

Wayfaring Sounds

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Wayfaring Sounds is the title of a composition for electronically produced sounds, and the heading of a collection of answers and comments to questions that most frequently arise in discussions about “electronic music”.

The record offers a brief introduction into the world of electronic sounds as well as the compositions *Wayfaring Sounds* and *Anepigraphé*.

The supplementary text consists of various sections, in which I try to state my point of view on some of the questions that are brought up, time and again, by visitors that come to the studio or concerts and lectures.

Music lovers, technicians, and students of all faculties asked the most and the most interesting questions. In this way I have been able to deal with the subject more broadly than would have been possible if I had confined myself to professional circles.

It has become obvious that behind the simple question, “How does one produce electronic sounds?” usually lies hidden the more important question, as to whether and how music can be created with electronic sounds. It is mainly this problem that I deal with here, and therefore I have called what I wrote: “reflections more or less pertaining to the theme”.

The theme of all work in a studio for electronic music is music.

1. All music, the creation of which has been determined by mainly musical thoughts and ideas, and in which the audible content in its entirety then represents these musical thoughts and ideas, is called serious music. The word “serious” here implies a seriousness towards music and music making rather than toward the possible mood content of the finished work. Therefore it is serious music which appears gay in Mozart’s *Figaro*, solemn in Bach’s passions, buoyant in Verdi’s *Falstaff*, and deeply fervent in Wagner’s *Tristan*.

On first hearing, all serious music presents itself to the contemporary listener as invented sound, only later as a sounding invention, that is, when one begins to listen to this invented sound in such a way that the memory of long since silenced associations does not intervene any more.

“Invented sound” is a term which definitely belongs to the world of musical thoughts, even though its materialization is a technical problem. The properties and limits of the human voice and of musical instruments are of a technical kind. Musical thought alone has converted them into musical means. If musical thought starts to direct its attention to the acoustical possibilities offered by electro-technical devices, it may be assumed with certainty that here too the result will be, in growing proportions, serious music. This should make apparent that the term “electronic music” proves rather misleading.

One often overestimates the quality of a word, its precision and its adequacy, until one notices that not only the word is wrong, but also the way in which it is used. For instance, the term “electronic music”—as if music could be “electronic”. As if, in contrast, music could be “mechanical” or “chemical”, or quite generally expressed, “natural”. Music has to be made. By people. With the help of implements which possess, among numerous other attributes, also those with which one can produce sounds. Especially such sound-producing attributes as can be controlled and administered to a high degree by those who perform and construct the music. Production of sound alone is not yet music. Only the control, the administration, and the organization of produced sound can eventually become music.

The fact that anyone wishing to produce sounds with the help of vocal cords, air columns, strings, and skins, will have to obey the natural laws of mechanics, should not lead to the conclusion that Beethoven’s Ninth Symphony is “mechanical music”. It is just as misleading to connect the adjective “electronic” to the word “music”, when it is only the production of sounds by electric processes that need obey the natural laws of electronics. Up to now, we have never heard of any music “composed” by electronic devices or according to electronic laws. The act of composing is now, as it always has been, an outcome of human initiative and responsibility, which obeys a natural law of creative spirit.

Regardless of whether music is electronically or mechanically produced, in both cases it is equally and mainly important to accurately perceive the sounds and silences that take place. Only in this way is it possible to grasp the constructive musical idea that needed the organization and properties of the sounds and sound groups in order to become the completed composition.

The difference between the sounds to be expected from an orchestra and those to come from a tape full of electronically produced frequencies is very big indeed. The reason for this difference is easy to see. The orchestrating composer finds in his instruments established sound colors which allow for a very rich, but still limited, variety of mixtures. The composer in the electronic studio does not have such limits. He himself mixes every color, every smallest nuance. Therefore, he can create new sounds. Or as the ethical law for creative artists has it: If he can, then he must create new sounds, in order to justify the

application of new devices in his work. If there were an ethical law for the inquisitive (that is, the good) listener, it also would demand just that from the composer.

2. When you hear a noise from the neighbor's apartment, you do not have to go and see whether it was a tray of china clattering to the floor, or the neighbor's son trying out some new tricks on his collection of percussion instruments. You know without looking. This ability to infer what is happening from what you hear is of utmost importance. Especially as a means of warning, a protection against all kinds of danger. Anybody who confuses the screeching of brakes with the squeaking of a door and who cannot perceive the difference between accidental and intentional noise, between disturbance and music, obviously will cut a strange figure in the street as well as in the concert hall. Most people however are quite able to hear and deduce intelligently. To disclaim this ability, all of the sudden, when presented with unusual sounds in a musical composition, is the complacent attitude assumed by coquettish persons to cover up their hostility toward anything new. You will know such people when you hear them speak. You won't have to look.

3. Art can at best contend with opposition, but under no circumstances with opponents. The personality of a consumer that interminably keeps him, the determined one, from consuming, in no way makes him a personality. Whereas he thinks apologetically but proudly of the personality he has, the artists nod aggressively, thinking of that which he is.

4. When a tray is dropped or a car screeches to a halt, in a large gathering of talking people, or when chairs and tables are being pushed about—in all these cases the noise produced is merely an accompanying factor to an occurrence, and not its purpose. Whereas, when a musical instrument is being played, the audible sensation is the purpose, and the actions of the player are the accompanying occurrences.

Music is intended, when that which is heard means to give evidence of something audible, and not of something visible. Music is not only intended, but achieved, when that which is heard succeeds in giving evidence of something audible, possessing the character of an event. Whether or not the result is good music, is not the matter to be discussed in this context.

5. Throughout the population, in all social circles, people, when speaking of electronic music, use phrases like the following completely unabashedly: "Electronic music is made of electrons. Electrons split atoms and a split atom is in some way part of the atom bomb, and one doesn't fool with such things. Above all, it shows complete lack of taste and tact, to want to make music with weapons of death".¹

Or: "These electronic composers don't really make music at all, they just measure, calculate, and construct. They don't have musical, but merely mathematical, ideas. Infested by this technical and materialistic age, they are trying to degrade and despiritualize music. With robots and electronic brains, they want to substitute the creative act."

Let me try to clarify, stating the following facts: Electrons can produce no music to date, not even one single tone. The electrons are the carriers of electric tension and must be passed on through tape recorders, loudspeakers, and the like, in order to become audible. The air in the flute and the organic or mineral materials in a violin string are carriers of mechanical tensions; these tensions need holes and tubes or sounding boards in order that they become audible.

But of what concern can it be to the listener, eager to hear music, an acoustical organization, how this music is technically produced? This interest can only arise in him if he, out of caring curiosity, wishes to ascertain what it was that gave him pleasure in what he heard, so that he may be able to phrase his request for repetition of his pleasure correctly.

6. How the tones are organized rather than what they are made of, is where the emphasis should lie in listening to music. In order to show how ridiculous the aversion against the word "electronic" is, I would like to add that "electric" and "electronic" are in effect the same thing. The term "electronic" came into use far more recently. Probably with the idea that this would sound more elegant, more sophisticated, and more marketable than the word "electric", which is considered degraded through its association with irons, street-cars, and razors. As water flows through water pipes, the electrons flow through the electric circuit. If we wanted to be absolutely precise and a little snobistic, then we would have to say, on hearing a speaker on the radio, that one is hearing an electronic voice, and, for that matter, that all music heard over the radio is electronic music. Therefore any attempts to push off the responsibility for a resistance against new tones on the term "electronic" seem rather ridiculous to those who know that all electrical means have the same function in electronic music as air columns and strings have in the orchestra.

¹For further examples of such audience responses, see L.A. Hiller and L.M. Isaacson: *Experimental Music*. New York: McGraw-Hill Book Co., 1959.

7. The urge of enlightened society, to define the phenomena of culture with terms that avoid the stigma of technical language, but rather have the nimbus of being popular, has reduced the meaning of the word “term”. It no longer is used only to show the limits of the sense which it is to encompass, but increasingly for the categorical exclusion of all other senses.

8. Most of the contemporary composers have agreed to use the term “electronic” for all music which consists of electronically produced sound material, and where the elaboration and modification of that material is done by electronic devices. In the case of *musique concrète*, at least the sound material is not electronically produced in the studio, but by microphone recordings of sounds and noises, which already exist in a concrete sense. Tones of instruments, fragments of speech, the noise of a railway, a factory or of traffic in the streets, all this may become the basic sound material for the *musique concrète*. Here too the artistic judgment is called upon only to find out whether the composer has successfully modified and organized these “concrete” materials in such a way that an acoustical event is created which will communicate its idea and its form to a musical listener rather than to an onlooker or a visionary.

