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Music and Chance

Reflection on stochastic ideas in music

It may surprise many readers to see the notions "music" and "chance" linked in the title by a simple, bold "and". Surely there is some incongruity here, they may think, not to say a downright contradiction. Music, subject in the main to strict rules of form, appears to be strictly opposed to any element of chance. Chance, on the other hand, may not, as Novalis said, be inscrutable, but the laws it obeys do not at all correspond to the application of principles of musical form. And yet there are remarkable mutual connections, as indicated, for instance, by such well-known examples from musical history as Mozart's Dice Minuets or John Cage's noise compositions, with their intentional lack of rules. Are these extreme cases, incidental phenomena marginal to musical history, or can one in fact find on closer inspection significant relationships in them relevant to the understanding of music or the arts in general?

In attempting to proceed further with this question, one would be well advised to begin by making a distinction between two essentially different points of view from which the relation of music and chance can be analysed. The first corresponds to the perspective of statistics in the broader sense; here works of music of any kind are subjected to a stochastic analysis, that is, one derived from the theory of chance. The second differs from this inasmuch as it considers the use of chance phenomena as musical material, that is, of the musical manipulation of chance. The first point of view belongs to the

aesthetics of the finsihed work of music, the second to that of the process of composition, and the two complement each other.

Let us look first at the stochastic analysis of musical works, which was founded by Wilhelm Fucks in the fifties, and is now one of the stock processes of informational aesthetics. It is based on an assumption both simple and plausible, namely that a work of music is not a continuum devoid of structure, but is made up of components that can be precisely defined. The methodical approach based on this premise is, however, rather less plausible. It involves the conscious ignoring of sensations or meanings which a listener, on hearing a musical text, connects with elements of this text. Instead, it is only the stochastic qualities of these musical elements, or, more precisely, the probability distribution of certain qualities of these elements in a composition, or a whole group of works, that are considered. A simple example is the frequency distribution of the pitches established by Fucks in the case of works by Bach, Strauss, Berg, Webern, and others. Traditional musicology would have expected no particular revelations from the study of such distributions, and there are also apparently plausible reasons for this. One can indeed state that Bach wrote notes of a certain pitch at any given point in any composition according to certain principles, and that this applies, further, to the environment of the points concerned, up to a certain point. It is, however, more than dubious whether Bach, or any other composer before 1900, ever consciously planned the distribution of the pitches as such throughout a musical work, or even considered composing on these lines. In other words, Bach treated pitch as a local phenomenon, not a global one, and the same goes for most of the other features (duration of notes, consecutive intervals, etc.) that can be considered in terms of probability distributions, and thus in a stochastic analysis. Does it not follow that this type of analysis contradicts the individual intentions, and indeed the basic approach of the composers concerned with regard to their mode of procedure in the creation of their art? At this point, however, the argument can be reversed, by noting that, if it be admitted that there are demonstrable features of musical compositions not consciously intended by the composers, a stochastic analysis of them could be appropriate for this very reason. Not, admittedly, because the features concerned are to be considered as purely accidental; it is in their *deviation* from

pure chance in their occurrence that the key to understanding them lies. This makes it clear, moreover, that traditional and stochastic methods of analysis are complementary rather than opposed to one another. And indeed, Fucks has arrived at conclusions hardly accessible to methods other than the statistical. Most of these refer to the classification of qualities of the style both of individuals and periods. Thus Fucks has been able, on the basis of his pitch distribution analyses, to demonstrate "that so simple a parameter as pitch, containing as it does so little of the essentially musical (such as melody, harmony, rhythm, dynamics), is still remarkably characteristic, not only of the type of rules of composition applied, but also of the individual composer and even the individual work".

This procedure, of course, implies un-dreamt-of potential for the practice of musicological classification and work analysis. But reservations with regard to the stochastic approach can also be dispelled on a more theoretical level. Is the information provided about a given composition by the probability distribution in question really devoid of aesthetic interest? By no means; for since it contains that which lies to a great extent outside the conscious plan of the composer, we may be confident of finding in it elements that are suprapersonal and typical in general of the art in question, in this case music. We should not, it is true, jump too hastily to conclusions about the value of this; frequency distributions and the characteristic numerical values that can be arrived at from them always relate only to one partial aspect of music. For instance, we find that in Webern's music, by contrast to that of Bach or Beethoven, the distribution of pitches and intervals resembles that found in 'random compositions', in which they have no planned structure. It would, however, be incorrect to conclude from this that Webern wrote random music; what it does show is that the characterisation of a compositional style requires other and more far-reaching criteria, such as take into account, among other things, the mutual connections between, and arrangement of, the musical elements. This can be done with the aid of what are called transition matrices. These are rectangular schemes of figures containing the frequency with which a particular element, for instance the note C, is followed immediately or later by another particular element, say the note A. Such matrices, when represented in correlograms, provide "information on the extent to which the

composer, having made a decision at a given point in his composition, is still influenced by this decision at intervals of k = 1, 2, 3 . . . the data being averaged out over all elements under consideration" (W. Fucks). To talk thus of 'influence' may be somewhat hasty; at the same time, this method makes it possible to define in quantitative terms relatively complex contextual relationships within a musical structure.

