

Structure and its role in music

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*There is more experience in man than mere feeling;
there is thought as well*
- I, Stravinsky.

An obvious feature of contemporary art, music in particular, is that each artist works as he sees fit and there is little general agreement on working procedures. The lack of understanding between artist and society and even between artist and artist is not small. On the other hand, there is admiration for an artist's originality and independence of thought and displeasure when he is too obviously imitative of another artist's work. Originality is the one quality in art that most artists are confident of attaining.

What aspects of art (music in particular) can or cannot be agreed upon? It is basic to the understanding of art to come to some kind of conclusion on this question, for in the admiring of opposite positions, that of the traditional artist and that of the individualist, indicates a basic need for this pair of opposites. An art that is paradoxical in that it reflects both unanimity and originality of thought is needed.

Discipline must be sought in freedom, and conversely, freedom can only be found in discipline. The power of shock is quickly exhausted, the sensation is quickly dulled, the sparkle vanishes, leaving a feeling of having been cheated.

The artist has two means of understanding the outside world: 1. Numbers. By their effect we relate things - order, harmony, beauty, in fact everything that is of the mind. 2. Space. This gives us objects without interest, without life, without beauty, but with the property of extension. The ancient Greeks, among many peoples, were concerned with the basic and most generally accepted concept of aesthetics - beauty, unity, symmetry, proportion and harmony. They were also concerned with the way in which the form of a work of art may project a world. They considered that the beauty of objects must lie in some way in the relationship of part to part within a unified whole proportion was all. As Plato explains:

The qualities of measure (metron) and proportion (symmetron) invariably . . . constitute beauty and excellence. (Philebus, 64E)

Aesthetic contemplation served a religious function; like mathematics, according to Plato, it "draws the soul upwards" through a hierarchical

ordered universe, for everything is beautiful that is ordered.

Aesthetic proportion doesn't only have this religious function - it also *unifies* a work of art. Aquinas also holds this view:

. . . Beauty relates to the cognitive faculty . . . hence beauty consists in due proportion, for the senses delight in things duly proportioned, as in what is after their own kind - because every sense is a sort of reason, just as it is every cognitive faculty. Now, since knowledge is by assimilation and similarity related to form, beauty properly belongs to the nature of a formal cause. (Summa Theologica, Q. 5. article 4)

In ordering a work of art according to ideals of proportion and symmetry one was obeying laws of nature. A work of art thus organised would in turn *harmonise* the soul of the beholder. What is remarkable about all this is its rationalism. There is in no way a simple reliance upon the Romantic Inspiration as the controlling factor. For the artist, his work was a responsible business.¹

A similar attitude is expressed by Pierre Boulez in this century in his book *Boulez on Music Today*:-

. . . it seems to me essential to explain the absolute necessity for a logically organised consciousness, which avoids slipping into the coincidental. Let us discipline our mental universe, so that we have no disavowals to face disillusionments to undergo, or disappointments to overcome. Let us organise our musical thoughts strictly, it will free us from the casual and the transitory. Libertinage is not liberty and it often leads to monotony Dilettantism was justified under a new pretext by renewing a kind of pact or contract with mental laziness and intellectual inconsistency. The most degenerate myths of cheap romanticism were once more flung together, and in effect the primacy of fantasy and inspiration was re-established.

There exists an historical parallel between European music and successive attempts to explain the world by reason. The character of our response is either taught or intuitive-The intuitive approach essentially involves all the problems of the *Gestalt* of symmetry and Golden-Section (see later) objects. A consideration which may lead one to believe that these intuitive responses are in fact taught, is outlined by Scholfield in *The Theory of Proportion in Architecture* (1958, page 1). He says that in the use of systems of proportion, if it

¹These artists made an *a priori* assumption that the world with which they were dealing was capable of being given numerical order, and that a work of art could reflect this.

was the result of intuition, one would expect the same types of relationships to have appeared spontaneously in all periods of design. In fact, this is not the case, and the sorts of mathematical relationships which occur are closely related to the mathematical knowledge of the period.

The casual and deterministic music of antiquity was strongly influenced by the schools of Pythagoras and Plato. Plato insisted on the principle of casuality:

for it is impossible for anything to come into being without cause.

Adherence to strict causality lasted until the Nineteenth Century when it was transformed as a result of statistical theories in physics. Since antiquity, the concepts of chance and disorder and disorganisation have been considered as the opposite and negation of reason (the Greek *logos*) and order and organisation. Only recently has knowledge been able to penetrate chance and has discovered how to separate its degrees.

Atonal music destroyed the tonal function and opened up a new path parallel to that of the physical sciences but was at the same time constricted by the virtually absolute determinism of serial music. It is not surprising then, that the presence or absence of the principle of casuality, first in philosophy and then in the sciences, might influence musical composition. It caused it to follow paths that appeared to be divergent but which share a common base in probability theory and finally in Polyvalent logic - all enrichments of the principle of casuality.

