

THE TRAINING OF THE COMPOSER IN THE USE OF NEW TECHNOLOGICAL MEANS

by

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IN an age of technology we would be remiss if we denied our young composers the training necessary to master the techniques of electronic music and computers. But before we can discuss the nature of this training, we must examine even more fundamental issues which arise from the study and teaching of musical composition.

Historically, the training of composers has often displayed a discrepancy between pedagogy, what we might call theory courses, and the works supposedly produced under the influence of this pedagogy. Surprising in this respect have been the past 300 years, for during this period of many stylistic changes a succession of teachers has found it convenient to retain pedagogical material which was already outmoded when it was first devised. That composers as unrelated as Mozart and Cage seem to be products of this training is even more perplexing.

Training the composer to understand the technology of electronic sound production, though not without problems, appears to be fairly straightforward. But must we retain the other aspects of his training, the traditional study of harmony, counterpoint, fugue, etc. ? How can we by any stretch of the imagination state, after hearing even a non-electronic work of the past two decades, that it required the study of traditional theory courses ?

In defense of teaching traditional music theory as the basis of compositional study, we are told that by executing reams of Palestrina-like counterpoint and Bach-like fugues, our efforts rarely resemble the originals, we gain experience in the realm of creative decision making. One famous teacher of our century is supposed to have said, « Bach's compositions are impossible to imitate, so let us imitate them ». We could just as easily suggest that the electronic works

of Stockhausen are impossible to imitate, so why not imitate them ? The model might be fundamentally unimportant, but the young student composer of our time is demanding relevance and an awareness of our age and world.

With the emergence of a new technology and a resultant music, we have been forced to re-examine the basis for the training of all composers whether they employ old or newer means of sound production. Our new awareness indicates that the training a composer acquires in the use of technological means, appears to be the proper training for a composer even if he does not have continuing access to the new technology. Composition probably cannot be taught but the craft of composition can be nurtured through an understanding of sound production with technical means. For once a composer has been exposed to an electronic music studio or computer, his « normal » compositions will never be quite the same. In fact, his appreciation of music of all cultures and epochs will also grow. It is difficult to put into words the confrontation of creative man and machine, the production of sound through electrons, and the realization that musical composition is simply sound, silence and time. It has always been this way and the new technology has revived our awareness of this fundamental fact.

The union of technology and music which can be conveniently called electronic music, began in 1948 though many interesting anticipations and predictions of its arrival can be documented at various times in the first half of our century. During its two decades, electronic music has adopted technical achievements and also paralleled, even influenced, modes of musical composition

We can speak of three phases of electronic music. The first phase introduced the sound vocabulary of electronic composition and the basic premise that sound can conveniently be stored, manipulated and played with the aid of a tape recorder. The importance of this primary tool for electronic composition cannot be overestimated. Its emergence in the late forties aptly fulfils McLuhan's thesis for understanding media, where an artistic need converges with an appropriate technology. A particularly apt term for this phase is *tape-music* and the studios emerging from this phase are already referred to as *classic*.

The second phase saw the composer and engineer seek out more efficient methods of working through automation. With extensive application of transistor technology, the currently available apparatus which we call synthesizer was developed. The second phase is closely related to the third, where complete automation of the work process is possible with the assistance of a computer. Though the applications of computers to music are many, for the purposes of this paper we shall limit them to composition and production of sound with the aid of a computer.

During this technical development, electronic music had periods of waning artistic interest where the pioneer composers abandoned the art for more

fashionable modes of composition. In spite of these secessions, the growth of electronic composition has continued steadily and has reached a point where most composers acknowledge its validity and a need for suitable training.

