AVANTGARDE
Revue internationale et interdisciplinaire des arts et littératures du XXe siècle/International and Interdisciplinary Review of the Literatures and Arts of the 20th Century.

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Avantgarde paraîtra trois fois l'an. Les articles sont écrits en allemand, en anglais ou en français.
Avantgarde will be published three times a year. All contributions are written in English, French or German.

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Prix de l'abonnement/Subscription Rate
Institutions: Hfl. 100,– les trois numéros/three numbers.
Abonnés individuels/individual subscribers: Hfl. 35,– les trois numéros/three numbers (Commande directe aux Editions Rodopi obligatoire/only if your order is directly placed with the publisher)

Comp(exp. ♪)≅$f_t(\sum_i$ ('parameters'(∿))*

Leigh Landy

In the early 1950's music's *Wiederaufbau* included several developments which demonstrated a great deal of inventiveness as well as creativity. Several of these developments parallel similar activities in the 'hard' sciences. As in the sciences one became more acquainted with minutely small and extremely large wordly phenomena, composers searched to expand their own dimensions.

Take for example the element of musical pitch. In early music history, a typical musical scale contained 4 or 5 pitches; modality and tonality utilize a scale of 7 tones; in the 20th century, Arnold Schönberg's dodecaphonic music gave equality to all 12 tones within the musical octave; at the same time Alois Haba and many others even divided the smallest interval on the piano into yet smaller pieces, creating micro-tonal music of up to some 43 tones/octave. With the first experiments in the electronic music studios in the 1950's, C-D-E (do re mi) were replaced by pitch described in terms of its physical characteristic (cycles/second or hertz). C might be called 256hz; its upper neighbor no longer needs to be C-sharp, which is many hertz higher, but instead 256.1hz or even 256.01hz which are both 'playable' on many electronic instruments. In other words the pitch domain has grown from a handful of tones as basis to a universe of infinite possibilities.

Also the realms of time (rhythm, tempo), dynamics and even color (timbre) have undergone this form of expansion. And in fact there are many other musical dimensions that have been looked into, as will be shown below. Early avant-gardists were certainly aware of this potential, but lacking apparatus to make such expansion feasible, most early 20th-century composers limited themselves to dreams and manifestos. Experimentalism was thus not new in the early fifties, it simply made a quantum jump in importance.

* *The composition of experimental music is approxiomately equal to the function (in time) of a sum of as many sound parameters as you choose,* or, there is more than just one new dimension in recent experimental music.

The following text begins with the introduction of the concept of musical parameters to readers who are non-musicians. Three of the most respected experimentalists are then briefly focused upon, considering how they isolated several musical dimensions in their work in highly dissimilar ways. Finally an extensive list of parameters in new music will be presented.

The Parameter

Traditionally the word parameter, which evolved in the latter half of the 18th century and can be found in Diderot's encyclopedia, knows two main connotations, one mathematical and one derived from statistics. In general the first definition boils down to: characteristics of a variable which make it possible to describe and/or compare mathematical functions and/or systems. In statistics one speaks of 'parametric values' which characterize the properties of a probability distribution.

The term found its first application in music in the 1940's in various texts of the (music) theorist, Joseph Schillenger. He saw the arts as one continuum containing a system of unlimited parameters. Each art was said to possess two parametric components: general ones (time, space) and specific ones ('qualities'). Although the later use of musical parameters is implied but not stated here, Schillenger's thesis remains idealistic and a bit vague.

In the late 1940's and early 1950's, the information and acoustics theorist, Meyer-Eppler began his long study of potential music parameters independent of Schillenger (see Meyer-Eppler, von Blumröder). Essentially he sought, given the arrival of electronic music studios, a new form of musical description - a description which allows a sound to be broken down into its basic components according to the laws of physics. He supported his ideas citing the new objectivity in music derived from Schönberg's method and a drive to precision derived from applications of modern technology. Meyer-Eppler is seen to be one of the father figures of German electronic and serial music. His focus on musical parameters was fundamental to this theory.

