

## FOREWORD

It is a well-established fact that our approach to music is generally twofold : this is the physicists' as well as the musicians' doing.

On the one hand, music is considered to be based on acoustics, or even mathematics, which ought to give it the status of a science ; on the other hand, it is acknowledged that it proceeds from psychological and sociological phenomena which, over the ages, have developed into an art, itself depending on various crafts.

There is no longer any contradiction between the two approaches so long as one is prepared to accept them jointly, with enough insight to respect the methods proper to each end of the «chain».

Two initial problems, therefore, must be regarded as equally fundamental : the first relates to the correlation between sound, which is the physical vehicle of music and pertains to nature, and the sum of the psychological phenomena of perception which constitute the sound object : the second relates to the choice of definite objects which are deemed suitable for music by reason of their perceptive criteria, and leads to a sound morphology and a musical typology.

There is, finally, a third problem : that of the value that such objects take on within a musical composition, and consequently of the nature of the music (or musics) which the choice of certain musical objects implies.

It will be appreciated that these three problems belong to elementary musicology, which precedes any analysis of the musical ideas underlying composition.

Western music, «sophisticated» though it is supposed to be, seems to have ignored these distinctions up to now, and has been content with passing on the age-old inheritance of «simple relationships» from generation to generation. Linguistics has developed otherwise.

This is subdivided into phonetics and phonology, lexicology and syntax. One might then be tempted to draw a parallel with acoustics and «acoulogy» (tonic sol-fa), musical theory and rules of composition. To do so would mean making two rash or at least limitative assumptions : not only that music is nothing more (or less) than a language, but also the one familiar to the western world for the past few centuries.

Music cannot be boiled down to a well-defined language, nor can it thus be coded merely by usage. Music is always in the making, always groping its way through some frail and mysterious passage - and a very strange one it is - between nature and culture.

Such high ambitions require some caution : many different stages and infinite patience are involved.

In our **Treatise on Musical Objects**, an attempt was made to synthesize the three elementary problems as far as the «object» is concerned : the particular difficulty of such an investigation, and also the peculiar fascination which it holds, were stressed. One cannot, as in case of language, refer solely to the existing texts. Sound still remains to be deciphered, hence the idea of an introduction to the sound object to train the ear to listen in a new way : this requires that the conventional listening habits imparted by education first be unlearned.

The propositions contained in the **Treatise on Musical Objects** can, therefore, only be based on actual personal experience. For lack of textual references, which are still under research, or established quotations, it was necessary to re-create the materials and the circumstances of an authentic «musical experience».

Its purpose may then be manifold and those for whom it is intended many. Some are concerned with our first problem and look for proof of what is stated in



the **Treatise**. This is precisely the purpose of the first part of this collection, which is devoted to relationships between acoustics and music.

Others are engrossed in problems of composition. They will find in this same part both the physical and physiological limits set down by nature and the key to the distortions which occur between physical parameters and perception criteria. Furthermore, the second part will give them the means for drawing up an inventory of sound by providing a morphology and a typology.

But everyone will finally have to admit that each one of us hears with different ears : sometimes too refined, sometimes too coarse, but in any event always «informed» by all kinds of prejudices and preconditioned by education. Ours is therefore an extension of the rudiments of musical theory through a radical renovation of it.

Whether one's interest lies in comprehension, in performing or in listening, it is hoped that this work will contribute the basic elements of a musical experience. Confronting the ideas of a researcher with experimental materials is not enough, one must sense musical communication : the harmony of a group united to give meaning to the aural material, as a function of a listening intention.

It is therefore, hardly necessary to add that, decisive though the initiative of the present album's promoter and author may have been, its whole value stems from the cooperation of the research team.

To achieve such a work, several waves of researchers have succeeded each other. Following the first discoveries of concrete music with Pierre Henry between 1948 and 1953, the subject was taken up again some years later both by experienced musicians such as Iannis Xenakis and Ivo Malec and by younger ones such as Luc Ferrari, Bernard Parmegiani, François Bayle and Edgardo Canton.

But it is only over the past two years, simultaneously with the final drafts of the **Treatise on Musical Objects**, that a small team exclusively devoted to experimental research was set up with Guy Reibel and Henri Chiarucci, and their assistant Beatriz Ferreyra. It is due to their combined efforts and to the creation of the sound examples, for which Guy Reibel was responsible, that an encounter was finally made possible between a systematic exposition and relevant examples, to which the whole team has contributed at various times.

Far more than the customary expression of thanks, this is the acknowledgment of a solidarity and a common desire to be of assistance to others : let me therefore dedicate this work collectively to all those who take an interest in such work and in particular to the younger generation.

Finally, it would be unfair to forget those who put the finishing touches to these recordings and took part in their production and edition : my thanks to Jean-Louis Ducarme, Agnès Tanguy and to François Bayle, who supervised the work.

