EDUCATION IN THE CYBERNETIC AGE: A MODEL[1]

As five-year-old Lana wakes up in the morning she remembers something that puzzled her yesterday.

"How do birds fly?"

She walks into the education room adjacent to her bedroom, sits on the video-phone console, presses the button with her name on it, and says, "Hi, I am Lana. How do birds fly?"

The large screen on the wall brightens up and there she sees the familiar face of Mrs. Brown.

"Good morning, Lana, did you see some birds recently?"

"Yes, I saw some birds flying yesterday. We were out for a picnic and my Mum said when birds flap their wings they fly. But sometimes they don't flap their wings."

"Very good. Now let's watch carefully how birds fly; maybe you could tell me afterwards."

With Mrs. Brown's picture automatically moved to one corner of the screen, there appears on the rest of it pictures of birds in motion. A dialogue between Mrs. Brown and Lana begins.

With the aid of a few sets of pictures selected and transmitted from the Education Center, Mrs. Brown demonstrates effectively some relevant facts about the flying process.

At the end, she reminds Lana to carry on her morning routines and suggests that if she likes to she can visit Station 26 at Community Center A to get a close look at some real birds and perhaps find out how light their bones are compared with dog bones. She may also like to read some books about birds.

At breakfast Lana tells her mother what she learned earlier and asks permission to visit the community center Mrs. Brown suggested.

It is now 10 A.M. Usually Lana's mother would find something to do either on her own or out in one of the community centers. Life has certainly changed dramatically since she was Lana's age. People now do not work regular hours and most of the housework is scheduled and done by automatic devices. She has recently taken up painting and stage set design and is quite absorbed in both. But this morning her mind is occupied with something more important.

"Yes, Lana is becoming quite a girl now. And those questions she asks!"

As her thoughts travel, she feels a sense of pride and at the same time a touch of loneliness. "What is she doing now?"

She walks to the education room and begins to scan for Station 26 at Community Center A with the tuner on the video-phone console.

"There she is!"

What appears on the screen is a group of a dozen or so children from about four to 12 years old, all absorbed in their own activities. Right now Lana is gently stroking the feathers of a sparrow in her hands. From the angle at which she stands, mother cannot quite see the look on her face. But that should not be difficult to imagine. Lana's mother is soon lost in other thoughts.

That, in capsule form, is a view of patterns of living and learning in a cybernetic age.

I do not intend to write science fiction nor construct a verbal utopia. Today our technological and economic advances are in fact beyond the belief of the common man and beyond the recognition of scholars. What I wish to put before you is an education model that will have to emerge in the cybernetic age. Much of the technology and economy fundamental to this model are within our reach. What is left to be achieved is largely the decision to make full use of them. That, of course, depends on how much we understand what is emerging; how much we want to believe what we understand.

In the cybernetic age, an *education room* will be standard in every home. The basic content of this room is a video-phone console with a large screen on one wall and seats for members of the family along the opposite side. The content and physical arrangement of this room will, however, vary in accordance with the needs and tastes of individual families.

The video-phone console is capable of providing two-way communication both orally and visually. It is capable of recording automatically both the oral and visual message it transmits. For example, a person may select a specific edition of *Alice in Wonderland* before retiring and pick up the book in its original form in the morning.

Thus, through connections with an efficient communication system, the total environment is conveniently exposed to the educand so that he may respond to any part of it at will. Education then becomes a continuous self-actualization process. It is life and experience. Its richness depends directly on an educand's potential and learning appetite and how well the total external environment answers his needs throughout his developmental span. The school and its structured patterns of education will become obsolete, and so will much of our existing theories of learning.

The basic organization of the communication system alluded to is illustrated in Figure 1. The functions of the few agencies inherent in this system are described as follows:

The local education center is responsible for providing basic education to people within one large city or a large rural division. It consists of a computer system and a team of "comprehensive" teachers whose function it is to respond to enquirers (educands) with appropriate information, directions, and discussion opportunities. The communication process between a teacher and an enquirer includes understanding the enquirer as a person, his intel-

lectual and interest background and needs. The response will use the most effective communication medium hierarchy for him and his particular question. For example, the teacher may give a simple verbal answer, provide appropriate demonstrations, direct the enquirer to first-hand experience, reformulate the original question to challenge him to solve his own problems, or put together some combination of these.

For effective teacher-educand interaction, a complex information system is at the teacher's disposal. When an enquirer calls and identifies himself, the teacher and the computer system at the local education center are activated simultaneously. The teacher answers "Good morning" while facing the enquirer and a simple chart providing, on one side, a comprehensive record of the enquirer and his experience relevant to the question asked; on the other side are sets of response materials selected for him. The teacher's responsibility is to comment, mediate, reorganize, and, at times, select these response sets. At the end of each encounter between the educand and the teacher, the experience and observation of the teacher are automatically fed back to the computer. The experience record of that educand is then brought up to date.