As this writer has previously speculated, the resurgence, growth, and eventual stability of electronic music can probably be attributed in greater part to the acceptance of the medium by the university. The electronic music studio, at first associated with radio networks and electronic industry, has found a suitable environment in the music departments of universities throughout the world. It follows naturally that the university has assumed the greater share for training composers in the new medium. Though it does this in the traditional spirit of learning for its own sake, it also has the financial resources for maintaining elaborate and expensive equipment. A further benefit of the university environment is that the composer can call upon his scientific colleagues for expert advice and even collaboration on musical projects. This is not to deny the continuing importance of non-academic institutions in the training of electronic composers. For example, the Groupe de Recherches Musicales of the Radiodiffusion-Télévision Française in Paris, offers superb instruction in the craft of electronic composition.

At the present time many young composers throughout the world are within distance of an electronic music studio. The number of these studios, though inadequate to meet all demands, grows constantly and this can be attributed to the common availability of fairly inexpensive equipment designed expressly for small electronic music installations. The price of this equipment, roughly equivalent to the cost of a grand piano, is potentially within the budget of a small university, high school, or even some private individuals. More specialized facilities will continue to exist but new technology should make these smaller studios fairly common by the end of the 70's.

For the student composer, the electronic music studio is the classroom and his admission to present studios can be limited by various factors, the most common being the shortage of available studio time. It is a curious fact that the new technology has not necessarily brought a concomitant acceleration of the work process. The act of electronic composition demands that the composer appropriate considerable periods of studio time, thus limiting the use to a small number of composers. The problem of accommodating a larger group, particularly for training purposes, might be overcome with more efficient equipment design. There is no reason why compact, portable studios could not be manufactured, relieving the demand made on more elaborate facilities. One might argue that present commercial equipment meets this requirement already but this writer feels that even smaller and less expensive units can be fabricated.

Other factors which can limit the availability of a studio : some studios were established for research purposes only ; other studios have commercial commitments to justify their existence ; the university studio might have

academic requirements which the student cannot meet. In many North American universities, for example, the study of electronic music, rightly or wrongly, is offered only as a graduate-level course.

I have assumed in this discussion that the composer wishes to train and work in a fairly typical electronic music studio, one which we have categorized as first or second phase. It would appear that studios associated with academic institutions have reason to meet these demands. But what of computer music? Again the academic institution is in a favourable position, for though not all universities have an electronic music studio, a computer is always available.

But the mere presence of numerous computers does not guarantee an unlimited resource for musical needs. With suitable programmes, musical composition with a computer can be accommodated by literally any computer facility in the world, but generating musical sounds with a computer is a time-consuming and very expensive matter. Very few computer administrators are willing to allot the computing time, or purchase the associated hardware required for sound generating programmes of which the Bell Telephone Laboratories' MUSIC V is fairly typical. Programmes like MUSIC V demand a modern, high capacity, ultra-fast computer, further compounding the composer's problems.

Various solutions, already utilized by the scientific community, have been suggested: local terminals, time-sharing and the like. The essence of the problem is that computers and computing language were devised by mathematicians for scientific needs. Musical sound generation, however, places extraordinary demands upon existing computer technology. A partial solution to this dilemma would be to design computers for the specific problem of sound generation. But even with specialized computers, it is difficult to predict if enough time could be made available to meet the demands of all composers and students. Hence other avenues are being explored.

It is quite possible for the normal instrumentation of a studio to be placed under computer control. This is an attractive idea and is being implemented by the new studio at Sveriges Radio. A similar solution is offered by programmes like the University of Toronto's PIPER 2, where the composer sacrifices the computer's property of accurate sound synthesis and rather uses it for controlling already available equipment.

We have discussed at length the electronic music scene and the situation which prevails for the training of composers in the new medium. Throughout the discussion, the writer has invariably stated the problems in the framework of an academic institution, a situation with which he is most familiar. And yet there are many composers, student and professional, who have shed their academic affiliation or actively do not seek it. Provision for training these composers in electronic music and then allowing them *continuing* access to proper facilities has not been adequately met. Here the burden for meeting these needs would seem to fall upon the grant-giving organizations of State and

industry. But when the independent composer approaches an arts council for funds he is invariably referred to the science council and vice versa. The term itself, electronic music, implies both science and art and unfortunately provides a convenient excuse for not granting requested funds. Without belabouring this point I can simply plead : the need is urgent ; the investment can be comparatively modest ; the results immeasurable.