I very earnestly propose not to put too much store in the terms “electronic” and “concrete” if one really would like to understand or even to judge the so-called electronic music or the so-called *musique concrète*. There is no reason that we should undertake to investigate why the sound of a train or a drum should be more concrete than that of a generator, and why a filter, through which a sine wave tone is put, should be more electronic than the same filter when the sound of a whistle is put through it. As it seems that behind both headings lies the attempt to create serious music with untried means, and that only the artistic concepts still lack the adequate technical terms, let us, for the time being, rather try to discover what it is that is actually taking place, and not so much whether the nuances, titles, and slogans are well-chosen.

One must then also concede a few things as fact; for instance: that there is no such thing as an electronic composer or musician; that no robot, no electric or electronic brain can produce anything on its own (it must always receive information from some human being, formed and programmed absolutely accurately, in order to be able to function); that for centuries mathematical procedures have been used for the notation of durations and proportions in music, and that they are still being used only for that and nothing else. How else can one specify the duration of a tone except in seconds or, when dealing with tape, in inches? How else should one specify pitch than in cycles, when using a device that has no keys but a frequency dial? However, and however suddenly an idea may have occurred to a composer, in order to write the idea down, so that it can be performed, a well-calculated system always has to be employed. A system in which relevant values are expressed by numbers and proportions. Composers do not mathematically calculate music, but they do compute its notation with infinite care.

9. A work of art is a communication, the shaping of which is consciously artificial, and which is directed at a contemporary society with the aim of evoking an experience between cause and effect.

10. Imagine yourself to be a composer. One fine morning you receive two letters. The first one reads:

Dear Composer:

This coming year a series of concerts will take place in our new concert hall, for which we would like to commission you to write a new piece. The choice of performers, the decision as to the duration of the piece and the number of rehearsals needed for the performance are completely up to you. We have the best of musicians and conductors at our disposal. I don't believe we shall have any difficulty in agreeing on your fee; as you can see, we have no financial problems. I am hoping to receive what will doubtlessly be a positive answer, soon.

Your old friend, X.

A pleasant letter, a wonderful offer. At last, you say to yourself, as you are still the composer, at last I can really let loose and write the long and complicated masterpiece for which I have never had the time, the peace of mind, the courage, or enough hope that it would be performed, to overcome the numerous technical hindrances, the lack of time and of finances. Now what is it that I actually want to compose most of all: the symphony, the oratorio, the mass, the suite, the symphonic poem? What shall I start on? Actually, I have never thought about it this realistically. Besides, I shall have to go over all the musical ideas I had at one time or another, to test whether they still interest me as much now as they did then, when I only had to dream them up, without having to bother much about how possible or impossible they were. I fear, I shall have to start thinking anew. What musical idea could I have that would fully utilize this opportunity of not having to bother with certain conditions, as to instrumentation, durations, or technical possibilities? I am beginning to notice, that, somewhere between this letter and me and the masterpiece to be, there is still something missing. I shall have to figure it out.

In the meantime, you have opened the second letter and read the following:

Dear Composer:

The four of us formed a string quartet a few years ago, and we would now like to add a contemporary work to our repertoire. If you could let us have a composition of yours which has not yet been performed, we would be most grateful. We are looking for a piece that is about 10 minutes long, so that we can program it on our next concert tour. We would have to have the quartet within the next three months, as we only have time to rehearse our winter programs during the summer. We very much hope to find a means of agreeing on a fee. With the hope of receiving some answer from you soon and with the kindest regards,

Your Quartet Y.

Your immediate reaction to this letter might well include some of the following thoughts: How should I manage to get around to composing a quartet ten minutes long in the next three months? If they need the score and the four parts within three months, I have to be finished with composing and correcting in two months at the latest. Anyway, it doesn't sound as if they can pay decently. I won't be able to do it. Besides, who knows what those four consider a truly new aspect of music? I don't even know if any of the members of this quartet can play anything that goes beyond the technique of the nineteenth century and its use of the instruments. It is probably best to just turn down such requests or offers.

This is the way you believe you are thinking and rationalizing. In reality you have already begun to compose the wanted string quartet. You see the problems, and now you realize what it was that didn't come to mind after the first letter. Your old friend X offered you an unlimited apparatus, to do anything you want with, but he neglected making even the smallest demand on your ability to use a musical idea for solving a musical problem in a musical way. Naturally it is possible to discover a provocation even in such an offer. Because, if you were to translate this offer of working without any restriction into an order, the order could only be obeyed by writing the longest, most complicated, most expensive piece, for the greatest possible number of participants. But soon you would realize that the "musical idea" that would have to be found to make such an extravaganza plausible, could hardly be so entirely musical. Thus, you gloomily come to the conclusion that all the restrictions your friend X did not impose, you will now have to impose on yourself, which may be a more difficult task, considering the complete freedom given, than the actual composing.

There you have it easier in the case of the string quartet. That letter clearly stated a rather definite proposition. You, as a composer, are to find or invent such a musical idea that its materialization calls for four specified string instruments, namely, two violins, a viola, and a cello, to be made use of for ten minutes, in order that a series of musical happenings can be musically presented. These happenings (that have been derived from the musical idea) should differ as much as possible from all other happenings that have been created up to now under the same circumstances. As the letter said nothing about technical difficulties, you can make such demands on the instruments as are needed to give a clear performance of the music. If the string quartet players like and understand your composition, they will work on any and all technical difficulties, as long and with as much care as is needed to overcome them. And, if the whole proposition appeals to you, you will also manage to agree on a fee.

There are four points that should be clear before starting on a composition: the general musical idea that is to be materialized; the events and the order in which they occur, in order to display that idea; the source of sound which is to be used for the acoustical realization; and the total time in which all is to have its place and duration.

In the wording of an arithmetical problem, the letter from the string quartet would read: "Given are source of sound plus time. To be found is the idea plus the events." The letter from friend X, that offers so much, would be stated: "Given is nothing. To be found is everything." It is easy to imagine the problem, as it would be given by a poet, or for a poem: "Given is the idea. To be found is what is musical in the idea, and everything else." And for a rather popular piece, it would have to be put: "Everything given long ago. To be found is nothing."

I would bid you not to consider the simplified form in which I have presented this to be frivolous. In fact, every act meant as art is the attempt to solve such problems. It is necessary to quickly add, that, of course, that which is "given" and that which is "to be found" frequently may present themselves in a more complicated form. They can not always be stated in one word or term. Particularly when composers invent the problem for themselves, one occasionally finds that they take as given that which no one else has yet discovered, and set out to find that which nobody believes still worth seeking. It is probable (I, for instance, am convinced of it) that the word "creative", which has become so trite, would immediately be as good as new, if it were not only used for the fabrication of results, but also and above all, for the making up of problems. So that words like "contrived" and "artificial", traditionally words of censure in official music reviews, would, on the contrary, specify a most commendable approach.

One should not confuse the pattern of presenting problems with the elements contained in the problem, for which no pattern can be given.

When the *Sonderprogram* of the Bavarian Radio proposed to me to prepare a series of broadcasts, under the title *Sound Synthesis and Synthetic Sound*, they also commissioned the composition of a four-minute electronic piece for this series. The pattern of the problems posed by this assignment could be stated: "Given is the source of sound, the duration and purpose of the composition, and the date when all work must be completed. To be found is the musical idea plus the musical events to display it." The source of sound was to be the Siemens-Studio for electronic music in Munich. The duration, four minutes. The piece had to be completed before the beginning of the broadcast. The purpose of the piece was to serve as acoustical illustration in the broadcast series.

Under these circumstances, I decided, it is best to start thinking in musical terms only after having made myself more familiar with all that is given. First of all I must know what technical equipment the Siemens studio will put at my disposal. Second, it would be wise to work out a plan that will enable me to complete my studio work within the given time. Then I shall have to consider the musical advantages and disadvantages of the four minutes, as a period of time. Finally, I shall have to try to define what sort of a piece is suitable to be used, as a whole or in its parts, as an example within a general description of work in an electronic studio. Not until all this has been discerned can a musical idea be found which for its presentation demands such acoustical events as can only be produced in an electronic studio.

