

# TECHNOLOGY AND THE COMPOSER

by

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## I

**B**ETWEEN 1877 and 1896 Edison and Berliner developed their cylindrical and disc phonograph systems, providing us with the new ability to store audio signals and to retrieve them from storage by electro-mechanical means. About half a century later, and nearly 30 years after Lee DeForest had initiated « Electronics » with the first vacuum tube (the triode « audion »), the phonograph-disc was joined by « magnetic tape » and the phonograph by the tape recorder. During the last 15 years great progress has been made in learning how the computer could assist the musician towards achieving ever higher degrees of precision in storing and retrieving audio information.

The emergence of electronics, vacuum tubes, transistors, and all kinds of increasingly sophisticated circuitries supplied the impetus to delve anew into the still only vaguely answered questions about the physical nature of sound, the possibilities of analyzing and of synthesizing any desired sound, the problems of psycho-acoustical phenomenology. It also led to a vast arsenal of electronic sound sources, sound modifiers, devices for control and amplification of sound, to microphones and loudspeakers, but most important of all : it led to an improved concept of storage, to the concept of simulated memory, to the programmable studio and to the even more programmable digital and analogue computer system.

Although composers became aware of these developments rather early ; although Busoni, Schoenberg, Varèse, Schillinger, Stokowski, Chavez, and many others wrote and talked about the promising influence of science and technology on the composer in his search for new compositional procedures, it was not until rather late in the game that some notable connexions between technology and composition were established. Most of the time since Dr. Thaddeus Cahil demonstrated his « Telharmonium » or « Dynamophone » in 1906 was dedicated to the invention and enormous improvement of

techniques for the production, manipulation and performance of sound. In 1916 Edgar Varèse asked for new musical instruments, an enrichment of our musical alphabet, and a few years later for the co-operation between electrician and composer. From 1927 till 1936 he tried to get financial support for the development of an electronic instrument for composition at Bell Telephone Laboratories, where Harvey Fletcher and René Bertrand would have collaborated with him on the project. He could neither get a Guggenheim Fellowship nor any help from sound studios in Hollywood. In the meantime Hammond had produced his organ, the « Novachord », the « Solovox », and one can follow this instrument oriented trend through the years up to the present.

In the United States composers began to work with tape and tape recorders at about 1950. The next ten years saw the establishment of various studios and laboratories, where composers, musicians and technicians could collaborate in furthering all kinds of projects pertaining to the relationships between electronics and music. In North America almost all such studios are located at and affiliated with universities. Major examples are the « Columbia-Princeton Electronic Music Center » and the studios at the Universities of Illinois and Toronto (1, 2). Now there are hundreds of such installations to be found in the western hemisphere; and if ten years ago many a music department chairman did not know what an electronic music studio was, today he would at least always know whether his school has one or not.

For some time now music has been getting involved with the computer. This also began mainly at universities, notably at the University of Illinois, where Lejaren Hiller and L.M. Isaacson completed their first computer assisted composition in 1956 (3). If one combines positive experiences with apparently justified expectations then one can predict that the interaction between computers and the composer will prove far more fertile with regard to compositional procedures than will either the availability of new instruments, or the more and more stream-lined modular compactness of portable studio equipment and tape recorders, or even the integration of performing humans into ever-more sophisticated circuitries that allow for unlimited amplification of naturally redundant autobiographical sound portraits.

As the composer meets technology through the computer, both have a chance to see one another far more clearly, than the usual barriers, namely sound and industry, permit. The composer has begun to recognize that technology is not merely the provider of instruments, of devices, of conveniences; in short, he is learning that technology is not just techniques and engineering. He now defines technology as the science and art of applying

(1) Hugh DAVIES, *Répertoire International des Musiques Electro-Acoustiques*, *International Electronic Music Catalog*. London, 1967. The M. I. T. Press, 1968.

(2) Lowell CROSS, *Electronic Music, 1948-1953*, in *Perspectives of New Music*. Vol. 7, No. 1, 1968.