The community centers are set up to provide opportunities for direct multisensory experience and human interaction. They are so located as to be within the convenient reach of all educands.

These centers, while multidisciplinary in nature, provide within their various stations specific learning programs organized in developmental sequences. The staffs of these centers consist of people whose specialty it is to design and display learning materials in such a way that the environment itself invites learning. Within these centers individual educands may find friends and colleagues for interaction and team work. Video-phone consoles similar to those at home are part of the community centers, so that puzzles may be instantly clarified as they arise.

The scholastic centers are organized in the same manner as community centers and with similar goals. However, they are more structured in the sense that the individual's explorations in an area of learning are more vigorously in line with the specialized methodology of that discipline. Thus they cater to intellectual activities of a more advanced level, perhaps equivalent to those commonly found in our universities. At this level educand-teacher interaction is replaced by educand-computer interaction. At the same time, the individual educand could expect to draw adequate motivational and intellectual resources from friends with mutual interests.

The scholastic centers also sponsor scheduled lectures, performances, demonstrations, seminars, and symposia for interested audiences. These activities, while providing channels for expression for some, offer entertainment and intellectual challenge for others.

The education center's primary function is the instant organization of effective learning programs for specific enquiries. It may be organized on a state or provincial scale and contain three well-integrated departments: registration, behavioral research, and instruction.
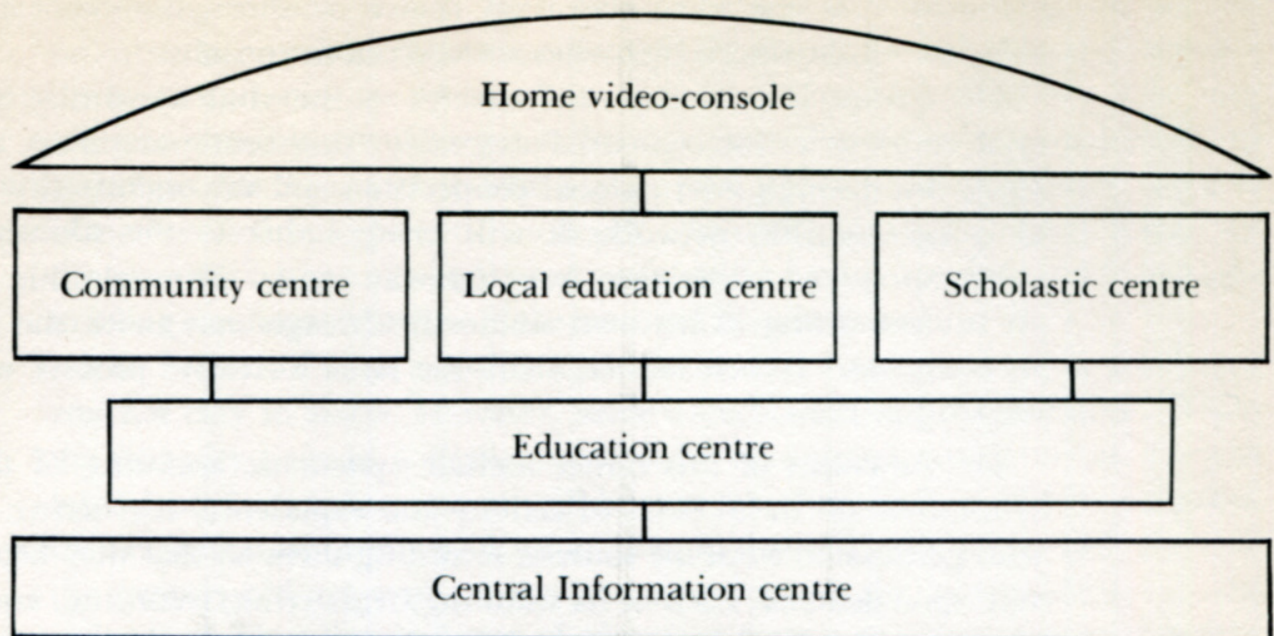
Figure 1
The Organization of a Total Communication System for Education.

The department of registration records the developmental characteristics of all individuals in a state or province. As a child is born, his name, physical characteristics, family background, etc. are recorded in the computer-operated registry. As he grows up, more information is accumulated in his file so that at any given moment his personal and educational data are available to guide the selection and organization of learning programs.

The department of behavioral research is primarily concerned with understanding the characteristics of human development and spontaneous learning in natural settings. It designs the structure according to which individual personal data is recorded, organized, and reviewed at close intervals. It also formulates patterns according to which information, learning situations, and materials may be organized and moved to suit the needs of individuals in specific stages of development. For example, while one type of information or experience may be most effectively communicated through a combination of aural and visual media, another type may only be communicated through the tactile medium. Individual educands also differ in the sensitivity of their sense modalities.

