COMPUTERS IN THE FINE ARTS*

"What is in Room 101?"

The expression on O'Brien's face did not change. He answered dryly:

"You know what is in Room 101, Winston. Everyone knows what is in Room 101...The thing that is in Room 101 is the worst thing in the world."

George Orwell, 1984

It is 1980, the beginning of the last fifth of the 20th century, and most of us now take its technology for granted. Computers -- unthinkable a generation ago -- are a fact of everyday existence. Calculators are as common as wristwatches, industry, government, education, scientific research, medicine -- all plug their problems routinely into the computer for analysis.

The fine arts have held out the longest against the unobtrusive but rapid takeover of the machine, viewing it with doubt and suspicion as "the thing in Room 101...the worst thing in the world." John Skow in a recent article in Time Magazine (September 1979) reporting on Dartmouth College's Fourth International Conference on Computers and the Humanities, commented skeptically, "Is the conference title a self-contradiction, like 'fresh-frozen' or 'Young Republican'? The observer, a humanist in a dry season, resolutely programs himself to suppress his real attitude toward computers, which is a feeling of smugness and superiority masking a feeling of inferiority and hysteria...It is not long before preconceptions begin to fall away -- some of them to be later picked up, dusted off and restored to use..."

Of what use is the machine to the professional artist? Electronic musicians, with their synthesizers, modulators, wave-form generators, and other complicated circuitry, have welcomed computers; visual artists work with computer graphics, Alwin Nikolais coordinates electronic sound and light projections by computer for his multi-media choreographic settings. But these art activities, though less likely today to be relegated to the avant-garde ghetto, are essentially phenomena of the artistic fringe. What about the standard performing or studio artist -- musician, actor, dancer, painter? Can the machine paint in oils, play a Bach fugue, interpret the soliloquy from Hamlet, turn the 32 fouettes in Swan Lake? And in an active arts education environment like the Iowa Center for the Arts, how can the machine help those who teach and advise as well as create? Can it explain Baroque ornamentation or translate Renaissance English into contemporary usage or help one maintain one's balance in pirouette?

*Reprinted from Hancher Circle News, a publication of The University of Iowa Foundation.

No, of course not. But the arts find themselves, more and more, assisted by computers in ways they had not thought possible a decade ago. The machine is, above all, the ultimate tool -- a tireless, efficient servant that helps eliminate paperwork, computation, and the tedious repetition that must occur when one learns any new language, be it Spanish, music or dance notation, ballet terminology, or the laws of perspective. Its encroachment on traditional arts territory has been gradual but inexorable, its assistance invisible but fast becoming indispensable.

The machine cannot translate the Iliad or Shakespeare's sonnets -- but it is a most efficient way to produce a scholarly concordance. It cannot dance -- but through it, a choreographer can preserve his work in the movement-recording system called Labanotation. It cannot design a set -- but it reduces the mathematics of a lighting plot. It cannot throw a pot -- but it can check the surface stress on a piece of metal sculpture before the work is cast. And although it cannot plan a symphony season or audition dancers or actors, the computer can help the harried arts manager retain his sanity when he plunges into the fearsome complications of budgets and salaries, box office receipts, travel schedules and tour arrangements.

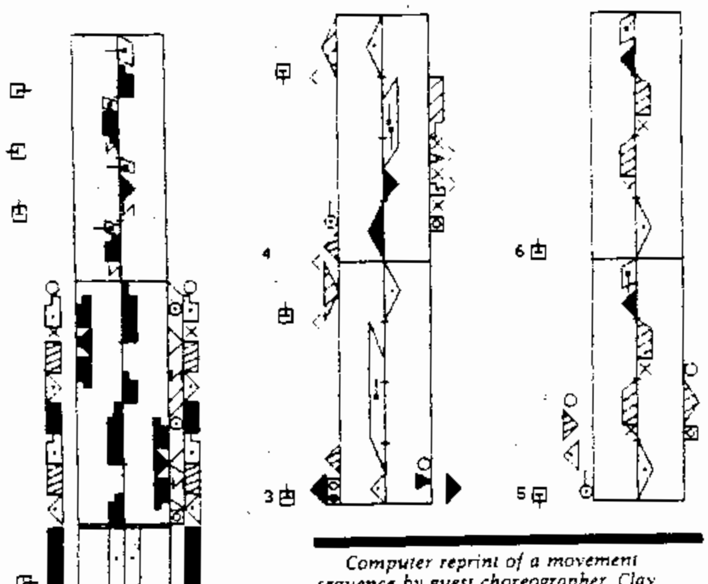
Here at The University of Iowa, computers operate, or have the potential to operate, in nearly all these areas. Room 1017 of the Music Building houses a cluster of computer equipment given over to the exclusive use of music, dance, drama, and studio art -- not just for the students, but for faculty research and performance projects as well.

