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The Musical Background of Computer Music

Behind all artistic creativity which may rightly bear that name, the common problems of life constantly reappear. The source of art is life.

But the artist needs some sort of material with which to give artistic form to the particular life-problem in which he is interested, regardless of whether these problems exist for him as an expressed thought, an experience or a feeling. In music, that material is composed of a stock of tonal elements such as pitches, intervals, timbres and envelopes, a set of rules governing the technique of composing, which is applied to building up structures from the elements of the stock of tones; and finally, an instrumentarium for the production and

distribution of sound. The three parts of this material—the stock of tones, the rules of composition and the distribution apparatus—are mutually dependant upon one another. No major change can be undertaken in any one of the parts, unless a correspondingly large alteration is made in the others. The reason for this has already been expressed in my previous statement—namely, that the artist's intention is to communicate something of his life-experience or life-problem, and in order to do this, he makes use of a material, which thereby becomes united with that which he wishes to express. The idea is given its own means of expression. The means of expression expresses the idea, nor can it by any single

individual be given any other significance than that which a whole generation of composers has intended it to have. The classical technique of composition expresses classical ideas and is going to do so, even if a present-day composer should employ it and give it his own personal meaning — with or without directions for use.

Let us for a moment see what happens if we make changes in one of the three parts of the material without changing the other two. We can first retain the classical technique of composition and the concert hall, but change the sound material from the classical symphony orchestra to electronic sound material. It would doubtless be amusing to listen to Beethoven's *Eroica* interpreted by a thousand tone-generators conducted by a famous IBM machine—and that, in a gala-attired concert hall, with the concert manager courteously attending to a royal personage. Oh well I pass the idea further, to some patron of instrumental theatre.

But if we now keep both the classical technique of composing and the symphony orchestra, but do away with the concert hall, we are on more familiar ground. An experiment was recently made by Stockholm's Philharmonic Orchestra, which moved itself from the concert hall podium, outside to the concert hall steps, facing The Haymarket—and played for a most astonished gathering of people, who had actually come there to buy potatoes. The resonance must have been rather poor out-of-doors, and very likely one could observe that the musicians' concentration was disturbed by their overcoats and by their anxious glances at the heavy rain clouds. Had it begun to rain, the end of the story would have been quite dramatic—either ruined instruments but heroic musicians, or else an ignominious finish to the outing.

Another example. The symphony orchestra and the concert hall are maintained, while the composing technique is altered. This is the reverse of the example in which the tone-generators performed Beethoven. This time, electronic music is produced with the help of the symphony orchestra. The musicians have become tone-generators, to which they obviously raise objections, refusing to perform and thereby give publicity to that constellation of the parts of the material. Nevertheless, the use of musicians as tone-generators can, in certain cases, be both motivated and defended in a sensible way. Namely, with the explanations that this is the only way in which that type of structuring can be sonorously realized, as long as we do not have access to sufficiently advanced studios for the synthesizing of such complicated sounds.

We notice now that my examples begin, more and more, to resemble a situation which we recognize—like, for instance the variation in which the symphony orchestra and the concert hall are retained, while the distribution link has been replaced by microphones, wireless transmitters and loudspeakers. This constellation is easier to accept than those previously described, but at the same time, it is much more dramatic in its effects, as is disclosed by a closer examination. The electro-acoustic chain of reproduction—reduced, in this

case, to the loudspeaker—is one of the media of the new technology—a mass medium whose utilization in the community incurs a growing responsibility as its effectivity increases.

