

## PRINCIPLES OF MUSICAL THEORY IN THE COMPOSITION OF ELECTRONIC MUSIC

Inasmuch as the techniques used in electronic sound production and manipulation are sufficiently well-known, I should like to touch upon some problems concerning composition <sup>with</sup> ~~for~~ electronic instruments by presenting some reflections in musical theory.

Each new material makes its own particular stylistic demands, leading on to new forms. A number of developments in the history of music spring from this fact.

The linear development of a tonal scale resulted in the case of Oriental music in heterophony, while in the music of the Western world it led to polyphony. Ars Nova <sup>developed time-measure as a basic compositional principle</sup> ~~is the expression of an age~~. Again, harmony led to a different understanding of musical material. ~~The~~ This was lucidly set down by Rameau, who conceived of the basic tone as "geniteur", that is, as a physical starting point of sound, in contrast to Riemann's explanation of the basic tone as the central tone between the <sup>overtone row</sup> ~~upper~~ and the <sup>its inversion</sup> ~~lower~~ ~~ring~~. The 20th Century created a musical language which derives both linear and vertical relationships from a superimposed 12 tone <sup>row</sup> ~~ring~~. This principal, which was soon applied to all parameters, created the need for <sup>total</sup> ~~complete~~ serial ~~pl~~ planning.

This process is accompanied by no less marked changes in the sound - {material} itself. To produce it we use instruments capable of fulfilling these ~~(requirements)~~ new demands.

The developments brought on by electronic music follow yet another pattern. Because the sound is synthetically produced, the compositional process begins as soon as ~~the~~ <sup>it</sup> has been conceived. In this case, too, we may point to precedents, for example, Monteverdi's experiments in instrumentation. But, unlike electronically produced sound, the sound

made by the mechanic, 1 musical instrument cannot be dissected into its component parts. Basically, the mechanical music instrument produces a sound type whose modifications in the course of interpretation remain within a narrow framework. Electronic sound, on the other hand, can be analysed and put together again in another order. These facts, and others like them, compel the thinking composer to face possibilities demanding a new orientation of him. Vacillations between rational and irrational values are expressed in the sophisticated circuits of electronic sound production, as well as in the often blissful attempt at creation, <sup>springing from a scientific attitude</sup> through a fruitful comprehension which may, however, as often as not, turn into the other extreme of arbitrariness. So that, if we wish to clarify principles of musical theory, <sup>pertaining to electronic</sup> music, we should avoid as much as possible all <sup>cultural-</sup> political, sociological, and ideological points of view. We must concentrate upon the consideration of specific phenomena as starting point and stimulant for the systematic investigations which should be made later on.

I make the axiomatic assumption that we are dealing with sensorily perceptible things. Every particle that has been grasped must be capable of further growth and change if we wish to view these things theoretically and to organize them on the basis of decisions. The idea of founding <sup>another</sup> a separate school should therefore not be contemplated from the outset, our energies should rather be concentrated in striving to maintain the greatest possible control over the material.

The quality of musical theoretical thought thus depends upon flexibility, and the ability to develop and integrate new interpretations of its formulations. Subjective experience may therefore be admitted; later, in the course of development, non-essential components may be rejected, enabling it to become empirically gained, objective fact, and thus a part of the musical ~~language~~ grammar.

Primarily we make use of the dual phenomenon of the active and passive ear. The passive ear perceives a sound complex produced by

synthetic fusion as a unit. The active ear makes itself felt as an applicator beyond the physiological ability to comprehend sound clusters, as it sets up musical-psychological ~~un~~classifications. At the very moment of creative <sup>imagination</sup> ~~visualization~~, the sum of the inner sensory perceptions takes shape in the formulation of the tonal material, from which the composing process must then draw its own conclusions. These conclusions are, however, predetermined by the synthesis of sound which has been decided upon and heard previously. It is therefore not "le ton, ce que fait la musique" (the tone which makes the music), but rather, as Wellek correctly stated, "die Musik macht den Ton"--the music makes the tone.

I shall, of course forego here the possible example of the effect of hammermechanics, from the joint work of Bach and Silbermann. As a parallel case I shall use instead the joint efforts of engineers and composers who see as their goal an emancipated composition of electronic music.

With this in mind, I shall now present some preliminary sketches for the composition of my piano concerto No. 5 with electronic. The construction of a function-generator containing 32 units makes it possible to vary successively the relationships of the inner components of a single tone.

#### Example 1

There is the further possibility of varying the density of the same tone~~s~~ by different degrees, through the use of an auxiliary oscillator as the trigger for activating a ring modulator.

#### Example 2

These two elementary examples suffice to illustrate how a tone becomes a definitive object through the re-working of its inner components; from its general effect details could be theoretically developed further. The toneform receives special ~~brilliance~~ }significance? from the painstaking construction of its two outer parts, attack and decay.

Example 3  
Example 4

High and low tones both cause the listener to form ~~strong~~ markedly spatial associations. Thus deep tones lead him to distant places, while high tones seem to come close. By electronic means we can add to this experience, which <sup>has been</sup> was empirically gained in orchestral music, a precisely-formed solidity of tone.

Example 5  
Example 6

The brightness of the high notes, on the other hand, makes an acceleration of the sound sequence possible.

Example 7  
Example 8

The acceleration of the sound occurrence within a definite time-span, causes us systematically to develop metrically organized beats. In principle we are able to develop beats by means of multiplication or addition within the framework of a given unit of time. Multiplication will result in symmetric relationships.

Example 9

Addition, on the other ~~hand~~ hand, makes it possible to have uneven proportions.