I started by thoroughly inspecting the studio and the possibilities offered there. Several such studios now exist, where one can experiment and compose with electronically produced sound, in Cologne, Milan, Brussels, Paris, Stockholm, Tokyo, and Warsaw, in New York, and at numerous American universities. Each studio looks quite different from the other. Neither the technical equipment, nor the methods of working are standardized. So that you nevertheless have some picture of what an electronic studio looks like, I will describe one, an imaginary model, which is, in principle, like any of them. This studio consists of one very long room. Looking from left to right one can see, at the extreme left, numerous large and small square box-like devices, with dials, dial-plates, switches, and buttons to be pressed and turned. These are the generators. The sawtooth generator, which produces powerful harmonic spectrums, from which any desired section can be filtered out; the sine wave oscillator, which produces sine waves, with which I can build together any desired spectrum; the noise generator, which produces white noise; this white noise contains the so-called colored noise, which can be filtered out; the impulse generator, which produces impulses; these are also called white, and sections can be filtered out for use. The second group of devices, to the right, appears to be very similar, but without all the gadgets. These are the filters, through which the tones, produced by the generators, can be modified and transformed. In the middle of the room is the control center. Anything that comes from the generators, directly or through filters, has a separate channel in the control center. How much one allows through a channel, can be controlled with regulators. Besides this, the engineer (or the composer) has the possibility of combining and mixing the channels with each other, of adding reverberation, of controlling the intensity and dynamics of every tone, sound, or noise. To the right of the control center there is another group of filters, which can be used to make final corrections on whatever is being passed from the control center to the group of recording and play-back machines at the extreme right of the room. This group consists of tape recorders and loudspeakers.

11. An electronic studio, at first sight, does not appear as fascinating as it should. On entering the quiet and tidily arranged room, the newcomer does not recognize, or even suspect, the enormous wealth and infinite variety of sound that can be found there. Were he fully aware of it, his first reaction might well be one of panic. The possibilities would then seem boundless to him, consequently making decisions and choice far more difficult than where limited possibilities are offered (as for example, by an orchestra, organ, choir, etc.).

The newcomer, in his innocence tends to embarrass the sound engineer of the studio with questions like: "What can the electronic studio do?" To the technician who knows the apparatus and how to handle it, this question seems stupid. According to him, the first question could be: "What can I do in an electronic studio?" And in the case of anyone who considers himself a composer, the question should even be: "What do I want to do in an electronic studio?"

There are a few things which should be understood from the beginning: The electronic studio is not an installation which does something or has an initiative or program of its own. An electronic studio does not make anything, nor is it a robot that creates music. Nor does it want anything. What then is it? It is a place, a room, sometimes a number of rooms, filled with devices, from which one can want something. A composer must study these devices in order that he know what he can demand of them. For the time being, and until further notice, it is best that we understand the devices in the studio to be a number of instruments (they are not musical instruments) which differ from one another in that each of them fulfills a different task, just as the instruments in the orchestra differ from one another, not only in that they look different, but above all because one can demand different things of them.

12. When speaking about the work in the electronic studio, one should begin by introducing the sound engineer, who is technician and advisory council, all in one person. His active assistance and cooperation is of the greatest importance to the

composer at all stages of the work in progress. He is the one who can master the equipment, who handles the switches and regulators, fixes and changes the connections, and who knows, above all, the methods by which musical ideas may survive the long and dangerous way from generator to tape recorder.

The electro-technical education of a composer is usually of a fragmentary kind, so that he may by rights be called a layman in this field. Laymanship will not only manifest itself through ignorance on a subject, but just as often through demanding the impossible of an object. If a composer has written a sequence of sounds which he wishes to materialize in the studio, he will also have to develop some ideas as to how he proposes to go about the technical production. Occasionally, these ideas are quite erroneous. The good technician will still call them neither absurd nor impossible. His attitude might be expressed like this: "It never worked out that way. But then, we have never tried it that way either. The equipment never had to answer a demand like that. We ought to try and see. And if it still does not work, we shall have to find a way to do it nevertheless." And so begins an exciting search for the solution of the composer's problem. This technician is interested in producing the desired sounds, even if this means that he has to treat his electric apparatus in the most unruly fashion. It is while experimenting in this manner that both the composer and the technician discover the richness of the studio, the wealth of nuances, which can carefully be measured, but also the dangerous nearness of the easy and practical to that which is banal and boring.

Sometimes it is the technician who presents the composer with a musical problem. It may well happen that the engineer has constructed a device which produces a special kind of sound. The composer might feel challenged to compose a piece of music in which these sounds are to play an important part as basic material, or as the goal aimed at by a musical sequence or a musical development.

Here the cooperation between musician and technician becomes rather close. For both of them will now be searching for sounds which will do justice to the sound of the new technical device by corresponding to it as variations or as contrasts.

13. If joy had as many barriers and obstacles, and as much prejudice and critical arrogance placed in its way as beauty, then joy would become the cause of beauty, instead of, as is customary, being merely its result.

14. One can find numerous technicians in electronic studios nowadays who understand so much about music that they can help a composer even in the creative process. Fairness requires the statement that one can also find a few composers able to write down their musical ideas and intentions in so clear a way that the technician enjoys it. Surprisingly often the technician feels provoked by such a score to investigate his apparatus, which he knows so well, as to whether it doesn't possess still further possibilities hitherto unrevealed. Wherever the cooperation between technician and composer is well-developed, work and events are likely to occur in such a way that they leave nothing to be desired in respect to science, art, philosophy, and poetry, no matter how anybody feels about the resulting music.

15. There is one sound that takes place in the piece *Wayfaring Sounds*, which has a particularly strange quality, due to the fact that the intensity of this sound changes eleven times within one second. If I had been working with musical instruments, this idea would not have occurred to me, as it is impossible for any person to change intensity that precisely and quickly by hand or by mouth. In an electronic studio such micro-structures can not only be precisely and distinctly produced, but are also musically well-founded.

Many people believe that the electronic studio might one day replace musicians and musical instruments. One would have to be deaf not to notice the supremacy of the sound produced by a well-played musical instrument over any synthetic imitation of that sound, may it be ever so cleverly done. The longer one works in an electronic studio, the more careful one becomes in the selection of suitable musical ideas. No serious composer would try to make a generator produce the familiar sound of a trumpet. He will always call for a trumpet player with a trumpet when he needs that particular and irreplaceable sound. He becomes more and more aware of the fact that the electronic equipment will serve him well only when he expressly means to enter into realms of sound which are unattainable by musical instruments.

16. Following a series of experiments, carried through mainly in electronic studios, it has been determined that a pause may not be longer than 8 to 10 seconds if the listener is to perceive it as a pause within a context. The normal concert listener, whom I don't mean to discredit here, is disquieted after only 5 seconds. A 3-second pause is enough to make radio listeners suspect that there is something wrong with their sets. If you would take the trouble to listen to jazz and popular music once with this in mind, you would notice that pauses just don't exist in that medium at all. It is easy to see for whom this music is meant and what the composer thinks of the addressee.

When John Cage writes music in which pauses of 20 to 30 seconds often occur, then this shows that he is trying to give us pleasure by a means not based on the intellectual pleasure in coherence. Those who consider the terms “music” and “coherence” inseparable, can, of course, not share in this pleasure. Whoever can imagine music that is not coherent, hears Cage’s music as it is meant, and possibly can form an opinion on the quality of incoherent music. I am not debating on whether or not Cage’s music is good. I merely want to prevent people from condemning him for the wrong reasons. Many people hold Bach and Beethoven in reverence for the wrong reasons; this too should be prevented.

17. Whenever music is composed and sounds as the composer wishes it to, then audiences speak of this music disrespectfully as being “contrived”. If, on the other hand, music is composed and sounds as the audience wishes it to, they admiringly call it an “achievement”. In both cases all involved are in the right. Only the expression accompanying these verdicts is, in any case, wrong.

18. The characteristic sound of instruments is no longer to be recognized, if one does not hear the build up of the tone, the so-called transient effect. To composers who orchestrate with care, it is important that this be taken into consideration. When many instruments are supposed to start together, it is obvious, one is not meant to hear the transient effect of single instruments. And if the composer writes in his score that many instruments are to start, one directly after the other, he probably means one to recognize a great many characteristic tones in a brief period of time. The completely precise and perfect performance, which unfortunately so many people sneer at, has still not sufficiently been attained, and is an absolute prerequisite for hearing sound structures as the composer meant them. The greatest impressions and the deepest emotions are a falsehood from an artistic point of view, if they are derived from an adulterated and distorted interpretation.

19. The extreme contrast in sound volume, characteristic for quite a number of contemporary compositions, including some electronic music, have proved uncomfortable even to otherwise well-wishing listeners. It should be remembered though, that the so-called discrete average doodling, which comforts the bored ear with well-balanced middle intensities, never corresponded to the intentions of good composers, but only to the desire of not-so-good performers to spoil their audience. Besides, it is not quite fair to complain of the effort which the occasional encounters with new music may demand of the listeners. They can get back more than their own by the much more frequent occasions for comfortably listening daily, or even hourly, to music good and old. It is already available. Good and new music must be made here and now.