The problems involved in using these new media may be briefly described as follows. Either these new media can be utilized to effectuate the distribution of the already established views of life, constructed for the society which existed before the mass media assumed its present influential position, or else they can be employed to spread the concepts which the new media have had a part in creating. As a result of the new technology, this question has become fundamental. It is of decisive importance to the maintenance of a balance between man's external conditions, exemplified by the products of the new technology, and man's image of the world—our conception of reality. A use of the new media's effectivity and capacity, for the spreading of an antiquated conception of reality, can only increase the disparity between our external conditions and our image of these conditions, with perhaps a catastrophe for mankind as consequence. The artist readily describes himself as a seeker after truth. In fact he quite often is, and as such, he must take a standpoint on the principle of how mass media ought to be employed. The justification which is pleaded for the present state of things, namely that a concept of reality based upon 18th and 19th century societies, has in itself, so much value for our time, that there is motivation for the spreading of such a conception, must be weighed against the antiquated components which that way of thinking also supports, its preservative effects and the time which we can reckon on having at our disposal for changing our obviously anachronistic conception of reality, before it is too late. Music is no exception in this question. Either it is to be a bearer of life-experience, life-problems, *weltanschauung*—and as such, must assume the responsibility which that involves, or else it has **nothing** to do with this, is thereby reduced to an object for the legitimization of a flight from reality, and as a consequence, is not worthy of public support.

For music, the nineteenth century was an era of expansion. The techniques of composition were refined, the symphony orchestra made more effective, the concert halls improved, public support became broadened, amateur musicianship flowered. The 20th century has, up to now, signified quite the opposite. First, the technique of composition was destroyed. After that, the classical orchestra was demolished, and during the last decade, the distribution-apparatus has been attacked. This preoccupation with the disintegration of established systems and organizations is, of course, a parallel to the equally drastic changes which are occurring in other sectors of society, such as science and technology, and within the social organization. This destruction is both understandable and necessary in the sense that the old must make way for the new and consequently, must be dissolved before its disappearance. But since some years back, we in the musical world, can claim that a new phase has begun in 20th century music, a phase in which we have exchanged the symphony orchestra for a new

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sound material—electronics, exchanged the concert hall for the loudspeaker, and exchanged both the tonal composition technique and the atonal—even cleaning out such test-kites as serial technique—for a search after a technique of composition, adequate to the two other components of the material. But note well, the composition technique which we are searching for, is so disengaged from the former, that we don't even need to polemicize against it. It is against this sketchy background that we—in my opinion—may regard the artistic aspect of computer music.

Let us linger a little while longer with the development of compositional technique during the past twenty years. Following Schoenberg's and Webern's dissolution of the technique of tonal composition and the classical symphony orchestra, there was a movement, around 1950, on the one hand, for a continued breaking up of metrical rhythm and of the symmetrically constructed musical form, but in fact, these efforts were even a groping for a new technique of composition which eventually became known as the serial technique. What was most important in this serial technique, was that it sought to gain expressive power without—as was the case with the atonal technique—so to say, sponging on tonality. This was a seedling for the music of our time.

In its more ambitious form—as when it claimed to be the successor to tonal technique—serial technique was a failure, because it presupposed a correspondance between physical systems and psychological systems which didn't exist. In its less ambitious form, wherein serial quantification takes its point of departure directly from these psychological systems, that is to say, our experience, serial technique becomes hardly more than a system of classification of the available pitches, intervals, envelopes and timbres.

Between 1950 and 1955, the new music was in part based upon the consistent application of serial music, which resulted in clumsy, earnest compositions (which mostly told of a pioneering spirit) and partly, serial compositions in which the composer tried to tamper with the technique, so that he could borrow expressions from atonal music, which most often resulted in banality. Among other participants in a sudden reversal was Bo Nilsson, whose "Frequenzen" fell upon the Darmstadt circle like a welcome bomb. I well remember the high spirits which broke loose after the performance, and also my own reflections over what it was which had released them. Bo Nilsson's work was neither clumsy, earnest nor fanatical, but, on the contrary, elegant—and even more important, it was not banal. But, for the absence of banality, he had paid a price, which that time, was accepted with pleasure, but which eventually was to lead to a new crisis—the price, namely, of avoiding any expression whatsoever. Of course, the music had an expression, but there was no *weltanschauung*, no life-experience behind that expression. It was, instead, a reaction against serial music—hence, a technology. A medium is, of course, an expedient for reaching a goal. Technology is a medium, and when technology, or a reaction against technology, is responsible for the

expression (consequently, the objective) of a composition, then one has become bogged down in formalism. The new music, which proceeded from success to success in the concert halls, during the last half of the 50's and up until our own days—the music which created the spurious problem which is called the problem of notation. The music which hid and hiding itself behind titles borrowed from the names of bombed cities, masses and opera parodies—is in reality a formalistic music, and as such, joins itself to that fairly widespread tradition in our musical history, which amounts to a combination of skillful craftsmanship and inferior artistry.

