answer to any of these questions crosses a node containing the corresponding standing question, that node will send you that information.

## Diffusion of Knowledge in a Mixed-Intelligence Network

Expertise can spread through these interpersonalized-media information networks in a way directed by the demand of the participants. Each node in the net can keep a record of how often it has asked a given question of a given expert. If the question is asked and answered often enough, then the node in question can store the answer received to be then used as its *own* standing answer, thereby moving that bit of knowledge one step outward through the net.

The decision at each node can be individually determined, but presumably would be based on the trade-off between the cost of contacting the expert and the cost of storing the information locally. This trade-off is conditioned on the likelihood of needing that information in the future, which can be judged by the need in the recent past. If a given piece of expertise is in great demand, it will spread through the network, becoming common knowledge.

In an area of knowledge that is rapidly changing, each node can guarantee the integrity of its own knowledge by leaving behind, with the experts consulted, standing questions that request any *updated* answers to those questions. In special cases, experts may want to selectively disseminate corrections to those nodes that had previously received answers to questions. In this way, knowledge among participants of an interpersonalized-media network can be flexibly and efficiently distributed and updated.

## Feasibility Issues

Are the kinds of interpersonalized media I have described so far possible


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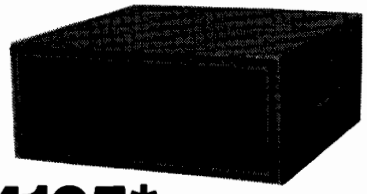

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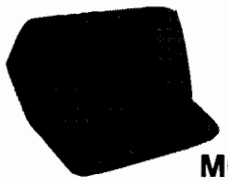

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**Listing 1:** *A typical message sent using the electronic-mail system called MSG at the University of California, San Diego. This particular message was sent to two recipients, the author (Levin) and Hutchins.*

```
To: hutchins levin
From: dan
Date: Thu Nov 15 17:42:31 1979
Subject: wednesday at 3 pm
cc:
Message:

I have put the two of you down for 3 PM, Wednesday. OK?

My office.

dn
```

**Listing 2:** *The procedure for generating a message under the MSG electronic-mail system. All input by the user is shown underlined. The caret (^) indicates use of a control character, in this case a control-D.*

```
<—sndmsg
To: hutchins
Subject: tomorrows meeting with dan
cc: levin
cc:
Type message, end with^D
Should we get together shortly before 3 to go over what we'll cover with dan?
^D
```

now? If not, what capabilities are needed to make them feasible? These kinds of information networks depend heavily on distributed processing and storage, features that are optionally available with relatively inexpensive off-the-shelf personal computers. The existence of computer-based community bulletin boards demonstrates the feasibility of using current microcomputers (for example, the Apple II and Radio Shack TRS-80).

The physical interconnection can be provided by the dialed-telephone network (as in existing bulletin-board systems), by a combination of dialed and leased lines (as in existing nationwide packet-switched networks), by cable television lines, or by radio transmission.

The simplest format for message transmission is to transmit straight ASCII (American Standard Code for Information Interchange) characters through an acoustic-coupler modem. With noisy lines (generated by all of the physical interconnections described above), you lose characters, but for many purposes this is acceptable (the English language is considerably redundant). However, a protocol called Dialnet is currently being developed at Stanford University for personal computers (see *Dialnet Protocol* by M Crispin and I Zabala, Stanford Artificial Intelligence Laboratory, Palo Alto CA, 1979). This protocol, which sends information in error-resistant blocks called *packets*, and ones like it, can allow personal computers to use noisy lines to send noise-free messages.

In many cases, users are not overly concerned about the possibility that some unknown person might look at their electronic mail. Yet most often we prefer to know that nobody else is reading our mail. In some cases, this need for privacy is critical. There are many simple encoding/decoding algorithms that provide some security; unfortunately, these simple algorithms are relatively easy to decipher. (As an example of such a system, you can encode a message by calculating the exclusive-OR of text segments with a secret key, then have the receiver decode it by another exclusive-OR operation with the same key.)

Recently, a series of *trap-door* encoding/decoding algorithms have been developed, at Stanford by Diffie and Hellman in 1976 and later at the Massachusetts Institute of Technology (MIT) by Rivest, Shamir, and Adleman in 1977 (see references 4 and 12). Trap-door algorithms prom-

ise an extremely high degree of security for even everyday use. A clear description of these cryptic functions is provided by Martin Gardner in the August 1977 issue of *Scientific American* (reference 5).

## MSG: A Usable Electronic-Mail System

Many different software approaches have been tried for sending and receiving electronic mail. However, certain features are common to many existing electronic-mail systems. These have been included in a system called MSG. Every message is structured in a way illustrated in listing 1.

One command that is needed is S (an abbreviation for *sndmsg*), which automatically puts in the "From" and "Date" parts of the message header and assists in entering the rest of the message. For example, a message-generation sequence is shown in listing 2 (user input is underlined).