(3) L. A. HILLER and L. M. ISAACSON, *Experimental Music*, McGraw-Hill Book Co. N. Y., 1959.



knowledge to the desire for problem solving and I, for one, concede that technology would have a far more beneficial impact on society if its potentials were controlled by technologists rather than industrialists and politicians.

It is desirable that the technologist take a fresh view of the composer. The time has come for him to see that the composer is not merely a music maker, an art maker, who thinks that his products have to measure up to an established standard of culture and who is eager to call them a merchandize and sell them. Many composers today would like to live in a socially concerned and courageously heuristic environment : they are looking for problems ; they do not claim to know but are eager to create models for solutions ; they would rather produce some dynamic input than find their product flatly output and consumed ; they have experienced the width and the narrowness of at least one « medium » in depth and so can move in it or on to the next. They would want contemporary technology to return the respect they have for it by using and assisting them so that their work may escape the psychologist's case study and the aesthetician's collection, and instead, be given a chance to become a dynamic input to the contemporary social system. Together with technology the composer defines « input » as something that induces and initiates such changes of state in a system as would not occur, without this input, at the moment or possibly ever.

## II

The story of music and technology tells of a very old couple which the composer keeps visiting in order to have his dreams materialize, his intentions implemented, his problems solved. It depicts in various terms, largely depending on the storyteller's choice of emphasis, the emergence of man's need for the control of acoustical events for a purpose, and his ways of catering to this need through a maze of apparently continuous chains of either observed or stipulated problems, and either found or invented or stipulated solutions. The story would show the composer to be motivated by a more-or-less intuitive allergy to the inevitable decrease of information in the systems through which he sees his world at any given time ; even the systems he loves, exhibit to him symptoms of decay and stagnation, and all he can do is retard the final curtain by creating systems wherein that which passes swiftly in reality would stay alive a little longer in an analogy. It does not matter much in what language and in which terminology the composer happens to think his thoughts : his concepts of what is to be music next are always related to some technological considerations, and this relationship ranges from extreme subtlety to gross obviousness. There ought to be no need at this point to elaborate on the rather-common place notion that technological considerations show the way from a musical idea to its realization, first in some code and then in a

performance; and that technological considerations lead to the availability of the acoustical phenomena needed by the composer for an audible representation of his musical ideas. It may be appropriate, however, to remember that musical ideas are thinking models in more or less deliberately stipulated linguistic systems; that, for reasons to be discussed later, the complexity of such systems is increasing in many a sense and dimension and that, therefore, the composer now has to turn to technology with the additional request for assistance in handling the systems he stipulates.

But as the composer turns to technology today, he is bound to find himself forced into two intertwined admissions: that the belief according to which we live in a technological era is merely a belief, unsubstantiated by any sufficiency of facts; and that the concept conjured up by the word « composer » needs broadening until it embraces more than just music, painting, or the arts in general; that it must extend its pretensions towards the regions where the languages thrive, grow old, and wither, the natural, artificial, formal, and the dead alike.

As long as technology is ruled and controlled by hard and fast beliefs and as long as it makes its way to the people through a veritable maze of filters consisting of almost exactly those same hard and fast beliefs, we are living in the era of hard and fast beliefs, in the ideological, not in the technological era. The services that technology renders to all those who — being no technologists — need destructive power in order to survive better knowledge, and to those who — not being composers — use the languages of an incurably sick system to curse and condemn even the discussion of attempts at composing a yet-unpolluted one: these services never were designed by technologists. Technology being the science and the art of applying knowledge to the desire for problem solving, it takes a believer and ideologist to present as applied knowledge the advanced techniques of murder, brainwashing and destruction. Where such a presentation is accepted and successful there one cannot help but rebel against the power that language wields over thought, imagery and desire. For much of the power of presentation rests in language, in the grammatical and syntactical innocence with which it acceptably supports even the unspeakable. As long as all this power and innocence act in favour of the believer's and ideologist's presentation, attenuating the voices of everyone else, so long the technologists and the composers have an axe to grind in common.