In contrast to Herakleitos, Parmenides was able to go to the root of the question of change by denying it. He discovered the law of the Excluded Middle and Logical Tautology and used them as a means of avoiding the notion of Being; of, that is, one, motionless, without birth and indestructible, the non-being, non-existing.

The *Poem* of Parmenides implicitly admits that necessity, need, casuality and justice identify with logic. Since being is born from this logic pure chance is as impossible as non-Being:

and what need would have led it to be born sooner or later, if it came from nothing?

If logic implies the absence of chance, then it is logically possible to know and construct all with logic. The problems choice, decision and of the future are resolved. If any element of chance enters a deterministic construction, all is undone. The inability to admit pure chance has even persisted in modern mathematical probability

theory, which has succeeded in incorporating chance into some deterministic laws. So pure chance and pure determinism are only two sides of the one coin.

Everything in pure determinism and less pure indeterminism is subjected to the fundamental operational laws of logic. These laws operate on isolated states or on sets of elements with the aids of operations, such as: union (notated «), intersection (notated «) and negation (notated 'X'). Equivalence, implications and quantification are elementary operational relations from which all current science can be constructed.

There is only one known example of pure chance in all the history of thought and that was in the work of Epicurus, who worked against the determinism of the Atomists, Platonists, Aristoteleans and Stoics, who finally arrived at the negation free-will, believing that man is subject to nature's will. It was at this time that all kinds of sophisms were debated, beginning with the logical calculus of the Megarians and it was also the time in which the Stoics created the logic called Modal, which was distinct from the Aristotelian logic of classes. It is interesting to compare this theory with the kinetic theory of gasses first proposed by Daniel Bernoulli. It is founded on the corpuscular nature of matter and at the same time determinism and indeterminism. No one but Epicurus had ever thought of utilising chance as a principle or type of behaviour.

1654 first saw a postulation on the use and understanding of chance. Pascal, and especially Fermat, formulated it by studying games of chance using dice and cards. Fermat stated the two primary rules of probabilities using multiplication and addition. In 1713 Bernoulli stated a universal law, that of large numbers:-

- if*
- 1. p - is the probability of a favourable outcome.*
 - 2. q - is the probability of an unfavourable outcome.*
 - 3. e - is a small positive number.*

then the probability that the difference between the observed ratio of p and q (p/q) and the theoretical ratio p/q is larger in absolute value than e will approach zero when the number of trials (n) becomes infinitely large.

The law of large numbers reduces, and theoretically, eventually removes pure chance, with the help of time and space.

What we know of the world is its structure, not its essence. We think of it in terms of relationships and functions, not of substances and accidents. Similarly we should not start with the "substances and accidents" of music but rather think about it

in terms of "relationships and functions". Music is a continuity of sound. In order that it may be distinguished from *non-Being* it must have structure; that is, it must have parts that are clearly separate but that interact in such a way as to make a whole. In order that this whole may have a quality of presence, of being alive, it must have form. Form in music can be described as the morphological line of sound-continuity. As the sociologist Levi-Strauss affirms, on the subject of language proper:

*I am convinced that in music there is no opposition between form and content, between abstract on the one hand and concrete on the other. Form and content are of the same nature, subject to the same analytical jurisdiction. . . . The content draws its relativity from its structure, and what is called form is the structural disposition of local structures, i. e. of the content.*²

The differentiation between form and structure may first only seem an arbitrary distinction. In order to clarify this distinction, an illustration which John Cage used in a lecture at Darmstadt should prove sufficient: We as human beings all have in common the factor of our structure as human beings, but the way in which we live, i. e. the form of our lives, is individual. ("Every man is an individual" yet "No man is an island".) Besides having structure and form, a piece of music must have method; i. e. a continuity producing means. In life, it is that observance of an orderly way of living that makes one to some extent dependable. Method in life is performing particular functions at particular times, rather than at just any. Method in life is being systematic.

Apart from these three things, music also has its own sounds; it has material. In life we have physical differences - we eat different foods and wear different clothes - and we would not be pleased if all of us dressed alike. Even a single individual dresses differently from one day to another. In the area of material, we need differentiation, and we ought not agree on the *contents* of material. People have lived, and indeed do live, in different ways, and this is one of the things that makes them interesting.

On the question of form - the life-line of an individual - there is no need to illustrate to make clear the necessity for individuality, rather than an adherence to a tradition. On the question of structure, however, it is absurd to imagine a

human being who does not have the structure of a human being. There may, of course, be cats rather than human beings - i. e. other structures. In all fields of life and art there must be some kind of structure otherwise chaos. It is in this aspect of Being that it is desirable (necessary) to have agreement.