The fine arts cluster is a long-range project of the Computer Assisted Instruction (CAI) Laboratory, directed by Dr. Bobby Brown, which designs and manufactures instructional programs and services for the entire U of I campus from its office in the Lindquist Center for Measurement. The project began several years ago with a sequence of music theory instructional programs designed by Dr. Marvin Thostenson, but it had difficulty establishing itself because of the cross-campus distance between music students and the Computer Center. At the suggestion of the CAI staff and the computer resource persons in the various arts programs, the Graduate College and the College of Liberal Arts agreed to fund the initial cluster of terminals for the arts. The School of Music supplied the space, which (not coincidentally) is directly across the hall from Thostenson's office. It took 15 months of negotiation to set up and fund the fine arts cluster, which opened its doors in the summer of 1979.

The development of the fine arts cluster is under the general guidance of Donald McClain and David Sealey, applications analysts for CAI. Sealey has feet in both art and technology -- he learned computer programming in high school from his father, an electrical engineer, and holds an M.F.A. from the U of I in technical theater. He joined the CAI staff just at the point when Brown wanted CAI to make a concerted thrust into the fine arts area (after programs had already been established in medicine and engineering). He has been responsible for CAI's work in art, dance, and theater, while McClain has primarily dealt with music.

> Imagine, if you can, a small room hexagonal in shape, like the cell of a bee. It is lighted neither by window nor by lamp, yet it is filled with a soft radiance. There are no apertures for ventilation, yet the air is fresh. There are no musical instruments, and yet, at the moment that my meditation opens, this room is throbbing with melodious sounds.
>
> E.M. Forster, "The Machine Stops"

