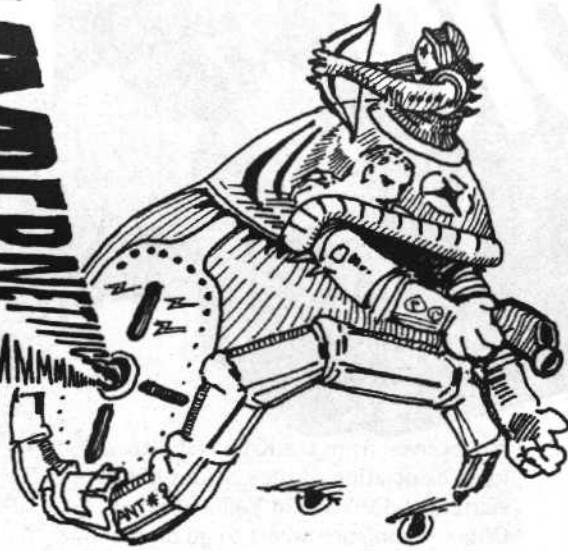


CLASSROOM



*A question is priceless, like a fine pearl.
An answer would dissolve it.
Rather, it should be admired
and polished and given back.*

High tech gadgetry just keeps rolling off the line — its salesmen, like the deodorant kings, keep looking for another hole to fill. And sooner or later they all converge inside the schoolhouse door, dazzling the uninitiated with their magic paraphernalia.

But there is danger here. Computers can be big guns but with low aim they are just expensive drill instructors. Performance conscious school chiefs will program to fit their rigid, fact-oriented curricula — taking advantage of the hardware's efficiency but ignoring its meta function as a partner in the learning process.

Fortunately some settlers on this frontier have mapped out a man/machine interface bearing fruit for personal growth in school and beyond.

I culled the following information from reports and projects developed by Dean Brown at SRI with Adrienne Kennedy and Janet Lederman, Palo Alto teachers and gestalt trainers, and a host of others.

The two projects mentioned here include an experimental summer school session with first through sixth graders and a second project somewhat larger in scope — the revamping of the educational system in Spain.

—RK

Education is the realization and the unfolding of the limitless potential of the mind. The teacher is a creative artist, a sculptor who helps the student to release his person from rough-hewn formless potential. The computer can be a chisel in his hands — one tool among many of his kit of tools, to be sure, but one which is quite different from all the others, one which can serve him in a way that no other can.

The mind functions at many levels; each level responding to and influencing all of the others. We might view these functions in a certain hierarchy: sensory-motor, cognitive (including contrastive sets and technical and socio-cultural facts), techniques, world views, self-images, and self-knowledge. Everyone can remember from personal experience some gifted teacher who possessed the art of teaching at all of these levels simultaneously. Sometimes these levels were taught explicitly. More often, perhaps, they were communicated implicitly from innate wisdom. The truly great teachers succeed in conveying the process of human development in its essence and thereby pass on the art of self-education to their students for each to develop independently toward his own goals. Much of this same spirit can be conveyed in computer teaching programs and the computer can thus become a valuable tool for the teacher. It can serve as a medium for the creativity of the teacher and for communication between teachers and students in the total educational process.

When computers are considered within this broader concept of education, we immediately discover a multitude of applications beyond the conventional drill and practice, tutorial, rote learning programs that have occupied the major part of research to date. Indeed, the term "computer-aided or assisted instruction" contains two concepts that betray this larger goal. The computer can do more than "aid" and "instruct". It can teach directly, just as a good book can teach.

*I am a machine
I am not magic
You bring what you are
who you are
how you work, play, see, feel, imagine.
You bring your fears
your expectations
your enthusiasm
... and maybe something special can happen
between us.*

*I am a machine
I won't tell you:
"Stop it," "Be quiet," "Sit still,"
I won't say
"You're wrong"
I won't say
"You must do things to please me or
I won't like you."
I am a machine
I won't leave when you want me;
I won't force myself on you
when you want to be without me.
Our relationship is open, closed,
empty
full
— whatever you want it to be
— whatever you can make it be for you.
(Our relationship exists
only as a relationship with yourself.)*



