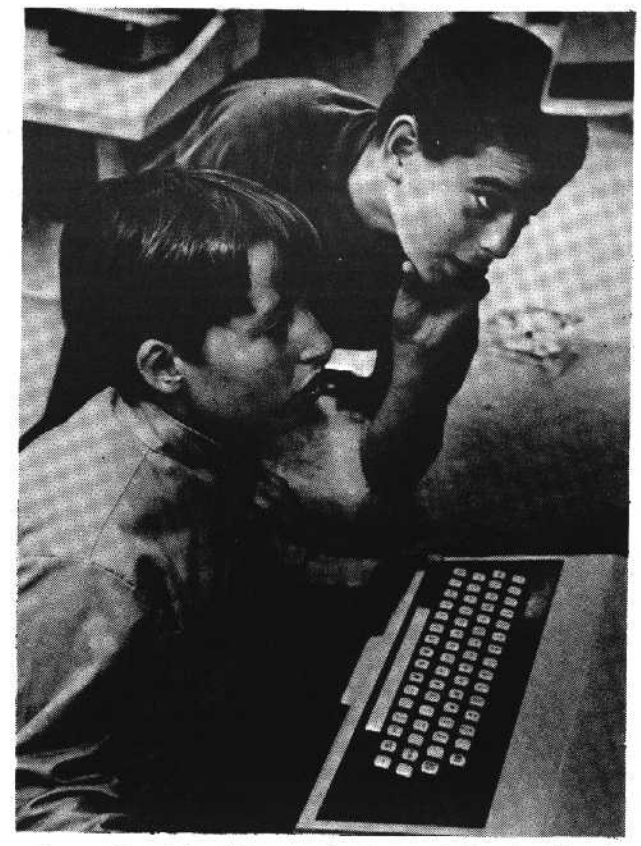
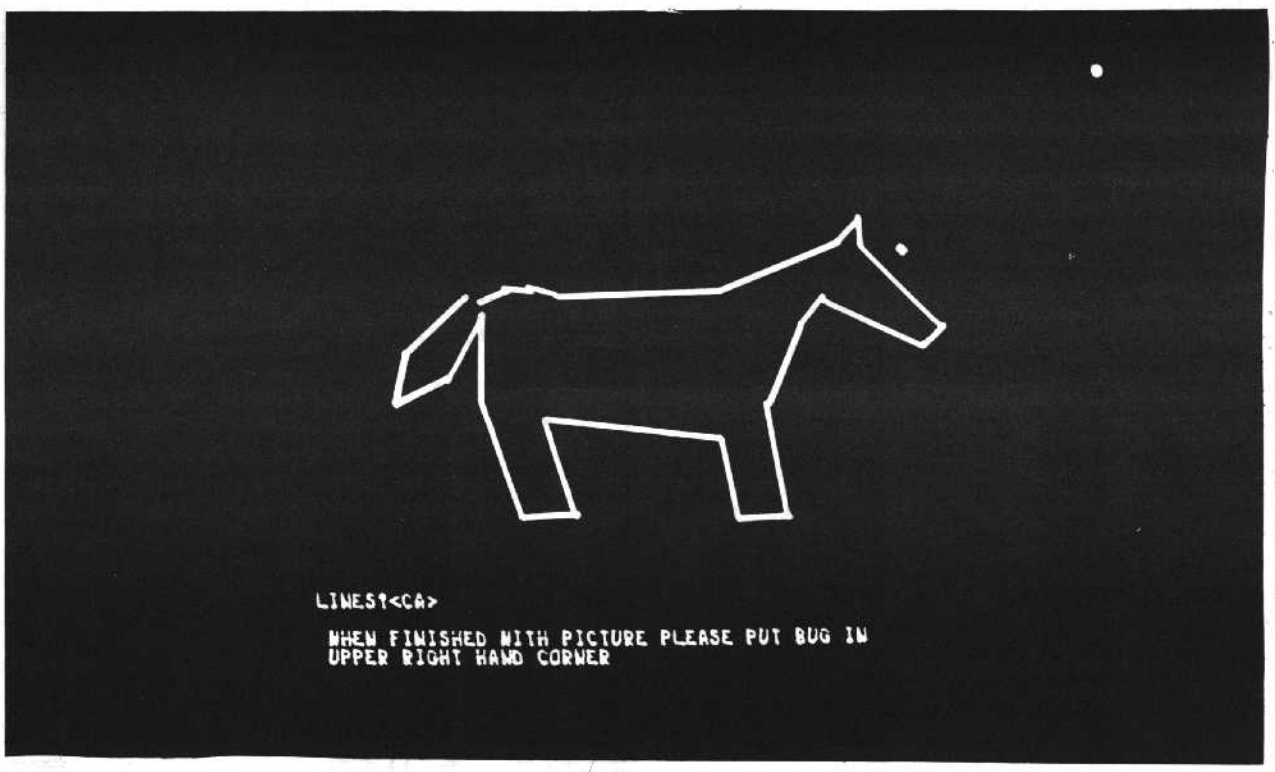
A program in open format could be used in teaching music. Five lines might be drawn by the computer on a display screen. The child introduces notes of his choice on the five lines with a pointing device (mouse). The computer interprets the notes as music and plays the music back to the child from the 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
•THØUHT I JHEARD JUST ØNE SHEEP BAYING.
•SØMETIMES I WAS PRETTY SMART
•HØW IS THAT YØU ØLD RETART.
•FØR PEØPLE WHØ DØNT KNØW 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 RAELLY 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)





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."

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.

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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, experimental, experiential learning; it was the child alone who could supply the open-endedness, the experimentation and the experiencing.