The department of instruction operates with the coordination of four major machineries: a receiving device, a scanning device, a selecting and matching device, and a transmitting device. Its function is to search, organize, and transmit appropriate information to satisfy the needs of the educand at the time and locale in which he finds himself puzzled and inquisitive. Its operational sequence usually follows this pattern: A question is received, the educational data of the enquirer is scanned to determine his sophistication level and interest depths, an appropriate learning program is searched to match these characteristics, and finally the selected program is moved either to

the teacher at the local education center or through modification of its computer to the educand at his home video-phone console.

The central information center serves as the vital nervous system of the total communication system. Foreseeably, this center starts on a national basis. But through international cooperation and the organization of a global communication network, it will bring home to the educand original information and experience from faraway lands. Through this center, an art student sitting in his own studio in Chicago may, with the consent of an established French master, share the latter's creative process while he is working in Paris.

The functions of this center include systematic scanning of the sources of information in all fields of activity and experience, registering them and, with permission from the sources, recording them so that they become available upon demand. Each of its scanning, registering, recording, and directing functions is guided by the principle of effective information transmission. That is, information transmission is most efficient when only the content is transmitted, not a physical base of paper, tape, people, etc. The duplication of information is accomplished at the receiving point, in our case at the home video-phone console. The recording function is supervised by the department of behavioral research so that all information is available in the form and medium which proves most suitable. For example, an author with a finished work may register it and, after consultation with the department of behavioral research, agree to record (publish) it in any of a number of forms—as a play, a recital, cartoon illustrations, video-tape, print, etc. Or he may not wish to have it recorded at all, but simply agree to register an abstract of it with the understanding that he is available to discuss it with interested readers.

When people begin to accept education as one of their basic responsibilities, renowned scholars and artists may contribute some of their own experience to the public. This means that, with an acceptable schedule, individual educands may have the opportunity of reaching specialists in their fields of interest.

Thus within this education system any person at any given time in his life, from the cradle to the grave, is free to enquire, explore, practice, create, and express. There is no prohibition against continued learning, nor are there restrictions as to what one may learn or how he will learn it.

To realize fully the significance of the educational model outlined above for the emerging cybernetic age requires considerable imagination. One must recognize the characteristics of our evolving socio-economic environment and its impact on the individual.

Among writings on automation and cybernation, regardless of the specialty of the author, two major issues usually form the main theme of discussion:

1. What will people do when production of consumer goods is being done by cybernetic processes?

2. How will people maintain and perhaps extend their living comforts when they are not employed in production work?

Many economic models have been advanced in response to the second problem. It is perhaps a little too early to decide what kind of model provides the best solution — for other solutions are in the making. However, diverting our attention from working details of economic systems, it is reasonable to speculate that in a society where most and perhaps all productive work is being handled by cybernetic processes, the individual will be less bound by the necessity for socially regulated work, and he must be guaranteed the right to living comforts regardless of the nature of his activities

The impact of such a socio-economic structure on education is enormous and not easy to assess. However, some aspects of it may be discerned. When the necessity to earn a living is virtually elimintaed, much of our present job-oriented education system will become obsolete, and so will its standardized examination and certification system. Instead, education will embrace the century-old concept of the actualization of the potentialities of the *individual.* Thus the challenge of education from a social standpoint involves providing the individual with adequate exposure to the total environment and the opportunity for him to choose and pursue in depth whatever interests him most. From the standpoint of the individual, it involves active participation in one's environment; through the process of learning, he will gain insight into his own interests and abilities. Ultimately, he will derive satisfaction and happiness from his own pursuits.

This brings us face to face with our first question, a much more important one, since it touches on man's dignity as a working and creative being:

What will man do when deprived of the necessity to work?

How will he feel when he is "worthless"?

How will he justify his existence?

What will he become?

It is commonly agreed that man should find means of living creatively. Creative living presupposes a few conditions: that an individual can make an independent choice as to what he likes to do, that he can find enough to do, that he could find means to improve on his activities, and that he could derive happiness from such activities.

Much of the debate on man's role in a cybernetic age to date centers on the question of whether man is capable of leading a free life. Superficially, this seems to be a silly question. Man has always been striving for a free life. Yet freedom implies responsibility and independence of thought. Not only are there good indications that the large majority of our present generation is not prepared for this, there is also an indication that we have not developed adequate means of preparing people for responsibility and independence.

If we do believe that cybernation is inevitable, it is essential that we explore means that will enable us, and generations to come, to prepare ourselves to lead creative and free lives.

Our education model, which provides every individual with adequate exposure to the total environment and creates convenient opportunities for continuing self-education, seems to embrace all these demands.

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