20. If you tap with your finger on a table at the rate of 5 taps a second, then your finger tapping would be equivalent to 5 cycles per second (this is an analogy, as cycles really only measure oscillations). We perceive 5 strokes a second as a rather rapid meter, but it is slow enough, in order to ascertain 5 separate occurrences. In very virtuoso pieces for piano or for string instruments there are passages where the performer has to play up to 12 notes in a second. There passages would then be equivalent to 12 cps. A very good drummer executing a perfect roll touches the skin of the drum with his sticks up to 25 times per second. If you would like to know what it sounds like when a string oscillates 28 times per second, you simply have to play the tone “A” at the left end of the keyboard of a piano, which means that somewhere between 20 and 30 cps we begin to perceive speed as pitch. This sentence can be reversed of course. Somewhere between 30 and 20 cps we begin to perceive pitch as speed. In theory at least, we may proceed one further step, saying, that speed is a very low pitch, and that pitch is a very high speed. In fact, one can find on very large organs in the lowest register a few pipes which produce a fast soft knocking sound and no perceptible pitch. Only when combined with tones of the higher registers will their pitch become noticeable in the bass. Let us, therefore, agree to accept the theory wherever it proves to be useful. And let us admit, that here and there it may be in the nature of things, if they do not pay attention to our categories of perception. At the same time, however, let us concede that our perceptions, and the terms we use to describe them, are quite important and to be fully considered, even though they may not correspond to the nature of things. Here as always it is most desirable to avoid all confusions between our perceptions and the real nature of things, and to determine with care which of them is to be talked about at a given occasion.

According to our perception, therefore, a very fast pulsation may turn into a very low tone at any moment. This phenomenon, however, can be observed under one condition only: The pulsation must be of a periodic nature, in that the impulses follow each other in equal distances. A tone is produced by periodic oscillations of the air, a string, an electric current, and so forth. Only a periodic pulsation can by acceleration turn into periodic oscillations, thereby assuming the quality of a tone. Aperiodic pulsations and aperiodic oscillations create what is called noise. Noise is acoustically speaking nothing else but an audible phenomenon which is produced by aperiodic pulsations and oscillations. If I could control a noise to such an extent that I could lengthen and shorten the distances between its elements until they would be of equal size, I would be able to change a noise into a tone. This is to show that perceptible pitch is to be considered as a special case of noise. Aperiodicity is the rule, periodicity the exception. Perceptible pitch is, so to speak, the most periodic noise. It is not possible to reverse this sentence, saying that

noise is the most aperiodic perceptible pitch. Therefore, we must accept noise as the overall category in which tones represent one specific case.

Put simply, shortly, and practically, all this boils down to the following: An audible periodic pulsation, if continuously accelerated, will eventually enter the reaches of our tone perception. The greater the acceleration, the higher the pitch we perceive. An audible aperiodic pulsation, if continuously accelerated, will eventually enter the reaches of our noise perception. The greater the acceleration, the denser the noise we shall perceive. The border line, however, between the reaches of tone perception and of noise perception is not as sharply drawn as the foregoing definitions may make it seem. If, namely, I simultaneously produce so many notes that their pitches get lost in the maze of different and counteracting periodicities, the consequent result will possess the quality of noise. If, on the other hand, I filter out of a noise a very narrow band of frequencies, the chances are that I shall find there the quality of a tone.

Here the composer is faced with two questions: Can a noise be called music when the noise is controlled and produced in detail according to the definitions and laws of composition? Can an organization of sounds, which is correct according to the definitions and laws of composition, still be called a musical organization when the audible result is noise?

In both questions it is asked whether something “can”, not whether it “has to” or “will” be called music or musical. A certain kind of question asks to be treated as if one were looking for potential possibilities rather than for definitive confirmations. The composer too, at the beginning of each work, has to deal with possibilities, and not with certainties. However great his experience and knowledge may be, he always is tempted to try the untried and the unknown. If he would answer even one of the two questions, asked above, with “no”, he would not really be a composer of music. For if he has no confidence in the power of composition over all means and materials, what else then will give him the courage and impetus to add his music, where so much music exists already? It is by composition alone that he can try to organize the unheard of into contours and structures, so that it may become heard. Wherever this is achieved, the composer has, by his composition, created new music. And the term music will mean, as it always has meant, what thus successfully has been achieved.

21. Ever since artists have existed, there has been a discussion about the meaning of art for human society. Can art better mankind? Is art a splendor, only perceived by good people? Is art a luxurious protuberance of culture, or is it a necessary basis for all culture? Does the awareness of what is good and what is beautiful create art, or does art create the awareness for good and beautiful? And so forth.

Even if one withdraws oneself from the responsibility of giving answers, supported by certainty and conviction, to such questions, one can by no means help but notice that art always has certain traits of the society in which it can exist—no matter whether it is the cause of these traits, or whether it just goes along with them.

In this sense, a criticism of a piece of music is always also a criticism of a society which accepts this music, or which induces the artist to write it. Only for this reason, and only if understood in this way, is a discussion about music interesting or of importance for the listener and the non-musicians. It is not a matter of the criteria of musical workmanship alone, but also of the implied conditions of society, represented by this workmanship.

22. Anarchy and arbitrariness in art are but temporary illusions. When an artist ceases to recognize as valid a certain set of aesthetic principles, he inevitably finds himself in the process of becoming deeply involved with another certain set of aesthetic principles. The awkwardness of dealing with the yet unfamiliar spirits conjured up by such a change, is at least as much a problem to the composer as to the listener. However, it is up to the composer alone to master that which he has begun to love, without beginning to annihilate it. Only when the music listener convinces himself of the composer’s earnestness in this love-conflict, and understands the created composition as a musical enactment of this conflict, then only does he show real friendship to music, and partisanship with its everlasting fight against the complacent pettiness of everyday life.

23. Time and again things have occurred in art that could never stand up to a high court of morals and virtue, if the presiding judge were of the opinion that all is so good as it is, and that it should remain so. But he has never been of that opinion long, and so it is that strict morals and pure virtue time and again have been forced to allow that which had been held for truth, drastically to be put in question. It is art above all (and only art) that is capable of expressing doubts as to the excellence of the existing order in an amusing or serious manner without in any way endangering any man’s life or goods. It is of no matter whether the artist has the wish to help better mankind, or whether he is without such interests and has his pleasure in discovering and composing new orders, or whether he just wants to concern himself with his own production. As soon as he presents his work to people, it is all the same, what his motives were for creating it. Only what he has created, only the quality of the work of art, only that will be measured by the existing social standards. And from this moment on, under all circumstances, a contest

takes place, completely independent of all personal inclinations and aversions, to decide what will remain longer: the existing social standard or the newly created work of art. This contest takes place in a realm where the problems of society and the problems of art meet in a reality in which their differences and their similarities obey a common law. This contest should not be confused with the daily contest of the predictions on its outcome. It is unfortunately the latter, which is part and parcel of cultural industry, that is so often mistaken for a history of contemporary art. It is evident that these predictions in all forms, professional or amateur, have nothing to do with art, as their consequences often endanger an artist's life and goods, which is not allowed by the rules of the game in culture. But as the rules of the game in culture do permit one to discuss and decide on matters of society and art in speech and in writing, there must be methods of so doing without infringing on the rights of man. Only one way can lead to these methods and that is: correct information about the object. Only when one is well aware of the society, whose standards one means to represent, and only when one knows exactly wherein the art of the work lies, which is to be examined, only then is it possible to attain a point of view from which one may be able to express oneself in such a way as to endanger neither dignity of subject matter, nor existence and reputation of the artist. It is very difficult, almost impossible, to have informed oneself to such an extent as to feel sure of having reached the state of "absolute justness". Maybe this is quite comforting, for having reached such a state, one would be forced to obey an unconditional strictness and inexorable austerity, which those who feel insecure happily need not. But there also exists a "justness" of the insecure. As a matter of fact, our culture is founded on this fact. Culture does not manifest itself alone through the existence of art, but far more through the quality of the relationship of society to art. Only because there can be no certainty within this relationship, room is left for discussion. It can so easily happen that a controversy over a work of art proves far more significant and important than a categorical verdict on it, or even than the work of art itself.