It was not in order to belittle Bo Nilsson, that I brought up his name in this context. His artistic path rapidly revealed itself to be quite another than that of the neo-formalists. Namely, an effort towards the continuation of the traditional artistic means of expression within that special variant, which is known in Sweden as "40's-isms" and which can reckon Blomdahl's setting of Lindegren's "the man with no way", among its musical works.

Bo Nilsson's connection to what was first and foremost a literary movement, was, as we know, the poet Gösta Oswald. Bo Nilsson found himself at an impasse. The discrepancy between his artistic message and our outer reality became a burden too heavy to bear. Even the neoformalistic way is a blind alley, fated as it is to constantly sponge on the work of others. But what, then, is to be found between these two?

In between is to be found John Cage, for example, who for many years has been working to demolish our respectful attitude towards the concert hall and towards works of Art—with a capital A. In between is to be found, moreover, Pierre Schaeffer and his work-group, who laid the foundation for so-called *Musique Concrète*, and who now, lately, is emerging as an important musical theoretician with his work on the musical object. This work has an obvious importance for the development of computer music, an importance, however, which does not yet have its contours. In between is to be found *Elektronische Musik* which, in the beginning, was a sort of atomised instrumental music, since it, in regard to both means and end, attached itself to instrumental music (though with the instrumental tone split up into sinus tones) but which evolved its own goals and its own technology. In between is also to be found Iannis Xenakis, who stands out as the grand old man of computer music.

About the musical situation today, I believe I can say, in summing up, that in the first place, the remnants of the tonal tradition as it appears to the composer, is without interest (nor have I touched upon that course in this lecture). In the second, that the serious efforts to renew that tradition within the orchestra and the concert hall, exemplified by Bo Nilsson's work, have faded out. Thirdly, that the music which is now widespread in the orchestras and the concert halls, exemplified by the work of Penderecki and Ligeti, is formalistic music, tightly bound to that which it outwardly denies—the traditional orchestra, the concert hall, the traditional theory of instruments and the traditional musical life in its entirety. Fourthly, that the music which polemicized against respect

for the concert hall and respect for the work of Art, exemplified by the work of John Cage, has done such an effective job, that we, at least in Sweden, can consider that this direction has done away with itself.

A good score. Fifthly, that electronic music, in the development of its composition technique and apparatus technique, has reached a point at which the use of the computer as an aid to the composer and the technician, is an unavoidable necessity, if stagnation is not to set in. Sixthly, that hidden in the work of Pierre Schaeffer, are possibilities for the future which, however, are difficult to survey today, and seventhly, that Iannis Xenakis has entrusted us with the administration of a tiny heritage of computer-music. And with that remark, I consider myself to have covered the situation and can therefore take the first step towards a closer description of it.

Around fifteen years ago, Xenakis began to lay out a route, the first stage of which involved an endeavor to rid himself of an aesthetic confinement to the concepts of mechanics—to levers and wheels, centimeters and kilos; and whose second stage is the building up of aesthetics which, at least, are not in opposition to the electronically dominated outer reality which we are confronted by today.

Xenakis' work resulted in the first composition of the "sound-cloud" type—more precisely to be regarded as a musical description of the changes in cloud formations, or the path of gas molecules, or similar images. This structure was almost entirely free from the accelerations, climaxes and terminals which are so characteristic of the aesthetics which take the mechanistic concept as prototype. In order to realize that structure composition-technically, Xenakis divided the orchestra into as many independent parts as there were musicians. In other words, he even broke up the technical construction of the orchestral instrumentation—with its divisions into winds and strings—and its sub-divisions, such as first and second violins etc. It is this grasp of composition technique which the neo-formalists took over and which gave the necessary extra touch of novelty to their work. But it is to be noted, that for Xenakis, this discovery in composition technique was not a goal, but rather an expedient which he had to avail himself of in order to realize a non-mechanistically bound composition.