Many have defined the term parameter in music. Häusler's definition will suffice for this discussion: *Musical parameters are all sound or compositional components which can be isolated and ordered (1969).*

In the Middle Ages, Machaut composed isorhythmic motets which called for a melody of lenght X to be repeated as well as a rhythmic phrase of lenght Y. The fact that X and Y were of different lengths meant that there was a certain autonomy of pitch and duration. Schönberg's 12-tone music, formulated in the early twenties, was based upon a row of pitches which was to be permuted and combined in various manners without specification of compositional method for any other sound component. Messiaen's short piano study, *Mode de valeurs et d'intensités,* dating from 1949, specified for

each pitch its own unique length, dynamic level and characteristic (accent, pedal, etc.). In this case several parameters were fused into a single new one.

Furthermore, recent physics research has helped the musician describe sound color by way of spectral graphs. This sort of research has led composers and musicologists to investigate new orderings. Berio is known for his experiments with potential sounds of various instruments in his series of *Sequenze.* Erickson has written a monograph (1975) in which timbral types are defined. Schaeffer is well known for the search for order in his *objets sonores* and *objets musicaux* which he employed in his works of *musique concrète.* The Canadian Schafer calls for the description and ordering of all sounds in his 1977 work.

Information science has influenced music significantly. Today one uses the computer to produce, manipulate and record sound. Hiller (1959) has been making computer-assisted and computer-generated music since the late fifties. His programs, which call for main parameters and parametric priorities, after being run, result in encoded musical information. Some of his works are entitled 'Algorithms', a computer term. In fact several terms from mathematics have entered into the musical language since the fifties: stochastics, groups, sets, aleatory, and many others. Barlow (1980) tries to 'formalize' his compositions as the computer studies esoteric parameters including melodic curve, metric and harmonic field-dynamic, chord density and several others.

Now that the extent of the potential of musical parameters has been briefly sketched, it will be shown that three major composers of our time have all dealt with the concept parameters in very different manners.

3 Parameters-users: Cage, Xenakis and Stockhausen

- *John Cage:* Perhaps the most radical experimentalist of the century he was also the first to discover more than one potentional application of isolating sound components. Cage is known for adding degrees of freedom to any conceivable phase of music-making. Although most of these phases will be presented in the following section of this text, one historic example should demonstrate how Cage works. In 1951 he composed his *Music of Changes* for solo piano, one of the first two pieces in which he utilized chance operations while composing. 28 charts were constructed: for sounds, durations, tempi, dynamics (including accents and the like) and 'superpositions'. Each chart contained 64 positions corresponding to the 64 possible *I Ching* hexagrams. The *I Ching* assisted in determining how many of the 64 positions a given pitch (including silence, 'sound aggregates', 'sound constellations' and indefinite [noise] sounds), dynamic, length and tempo would have. It determined the lenghts of the four movements as well.