If I compose with electronically produced sounds and play the product of my work for people, and thereupon someone asks me how he is supposed to find any intellectual or sensual stimulus in something which contains no forms or orders familiar to him, then there are two possible ways of answering, if he is really interested. The one possibility would be to discuss the question, whether intellectual and sensual stimulus can only be found in familiar forms and order. The other would be to help him become familiar with these forms and orders, so that he is capable of finding the intellectual and sensual stimulus. There is still one more possibility, but I find it rather unworthy. This would be to play the piece for him again and again, until he has gotten so used to it, that he confuses the passive enjoyment of habit with the intellectual or sensual stimulus of the still undiscovered forms and orders. This is the method of the cultural industry. It should not become the method of a composer, and certainly not of those commenting on art. They should know that habit does not guarantee knowledge, but is merely a way of getting around the necessary mental effort.

24. Aesthetics can only determine whether a work of art can still be judged according to traditional and contemporary criteria of taste, or whether it is rather the taste that should enlarge and develop itself by the criteria of the work of art under consideration. As the reality of a society is formed through the steady and simultaneous reciprocal action of both functions (without taking aesthetics into any consideration), the aesthetic question in itself is already a serious attempt to inveigle the better half of the whole truth with the help of the no-longer-honorable "either-or". The choice between two half-truths is always a purely aesthetic one.

25. If I say of a musical happening, that it communicates the impression of great slowness, I choose this way of expressing myself because I would like to underline the difference between "being slow" and "communicating slowness". However much it may be tabooed in decent society, in art one has to apply standards of two or more kinds. Not only ambiguity but also multifariousness of meaning are the morals of art, its virtue, and its right to existence. In the simulation of realities lies the physical harmlessness of art, but also its intellectual power. To express slowness by means of something slow is, so to speak, not art. One could well write a book about the slow movements in the sonatas and symphonies of the great composers in order to show that nearly nothing slow occurs in them. Wherever the terse multitude of harmonic, metric and dynamic changes piles itself up to a breathtaking abundance, one can speak of slowness musically only as the necessary means, and not as the communicated attribute. The greatest slow movements contain the most time-consuming speed.

What is important, therefore, is that the listener not only notice which attributes are contained in the single layers of an acoustical event, but that he also become aware of what the layers, partly due to and partly despite their attributes, communicate in their entirety, collectively.

Electric devices have the ability of complying with a demand for ambiguity and multifariousness with such precision and speed, as could never be expected from the most artful and skilled ensemble of instrumentalists, and, for reasons of style, should never be demanded of them. This, on the other hand, also for reasons of style, demands of the composer that he only compose for electronic sounds when his musical ideas require these possibilities. The listener should actually welcome as fitting and even as essential the fact that electronically produced music goes in more complicated and intricate ways than correspond to the

experience of listening to instrumental music. I use the terms “complicated” and “intricate” here not to describe a quality, but to describe a method. The comparison between instrumental music and electronic music is never one of quality.

Neither music is better or worse than the other. The comparison can only be one of methods of composition. It is essential, therefore, that the composer not look in the electronic studio for that which an orchestra can perform better, and not demand from an orchestra that which is intrinsically suitable for electronic apparatus.

26. Under the impression of so many sounds, hitherto never associated with the term “music”, it is only natural that the nuances, though noticed here and there, get lost, to a great extent, in confusion. Certain seemingly conspicuous sound values, heard at one point or another, be they pleasant or disturbing, have the tendency to take on distorting proportions in one’s memory of the first hearing. Similarly, one tries to characterize a foreign language, which one does not understand, with those of its sounds which seem the most unusual. In all imitations of the Chinese music since Tschaiikovsky, accidentally harmonized pentatonic scales are used, only because our instruments are unable to divide the octave into five equal steps, as the Chinese instruments have done for centuries.

27. It can sometimes happen, that certain characteristics manifest themselves in a way that is in itself unusual. Whereby it may occur that the bearer of a distinctive feature seems more striking, to begin with, than the features which he bears. Quite frequently, the powerful position a man had was considered more significant than the things that he tried to accomplish with the help of this power. Still today, one mistakes the occasional abundance of embellishment in Mozart’s music for rococo charm and thereby overlooks the protest, which was definitely vigorous to the point of being revolutionary, that lay in the fact that he put these mannerisms to use thematically.

This confusion of old meaning with new functions is responsible for the belated contact between a work of art and an audience, even when the audience thinks itself well meaning.

28. In following a musical context the listener usually can rely on his ability to notice and to recognize certain patterns of a harmonic, melodic or rhythmic kind, which will give him a hint of the structure according to which the composition was built. We can all easily recognize again and again a rhythmical motif, even when it is repeated by different instruments, at a different pitch or in a different tempo. Less easy, but still possible to everybody, is the recognition of a melodic or harmonic progression, when it is repeated under a different rhythm, in a different tempo, or with a different sound color.

Some of the new music now demands from the listener that he should find his bearings by following, remembering, and recognizing dynamic structures, relations of sound quantities, proportions of changing tempi, variations of sound color, and many other musical elements, which up to now usually played an accompanying part only. The music of the last three centuries, which has formed our listening habits, has failed to sharpen our attention for more than a few of the numerous elements or parameters that have to combine their attributes and forces in the manifold aspects and movements of a piece of music. This failure is responsible for the fact that we now must learn to hear what is new to us, instead of being able to hear and judge it immediately. What we have to learn is to follow the basic elements of music, even when they do not present themselves to us in patterns of a melodic, harmonic, or rhythmic kind. Obviously enough, it is much easier to follow new ways of hearing while listening to a music which was composed in these new ways, than while listening to Haydn or Mozart. Inevitably, though, once one has discovered the new treasures, even listening to Haydn and Mozart will reveal them, adding fresh pleasures to those found before.

Every musical element can be chosen by the composer to be the carrier of a characteristic moment in the composition. A well-articulated progress from a section densely strewn with a rapid sequence of tone clusters to a section in which a drum and a bassoon each play just one sound into a long silence, can be just as musical a progress as a melodic line harmonized in four parts. Instead of being carried by melodic, harmonic, and probably periodically rhythmic elements, the progress is carried by the elements of quantity, density, speed, sound color, and dynamics, and offers enough characteristics to be recognizable, when repeated in a varied form much later in the piece.

When a friend of yours has put on a costume and mask, you will still recognize him, sooner or later, because he can not hide all that is characteristic of him. Be it that he did not change the way of holding his head while speaking, or that he didn’t disguise his voice, be it that he forgot to modify his manner of walking: some element always remains which, in spite of costume and mask, will lead to recognition. And I think that the fun of the spectacle lies rather in the revealing relationship between the costume and its wearer, than in the originality or the success of the costume.

It is the seeming anonymity, and not the real one, which lends the character of playfulness to the masquerade. The understanding of composed music can become a more musical and less literary pleasure when the listener has heard and penetrated the

masquerade of the musical elements. It will then be up to the listener to enjoy the mask, or the wearer, or the amusing and surprising relationship between the two. His decision will be influenced by his own, just as interesting, relationship to playfulness and its frequently significant aspects. In art, both the gay and the serious are but make believe. How earnestly this make believe was enacted will decide with how much esteem the gayness and the seriousness have been treated, and how much the enactment made believe. Foolish laughter is no less foolish for expressing most righteous feelings, because vested rights do not guarantee the owner to be right. Joyful laughter, however, is full of some understanding even where it occasionally blunders in the dark.

By learning to observe and to follow the masquerades of the musical parameters and the musical elements, their variations, metamorphoses, and mirages, the listener will come to experience music in a way which, as found without the help of stories and symbolisms, leads directly from hearing to understanding.

Due to the construction of musical instruments and due to the limited performing abilities of man, several musical parameters could not be mastered sufficiently for the composer to use and control them completely. Especially in the realms of sound duration and speed of sequence, sound color and dynamic relationships, results were always more or less dependent on chance, mood, performers and other non-musical categories. It is by no means the aesthetic problem which I wish to consider here. There are practical limits to man's perceptiveness and to his accuracy in execution.

It is here that the electronic studio opens the door to regions of music that could never be investigated before. The sine-wave generator makes it possible for the composer to build each sound according to his wishes. Up to now, he had to accept what all musical instruments produce as a single tone. Namely, a prefabricated, nearly unchangeable spectrum of many different frequencies, and always a harmonic spectrum at that. With the help of the generators the composer is at last able to extend the idea of his composition also to the structure of the very sounds he needs. In the same way he is able to determine and to produce tone mixtures which possess colors not to be found in any orchestra, or even in nature. As to the parameters of speed, rhythm, and duration, all functions of time, the electronic equipment allows for well-controlled complexities and irregular combinations to a degree that would be, and probably will remain, unattainable for instruments in the hands of even the most skilled musicians.