The summer project emphasized developing the student's internal self-sufficiency and inner-directedness. One of the researchers participating in the project suggested three reasons for using the computer in education:

- The computer can provide a nonverbal experience; thinking, concepts, and ideas can be approached without that intermediate level of communication called language.
- The machine is nonjudgmental; it neither approves nor disapproves of a student's decisions; reinforcement for the student's effort lies in the experience itself, the process of learning.
- The computer makes possible activities for which the child has not yet developed the mechanical skills, coordination, or information necessary for independent participation; with the machine performing these mechanics, the child is freed in the use of creative energy, making possible, for example, the writing and performance of a symphony composed by a six-year old.

The underlying motif of the summer program, both in the computer component and the classroom component, was discovery. The children were encouraged to try what they liked, discover what they could, and proceed on an undirected course through their thoughts, following their curiosity. This imposed a requirement in the structuring of the computer software to make the material stimulating and encouraging to maximum discovery.

The CDC 3300 system was used, comprising the CDC operating system and the DD1 display console. The languages used were EUCLID, NLT, FORTRAN, and COM-PASS. EUCLID is an SRI ALGOL-like compiler with commands to operate the display console. It is a language that requires little computer technology and can be learned in several hours. The programs written to operate on the CDC 3300 allowed the students to define the parameters controlling the machine's response. The student observed the machine's response and then introduced new demands on the machine, progressively probing deeper into the nature of the program, into the man-machine interaction, into the stimulus-response relationship underlying the project, into the methods of inductive reasoning.

The programs merely provided the framework and allowed the student to build around this structure. He could write a story, describe the mountains, write a poem, describe his environment. It was possible to create many stories from the same framework or program. The framework was typed by program control in PILOT language; when a student was asked for input, the Teletype would start a new line of print, wait for the student to fill the structure, then continue to provide more of the framework.

Programming material for (this) open-format teaching is simpler because no particular emphasis is placed on "right" answers nor the logging and analysis of student responses with reference to the teacher's expectations. "Wrong" answers are encouraged so that the student can pursue blind alleys and test "unreal" situations that allow him to place "correct" results in broad context. It took twenty centuries for man to reject some of the axioms of Euclid and develop Riemannian geometry!

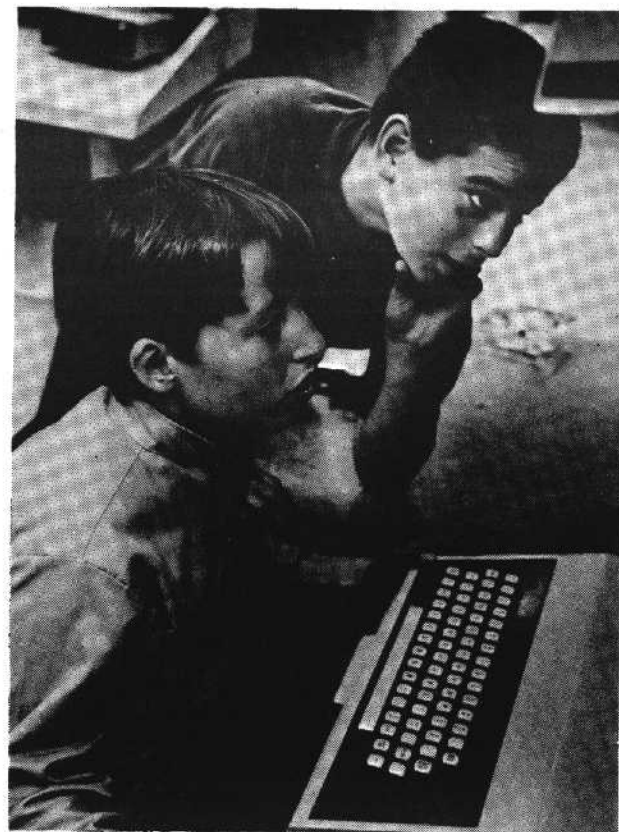


IN THE END
WHØS YOUR FRIEND?
•A KITTEN WEARING MITTENS
DØ YØU KNOW THE SEA
WHERE IT'S FUN TØ BE?
•WITH THE SAND UNDER YØUR HAND
CØNNIE FELL
AND FØUND A SHELL.
•SHE RANG A BELL BUT DID NØT YELL
LØØKED AN HØUR
FØUND A FLØWER
SPILLED THE FLØUR
TØØK A SHØWER.
•LET'S GØ SEE DEAN BRØWN BEFORE
JENNIFER TURNS INTØ A CLØWN