The individual tones in a "sound-cloud structure" of Xenakis seem—to the listener—to appear quite by chance. It helps him very little to know that each tone, seen composition-technically, is determined by mathematical descriptions of various processes which take place in nature. But just as the means of expression of traditional music—such as synthesis, variations and contrasts—presuppose that the differences in the elements which shall be embodied in that synthesis, or be varied, or create contrast, are solidly experienced; just as each such element lends its individuality through tonal analogies, to the laws of mechanics (from whence we derive the pattern with which we experience musical balance), in the same way, it even ought to be possible to create sonorous analogies both to thermo-dynamics or the laws of plasma physics and to the procedures

for creating new elements, for which there are mathematical descriptions of the type which is characteristic of the points of departure in Xenakis' composition technique.

But that seems to be difficult. From the point of view of composition technique, one can certainly say that Xenakis has succeeded, but it seems as though when we depart from the traditional mechanical analogies, our ear refuses to follow along.

I believe, however, that this is caused only by obstacles on the—in the broadest sense—instrument-technical level. The symphony orchestra and the concert hall are both constructions which aim at gathering together the sound mass and emphasizing thereby the solid quality of the unique in the compositions and their elements. The sonic concentration prevents traditional orchestral music from acquiring an undesired spatial quality which—were it realized—would only serve to destroy our experience of musical continuity. We call the traditional theatre a peep-show theatre—the traditional concert hall is to just as great an extent an eavesdropping hall. As such, it watches over the mechanistically tinged aesthetics and undoes all efforts towards the creating of electronically tinged aesthetics—which cannot under any conditions dispense with exploitation of the spatial dimension.

An example from the sphere of visual perception may shed further light on the situation. It has been demonstrated that a structure which when reproduced in a two-dimensional photograph, appeared to be put together quite by chance, had quite other and, for us, meaningful structures, when it was reproduced in a three-dimensional photo.

This has awakened my curiosity to know to what degree the same would apply to sound structures, if one, on the one hand, should reproduce these in the traditional, non-spatial manner and, on the other, exploited the spatial dimension. As far as I know, nobody has yet made such experiments, and they are also, in practice, impossible to do, without access to a computer with a four-track analogical output or an electronic music studio of the type which we are soon going to have in Stockholm. A technically perfect exploitation of the spatial dimension may be what is needed to give Xenakis' ideas the desired success.

Whereas Xenakis has placed the chief stress in his compositions upon structure, Pierre Schaeffer has to a greater degree taken sound as the basis for his work. This does not mean that Schaeffer finds sound more interesting to work with than structure, but rather that the study of sound is an essential preparatory study. I should think that Schaeffer is looking forward to the day when the composers in his research center will be able to make the jump from creating sound to creating structure, in a way which is acceptable to him. Unacceptable to him, is to ignore the gulf between the creation of sound and the creation of structure. This would be just as much of a blunder as to invest the new sounds with the structures of instrumental music. In his book on the musical object, Schaeffer places before us a phenomenally conceived system for the description of sounds. With the help of this system, we

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can talk about and systematize sounds. We can classify sounds, choose among the classes, modulate the nuances within the classes, create unexpected and promising combinations of sounds through teaching ourselves to listen to them in a new way. Schaeffer has created a new "theory of harmony"—or theory of hearing—which I, personally, believe is going to form the basis for research in musical composition, from now on and as far into the future as it is meaningful to try to imagine.