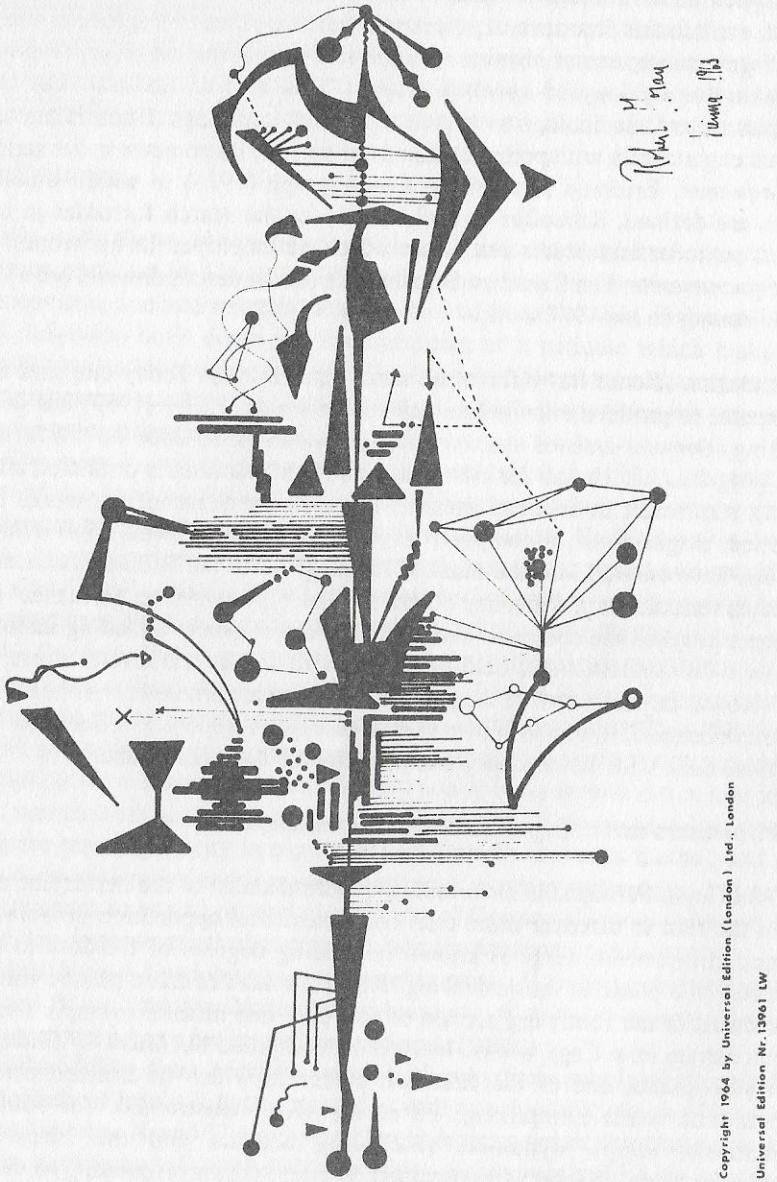

Illustration 1: Xenakis' degrees of order ranging from complete order (here for example a chordal sound held for a certain duration) to complete disorder (notes moving in random directions).

Once the graphs were made (Cage: 57-59), the *I Ching* was used to fill in the entire score, each 'sound characteristic' (Cage's term) separately. In this way Cage isolated each sound dimension in his composition to an extent that he could not possibly know what the piece was to become until he had completed it!

- *Iannis Xenakis:* As Cage works with enormous compositional as well as performance freedom, Xenakis calls for mathematical rigidity. In his wellknown book, *Formalized Music*, Xenakis attempted to create a universe of sound based on numbers (as did many Greeks, not to mention Pythagoras). He is the only composer who uses the word parameter only in the statistical sense (Xenakis: 103-105). Nevertheless, this connotation is less relevant here.

One sees that each of his pieces is dependent on a branch of mathematics, be it calculus, group or set theory, probabilities or whatever. What holds these works together is his personal technique: decisions are made inside- and outside- (musical) time. The outside-time operations form the mathematical foundation of a work. Potential 'paths' or 'chains' (orderings) are generated in terms of their own 'vector spaces' (Xenakis' term for parameter: 23) and later projected onto the musical graph also known as the score. Xenakis takes for granted that pitch, dynamics ('intensities'), tempi ('speeds') and durations ('instants') are to be treated separately. He also looks into scales of timbre, sound density (many 'grains' of 'clouds' of sound can create a high 'sound energy') as well as a scale of (dis)order (*ill. 1*). Outside-time functions can call for new parameters which essentially consist of the fusing of two or more of the above-mentioned ones. This of course does not change the definition of parameter as the new parameter is also isolated and ordered.

Karlheinz Stockhausen: Stockhausen is without question the most difficult of the three here. The simple reason for this difficulty is that this composer has done nothing else than theorize about and apply parameters in his work since the early fifties. In the four volumes of his writings one discovers very unusual proposals for musical parameters: the continuum between rational compositional approaches and intuitive ones, a parameter which couples physical movement (dance) to specific performed sounds, one formally handling the physical placement of sounds within a given space, another defining all world music as one large gamut (Stockhausen 1978: 468-476) and, above all, several scales for anything that has to do with musical form. His works entitled *Punkte, Momente* and *Gruppen* all illustrate one of his proposed time entities which in turn may be used to help generate compositions.

Stockhausen believes in a implicit cohesion of all musical outings. In this way his entire music theory formulates continua which eventually can lead to a sound being related to a work in the same manner as a work can be

related to a series of works. Therefore an element that has always been seen to be small (micro) can suddenly take a position of magnitude (macro) on a new scale (for example the isolated note, earlier the smallest entity of a composition, can also be seen as a totality comprising the complex sum of pulses). One again thinks of the sciences, for example biology, in which the nucleus was earlier seen to be one of the smallest possible entities and now is studied as a large body which is composed of many elements. In Stockhausen's case, there is no end to the potential of 'serializing' (Stockhausen's most used term for parameter) musical components. The following list is therefore a *capita selecta* of the parameters used by the above-mentioned composers.