The devices and the implements of an electronic studio offer their goods directly to the inventor of sounds. They are capable of working with an absolute precision, which is their great blessing and not a curse. With their help, the musical parameters stand prepared to play new parts, some of which they have tried in vain to play for hundreds of years. The composers can write and materialize new pieces for yet unused elements of music. Let us hope they find many willing listeners who will not take offense if the pitches, intensities, durations, speeds, types of sound and sound colors now suddenly run and fly loudly, softly, uncouthly, and tenderly past ancient and sacred borders. Never were any borders sacred to art. It is always a little absurd when biographers, who give glowing and enthusiastic accounts of "titanic composers breaking through to new frontiers", then turn around and, instead of having learned by their own praise, frowningly claim, on the last few pages, that unhappily since those times nothing really good has been written, because "these young composers just do not respect the laws and limits established by the composer in the book, but flippantly break through all decent limits."

Thus "titanic" becomes "flippant", and the enthusiasm for things past, a thoughtless nagging at things present.

29. In the language of those who comment on music, adjectives are mostly used as a means of publicity for the opinions of the commentator, or as a judgment of his ability to judge, or both.

30. If the quantity and the velocity of acoustical events surpass a certain mark, the ear can no longer dissolve the complex sound. The musical ear understands how to hear such sounds as the sum of many single, but not quite identified, elements. It hears statistically. Most music listeners in a concert perceive statistically that at a certain moment of a piece of music the sound is produced by strings, woodwinds and percussion, although they cannot precisely say *what* each of the instruments is doing and exactly *when* it is doing it. Still it would be noticeable to many listeners if one of the elements should be omitted. There is no reason why a composer should not compose for statistical hearing, if this is important for music listening anyway. When a composer in an electronic studio goes to the painstaking trouble of measuring out dozens of tiny pieces of tape to the millimeter, cutting and splicing them, he does not always do this because he is in love with micro-acoustical details, but very often rather because, with the mass of these details, he can attain the overall sound and the sounding color he had imagined.

31. The universality of music is underestimated even by those who tremulously and lovingly strive to protect it against profanation.

32. In the course of innumerable conversations and discussions on the subject of “electronic music”, I have frequently heard the following opinion offered in one form or another: “Quite interesting, though probably not as suitable for absolute music as for the acoustical background to plays, movies, and television.” I shall try to explain why this seemingly harmless opinion may hurt a composer’s feelings in some cases. If a composer is told to arrange a musical background for a scene in which it is raining, he will try to compose a music which communicates a “rainy” impression without using the real noise of real rain as an instrument or as a model for naturalistic imitation. If this composer should still be willing to see artistic values in the production of background music and mood music, he will consider it his task to translate impressions into music and not to substitute them with music. That it is easier to imitate rain, thunder, lightning, wind, explosions, and other noises of nature with electronic devices than with the instruments of the orchestra is so obvious a fact that the composer’s interest for it is reduced to zero. (Besides, composers are, above all, competent for the orderly organization of sounds, and their interest in the non-musical desirability of a single sound can only be expected when they wish to be competent for the realistic sound track too). Now instead of congratulating the composer for scorning the use of electronic means for purposes of cheap substitution, one tries to persuade him to inartistically imitate familiar sounds of nature and of everyday life. Benevolent tolerance, when based on considerations of expediency, will soon prove to be nothing else than intolerance toward art. Certainly it can painfully misunderstand the artist, about which a lot more could be said.

33. While producing a sound in an electronic studio, it can well happen that one needs to listen to this sound and the components hereof many hundred times. The more often you hear it, the more critical you become and the more further work on the tone seems essential. Not one of the still small collection of electronically produced compositions is a superficial piece of music. Composers who prefer to take things lightly would never be capable of holding up under the serious attentiveness and great patience which are needed for serious work in the studio. They prefer to just take along a few original sounding effects, that lay no claim to being music and can quickly be produced, for use in film, radio, theater, or television. Electronically produced sounds may be fashionable and seem handy to pseudo-artists in order to construct something unfamiliar, by simply using something unfamiliar, rather than by creating it. The few composers who seriously mean to create music out of electronically produced sounds are not after the unfamiliar. They are trying to become intimate with unfamiliar material, which they had envisioned for a long time and which has now become accessible to them.

34. The breaking down of a sound into its various components reveals its spectrum. The spectrum shows the sound to consist of a fundamental tone and numerous overtones. If the intervals between all the components of a spectrum can be expressed by integer relations, this spectrum is harmonic. All musical instruments, from the fiddle to the double bass, from the piccolo to the tuba, from the celesta to the kettledrums, when playing a single note, automatically produce a harmonic spectrum. In all instrumental as well as vocal music, consequently, no single tone, that is, no sine-wave tone, can be found: each sound is a harmonic spectrum.

The quality of this harmonic spectrum is varied through the quantity and dynamic attributes of its components. Thus the specific characteristics of the various instruments are attained. In one instrument, for example, the even-numbered overtones are heard most strongly while in another the odd ones are predominant. In some instruments there is a gap after the third overtone, and the row is resumed with the eighth or ninth overtone. Where timbre is concerned, all our musical instruments simply produce variations on one single sound structure, namely the harmonic spectrum.

35. After having heard a composition of electronically produced sounds for the first time, some people told me that the music frequently reminded them of the static and disturbances which they sometimes hear between or instead of stations while listening to the radio. It is true that these statics are electronically produced and that they very often consist of sine-wave tones or groups of sine-wave tones. But they should only be called disturbances when they disturb us in hearing something else, the news or a symphony by Mozart. If, on the other hand, we wish to hear just these sine-wave tones, then it would be the news or the symphony by Mozart which are the disturbances. Words and their meanings very often depend on whether an agreement has been reached as to what one is talking about.

36. Unfortunately, objects always become mutilated when used as examples. Whenever one uses a piece of music as an example, be it electronically or otherwise produced, one has a tendency to put the spotlight on just the one aspect of the piece one is talking about, thus leaving the rest of the composition in the dark.

When I use a chorale by Bach to illustrate four-part settings, I am aware that the beauty and musical meaning of the chorale is by no means constituted merely by this four-part setting. The same holds true if, when speaking of sine-wave tones, I use as

an example a composition in which the use of sine-wave tones plays an important part. Obviously the composer of this piece needed the sine-wave tones to bring about his musical idea, just as Bach needed the four-part setting.

Formal concepts, methods of composition, and technical means become musical concepts, methods, and means whenever they serve a musical idea.

What I am trying to assert here is that the story is not that of a sine-wave tone that wanted to become music, but rather of a musical idea that sought and found the sine-wave tone.

A musical idea thrives on the notion that one can arrange acoustical phenomena next to each other and on top of each other in such a way that the listener can follow the process with interest, possibly even enjoying it. The musical idea believes that this process should be a purely acoustical one and understood as such, and that, due to the manifold forms in which this process appears and due to its tremendously large scale of nuances, it contains and offers all the elements of contour and movement which should be part of any process, in order that it be perceived and observed as an event. The ideal composer always wants to compose a musical process in such a way that it represent only his musical idea and not any literary, visual, theatrical, or psychological ideas. The ideal listener, on the other hand, attempts to recognize the musical process in what he hears and to deduce therefrom the composer's musical idea. He will not let himself be disturbed in this by any of the visions and associations that come to his mind, or measure what he has deduced with these visions and associations in order to pass judgment.

In stressing the importance of seriousness in seeking and finding the "musical idea" I do not mean the term itself to be taken too academically. The aversion that every musical idea has against remaining an idea, its very longing to become sounds, pauses, music, an acoustically formed perceptible event, keeps it from taking on any stiff ideological form of theory. Never has a truly musical idea been law-abiding. Only laws are law-abiding, faithful to an idea, be it good or bad, dead or alive. When a composer comes up with an idea and the critic comes down on him with the law, the work remains misunderstood.

37. The association of ideas summoned up by a musical event is no proof that the event really took place; it is not even a guarantee that the event perceived was not in itself already an association.

38. Variations on a sound material belong to the most ancient musical enterprises. Just where we usually speak so glibly of "primitive" music, where only one drum or one gong or a melody of only 2 to 5 tones is played, just there the idea of variations on a sound material is realized in the richest and most exciting form. Concerning eras and styles nearer to us, we should, quite rightly, feel entitled to inquire as to how many of Bach's compositions for solo violin and how many of Beethoven's piano sonatas ought to be understood mainly as variations on a basic instrumental sound material, and only besides and in addition to this as a faithful execution of thematical developments. It is true that no music, not even the most "primitive" music, is built on one single musical element only. Thus it is of primary importance to the listener who wishes to understand a composition that he recognize the number of elements used and that he hear which of these elements carry the burden of the musical structure. One of the easiest ways of understanding electronic music lies in paying close attention to variation on types and materials of sound. There the new medium appears at its strongest, for it is in this direction that the electric devices prove most proficient.