Before turning to a detailed outline for a suitable course of study in electronic composition, we must admit a problem common to all teaching situations. Regardless of intention, not *all* composers will master the techniques of electronic music, particularly the species known as tape-music. Tape-music demands that the composer literally handle the tape and associated equipment. He may occasionally require the assistance of a technician but usually he is composer, technician (and, in a sense, performer) simultaneously. As a good deal of compositional activity involves physical control over machinery, some composers will be incapable or unwilling to handle the necessary hardware. Obviously this is not to be construed as a deficiency in their creative powers or musicianship. Quite often the composer who shies away from tape-music finds himself attracted to synthesizers or computer music where the confrontation with machine is of a different order. He might also find that tape-music is a natural medium for collaboration with colleagues who are more adept with machinery.

A suitable course of study for electronic composition can be divided into two parts : (1) an examination of the theoretical, scientific and historical aspects pertaining to electronic music ; (2) the practical techniques of electronic composition.

The first part of the course would include at least a survey of the following :

(a) The terminology of electronics, particularly terms encountered in audio engineering. The depth of knowledge essential for electronic composition will probably depend on the natural curiosity of the composer. Generally speaking, the ease with which the composer handles electronic equipment will be dependent on a technical understanding of its electronic properties. The point might be debatable, for many musicians and composers do not completely understand the scientific basis and engineering of common musical instruments and yet they play and compose for these instruments effectively.

(b) The terminology of audio-acoustics. Fundamental as the study of acoustics is to music, rarely is a composer given training in this subject. Its importance for all compositional activity cannot be overemphasized.

(c) A rudimentary examination of those branches of mathematics related to the above. In addition, the composer should be introduced to the arithmetic of computers and one of the common computer languages like ALGOL or FORTRAN. A thorough mastery of a computer language might be difficult

for some composers but even an understanding of basic rules will help them to converse with programmers.

(d) A historical survey of so-called « experimental music » techniques. The composer should also be made aware of musical cultures and repertoires other than his own, for there are many equally valid ways of expressing the basic parameters of music.

(e) An examination of other media and their importance for music and art in general. For example, few electronic composers realize that many problems are common to cinema and electronic music. Many electronic music techniques have been borrowed from cinematic techniques.

(f) The « new » music theory and its application to the electronic medium. The abundant literature on the theoretical aspects of composition which has appeared over the past 20 years would almost provide a course in itself.

For any student of composition, much of the above material is offered as an alternative to traditional theory training as described in the first part of the paper. This course provides the necessary background and runs concurrently with studies in practical electronic music making.

Ideally, the practical part of the course should train the composer so thoroughly that he should be able to work at almost any studio after a brief period of orientation. There must obviously be more than a surface comprehension of the techniques to meet this condition. In this regard the writer does not believe in local manuals where, through the application of rules or diagrams, the composer achieves a result. Many manuals unnecessarily illustrate *all* permutations for interconnecting equipment. But if the composer truly understands the apparatus and the simple logic for interconnecting sound equipment, he will not require a manual.

The practical side of electronic music can be presented in different ways. In one approach the composer, through the application of suitable apparatus, recreates the schools or phases of electronic composition in more or less chronological order. Another method, favoured by this writer, combines the categorical presentation of basic equipment with suitable exercise material. In either approach, the exercise is considered a creative act, no matter how brief it might be.