If ever there will be a technological era worth talking about, it will be thanks to technologists and composers. By their joint efforts, extended over a prolonged period, they may contrive to emancipate thought from language sufficiently for a rehabilitation of both, and continuing from that, introduce an era for mankind where every thought has its language, and where every man has at his disposal a device that will respond to his input according to the language he stipulates. Today we still labour and suffer under the oppression of those who can hide their determined unwillingness behind a modestly



confessed lack of understanding, behind less modestly uttered claims for everyone's right to misunderstand, behind aggressive attacks on an allegedly unrealistic but in effect only nonconformist intellect. Tomorrow, in the technological era, if it is to merit this label, this kind of hide-and-seek game should have lost its power-illuminated glamour, and have made place for a prosaic, and thus non-violent but transparent confrontation, in language and in action, between those who can articulate the desire for an intelligent society and those who understand but do not want it. There should be no question as to what an intelligent society is, nor as to who wants it and who doesn't. The difference between technology and composition will dwindle to an insignificant degree of a nuance; whereas the difference between nuances of thought will acquire significant proportions, worthy of the discriminating potentials of the human mind.

When, many years ago, I was first invited to give talks and lectures, the invitations meant that I was to be a composer of music who is to discuss and to present music for an audience interested in music. I felt that, therefore, I had to show how the thoughts I really wished to talk about were relevant even to music. Under this pressure I soon found out that the composition of music is, in fact, relevant to the thoughts I consider important at any given time. Finally, I asked myself: What if it were true that « composition » simply is the generator of relevance, and that a composer, no matter of or in what, is a person who desires that whatever he creates be relevant to whatever he considers important? If this were true (and I stipulate it is), then I could go on and state: The thoughts I consider important, and the medium in which I try to create what otherwise might never happen, are related through my desire for relevance; thus they become representatives of two systems which ought to show a high degree of mutual analogy, once a structure composed by me is applied to both. Wherever such an attempt is successful one can consider the process as a model of some effective method for reaching a desired state; this, then, allows for a new look at what may now appear to be — besides and beyond being desired — also desirable.

The definition of a problem and the action taken to solve it largely depend on the view which the individuals or groups that discovered the problem have of the system to which it refers. A problem may thus find itself defined as a badly interpreted output, or as a faulty output of a faulty output device, or as a faulty output due to a malfunction in an otherwise faultless system, or as a correct but undesired output from a faultless and thus undesirable system. All definitions but the last suggest corrective action; only the last definition suggests change, and so presents an unsolvable problem to anyone opposed to change.

To the composer, however, a suggestion of change is a signal sent out by the system, signifying a deficiency of input and the urgent request for the creation of what otherwise may never happen, be it even a new and different

system. The composer's basic attitude is system-conscious and is nourished by observations which reassure him repeatedly that « it » will always look only the way « he » looks at it and so may look different if he looks at it differently.

Discerning between « composition of art » and the far broader concept of an « art of composition » I contend that the latter need reach a higher level if the former is to be an input for, not only an output of, society. I suspect that an intuitive awareness of the recent meagerness of input has led, almost justifiably, to the contemptuous sneer at the word « culture » prevalent in many circles, intellectual and otherwise. Many words, including this one : « culture » could be rehabilitated if they were to refer to the dynamics of input rather than to the kinetic triumphs of output. Not that there is a lack of continuously offered input. But the words that indeed refer to it also reject it. The message announcing an offered input is called a threatening disaster, disorder, anarchism, and the like ; yes, this society's language is in such a panic that it frequently, in its confusion, calls a threatening disaster that which actually was nothing but a message of its own accomplished output. Such an obvious disorder in so highly a respected system as our language is a challenge to all those composers not exclusively interested in their music. It is a challenge to the art of composition in general ; and the composer — oscillating between music, languages, linguistics, analogies, systems, structures, logics, logistics, some mathematics, and an enormous repertory of words burdened with apparently indelible and frequently quite obsolete meanings — calls it all « just so much language » and begins to search for some way in which he might construct languages that do not yet support any power but their own.