In contemporary music, then, it is important to look at the question of structure, since this is something that must be agreed upon. There has been only one new idea since Beethoven, and it can be seen in the work of Anton Webern and Erik Satie. Generally speaking, with Beethoven the parts of a composition were defined primarily by means of harmony, while with Webern and Satie they were defined by means of time-lengths. Consider: sound is characterised by its pitch, loudness, timbre, and duration, whereas silence, the opposite, and therefore necessary, partner in sound, is characterised only by its duration. This forces the conclusion that of the full characteristics of the material of music, duration is the most fundamental, since it provides the vital connecting link between sound and silence.

The Pythagorean concept of numbers affirmed that things are numbers, or that all things are similar to numbers. This developed from the study of musical intervals. All musical theorists from Aristotle to Hucbald and Rameau have returned to this same thesis. All intellectual activity, including the arts, is involved in the world of numbers. Until now, the duration of notes was a phenomenon parallel to the phenomenon of sound. Composers used them and are still using them in the same way that the physicists of the classical school of mechanics did. In physics in the Nineteenth century, time was a parameter external to the nature of physical laws. It was uniform and continuous. Relativist mechanics has destroyed this approximative conception and has incorporated duration into the very essence of matter and energy. The succession of tempered intervals is a geometric progression. Durations are additive; i. e. they belong to an arithmetic series. Amongst all the geometric progressions, there is only one whose terms possess the additive property. It is the progression of the Modular or Golden-Section, and it has created a structural link between time and sound.

The Golden -Section is a ratio of proportion between numbers, which can be expressed in geometric areas. The golden-section is generated from a single number, $(1+\sqrt{5})/2 \approx 1.617924$, usually called phi (F). Its chief property is, that $F^2 = (F+1)$. By proceeding similarly (i. e. $F \times F \times F \times F \dots$ etc), a series can be generated in which each number except the first is the sum of the preceding two. A simpler version of this is the Fibonacci series, using whole numbers; 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144 etc., which has the

² The term *structural disposition* is not meant to suggest a simple summation of these local structures. "A form", as Guillaume states, "is something other or greater than the sum of its parts."

same additive properties as the F progression.

Are we now to witness music stemming from the brain, coldly thought out at their drawing-boards by musical technicians? NO! One must take care to avoid the fallacy that intellectual music stems purely from the intellect, and is devoid of all feeling. Technical and intellectual postulates are a unity; inspiration and feeling, soul and intellect, are not separate but are working elements in a harder than ever for the public to appreciate multi-dimensional music. With ears attuned to the sounds of late Romanticism and minds prejudiced by various *-isms*, they have to listen to music that can only be appreciated by a great deal of effort, since it sets out to eliminate superfluous notes. No longer is listening made easier by thematic repetitions and cadences or the crutches provided by a key system. Ferruccio Busoni in his book *The Essence of Music and Other Papers*, recommends

...the casting off of what is sensuous and the renunciation of subjectivity (the road to objectivity, which means the author standing back from his work, a hard way, a trial of fire and water) and the re-conquest of serenity (serenitas). Not profundity and personal feeling and metaphysics, but music which is absolute, distilled, and never under a mask of figures and ideas which are borrowed from other spheres For the public does not know and does not wish to know that in order to receive a work of art, half the work must be done by the receiver himself.

Instead of trying too hard to discover the inner self, the artist should objectively study the outside world. Because objective factors are alien to the inner self, they are better able to act as extraneous accidents and so cut across preconceived and defensive clichés. In this way, the hidden parts of the personality which have become alienated from the conscious personality will emerge. Abstract expression began as an impersonal involvement with the objective effects of paint - action painting - a wish to act rather than to contemplate some inner meaning. Constructivism, at the other extreme, can serve the same alienation. The artist submits to the seemingly alien rules of numbers and geometry. In these cases, the seeming unrelatedness of the objective mathematical or physical factors to any preconceived form, will set into motion unconscious scanning which can deal more effectively with such complex and unpredictable factors. The present trend towards objectivity and alienation is only part of a more general re-orientation of art from introspection towards reality. Our under-employed syncretistic faculties that go straight for the object without regard for its

abstract pattern could be enlisted with this general re-orientation. Intellect and spontaneity have been kept apart for too long. With Abstract art it is no longer necessary to copy external objects; the artist can freely invent new forms that can express ideas in purely aesthetic terms. Abstract art has helped us to experience the emotional power inherent in pure form.

Realising that control is necessary for freedom of expression is one way of recognising the need for structure in art. Abstraction has showed us the aesthetic appeal of pure form and that this form can be arrived at through the use made of structure. Although types of material and the general form of a work cannot be agreed upon the means of arriving at a structure can be - through time-lengths while the Modular provides a logical link between time and sound. Today the exciting thing concerning structure is the ability to break away from strict determinism into a realm of controlled *mobile* structures through the use of probability theory.