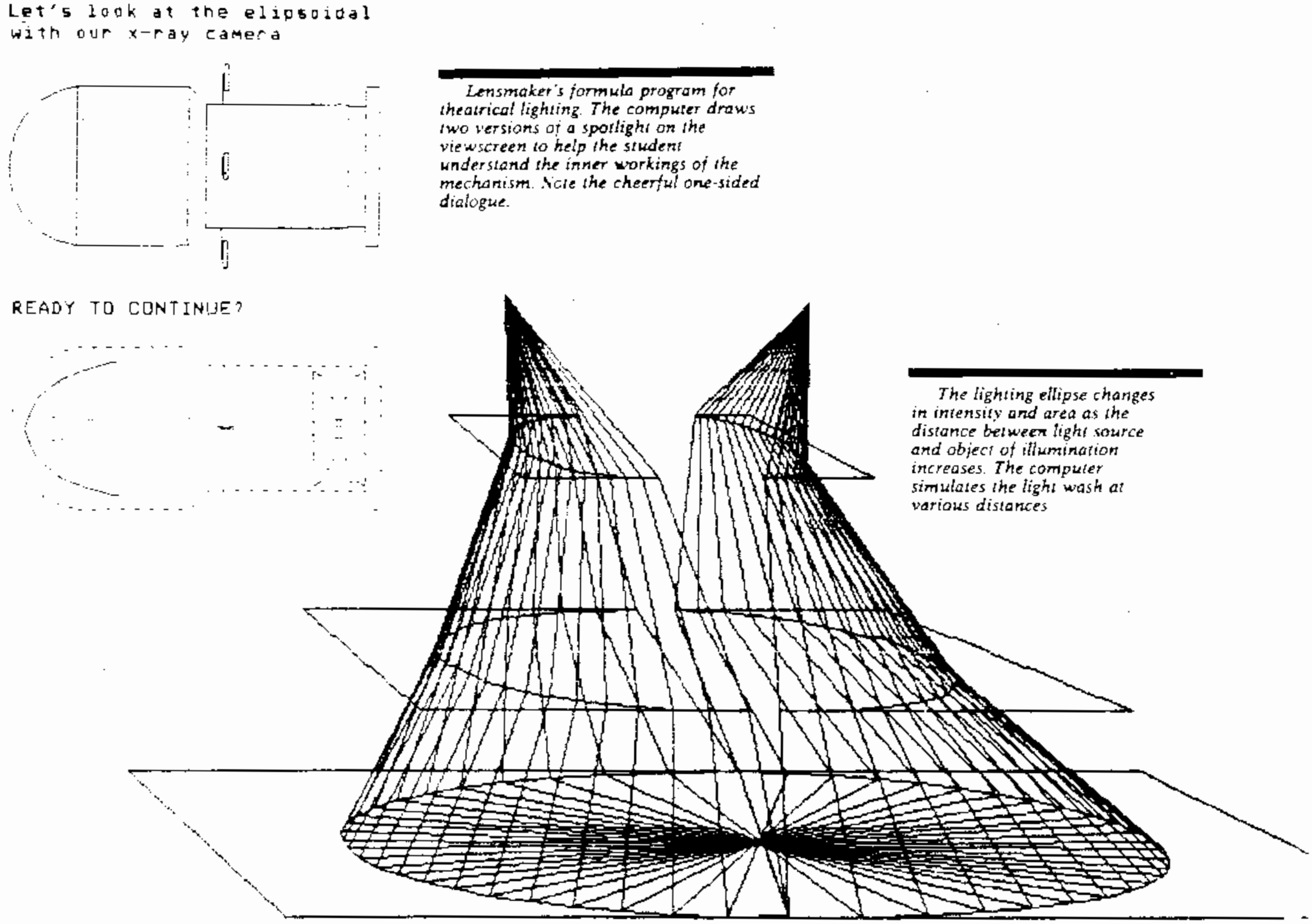
Except for the hexagonal shape, this description corresponds fairly well to Room 1017; the practice rooms just down the hall supply the melodious sounds. The computer equipment consists of four general-use video-display screens, a graphics terminal for drawing music and dance notation and the linear projections of theater and art programs, and a hard-copy printer that prints out the graphics material on paper; later the CAI staff hopes to add several videodisc players and a pitch generator. Room 1017 is accessible to students and staff whenever the building is open and the main computer banks are up (computers are not on or off but up or down) -- seven days a week, 18 hours a day, constant, untiring, and ever-ready.



Computer reprint of a movement sequence by guest choreographer, Clay Talliaferro, as scored in Labanotation by Judith Allen. Read bottom to top, six measures of music.

Figure 1

Until just over a half-century ago, choreographers had no notational language in which to preserve dances. Pieces rarely outlived their performances, except for a few works (those by August Bournonville in the Royal Danish Ballet repertory, for example) handed down by demonstration from dancer to dancer. Though many primitive notation systems had been tried, all had proven clumsy, inaccurate, or too narrow to apply to all varieties of dance. In 1928 the Austrian dancer and movement theorist Rudolf von Laban invented an abstract symbolic language called Schrifttanz (dance writing) that could be used to describe any movement. Codified, refined, and enlarged by his student Ann Hutchinson and monitored for accuracy and applicability by the Dance Notation Bureau (DNB) in New York City, Labanotation has become the most widely used system in the world for recording movement; primarily intended for dance, it is also used to record synchronized swimming, ice skating, and gymnastics routines, by social anthropologists to describe ritualistic movement patterns, and by industrial psychologists to determine work efficiency through time and motion studies.



Lensmaker's formula program for theatrical lighting. The computer draws two versions of a spotlight on the viewscreen to help the student understand the inner workings of the mechanism. Note the cheerful one-sided dialogue.