Isolated Parameters in Recent Compositions

- *Parameters of Primary Importance:*
- **Pitch**: (see page 1).
- **Duration**: Other than medieval Gregorian Chant, in which tempo and rhythm may be freely interpreted, Western music has always had its rhythms notated in various systems, of which the best known is the current system with its quarter, half and whole notes. Rhythm can be isolated. It can also be further refined and articulated in seconds (analogous to pitch's hertz). In this case the additive rhythmic relationships of traditionally notated music remain possible, but are no longer mandatory.
- **Tempo:** The second time parameter. Webern was one of the first to add frequent tempo changes in his works, which more or less took the beat out of his music. When scores use time notation, tempo and durations are fused into one single parameter.
- **Dynamics**: Amplitude, earlier always notated in *p* and *f* (piano and forte), and ordered for the first time by Messiaen, can be measured on its own continuous scale of decibels (db). This is of particular interest in electronic and computer music.
- **Timbre**: Sound color is in effect the combination of pitch, amplitude and of course time. Those mountainous graphs *(ill. 2)*, often used to make record covers look modern, which show a fundamental tone and all of its overtones expressed in three dimensions with amplitude and time, describe timbre in minute detail. Schönberg was the first to call for timbre as a special entity. He composed *Klangfarbenmelodien* in which color and melody played an equal role. Since the early 1950's timbre has perhaps been the sound parameter receiving the most attention by composers. Through the endless new color possibilities of our electronic instruments and the drive to attain new timbres in compositions (e.g. in the works of Berio and Ligeti), this parameter has reached maturity. Stockhausen again is not satisfied with only

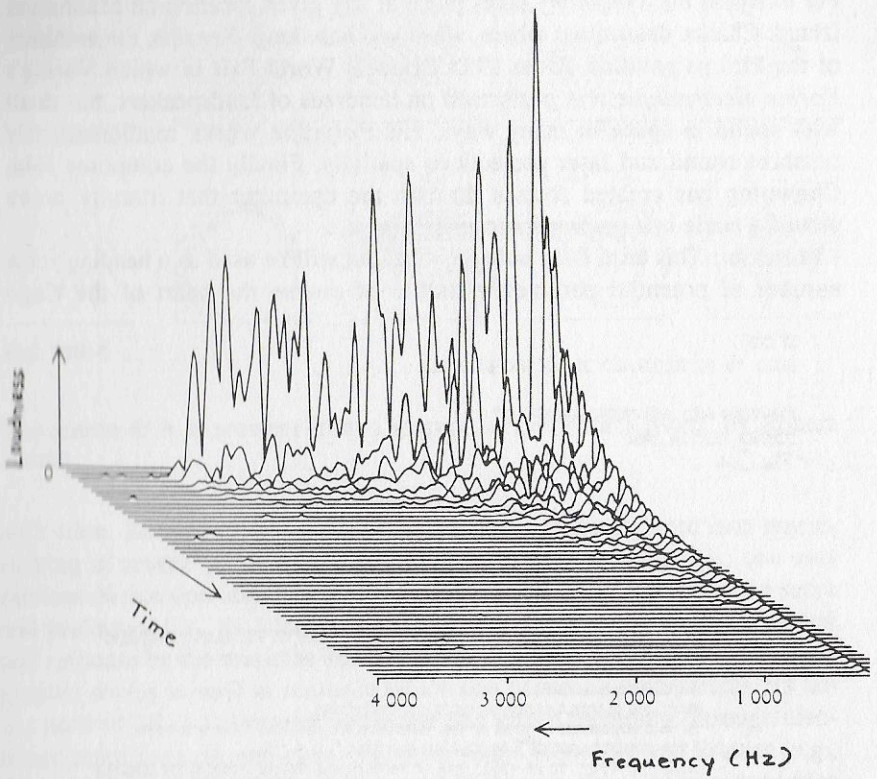

Illustration 2: A three-dimensional graph of a percussive sound.

one timbral parameter; in his article, ...*wie die Zeit vergeht* (Stockhausen 1963: 99-139), half a dozen new parameters are proposed which he applied in his composition *Gruppen* among others.
- **Space**: This is the first of two new parameters which have caught on to such a great extent that they can be seen to be of relatively great importance. Spatial music is by no means new. The San Marco in Venice was built with responsorial music in mind. In the early 20th century Ives dreamt of Music to be played on various mountain tops and he, alas, never completed his *Universe Symphony*. Nevertheless, the isolation and organization of sound in space, had to wait until the last couple of decades for its liberation. Stockhausen has constantly been interested in this parameter. His article, *Musik im Raum* (Stockhausen 1963: 152-175) is one of the most important treatments of the subject. Cage has dealt with sound-spaces for a long time.