But just as in the case of Xenakis, even Schaeffer's research suffers from the fact that he does not have access to first class technical apparatus. His researches in sound are based upon analysis, not synthesizing. He has therefore been restricted to the sound world which is accessible to the microphone and to electronic adaptations of the primary material. This material has suffered a certain obliquity since, for this reason, so much of it has been the result of mechanical sound production—strings, surfaces, miscellaneous musical instruments, machine sounds, voices, etc. The electronically generated sounds have had to yield to Schaeffer's rigid evaluation of their artistic suitability and richness. But there are gaps in his descriptions of the sounds which indicate that there are groups of sounds which are not represented in his material. It is here that the deficiency in the apparatus becomes apparent.

These missing sounds—which should be competing with the instrumental ones in the question of artistic suitability—are electronic, but are not reproducible in conventional electronic music studios. I shall explain why. Electronic music—such as it was developed in Cologne and other similar studios—took its point of departure from instrumental music and the technique of instrumental composition. The destruction of tonal music was to be carried out to the bitter end—out to the 'lonely' sinus tone—and from there, the new music was to be built up. That construction job was unsuccessful in its first phase, because the working method which was chosen, made no distinction between the physically conceived composition technique and the sonorous result, which was judged on quite another basis. In this case, electronic music chose the easier path. It let itself, namely, be carried away by the possibilities of the apparatus, instead of critically examining whether or not these possibilities corresponded, or the desired effect. The result was a crisis in electronic music, which the public experienced as the absence of serious compositions and which from the studio's point of view, was experienced as a cheapening of the instrument itself—the electronic studio.

There are plenty of composers today, who want to have a new arranging apparatus—a new gadget—so that they can be first with a new sound. It doesn't matter whether or not this sound has originated in their own musical fantasy. The electronic sound material is becoming a gimmick. The creation of sound is becoming a result of how the apparatus functions and not of how we want it to sound. The work of composing is becoming an uncomfortable parody on the one-dimensional society—to use Marcuse's terms.

The first treachery against the possibilities of electronic music must have occurred during the last few years of the 1950's, in the splice between the moments when the first post-war generation 'established' itself, and the following generation overtook the continued development. The responsibility for that too early 'establishment' must fall upon the musical bureaucracy, which about that time discovered the artistic possibilities of electronic music and its—for that reason—potential political power.

During the period which followed, in my opinion, one lost musical control over the apparatus which was built.

These were either built so that one could play upon them like on a piano, which gave them some purpose, or they were built like small music machines, which produced tone sequences, even if the composers didn't know what was going to happen when they turned the buttons. With such an apparatus, we cannot carry out research in composition. Searching for new sounds becomes, once more, the story of the needle in the haystack.

The one who led electronic music out of that crisis, were without doubt, Schaeffer and his group, as they had employed the interval of waiting, in research which led to the system for describing sounds. With the help of the computer, we are suddenly faced with the possibility of being technically able to realize complicated electronic sounds—complicated in the Schaefferian sense, rich in nuances and sonorous dimensions. The technical solution—at least, such as I imagine it to be—is to first set up an analysis/synthesis circuit, so that with the help of the computer, we can analyse a given sound and on the basis of the result of the analysis, synthesize that sound again via a synthesizer. If the result of the synthesizing is in agreement with the sound which we took as starting point, then we have succeeded in the first stage. The second stage is to, on the basis of the Schaefferian system of description, create a computer program with the help of which we can produce many-dimensional sound scales. These sound scales, we can synthesize, and thereby listen our way further, to the sounds we seek.

Schaeffer has characterised the building of this technically complicated sound synthesizing set-up as an instrument which establishes a synthesis between *Musique Concrète* and *Elektronische Musik*. These many-dimensional scales not only make it possible to search for the electronic musical sounds which are 'missing', but on the whole, to synthesize all types of sound and—what is the core and meaning of this whole complicated operation—keep count of (and thereby have command over and access to) these sounds. The microphone is eliminated, as are the wires of the traditional electronic studio—buttons and technical paraphernalia, which incessantly frustrate the musical fantasy.

Behind all this, is a very complicated and expensive electronic music studio which eventually is going to be able to tell us whether we, this time, have succeeded in wresting from the apparatus, its command over us, so that we once more can let our fantasy direct our creating.

Translation: Roberta Settels