The lighting ellipse changes in intensity and area as the distance between light source and object of illumination increases. The computer simulates the light wash at various distances

Figure 2

For all its utility, however, Labanotation is extremely time-consuming to learn, and it is a long while before the notator can work rapidly and comfortably with its symbols. The system works as follows: A vertical axis runs the length of the page, representing the center of the body; the basic movement shape is a rectangle, superscribed on the axis. The rectangle is altered in shape to show the direction of movement, in color to show level (high, middle, or low part of the performing space), and in length to show duration. Columns are added at the side of the main axis to show movements of the arms, legs, and head. For a piece with several dancers, the score can extend for many columns (unfolding like a road-map) and may include detailed floor-plans as well. The chronological measurement, marked off in seconds or bars of music, extends along the right-hand margin of the page.

"Labanotation is very detailed," said Judith Allen, who holds the DNB's advanced notator and teaching certificates and teaches beginning and intermediate Labanotation in the U of I Dance Program. "It is not meant to be a shorthand; it was designed to preserve choreography. Besides showing direction (forward, back, side), levels, and timing, it shows all parts of the body, including joints, limbs, and surface areas; spatial concepts and stage directions; dynamics (the amount of energy used); and the relationship of a dancer to other dancers, scenery, or props. It can be as detailed as showing the winking of an eye."

Because of its abstract geometrics and large number of detailed symbols (there are over 150 characters, of which the average notator must have a good working knowledge of about 75), Labanotation involves many hours of eyestrain for even a short score. The notator must rule out the columns, sketch in the symbols, check and re-check them for accuracy, have another notator or the DNB confirm the work, and then laboriously hand-ink the symbols onto the page. Any corrections (and there are always a few, despite the meticulous precautions) must be made with an ink eraser and a clamped jaw.

When the fine arts computer cluster was proposed and opinions requested from the arts resource people, Allen asked whether CAI could benefit her notation students. She spent the spring semester of 1979 on developmental leave (a paid sabbatical for research purposes) working with Sealey, who coordinated the overall program design, and John Anderson, a computer science student who did the actual programming. Putting Labanotation on computer required some large-scale preliminary work just to get the machine to accept the notation staff and symbols. Anderson drew the notation characters on graph paper, plotted their coordinates on the graphics terminal, then entered them into the system. A subsidiary program allowed the notator to change the symbols' size, rotate them on the viewscreen, or move them into different positions on the grid.

Allen's particular project is the Computerized Labanotation Instructional Program (CLIP), the teaching program for her notation classes. A series of modular lessons in question-and-answer format, CLIP helps the students learn the notation characters more quickly and thoroughly, eliminating much of the paperwork of early notation lessons by allowing the students to 'draw' the symbols on the viewscreen. It also gives both Allen and the students access to their errors, so that she and they can see where problems exist. Allen is pleased (and a little surprised) at CLIP's success: "I thought they were going to hate it," she said cheerfully, "but they really seem to have enjoyed coming over and using the computer."

Ten CLIP programs are now written, but only two have been fully programmed; a third needs only its notation symbols inserted to be complete. The big problems are, of course, time and money. Kathy Atwell, a graduate student in dance, helped Allen write the first CLIP programs, but her time is limited by her teaching and course obligations. "We need a full-time programmer now," Allen said. "If we had someone working eight hours a day for a year, we could complete the other seven lessons. One difficulty with applying for grant money is that no one seems to know which National Endowment to apply to. Is the Labanotation project primarily archival and historical or educational? Are we an art or a humanity?"

Allen hopes eventually to take a graphics terminal right into the studio and score pieces directly on it, which she says could condense 200 man-hours of work into about five computer hours. She also wants to use the computer to teach rhythmic analysis to dancers and random-access videodisc to teach ballet terminology with videotaped movements rather than still pictures. She hopes to tie the entire U of I Labanotation project to the Educational Dance Registry, a DNB project that will result in a library of scores for college reconstruction and a uniform nationwide curriculum for the teaching of notation.

Allen and Sealey are interested in a more profound and creative merging of Labanotation and computer technology. Notation on computer actually began with a project at Penn State to record completely notated scores. Their version, however, proved cumbersome to use because the geometric notation characters were drawn by hand-controlled dials, as on a child's Etch-a-Sketch slate; it was, moreover, expensive, which combined with the mechanical clumsiness to stall the project. The U of I project is organized along the lines of Penn State's, though with the greater accuracy and reproducibility permitted by computer graphics, to create a computer base for Labanotation that will immensely broaden the practical dissemination of the system.