On the UNIX operating system, the MSG program announces the arrival of new mail to you with the following message:

From levin: tomorrows meeting with dan

Two commands are used to read mail. The H (for *header*) command allows you to skim over mail, since it prints out only the sender and subject headers of the message. The T (for *type*) command then prints out the messages specified. The D (for *delete*) command is used to delete messages.

A command that seems to add significantly to the utility of the mail system is the A (for *answer*) command, which quickly sends a reply to the originator of a message. When the A command is used, the MSG system automatically fills in the entire header, so that the user can easily compose a quick response.

The ability in MSG to define a *group* of people to receive messages allows this message system to be used for teleconferencing. With the MSG system, a user can type a list of names into a text file, then send one or more messages to all of these people simply by supplying the name of the text file.

The particular MSG system described here has other nice features, such as a *forward* command and the ability to keep several different mail files. But the capabilities described above seem to be the ones that make the system valuable enough to be used widely.

## New Images of News

We have explored a new world—a world in which "news" is defined by each individual. Everyone serves as his or her own editor of news through the establishment of a set of standing questions. Everyone also serves as a reporter of news by submitting standing answers to the information network. These standing questions and standing answers bounce around the net until they are appropriately matched, possibly through the assistance of various kinds of mediators. Knowledge spreads through the net, following the heavily traveled paths to where it is needed.

This new kind of information network has major implications for us and for our society. I have touched on some of these issues here; I am also exploring the effects of this kind of interactive media on education and on entertainment (see references 8 and 9). These other uses of interpersonalized media will affect the information-interchange uses, since the educational and entertaining uses are likely to carry personal computers into homes, thus bringing about widespread use. Costs are dropping substantially, but even so, not many people are likely to invest several hundred dollars to improve their information access. However, they *are* likely to invest that amount for entertainment. So the educational and informational uses may well follow interactive entertainment.

## For More Information

If you are concerned with developing new forms of interactive communication, I urge you to contact me and my associates by whatever medium you select. Our mailing address is given at the beginning of this article; our telephone number is (714) 452-4410. We are located at Third College, Media Center Communication Building, and my address for electronic mail is "catt:levin" for those with access to UCSD's word-processing system. ■

*I want to thank the many Communications students at UCSD who participated in the development of these ideas, and Yaakov Kareev for helpful comments on earlier versions of this paper. My thanks to the many people across the country who participated in the evolutionary development of the MSG electronic-mail system, including Martin Yonke, John Vittal, and others at BBN, and Greg Haerr at UCSD.*

### REFERENCES

1. Christensen, W and R Suess, "Hobbyist Computerized Bulletin Board," BYTE, November 1978, pages 150 thru 157.
2. Crispin, M and I Zabala, *Dialnet Protocols*, Stanford Artificial Intelligence Laboratory, Palo Alto CA, 1979.
3. Costas, J, "Cryptography in the Field, Part 1: An Overview," BYTE, March 1979, pages 56 thru 64; "Part 2: Using the Pocket Calculator," BYTE, April 1979, pages 144 thru 165.
4. Diffie, W and M Hellman, "New Directions in Cryptography," *IEEE Transactions on Information Theory*, November 1976.
5. Gardner, M, "Mathematical Games," *Scientific American*, August 1977, page 120.
6. Hiltz, S R and M Turoff, *The Network Nation: Human Communication via Computer*, Addison-Wesley Publishing Co, Reading MA, 1978.
7. Johansen, R, J Vallee, and K Spangler, "Electronic Meetings: Utopian Dreams and Complex Realities," *The Futurist*, December 1978, pages 313 thru 319.
8. Levin, J A, *Computers and Education*, Laboratory of Comparative Human Cognition at University of California, San Diego, La Jolla CA, 1979.
9. Levin, J A, *InterPersonalized Media: Interactive Entertainment*, The Communications Program of the University of California, San Diego, La Jolla CA, in preparation.
10. Meushaw, R, "The Standard Data Encryption Algorithm, Part 1: An Overview," BYTE, March 1979, pages 66 thru 74; "Part 2: Implementing the Algorithm," BYTE, April 1979, pages 110 thru 126.
11. Panko, R R, "The Outlook for Computer Mail," *Telecommunications Policy*, 1977, volume 1, pages 242 thru 253.
12. Rivest, R L, A Shamir, and L Adleman, *A Method for Obtaining Digital Signatures and Public-Key Cryptosystems*, MIT Laboratory for Computer Science, Cambridge MA, 1977.

# BYTE's Bits

## Fixing the Fee

A Bits item in the March 1980 BYTE ("Real-Time BASIC Available Free," page 174) reported that the LLL BASIC system developed at the Lawrence Livermore Laboratory was available for just the duplication fee from the National Software Center in Argonne, Illinois. One of our readers called the Center and learned that the duplication fee for LLL BASIC is $159. ■