To sum up, the relationship between music and chance in the stochastic analysis of compositions may be briefly characterised thus: accidental phenomena are not smuggled in secret into music; on the other hand, the random music which they govern functions as a 'zero level of musical style', a yardstick to which the analysis of musical compositions can be related and from which it can derive its criteria. In view of this method, it is remarkable that there have been a number of composers, and are today a greater number than ever, who introduce chance elements into their music, regarding chance not merely as a point of comparison for the criticism of style, but as a starting-point or music-generating principle. It has become customary to group together such compositional procedures using the term 'aleatory' (from the Latin alea = a die). According to Pierre Boulez, "the sphere of aleatory music embraces all that not given by the notation". If that is so, how does this element get into the music at all? and what aesthetic significance does it possess?

We may broadly distinguish between two basic ways of introducing chance elements into music. The first is that of freedom to improvise; the composer leaves details of realisation and interpretation open. This practice is to be found in relatively radical form in Stockhausen's "Piano Piece XI"; to a lesser extent, it was customary in Baroque music, and still is in popular music. As early as 1500 the Cologne music scholar Nicolaus Wollick distinguished between "chance music" (sortisatio) and music completely prescribed by the composer (compositio). A systematic application of this principle is typical of the modern period. One example is provided by the "Answers (Réponses) for seven musicians" by Henri Pousseur. At the performance at Darmstadt in 1960 the musicians were allotted their places and their scores by the casting of dice, and were arranged on a huge coloured chess-board which functioned as scenery for the following spontaneous, playful happenings.

A second way of integrating chance with music – occasional-

ly in combination with the first way – consists in exploiting chance purposely and in an organised way for the composition of the note sequences. By means of a more or less arbitrary rule, chance events are encoded as music. As early as the 18th century there were experiments along these lines; the most-quoted is that of J. P. Kirnberger, whose "Ever-ready Polonaise and Minuet Composer" appeared in 1757. Similar books of musical 'prescriptions' were published by Johann Kade, chief musician at the court in Kassel, Maximilian Stadler, and Josef Haydn. The name of Mozart is connected with the "Instructions for Composing as many Walzes as Required by means of Two Dice, without any prior Knowledge of Music or Composition". If we are to believe Fred K. Prieberg, such experiments were based on the consideration "That it was reprehensible to waste human inventiveness and valuable creative energy on the composition and reproduction of music destined merely for dance and entertainment". This would demonstrate the value placed on the aleatoric method by Mozart's contemporaries.

At any rate, things are different today. The present-day exponents of aleatoric music pursue goals whose interpretation is none too easy; we may content ourselves here with hinting at the way in which some of the means they use create considerable "statistical and psychological problems of sound", as Werner Meyer-Eppler has it in one essay, of which this is the title. Among the most notable exponents of aleatory music are the Swede Bo Nilsson, the American John Cage and the Greek Yannis Xenakis. For these men, chance is not merely a source of material, but the basic principle of their music. Thus Cage is not interested in introducing chance phenomena into a definite formal framework, in integrating chance with order as in the dice-governed polonaises of Kirnberger; what Cage wants is to put on pure, unbridled acoustic chance, which, while calling it "production of notes and pauses", he declares to be music. At the same time he scorns common chance such as would be represented, for instance, by the noises-off of a building site, or a computer-produced list of random numbers, preferring, say, a ceremony with dice, coins and little rods recommended in the ancient Chinese "Book of Transformations" for the preparation of an oracle. What does seem incomprehensible, however, is that a stage performance is necessary for this kind of chance, solemn as it may be. But Cage has no reticence about thus

producing and conducting his works '–such as the "Imaginary Landscape No. 4" for 12 radios and 24 players, at the McMillin Theatre, New York. But what exactly is chance when produced on stage, framed by a ritual? This paradox arises in equally embarrassing form in view of the practices that Xenakis uses for the production of notes and pauses. Like Cage, he regards it as "an advantage to define chance as an aesthetic law, a proper philosophy". According to him, chance possesses "the beneficial power of an aesthetic regulator, including that of events in sound, their origin and their life". Xenakis, rather than having recourse to venerable books of wisdom, relies on the laws of probability theory; here he controls the frequency distributions of musical parameters by means of matrices such as are used in stochastic composition analysis. Examples of works realised in this manner are "Achoripsis" (Sound rays) or the one with the characteristic title "Pithograkta" (Action through probability). "Frequency distribution", as Xenakis has gone on record as stating in 1958 and thereafter, is carried out in this matrix according to Poisson's law of the distribution of vandom events". But why Poisson's in particular? Perhaps Xenakis banks upon his audience not enquiring why he does not use geometrical distribution, or that of Cauchy. Perhaps chance is involved in his selection, too. Xenakis wants to appeal to "a direct impact on the senses and imagination of the listener"; "... he must be gripped, and drawn willy-nilly into the circle of notes, without any special training being necessary. The sensuous shock must be as palpable as that on hearing thunder or looking into a bottomless chasm".

It is difficult to reconcile such notions with any 'normal' conception of music, however twisted. One is left wondering whether the intention to release sensuously shocking chaos on an audience derives from quackery, irony, arrogance or shrewdness. At any rate, the rituals are calculate to arouse suspicion; in the case of Cage, the quasi-theological ritual of the creator of worlds, and in that of Xenakis the pseudo-scientific ritual of the mathematically smart constructor of monstrosities. Chance thus created and presented, in the garb of a principle to boot, is more like a fetish. For the time being, therefore, the recommendation to leave aleatory music to appropriate cybernetic machines is the kindest commentary on the sphere of ideas of the philosophy of chance in music.