In the meantime I shall use the term « language » for denoting structured systems which are made by man, which man thus can change or replace, and which, as a significant property, possess the capacity for involvement in the storage and transmission of intended messages or unintended messages or both: Technologists in all the branches of science and engineering, and composers in all the arts, both continuously design, construct, create and change languages of all kinds, in order to store and transmit the thoughts or images they had in mind. Little of this is heard in an environment where power can be seized, and more power gained, by redesigning, reconstructing, and recreating thoughts and images that comfortably fit the language everybody knows and speaks already ; where trust and confidence can be earned by proving these thoughts and images to have existed for generations as popular grammatical fictions in a language common to us all. No wonder then if within such boundaries everybody thinks he knows what everybody is talking about and words are said to mean simply what people take them to mean.

But wherever it is true that, as the saying goes, words mean what people take them to mean, these words cannot escape the meaning given to them by people. Where there is no escape, there are no alternatives, there is no freedom ; and any meaning that argues with word which never escaped it just tells the



story of its life. Every thought, idea, or concept, as it emerges for the first time in a given society, needs words so that it be expressed, be presented, be heard, understood and finally communicated. In search of such language one has to either create new words, or add and attach new meanings to old words. If a word, in the course of time and usage, has accumulated many kinds, shades, nuances of meaning, then we have to consider the context in which the word appears in order to know which particular meaning it is to carry. From this it follows that a new meaning of a word may be suspected, or assumed, if the context is such that none of the conventional meanings would fit. It is easier to coin and integrate into language a new word, a new sound, a new visual unit, than to make an old one mean something new. This is because the newly coined word announces its newness in every context. Its function is unambiguous and thus not context-bound. A new meaning, on the other hand, cannot be announced by an old word alone but only by a context to which the old word is a newcomer, in which it had never functioned before. The older a word is, the more meanings it has accumulated; the more ambiguous it becomes, the more context-bound it is. Whereas a new word adds to the language by enlarging the vocabulary, a new meaning adds to the language by increasing the significance of context.

All this I contend to be analogously the case in all systems in which the elements enter into temporarily significant coalitions, and where some communicable meaning becomes associated with either their moments of appearing or with the particular structure causing their appearance. Words in language, gestures of sound in music, definitions of visual units and colours in painting are just a few of the many terms denoting such coalitions.

On the one hand, I concede that in order to relate or permutate established thoughts and ideas it may be sufficient to know what the listener takes words to mean, and to form one's language accordingly. The success of this language is then measured by the degree of comprehensibility. The problem of the speaker here is a problem *in* communication. His aim consists in having a new constellation of old thoughts understood by the currently valid rules and usages. For the presentation of new thoughts, on the other hand, the speaker should be requested to *make* his words mean what they heretofore had not meant, thus adding to the available repertory of a word's meanings that new meaning which is necessary for the presentation of the new thought. The success of this language can only be measured by the degree to which it questions the sufficiency of meanings already associated with words, and by the quality of the thoughts that so become audible for the first time; at which time there is, obviously, never enough of the kind of evidence available that would allow for completely correct evaluations.

As this is the point where the arts, including music, come in, let me formulate a useful term. Where a new thought is presented, the speaker's problem is not any longer only a problem *in* communication, but one *of*

communication. My useful term is introduced thus : A speaker with a new thought has to solve a problem of *anticommunication*. The syllables « anti » are used here as in antipodes, antiphony, antithesis ; not meaning « hostile » or « against » but rather « juxtaposed » or « from the other side ». Anticommunication faces communication somewhat as an offspring faces the progenitor. And just as the offspring eventually will in his turn become a progenitor so will anticommunication, in time, become communication. This knowledge ought to make it possible for a community of people to have a good time with either. Indeed it should be noted that the good time lasts longer with anticommunication which leaves a lot open for the next occasion than with communication which puts everything neatly away on the spot. Anticommunication is an attempt at saying something, not a refusal to say it. Communication is achievable by *learning from* language how to say something. Anticommunication is an attempt at respectfully *teaching* language to say it. It is not to be confused with either non-communication, where no communication is intended, or with lack of communication, where a message is ignored, has gone astray or simply is not understood. Anticommunication is most easily observed, and then often can have an almost entertaining quality, if well-known fragments of a linguistic system are composed into a contextual environment, in which they try but fail to mean what they always have meant and, instead, begin showing traces of integration into another linguistic system, in which who knows, they might one day mean what they never meant before, and be communicative again.

