

EDITORIAL

One of the most remarkable aspects of the current development of the computer field is that the barriers between computing, communication and entertainment are falling rapidly. Not too far behind these areas is education, which will also be inseparable from computation and communication (and perhaps entertainment) in the near future. In this Editorial I propose to discuss the implications of this “coming together” of technologies which were quite separate not too long ago. I believe that these falling barriers are particularly important in Ibero-America, since they can facilitate progress and development on many levels.

Not too long ago computers were used for computing solutions to mathematical problems or simulating physical processes; communication was done by telephone or telegraph or radio; and entertainment was provided by movies or television. Now these processes are inseparable. One of the major uses of computers is to carry e-mail messages throughout the world. Internet telephony allows many users to bypass the traditional telephone system. Communication satellites carry voice mail, Internet traffic, e-mail, and digitized images throughout the world. I write joint papers with collaborators in other countries: we freely exchange text and images, we consult each other via e-mail on issues concerning our manuscript, we post the manuscripts on our World Wide Web pages and link to each other's pages as well. I can watch commercial television programs on my computer monitor if I wish (I don't, but I could!). Movies like “Toy Story” are made on computers; “Jurassic Park” uses computers to generate dinosaurs. What we see here are not just special effects, but a genuine disappearance of the separation between these disciplines, so that what emerges is not only computing or only communications or only entertainment, but rather a seamless blend of all three.

Why is this so important to developing countries? Because the traditional, compartmentalized structure required the development and installation of huge infrastructures for all three domains. Telephone systems required the installation of cables and wires to connect all the potential users. We all recall the heroic efforts required to lay telephone cables under the ocean, or to install telephone poles on mountain ranges using helicopters. Cellular telephony and Internet communication require only local connectivity to transmitters which can relay signals to and from communication satellites. The enormous investment in telephone system infrastructure made by the major industrialized countries can be dramatically decreased. Further, because of the falling barriers we mentioned earlier, these wireless connections also enable computer technology, such as electronic mail, collaborative work, or data and resource sharing via FTP or shared whiteboards. For these reasons it should be possible for the countries of Ibero-America to leap over an entire generation of technology, and move rapidly and directly into the information age.

The “falling barriers” will also have an enormous impact on education. Whereas in the past it was necessary to construct expensive facilities throughout the country and recruit teachers and professors to staff them, it is now possible to use “distance education” to reach students at all levels. Synchronous distance education implies the transmission of televised lectures to distant locations, where they can be received on desktop computer screens or displayed on large monitors, with provisions for interaction, examinations, and so on. In addition, if courses are appropriately digitized they can be stored on servers and accessed by remote students at any time and any place, wherever an Internet connection and a computer are available. Since it will now be possible to include not only text and voice but also graphics and video in these courses, we have another indication of the blend of computing, communications and entertainment.

The title of this magazine, *Computación y Sistemas*, expresses the essence of what this revolution is about. Clearly, none of this could happen without computers and computer science. However, it should be noted that the blend of computing, communications and entertainment leads to new and complex *systems*. Those who will contribute to their development must be aware of system issues (like stability, sensitivity to parameter variations, the problems in the interfaces). One cannot connect complex technologies without encountering system issues.

Let me also point out a potential danger in the increasing use of computer and system technology. As the systems become more complex, there will be greater and greater needs for good human interfaces so that people can interact with them productively. Creating new systems with which the average person cannot interact will be counterproductive. But there is another, more subtle danger. It is possible for a country to develop a technological aristocracy which can lead to a large gap between this elite group and the average person. I believe that a gap between those who know and those who do not is as dangerous to democracy as the gap between the rich and the poor. It is for this reason that the educational potential of the technology must be taken very seriously.

So, the new technologies are giving us an opportunity to move into the information age with much smaller infrastructure investments than in the past. To accomplish this goal will require trained people and leaders with vision. I believe that readers of this journal will be among those who will bring this vision into reality.

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