While working with the sawtooth generator and some filters, I found that the combination of certain regions of the harmonic spectrum will produce the vowels of language. So that here, an element of language becomes a musical element by being the variation of a sound material. When I used such "vowels" in my composition, I treated them as musical elements only and did not try to diminish the difference between the characteristics of the sawtooth generator and those of the human voice.

I mention this not only as an example for what it may mean when one speaks of variations on a sound material, but also as a hint at the approaching breakdown of the borders between music and language. It will be the poet's and the composer's problem to see to it that neither language nor music get lost in this process. In my example the vowels were reached by purely musical materials and procedures. Further experiments have shown that the consonants of language can be approached in the same way, even though they consist of far more complex structures than vowels. In theory at least the time is near when poetical elements and musical elements will meet and mingle with each other on the common ground of sound, to become one homogeneous material, which a "composer-poet" can organize under one idea of composition. Whether the result will be called art of language or art of music, I do not know. Probably a new name will be invented, to distinguish the new medium from both its forerunners.

For the production of the "vowels", which I used for the fifth section of my piece, a prolonged period of research and experiment was needed. Although we had at our disposal some tables of vowel formants compiled by research workers in their acoustical laboratories, we could make only very limited use of them. The differences between the technical conditions in their laboratories and those which we found in our studio made it necessary for us to start from the beginning. In the end we had eight vowels on tape, each of them in twelve varied timbres. In selecting those which I meant to use, I was careful to produce a sequence

in which the vowels should remain fully recognizable but at the same time should clearly show their being originated from a sawtooth generator. I wanted it understood that the “vowel” section should not be heard as an imitation of human sounds but as a special instance of variations on sound color. Had I been interested in human sounds, I would have used the human voice.

39. The mutation of the meaning of words from one era to the other affects also the descriptions of works of an era by those who write music and those who write about music. As compared with what the compositions express, these descriptions have but a passing value and must be thoroughly revised from time to time.

40. As soon as a composer has finished writing a musical score, this score lies waiting to be materialized in some way, so that it may become audible. Instrumental music is made audible by musicians and their instruments. The materialization of a score for electronically produced sounds lies in the hands of the composer and the sound engineer.

The last few days and hours of work on a piece for electronically produced sounds have their own problems and excitement. Now all that has been produced, in weeks and months, tone for tone, layer for layer, fragment for fragment, has to be put together, synchronized, spliced, and combined in such a way as to attain the wanted result. A result that presents all the plans, theories, and ideas of the composition in a clear manner, without preaching them.

Too great a love for a detail, because it is new or was difficult to attain, can be fatal, as it weakens the judgment of the composer in the studio, just as it does the performer of an instrument.

All details and interconnections should be intelligible without stepping out of line and yelling “Look this way, here I am!”

Finally, all work has been done and the completed composition is on tape. The encounter of this result of a purpose and its materialization with the listener can lead to one of two results. Either he wants to hear the piece again, or he doesn't. In the many reasons for one or the other decision, the criticism of the piece is implied or stated.

If I now take on the rather ticklish task of criticizing my own piece, I must begin by stating that two things are not possible for me: I can not tell what effect this piece will have on anyone else, because that I don't know; nor can I tell what function the piece will have in society and for the development of music, as this can always be judged only far later.

What I can and may do is state my point of view as follows: The idea of continually and simultaneously varying four types of sound (sine tones, noises, impulses, and harmonic spectrums) was carried through. But the distinctness with which the layers can be distinguished from one another brings up the question whether perhaps, in this way, the methods of orchestration for orchestra appear to have been imitated to a certain extent. Wherever this proves true, the reproach must be conceded that inconsequence of style has been risked for the sake of distinctness. In much modern music, most particularly that written for electronic sounds, one seems to be seeking musical sequences that do not make use of the means of individual voice leading. In an effort to demonstrate the technical equipment and methods of production in an informative manner, I have somewhat neglected to take part sufficiently in the search for a complete synthesis. But this the piece gains as an example that which it may be lacking as a composition.

A similar point could be made in regard to the formal aspect of the whole composition. The beginning and end of each of the six sections can be so clearly discerned that the term “episode” can be used here in an almost literary rather than musical sense. As no other suite- or story-like characteristics are implied in this work, it becomes evident that I wished particularly to stress the proportions of duration of one section to the others. The four-minute complete duration of the composition is divided into six entirely different periods of time, and these divisions are an important factor in the treatment of the parameter of time. The undeniable pleasure in perceiving such proportions of duration, especially when they correspond to proportions within the sections, is somewhat disturbed if, as a consequence of these divisions, certain sets of sound take on the character of a solo. It is the fact that the sections can easily be distinguished from one another, through distinct characteristics of sound and through distinct divisions, which is somewhat contradictory to one of the requirements of style in working with the medium of electronics. The electronic medium offers absolute continuity of all aspects, whereas musical instruments function stepwise. The composer's problem in an electronic studio is, therefore, really only solved in an appropriate style if he succeeds in presenting a musical idea by way of acoustical events in which changes are composed by steady means only and not in sections or through marks of distinctions.

The third point particularly to be noted is the occurrence of vowels in a composition that claims to be a musical one. Acoustically speaking, every audible sound consists of component parts, the sum of which may lie anywhere between one and infinity. These components can be defined by physical and mathematical quantities and proportions. A musical quality can be attached to these data only when they occur in a context which strives to present an idea that dominates above and beyond the acoustical means. In this particular case, it is the harmonic sound spectrum which serves as a theme for several variations. In one of these variations the sound spectrum assumes the outward appearance of vowels. Being the result of musical variations however,

the musical legitimacy of these vowel-like sounds should not be doubted, even if the phenomenon itself seems to belong to a different sphere, namely that of language. Besides, the benevolent observer might notice that the source of the harmonic spectrum, the sawtooth generator, was used throughout the piece for articulation rather than for sound formation. One problem still stands unsolved. There is, after all, no reason to assume that what is proven by logic will supersede and supplant illogical habits of associative thinking. In other words: even though a listener may know, understand and admit, that he is listening to musical sounds, it is to be doubted that he could resist the association of language, when suddenly recognizing vowels. This problem of the listener is neither of a musical nor of a literary kind, nor does it call for aesthetical or philosophical deliberations. It is rather a psychological problem. But is it really of importance? Is categorization of perceptions an aim in itself? Would an amalgamation of the categories: music and language, constitute a loss or a gain? Should music stop the variation of sound, because it might intrude on the domain of language? Should language dam up the flow, because it might become music?

Here, where my piece does not reliably answer the questions which it provokes, I shall doff the disguise of the critic, and withdraw behind the hopeful truism according to which every work of art can solve but few of the problems, answer but few of the questions, it poses. With this in mind, without any self-denying modesty or self-accusing coquetry, I regard the term "work of art" with misgivings and therefore gave my composition the name *Wayfaring Sounds*. Sounds are wayfaring, not only for me, not only in electronic studios. Everywhere, in theater, in poetry, in language, and in music a powerful movement has started, scorning all categorization and mocking at the conventional associative patterns. Everywhere sounds are on their way to take possession of articulation and of communication, augmenting them and trying to liberate them from outdated routines of misunderstanding.

41. Performances of electronically produced music in a concert hall really do present some hitherto unsolved problems. Even where the loudspeakers are of the finest quality and the volume is controlled with the greatest respect for the listener's comfort, and for once a very willing audience generates an ideal atmosphere, there still remains something lacking, even for those who have the best intentions. The enterprise, as a whole, is somewhat unsatisfactory. In the hope of solving this problem, many hypotheses, speculations, and theories as to the reasons are continually being discussed. Different seating arrangements for the audience, spherically built concert halls, large or small numbers of loudspeakers, and many other technical and psychological details are the subjects of research and experiment wherever new music is created, invited, and sponsored. All this has proven very important. For every experiment has taught something and added to our experience, even if sometimes what one was seeking just did not appear. Due to the comparative rarity of concerts that include electronically produced music, progress in research has been slow, and no opinion about the problems involved should yet be regarded as information. This holds true also for the opinion which I wish to contribute and to discuss here.