Sealey attended a conference in London this past summer, a two-week celebration of Laban's centenary sponsored by the International Laban Centre of London University's Goldsmith College. Although he went (with assistance from a grant from Hancher Circle) to demonstrate the U of I's programs and equipment, several important secondary projects resulted from the conference. Labanotation is relatively new and still in the process of evolving; all suggestions to improve or expand the system must be presented to the International Council for Kinetography-Laban, which rules on the official integration of proposals into the symbol-set. Muriel Topaz of DNB, and other notators agreed, after seeing Sealey's materials, that the computer is here to stay; they will henceforward evaluate all symbol proposals according to how easily they can be integrated into the current computerized system. Hutchinson and Topaz, in return, will work with Sealey and Allen to suggest minor changes and improvements that will make the system more readily available, easy to use, and of maximum practical benefit to the working notator. Topaz visited the U of I campus in December to 'interface' with the computer, and Mary Sweeney, a Dance Program graduate student, went to London in November to work in an exchange program with Hutchinson. The next step, said Sealey, is a grant proposal to the National Endowment for the Arts to hire a full-time professional notator from DNB, who will work completely through the computerized Labanotation sequence and recommend revisions in the programming. After that, the entire system could be made available to professional notators. "We are the only ones in the U.S. and the world doing this work," Sealey said.

There are also great possibilities for computer assistance in the relatively unexplored territory of movement theory. Laban's Schrifttanz was originally intended to be an empirical tool for the theoretical study of movement. In 1939 he wrote a book called Choreutics (it was not published until 1966), an analysis of form in movement. Laban's theories of 'choreological order' were further developed by Lisa Ullman, Sylvia Bodmer, Kurt Jooss (the late German choreographer whose works have been revived by the Joffrey Ballet), and most extensively by British movement specialist Valerie Preston-Dunlop, of the Goldsmith College International Laban Centre.

Choreutics does not describe the personal style of a specific dancer; it is rather, writes Angiola Sartorio in The Dance Encyclopedia, an impersonal system based on the changing relationship of the dancer to the space in which he moves (the kinesphere). Laban theorized that all movements, whatever their quality (strength, speed, size) could be inscribed within an 'icosahedron', a solid geometrical structure composed of twenty equilateral triangles. The icosahedron is the crystalline form closest to the ideal sphere of movement, and Laban stipulated the geometric form because the sphere, by its very uniformity, provides "no means of organizing activities within the kinesphere." Laban devised the choreutic system to describe "the rules of grammar of the language of movement."

Preston-Dunlop's book on choreutics, subtitled "The Study of Logical Spatial Forms in Dance," analyzes Laban's solid geometrical shapes in terms of the expressive possibilities inherent in every structure as it is affected by variables of quality. When she visited the U of I last February, she saw the beginning stages of the Labanotation project, and at the summer conference she and Sealey discussed using the computer's natural ability for advanced mathematical analysis to assist her choreutic research. Her book, says its introduction, is intended to define choreutics as a study similar to the position of harmony in the analysis of music. Just as mathematical explanations can never provide a recipe for musical composition, she writes, neither can choreological grammar provide the recipe for dance compositions, but both can provide a means of yielding greater understanding of a piece and of the art form's expressive potential.

The computer can be used, said Sealey, to describe and analyze the geometric shapes of choreutics. Many of his computer graphics programs in theatrical light projections and set design renderings are based on similar principles of the analysis of three-dimensional shapes on a two-dimensional viewscreen.

The unlikely conjunction of the cerebral and the boisterously physical when computer programmers and dancers meet has led to some unexpectedly funny results. Allen amused the CAI staff by periodically leaping up from her programming terminal to execute a step in order to check the accuracy of the computerized notation. She, Atwell, and Sweeney took Sealey's elementary computer science course to understand the basics of programming, so he reciprocated by taking beginning Labanotation last semester; during our interview, he got up and proudly 'read' the notation sequence you see reproduced here, kicking up his heels to execute the steps. Allen summed up the feelings of everyone involved on both sides of the project when she said, "I never would have believed I'd end up in computers -- but here I am."

Judith Green