However, when something new is conceived, introduced, and noticed, then there appears a temporary gap, an interregnum which will disappear only when that « something new » begins to be accepted, understood, and used : when it begins to grow old. This time of transition is a time in which messages are sent that no one receives and in which messages are received that no one sent. This is the time in which a language gained is a language lost. By most people this time is experienced only occasionally, in passing, in some concert, some exhibition, some reading, and then usually not too happily ; for it gives them a hard time or no time or too much time, but no answer to their question « What does it all mean ? »

It is this time, however, that is the almost continuous time present for those poets, painters, and composers who move with it, who always think of themselves as living and working just in that mute and dumb moment where the language they gained got lost, where it won't do and say what they would have it do and say. It is therefore a sign of understanding and perceptivity if one expects their productions, their works and words to escape the prevalent level of communicativity, under the condition that all of their activities and objects be at least propositions and at best provisions for the next, now the future, level of communicativity. Creative Art resides in poetry, music, dance, painting, architecture, theatre, film, television, writing, and even in



« happenings » only if each of these sub-disciplines functions by anticom-  
munication, which is my term for potential and virtual expression in a field devoid  
of communicative guarantee. One ought to expect, yes, as an ambitious  
audience, even demand that this field be cultivated at a time later than the last  
harvest and earlier than the next.

But what if it is not only the much maligned audience, the people who  
come to listen and to see who have the wrong expectations ? What if it is  
society itself, and therewith also the performers, the dancers, the actors, the  
musicians, who do not know that their profession consists in handling  
competently the temporary incompetence of their language ? What if it is a  
property of all our social systems not to have matured enough in order to  
liberate and promote language from its fictitious status of a slave who will do  
the best he can, to the status-independent existence of a student and scholar,  
who will try to do better than the best he or anyone can ?

### III

I challenge technology to escalate its push towards a socially beneficial  
technological era for mankind by designing and constructing for all of us the  
compound facility wherein and wherewith many people can be induced to  
come and enjoy the effort of learning how to compare and measure their  
languages against and with their imagination and their desires. I am speaking  
of an artificial system which should function as an accepted member of society  
and be respected and used equally by the few and by the many, as long as this  
differentiation will have any validity left.

I imagine a building in which the arts are met by technology and the  
sciences on their common ground. They all investigate, stipulate, create and  
exploit systems. They all are faced with the puzzles and the functions of  
structure. And their aims and results complement one another because of their  
difference. While the sciences observe or stipulate systems which are *to be*  
*analogous* to an existent truth or reality, and while technology stipulates and  
creates systems that are *to function* in an existent truth or reality, the arts  
stipulate and create systems which are analogous to an existence *desired to*  
*become* true or real.

All three must be represented with all their branches and departments in  
the team that has to invent, to stipulate, to study, to discuss, and eventually  
to decide on the interior and exterior requirements that such an artificial  
system must be able to fulfil. Let me mention just one area of research that  
might demand no less than such a team's collective efforts before it will even  
begin to reveal its dimensions and secrets.

What if it were true that, as the saying goes in many quarters, man's mind  
is limited by nature to the potentials we already know, and that we may thus

not expect it to ever possess the properties necessary for the creation of what we call an ideal society ? If this were true we would need artificial systems that possess those properties to guide us. And if it were true that, as the saying goes in other quarters, man's mind has shown here and there the potential for change and development but that precisely the rarity of such an event generates hostility against it in the many who did not participate in it, then we would need artificial systems that remove the property of rarity by demonstrating the participation of all. No matter on which assumed truth it is based or to which conjectural reality it may be meant to correspond : any such artificial system should possess properties that man either cannot have, or does not yet have, but that he needs and thus should be able to imagine or be taught to imagine.