People who know how to make music, look for listeners. People who want to listen to music look for those who make it. But nobody wishes to make or hear musical continuously. Therefore, appointments were arranged, fixing a time and a place, where musicians could meet listeners. Leaving out for the moment all the well-known historical and commercial details and sociological commentaries, it can briefly be stated that in time such appointments develop into "concerts" and "the concert hall". With the coming of records, radio, and television, it looked as if the venerable institutions might be rendered unnecessary and obsolete. But they have held their own to this day. People keep on going to concerts, in order to be present at a musical event in which people perform for people, there and then. The directness of such an experience, be it of a musical, a psychological, or social nature, can not be matched by even the finest technical means of transmission. For the sake of fairness all round, one has to understand and to appreciate the difference between a piece of music and its performance. It is a most frustrating dialogue, when, on returning from some festival a man tells of the exciting performance of a symphony by Mozart under a certain conductor, only to be condescendingly reminded by his friend that time and money were wasted, as he himself owns the record with this symphony conducted by the same conductor and willingly would have played it for a welcome guest at home and in comfort. In a way, both men are perfectly right. But that is of no help, for they are not speaking of the same experience. The way to the concert hall, the pilgrimage to a concert are closely connected to the fact that in a concert people are performing for people, there and then.

But it is just this which no longer has any application to electronically produced music. At least so it seems to me. This music is still composed and produced by people for people, but neither there nor then. A performance by tapes and loudspeakers irrevocably lacks that surplus experience, given by being present, which renders worthwhile the way to the concert hall, even when one possesses on records the entire program of the concert. This is one thing that even the most enthusiastic friend of electronic sounds can't get over, when after a long trip he finds himself surrounded by loudspeakers and people looking at an empty stage. The atmosphere of his own radio set at home seems more stimulating to him than the purposeful arrangement of devices which turn the concert hall into a stadium. The general utterances of pleasure or displeasure seem pompous and ridiculous to him. They are not meant for any performers or composers, as none need be there, but merely for the people who happen to be sitting close by, who mean nothing to him outside the concert hall; or maybe for the concert manager, who only considers the audience as a collection of clients and buyers anyway. At home one would either listen to the music or turn it

off, without unduly dramatizing either decision. Thus put, my opinion leads me to a conclusion, which may seem slightly absurd to some: Electronic music (or as I prefer to call it for precision's sake: Music with electronically produced sounds) is music for the home, and its proper transmitters are tape, record, and the radio. Should it be true that this music represents tendencies of revolution in art, it certainly can not reach its goal by means of collectivistic psychosis. Sounds from tape, through loudspeakers, lack the impact of personality which can only be expected to come from people, and which can bring to light that which it just as often obscures.

Working with electronic sound demands a continuously critical attitude. For a correct appreciation and estimate of this new medium's possibilities and attributes, it is absolutely necessary to keep a critical eye on the standards by which one wants to measure them.

But without criticizing even one's own standards of measurement there would be no getting ahead anywhere, and without vehement attacks on one's own lethargic tolerance of circumstances, habits and powers there would be neither art nor artists.

Thus the genuine pleasure in music is also an issue of untiring curiosity. Not only to satisfy this curiosity, but more than anything to keep it awake always, music sends new sounds again and again in all directions. Occasionally even into realms yet unexplored. But who, being a true lover, and as he claims, of music, would then close his ears to it?

Articulations by György Ligeti

Let me introduce to you at this point a composition for electronically produced sounds, which I believe to be the gayest yet done in this medium. I heard the piece for the first time when the composer, György Ligeti, had just finished it in the studio for electronic music in Cologne, where I too was working. Ligeti played it for me, asking me at the same time to help him find a suitable name for the work. What I heard sounded to me like some acoustical leftovers of visitors which Ligeti might have had. Visitors, who had gone away, leaving behind them sounds, tones, accents, consonants, vowels, and other rudiments of what may have been an excited conversation. Cleaned of all traditional meanings and other human imponderabilia, and put together to form an acoustical context which proved to be at least as amusing as the conversation probably was boring, these fragments became constituents of an organization of acoustical events, that is, of music. Please do remember, that all this I only imagined, and that none of the sounds you will hear was taken from life; all of them were electronically produced. And of course one can not see this kind of midnight coffee-party gossip. One can only hear it. To the listener, sound structures simply should not possess any optically perceivable existence, nor should they conjure up any allusion to such an existence. Their well-ordered exuberance, permitted and enforced by the composer, becomes a self-contained process, an intended acoustical event, in other words: music.

I was quite surprised and even felt somewhat flattered, when Ligeti immediately accepted my suggestion to call the work *Articulations*. May I ask you, this lecture not being a concert, to try to find out, in what way your pleasure in Ligeti's piece is served better: By concentrating on the seemingly chaotic exuberance of the sounds and on the comical aspect of your association of your ideas, or by concentrating on the really well-ordered exuberance of the sound and the gayness of Ligeti's ideas.

Articulations

Wayfaring Sounds by Herbert Brün

I shall now give you a very short, but as I hope, nevertheless informative report on the work I did in connection with a piece, which is called *Wayfaring Sounds*, and which I was commissioned to compose and to produce for the third program of the Bavarian Radio, to serve as an example in a series of broadcasts I did on electronic music. The technical realization of the four-minute composition took place at the Siemens Studio for electronic music in Munich.

The technical equipment which I used in this studio could be found in almost every other studio of this kind, and consisted mostly of electric testing instruments. Due to their construction, these instruments can test, evaluate, and modify the electric current that flows through them. The devices themselves are silent. In order to make their activity audible, it is necessary to lead the electric oscillations they transmit, via an amplifier, to a loudspeaker. Usually one stores the results on tape so that one can continue to work on them.

The sources of the basic sound material I used were four kinds of generators:

1. The sawtooth generator, which emits a vast harmonic spectrum, stronger and more complete than any musical instrument

2. Then the sinewave generator, which produces one desired frequency at a time, that is, sinewave tones, of which nonharmonic spectra can be built
3. For nonperiodic oscillations, the noise generator with its white, and, when filtered, its colored noise
4. And the impulse generator with its white, and when filtered, colored impulses

This elementary sound material I modified for the purposes of my composition with the help of electric filters, which isolate or suppress certain regions of sound:

1. A frequency converter, which can add frequencies and spectra to one another or subtract them from one another
2. Electric reverberation devices
3. And finally, the control center of dynamics with its numerous regulators

The composition *Wayfaring Sounds* consists of six sections of varied length. The first is 31 seconds long. Sine tone mixtures, colored noise, and, as an extra ingredient, the harmonic spectrum from the sawtooth generator, were used as sound material.

The second section contains the same sound material as the first. But the sinewave tones, which in the first section were put together as six rising, short, impulse-like sounds, are used in the second section to build a falling line of 13 differently shaped swift sequences.

In the first section, the sounds of the sawtooth generator were but a miniature, in an inconspicuous place; here, they project into time the swinging shape of a question mark.

In the next part, the sinewave generator has a rest, and the impulse generator is heard from for the first time. A variety of frequency ranges, colors, and pitches were obtained from the white impulse with filters.

The fourth section is intentionally a fragment. It lasts only 15 seconds, and, with a swarm of impulses and a crescendo of restless noises, it acts as if it wanted to lead to some Finale. But into this crescendo a tone is blended that finally comes forward and tries to say "ah".

Thus an element succeeds in making its way, which the sawtooth generator tried to promote ever since the second section. And that is the vowel-building tendency of the harmonic spectrum. The fifth section is, therefore, dedicated to this theme. Those ranges of the spectrum were chosen and blended with the help of filters which, combined at certain pitches, form sound similar to the vowels in language. Among the many different varieties, I selected seven sounds which, formed into larger and smaller groups, constitute the structure of the fifth section. In the background, as the second voice of a canon, one can hear the vowels whispered again, because the sound of the noise generator too, is capable of variations, and thus of language.

You will hear now the whole piece *Wayfaring Sounds*, including the sixth and final section, in which impulses, noises, sine tones, and harmonic spectrums twice play the game of gradually disappearing. [CD Track 15]

Klangfiguren by Gottfried Michael Koenig

Here is a composition for electronically produced sounds, which although composed more than nine years ago, I still consider one of the best works to have been realized in this medium up to this day. My opinion is based on the fact that the musical idea which forms the work, is such that it already seems to contain the demand for synthetic sound. My admiration for the work is incited by the richness of changes, of colors, and of movement, by its command of my own time perception, and by the economy of means employed to bring all this about. The composer is Gottfried Michael Koenig, and the title of the composition is *Klangfiguren*, that is, *Sound Figures*, or *Sound Structures*.

Klangfiguren