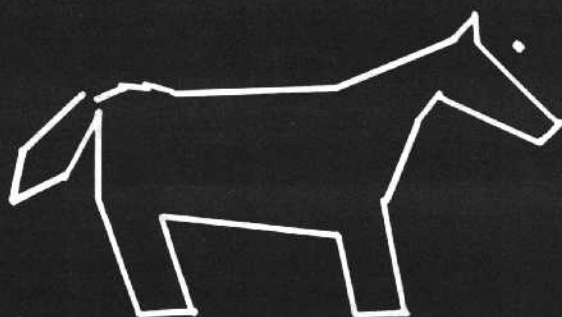
A program in open format could be used in teaching music. Five lines might be drawn by the computer on a display screen. The child introduces notes of his choice on the five lines with a pointing device (mouse). The computer interprets the notes as music and plays the music back to the child from the central processor. Then a column of words appears on the right of the screen with choices of the rhythm, "3/4", "2/4", "march time", "6/8", and "8/12", in which the child would like to hear his theme. The child selects one of these with his mouse, and hears his theme played in the rhythm of his choice. An additional possibility appears — "make your own". If the child selects the "make your own" light button he enters the rhythm of his choice at the keyboard. He may put in 312/698 time or any other arbitrary choice. This is taken by the machine as the desired rhythm and his theme is played thus. Then the column of words on the right vanishes and another column appears designating choices of instrument. The child sees the words "violin", "tuba", "cello", "recorder", "clarinet", and "trumpet". By selecting any of these words with his mouse he hears his theme played in the rhythm of his choice and the instrument of his choice. Again, one of the possibilities offered on the screen is, "make your own". If he selects this, the waveforms of single notes of the instruments appear on the screen. Now he sees the harmonics on the violin, the relative purity of the sign wave of the recorder,

MY STORY

YESTERDAY WHEN I WAS PLAYING I
 •THOUGHT I HEARD JUST ONE SHEEP
 BAYING.
 •SOMETIMES I WAS PRETTY SMART
 •HOW IS THAT YOU OLD RETART.
 •FOR PEOPLE WHO DONT KNOW ANYTHING
 •I HAVEGØ GØT A MAGIC RING
 •AND INSIDE MY LØVELY BRAIN
 •SMARTNESS IS JUST LIKE RAIN
 •HAVE LIKED JUST MANY PEØPLE
 SØME ARE AS DUMB AS A
 •AN ØLD PØST STEEPLE
 •SØME ARE NØT MUCH VERY BIGGER
 THAN A PØST ØR AN ØLD DITCH
 •DIGGER. BUT SØME ARE RAEELLY CRAZY
 SØME ARE HAZY
 •SØME ARE DUMB LIKE TØNY THETY
 REALLY LIKE
 •MACARØNI. SØME ARE NUTS LIKE
 TERRY ARCHER
 •SØME JUST LEARN TØ BRE A PARCER
 •THIS IS THE END ØF MY FAMØUS TALE
 •AT THE END ØF THIS STØRY ITS
 WRITTEN IN
 •BRAIL
 •88 (NØT REALLY WHEALLY)



Conventional teaching emphasizes verbal and rational components of the thinking process. Still, experience teaches us at much deeper levels, and it is often necessary for the student to translate from the verbal-rational expression of the subject matter into his own experience by a process of synthesis and imagination. The computer, with its display, is capable of teaching directly at these levels without going through the verbal or rational forms. Thus, for example, it was possible to teach small children the concepts of conic sections, polynomials, degeneracy, slope, curvature, inflections, continuity and other abstract mathematical quantities without the children even knowing the words with which to describe them. Later on the teacher might introduce the appropriate terminology in discussing the experience. At that time, she might ask questions such as "What are the minimum number of real roots of an odd order polynomial?" or "How do you resolve degenerate roots?" or "What relationships do the quadratic forms hold to the sections obtained by cutting a carrot?" Children of all ages were able to answer questions of this type, not by having learned the material verbally, but by consulting the memory of their experiences at the display.