It is quite obvious : any such artificial system will contain a computer installation. But what kind of an installation ? Nobody knows yet because it should not be developed before the software, the programmes, that define the structure of the system have been written. And these programmes should be written, and the assembler code should be constructed, only after a decision has been reached as to what the whole system is supposed to do for the user. The user, however, is not to be seen as a paying consumer, whose demands have to be educated until they fit the available offers. The word « user » refers instead to a member of one subset of the set of all possible kinds of input. The first task then is to define this subset until it contains every possible kind of user. Every user is an element of at least two social systems : the social system he sees and at least one social system that sees him. The artificial system must be able to insist on getting just so much input from the user as it needs for identifying the social systems in which the user's existence is definable. The response of the artificial system could then adopt the property of an input to any one or all of the systems defining the user's existence. The complete set of all possible kinds of input would thus contain all users and all responses by the artificial system. If we roughly define « input » as something that induces and initiates such changes of state in a system as would not occur, without this input, at the moment or possibly ever, then we may expect that the artificial system thus would be capable of supporting what I called « corrective action » as well as what is called « creative acts ».

What is asked for is a heterogeneous assembly of input oriented minds that would define an intelligent society, redefine the user, and develop an artificial system that by its response capability would show the user his rôle in an intelligent society so that he may become induced to also want it in reality.

Inevitably such a project progresses in stages of partial fulfilment of set goals. At every significant stage, however, the results reached should be incorporated into a systems programme which is to be submitted to and analyzed by technologists. They, in response to this input, would proceed and invent and construct the apparatus, the hardware, the computer, the input-output interface which best can represent, simulate, execute, display the



functions of an artificial system that possesses properties which man either cannot have or does not have yet. Clearly this installation will also be used to reach the next stage of significance, and will, if intelligently conceived, eventually only have to be modified and improved. Should there ever come the day, and an invention or discovery be made, that would render obsolete this whole machinery, possibly even the whole project, it will be either a no-man's day or a day for world-wide celebration.

Work on the project has to begin simultaneously in as many places as possible all over the world. Every school, every university or equivalent institution could assign to a selected but preferably heterogeneous group of its members the task of starting research towards a definition of the potential user in the immediate environment up to and including the areas overlapping with those defined by neighbouring groups.

The building I imagine should be planned and constructed at each place, combining special features reflecting local preferences with those more general features that would make it a compatible member of a world-wide network of equivalent institutions. Everywhere it should grow as the results of such research accumulate everywhere.

The composer in the technological era is a professional member of such projects. His profession is the art of composition and his work establishes and demonstrates connexions of various kinds between various elements, stipulated and desired connexions that cannot occur in the eternal feedback loop of empirically functioning thinking processes.

Technology in the technological era sees the composer's work as an input of a particular nature, as an analogy to a desired reality which may have to be implemented and to be observed in functional action before anyone can possibly judge whether such a reality is — besides and beyond being desired — also desirable.

To the question whether a statement is true there be added the question : what if it were true ?

To the question whether a composition is music there be added the question : what if this were music ?

So that language may not become a fossilized fetish, let it be praised for the thoughts it expresses, but ruthlessly criticized for the ideas it fails to articulate. Language is not the standard against which thinking is to be measured ; on the contrary : language is to be measured by a standard it barely reaches, if ever, namely the imagery of human doubt and human desire.

To measure language, with imagery as a standard, is the function of art in society. The arts are a measuring meta-language about the language that is found wanting. If the imagery succeeds in containing, anticommutatively, for later, the simulation, the structural analogy to that which was found wanting, then, who knows, it may tell us or someone some day with breathtaking

eloquence and in then simple terms what we, today, almost speechlessly have wanted so much.

Our present era meanwhile dictates in ever more venomous terms that we must turn to artificial systems if we wish to conduct intelligent research and intelligent experiments without causing bloodshed, corruption, and misery.

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