For example his *Symphony* takes place at any given location on Manhattan Island. Chance determines where, when and how long. Xenakis, the architect of the Philips pavilion at the 1958 Brussels World Fair in which Varèse's *Poème électronique* was performed on hundreds of loudspeakers, has dealt with sound in space in many ways. His *Polytope* works mathematically combine sound and laser projections spatially. Finally the composer John Chowning has created sounds through the computer that literally move around a circle in a quadrophonic environment.

- **Freedom:** This term is an unhappy one, but will be used as a heading for a number of potential parameters and is of course the heart of the Cage

0'00"
SOLO TO BE PERFORMED IN ANY WAY BY ANYONE

FOR YOKO ONO AND TOSHI ICHIYANAGI
TOKYO, OCT. 24, 1962
Pure Cage

IN A SITUATION PROVIDED WITH MAXIMUM AMPLIFICATION (NO FEEDBACK), PERFORM A DISCIPLINED ACTION.

WITH ANY INTERRUPTIONS.
FULFILLING IN WHOLE OR PART AN OBLIGATION TO OTHERS.
NO TWO PERFORMANCES TO BE OF THE SAME ACTION, NOR MAY THAT ACTION BE THE PERFORMANCE OF A 'MUSICAL' COMPOSITION.
NO ATTENTION TO BE GIVEN THE SITUATION (ELECTRONIC, MUSICAL, THEATRICAL)
10-23-62

THE FIRST PERFORMANCE WAS THE WRITING OF THIS MANUSCRIPT (FIRST MANIFESTATION ONLY).

THIS IS 4'33" (NO.2) AND ALSO 2T.3 OF A WORK OF WHICH ATLAS ECLIPTICALIS IS 2T.4

Illustration 3: A prose score.

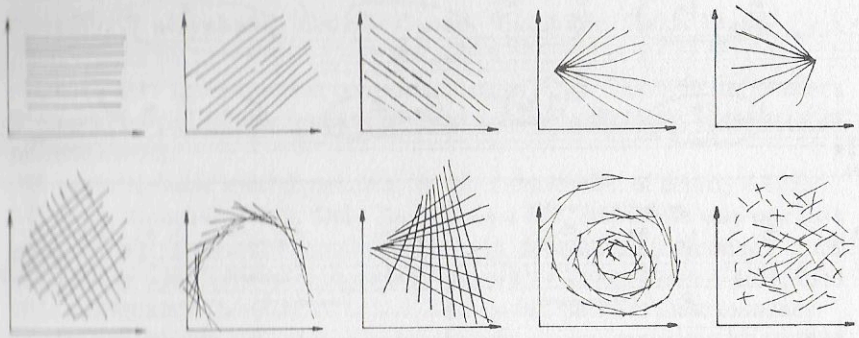

Fig. VIII-4

Illustration 4: A movement from a graphic score, 'Four Visions' by Robert Moran.

collection. Benitez (1978) writes that freedom can be injected into music-making in several phases: - between composer and the score (i.e., one uses random-choice operations during the composition process), - between score and performer (i.e., the score is notated in such a way that it demands choice and response by the musician during a performance: improvisation, prose and graphic scores as well as scores in which one or more sound parameters are not notated: *ill. 3-5*) between performer and sound recording (through electronic modification), and even - between sound recording and listener (e.g., the recording of *HPSCHD* of Cage and Hiller supplies a unique dynamics chart for each listener to mix a personal stereo version during the duration of the work). Stockhausen also adds his own continua: some refer to notation, the others to form (see below). Xenakis is obviously not at all interested in these parameters.

- *Parameters of Secondary Importance:*

- **Density:** Cage lets the *I Ching* determine the number of notes per unit time. Xenakis never works without considering the parameter of sound density. Stockhausen discusses this parameter as well (Stockhausen 1978: 360-401). Certainly music has always known great changes of note density in time. These composers formalized this element.