LINES!<CA>

WHEN FINISHED WITH PICTURE PLEASE PUT BUG IN
 UPPER RIGHT HAND CORNER

and the different overtones that distinguish the other instruments. The child is given a working space at the bottom of the screen to construct his own waveform. He draws the acoustical characteristics of an instrument of his own invention, at random or by careful modification of the frequencies appearing above. He then hears his theme played in the rhythm of his choice by the instrument of his own choosing or invention. Again the column of words on the right vanishes and is replaced by one which asks for his choice of harmony, according to rules of Bach, Hindemith, or Schonberg's twelve-tone scale. The computer then composes counter themes from random notes, rejecting those sequences that violate the selected rules of harmony. The child hears his theme harmonized according to his own rules, played in his rhythm by the instrument of his choosing.

In the linguistic area, second-grade poetry is taught by the computer offering the child several lines of rhymed couplets and then waiting for the child to type any response that he chooses. Usually, after two or three rounds of dialogue, the child is responding in rhymed couplets. Many times the child overrides the computer and goes into long sessions of poetic composition by himself.

Similarly, in story-telling programs, the computer begins a familiar story. The child then continues with his own paragraph, the computer adds a paragraph to that and together they build up a dialogue. The computer takes information from the child and weaves it back into the computer's portion so that there is a continuity of topic but always a new outcome. The child often goes through a program a dozen times — each time playing a different role in fantasy.

JOHN

John sits at the machine. He asks, "What do I do?" and he looks at me — not the typewriter, not the screen — but he looks at me, and he says, "Help!" I ask him what he sees in front of him, and he says, "I don't know." "How can you find out what there is to see, John?" "By looking," he says. "So . . . what do you see, John?" "I don't know," he answers. I see John wiggle in his chair, I hear him sigh, I see his forehead wrinkle, I see John look up, down, around him, aimlessly. John cannot yet see. John has close boundaries; he is nearsighted.

(John and I in the conference room:)

John and I sit down opposite each other in chairs in a conference room off the computer room. I say, "Close your eyes and go back in fantasy to the computer. What's happening, John?" "I'm sitting there, I don't know what to do, my stomach feels tight." "Be there; let it get tighter. Now what are you doing?" "I'm angry with the computer," John says. "What do you want to do now." "Hit it," John says. "This chair is the computer." (I see John hit the chair. Three times. Hard.) "Come back here and open your eyes. What's happening now?" John: "I'm sitting here." "John, what's happening with your face?" "I'm smiling." "Now what do you want to do?" "I want to try Pilot."

Within the context of the Gestalt Learning Process, attending to reality was central to the experience. Essentially this meant using the SRI facilities as another environment in which the child and the teacher could each experience his own reality. The machine provided an important time-space dimension through which both the child's reality and the teacher's reality could emerge, be explicit, and be attended to.

The machine's reality became a crucial factor in giving both the child and the teacher a setting in which each could begin that which he would have otherwise projected out to other people or things in his world.

This particular facet of projection deserves a closer look in regard to the machine's nature which of itself causes the person to view his reality in the dynamic dimension in which it rightfully exists. The machine provides the static backdrop against which a person can experience his dynamics in a way that is otherwise impossible. For the moment, the machine's static nature reduces the three-body problem (I, you, we) to a solvable two-body problem (I, we).

This notion of the machine's static reality is not the same as a static nature is commonly imagined. It must be remembered that each program was designed to operate on student stimuli, within the parameters of the program. In essence, each program carried with it its own process, i.e., the machine configurations and the basic boundaries of the program itself. Yet within this aspect of process, each child brought his content, his style and level of functioning, his individual cognitive and affective processes. He brought his reality, which by the very nature of "what is now," was a dynamic, constantly changing reality of the moment. The programs were designed to allow for open-ended, experiential, experiential learning; it was the child alone who could supply the open-endedness, the experimentation and the experiencing.