The point of departure for the practical studies will inevitably be the examination of the medium of tape recording. The tape recorder is common to all phases of electronic music, including computer music, and a mastery of recording techniques is essential. As the composer is already familiar with the sound of traditional instruments, he should first use these sources for exercises in recording. The next stage in the acquisition of recording technique would require successful microphone recordings of natural and concrete sounds. Very deliberately the least known quality, that of pure electronic sound, is left to the end of this orientation period, since faithful recording of electronically

generated sound can be a difficult and frustrating task for the newcomer to this medium.

Though newly-developed equipment for electronic music has minimized the time-consuming techniques of splicing and editing, this aspect of the craft should not be slighted. In a sense it is this command of time and sound (what Varèse called « organized sound »), through the techniques of splicing and editing, which makes electronic music a unique form of composition. If the composer is acquainted with the successful electronic compositions in the repertoire, he will soon realize that they often rely on a simple tool, the razor blade. This is not to deny the value of « real-time » equipment which has recently appeared under the fanciful designation of « synthesizer ». Ideally a well-planned studio makes available to its composer as much different equipment as possible, be it labelled real-time, synthesizer, modular, classic, etc. Regardless of the species of equipment or doctrine, the time spent in splicing together simple « timbre » melodies will be found rewarding.

The techniques of assembling and synchronizing multiple-strand textures grow logically from the previous exercises and, at this point, there is no reason why the exercises cannot be cast in the form of short compositions or sections of longer compositions.

The next section of the course introduces the composer to the techniques of sound-modification. Standard tape manipulations, filtering, reverberation, modulation processes, etc., can be presented in any convenient order. This presentation will of necessity be limited to the equipment found in the studio, but the composer should be familiarized, through recordings and literature, with specialized equipment found in other studios. A complete understanding of sound modifiers will not be immediate and it will take much practical experience before the composer can predict the results of their application.

In addition to the foregoing, the composer should examine the available scores, listen to and analyze compositions found on commercial phonodiscs and tape. Analysis of electronic music is extremely difficult for the beginning composer even when detailed information on the composition is supplied. A useful exercise in conjunction with analysis is the realization on tape of a short section from another composer's electronic score. From this he will be made cognisant of the problems of devising a suitable notation for electronic music. A more difficult exercise involves the recreation on tape of a recorded model, perhaps a fragment from a tape composition for which a score does not exist.

Some readers might question the writer's neglect, in the above outline, of composers who are primarily interested in computer sound generation. Essentially, the steps taken by the electronic composer are similar to those of the composer creating sounds with a computer. They both deal with the generation, modification and organization of sound. To illustrate the point : a studio composer employs a sound source, say an audio oscillator, which will be

modified with a filter ; the composer working with a computer must specify routines where « models » of the sound generator and its associated filter are created. The aural result for this simplified example will be the same, for the difference is one of hardware. As the sound world of both composers is essentially identical, the training of the computer composer will follow similar lines.

Finally, the composer should be given the opportunity of hearing his compositions presented in concert. Concerts of electronic music present few administrative problems, as the traditional obstacles of rehearsal time, availability of performers, etc., do not exist. Even so, public concerts allow the composer to hear his works in a larger acoustical environment, usually the traditional concert hall. Whether the typical concert hall is the only suitable setting for electronic presentations is open to debate. Certainly the spectacle of an audience at an electronic concert staring at an empty stage, would suggest that the new technology has yet to provide us with an appropriate architecture.

The writer will readily admit that the proposed plan of study demands a considerable allotment of time for completion. The first part of the course, particularly the scientific, will demand more of the average composer but will depend somewhat on his previous education. The practical part of the course proceeds more quickly and, with the reservations already mentioned, is within the grasp of any composer. When a training plan like this has been suggested, there is the inevitable question of textbook.

It is difficult to imagine, at the end of two brief decades of development, a practical treatise on electronic composition which would be accepted universally. A few books have appeared but the greater bulk of writing, as any standard bibliography will show, has been in the form of articles. We cannot deny the value of these writings but, as the writer has already stated, the electronic music studio is the classroom. It follows that the electronic compositions produced in these studios are the text.

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