Example 10

Mixed forms provide us with a prolific source for ~~unintended~~ free composition, for which I shall bring an example later on.

These configurations form the principal constructional material for further development in free composition in my piano concerto No. 5 with electronic.

I shall now present a demonstration of compositorial <sup>consequences</sup> ~~consequences~~ based on these sound forms, I have chosen these particular selections because of the necessary dialogue between the piano and the electronic ~~instrument~~. <sup>Sound development.</sup>

If we consider that the passages we have just heard, primitive though they may be, are nonetheless the result of a reciprocal relationship, then the following selections will make it still clearer

that in electronic music especially, you must return to the forma formans, ~~to~~ to the cell-like stages of becoming. The forma formata, that which has already been created, is the privilege of an accomplished tradition.

The composition begins with the postulation of a sound having a strong attack and a precisely executed decay.

#### Example 11

This image-like quality is formed by the sum of its parts. Reflected in it we see both the spontaneity of the composer's individuality and the contemporary cultural response as well.

In contrast to this (sound image) {Klanggestalt}, the ringmodulator develops one narrowly-defined component of the soundcomplex into a time variant which corresponds to attack and decay, namely, attack--a sequence of assymetrical, close beats; decay--a sequence of symmetrical, attenuated beats. The dynamics of this section are determined by the form of the entire complex, that is, high amplitude at the start gradually dying down in a pre-arranged pattern.

#### Example 12

And now, by relating the two elements to one another, the varied tensions are given full play through the exposition of their contrasting qualities.

#### Example 13

Within this first episode the composer attempts to make a statement concerning the meaning of his work. It is, however, quite clear to me that the meaning of a composition is no indication of its ~~importance~~ <sup>value</sup>. The technical means, which at this stage are conspicuously made use of, will unfold into many-sided constellations as the work continues. The sense of experimentation in the application of technical means is not to be separated from the spirit of the compositorial process. I should like to quote here Eyth's formulation of this mental attitude:

"Everything that gives form to spirit may be called technique. Technique is all that makes a man's will take on physical shape. And, whereas this includes an infinite variety of forms of expression and possibilities of being, therefore, in spite of the bonds which shackles it to the world of matter, technical skill has <sup>been with</sup> ~~some~~ <sup>of the boundlessness</sup> ~~thing~~ <sup>of the purely spiritual."</sup>

The next phase, which literally anticipates the entrance of the piano, is constructed upon the principle of acceleration in ~~such~~ a way which is, on the one hand, not performable on the piano, on the other <sup>counts</sup> hand/~~demands~~ of the perceptive listener's ~~impulse of~~ redundancy factor.

Example 14

The piano now joins in. Its part is differentiated by interval relationships and dynamic spotlighting in perfectly even movement. As an example I shall bring only the opening.

Example 15

This movement is stereophonically framed by the same sound material, which is, however, produced in multiplied and divided ~~relationships.~~ {ratios}

Example 16

Together with the piano the composition here continues on three levels of movement.

Example 17

No doubt, some rules ~~concerning~~ <sup>of</sup> musical theory concerning the simultaneous performance of movements will be formulated out of all this. In our studio we have begun work on this kind of systematic research. Our technical equipment consists of a programming unit whose nucleus is a multichannel light activated programmer. A piece of paper or film tape, whose speed can be precisely adjusted, runs over this. The graphic notation on the tape opens and closes contacts which control signals on pre-recorded tapes, which are run off simultaneously. These signals are combined on a 10x5 mixer-matrix, <sup>It also</sup> which either programs the ~~contents~~ <sup>of D.B. Gontcharev</sup> of all the parts beforehand, or, <sup>they may be</sup> ~~if preferable~~, manually corrected ~~them~~ while the tape is <sup>running</sup> ~~being made~~, and may be fed filter combinations,

~~at which.~~

envelopes and other details. Since the entire process is graphically recorded, it can be corrected as well as repeated again and again. The combination of visual and auditory processes is especially favorable for study purposes.

In connection with this I should like to play another selection from the composition which serves as a variant for the preceding example. In contrast to the defined pitch of the piano, electronically produced beats now appear. Their rhythmic patterns run polyrhythmically along different levels of movement, through even as well as uneven ~~units~~ multiples colours of their units which ~~are~~ are combined with Ostinato groups. The rejection of different <sup>over</sup> ~~upper~~ tonal regions provided a variety of pitch.

Example 18

Two ~~ma~~ contrasting types of sound were added to the composition's fundamental sound forms which were demonstrated at the start. One of these was gained through the sharply defined filtering of tone mixtures, of high frequency.

Example 19

The other type was won from a continuous coursing tone mixture of low frequencies, a resultant tone from the course of decay of the first example. Hornbo\$tel's theory which claims that the linear dimension has five qualities, namely, relative brightness, height, volume, weight and density, is here very clearly demonstrated.

Example 20

From all the above it becomes clear, then, that the field of observation of psycho-acoustic factors is of significance for the theory of composition with electronic instruments. Realizing this, we must systematically study sound material in all its typical manifestations, yet being careful to avoid standardizing classified emotional values.

Programming would constitute the second part of the theoretical task. The choice of the programming process would become an integral part of compositorial evaluation, beyond the technological procedure involved. Programming and composing would, finally, become synonymous terms for one and the same process.

The gist of my meager portrayal therefore is:

- a) The theory of sound material has as its goal the control of its subjectmatter.
- b) The theory of programming takes time as its "geniteur", which thus takes the place of pitch, which up to now has held the leading role.

I should now like to play for you my Fifth Piano Concerto, which came into being out of the thought processes here unraveled before you.