Pierre SCHAEFFER - 1966



# THE THEORY OF THE SOUND OBJECT

English

CD 1 01 an extract from Tautologos II by Luc Ferrari

## PROLOGUE : THE FOUR ELEMENTS OF MUSICAL THEORY

"Sound dwells in all things : but sounds, those "melodies which speak the higher tongue, of the realm of the spirit, inhabit only the bosom of man."  
Thus wrote Hoffmann at the dawn of romanticism.

### 02 melody on the Jew's harp

This, it seems, was fashionable for Neanderthal man at the time of the Jew's harp, one of the ancestors of all our instruments.

### 03 5 electronic sounds

Such, at the dawn of a new, electronic, age is the chant of the Cologne studio. A strange pilgrimage into the past...

"But does not the spirit of music, like the spirit of sound, pervade all of nature ? A sounding body, when touched mechanically, comes to life and reveals its existence or rather its structure, and thus enters our field of knowledge."

### 04 the sequence of harmonics in a sound

But what does this knowledge involve ? Does the harmonic series - which would seem to be a sequence of integers - relate to man or to nature ?  
Are intuition and logic shared between music and sound ?

### 05 Indian sitar solo

So turbaned, Hoffmann concludes : "Isn't, therefore, the musician's relationship with nature the same as the hypnotist's with the fortune-teller ?"

It is this riddle that our work sets out to deal with, as a complement to the earlier **Treatise on Musical Objects**, which reached the conclusion of a musical dualism. If music is a unique bridge between nature and culture, let us avoid the double stumbling block of aestheticism and scientism, and trust in our hearing, which is an "inner sight".

This sight is so keen, its idiom so clear, that we often neglect the framework which sound gives to music, and concentrate only on notation ; musical objects are boiled down to signs which refer to structures :

### 06 some notes from the Ricercare of the Musical Offering by Johann Sebastian Bach on the harpsichord.

In order to assess the gap between such signs and the actual objects which are their realization, it will suffice to hear the same musical ideas embodied in two different ways ; this is sometimes made possible by the genius of a composer and that of his period :

### 07 the Musical offering as orchestrated by Webern (a fragment)

Thus we become aware of the fact that one dimension is missing from the conventional score, that of "timbre". We suddenly wish, we were able to fashion some "Klangfarbenmelodie" under the safe guidance of a theory. But as to the question of timbre, theory's simplistic reply is that a flute is identifiable by its flutelike sound. One is a little disappointed. Does theory, by any chance, conceal some serious deficiency ? Are we to challenge its most commonplace maxims : a minim equals two crochets ?



## 08 rhythmic theme on the marimba from Durboth by Guy Reibel

This rhythm is abstract ; it consists of measured units. What it lacks is duration, just as Bach's schematic score lacked the life given by timbre. Durations shape rhythm, just as timbre gives colour to pitch :

## 09 the same sung, then played on the piano

Of the four elements of music theory, therefore, two can be expressed by a quasi-mathematical notation. The remaining two, timbre and intensity, are approximate and even empirical. This notation however, fails to account for very simple sounds :

## 10 gong, followed by its piano transcription

The lesson of the linguists must be born in mind : a foreign language cannot be reduced to the familiar patterns of our mother tongue. Nor must we lose sight of the fact that different civilisations probably have different instruments and different ideas, as well as theories of their own, which may be more sophisticated than ours :

## 11 Chatur-Lal commenting on playing the tabla

We now hesitate between a pilgrimage into the past and an act of faith in science. For our four musical values, acoustics offers three inexhaustible parameters, each with its specific unit : frequency in cycles per second, intensity in decibels, and time in seconds. The basic question is then the following : are musical objects reducible to these parameters ? If the answer is yes, then acoustics can account for music. If not, it will merely provide music with information concerning the physical properties of sound, whose relationships with musical qualities remain to be established.

Such is the theme of the first part of this essay : the interplay between music and acoustics.

## 12 **FIRST THEME : CORRELATIONS BETWEEN SPECTRUM AND PITCH**

### 13 ascending piano octaves

In such a simple phenomenon, we are led astray by appearances : nature and culture seem to have joined in a unique encounter. First of all, the language of numbers. Let us consider, for instance, 65 vibrations per second produced by an electronic oscillator :

### 14 sine sound of 65c/s

If we multiply this frequency of 65c/s by 2, 4 8 and so on, we obtain the following, which seems to coincide with the preceding series :

### 15 pure tones in ascending octaves

We have now related a parameter - fundamental frequency - to quality : pitch. Perhaps, but even so, the musical notion of pitch has still to be defined. Isn't it different from that of the octave, which relates to a specific quality of our field of perception, repetitive pattern like the sequence of the powers of two ?

### 16 bassoon, clarinet and flute in ascending octaves

There is little likelihood that the god Pan had a frequency-meter at his disposal ;