- **Simultaneity:** Also known as harmony, this parameter considers which pitches (or noises) are to be played at the same time and is thus a combination of pitch and density. The fact that chords may be ordered and given values is of relevance here. Variations on this theme can be found by Mauricio Kagel ('cluster widths' for very dense simultaneities), Henri

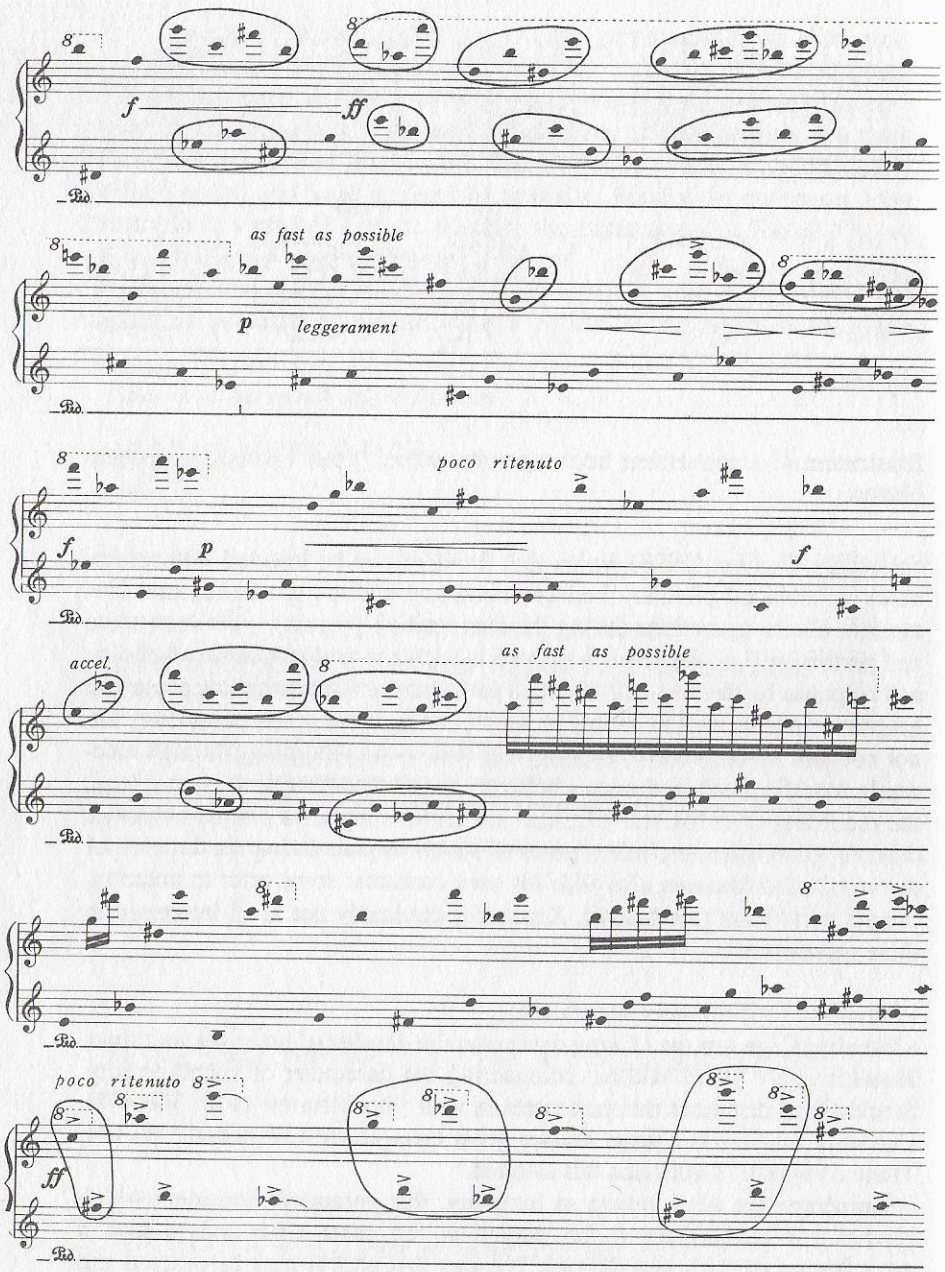

Illustration 5: An example of a score in which one parameter (in this case the durations of the piano notes) is left open to the interpreter: 'Tone' for piano by Shuko Mizuno.

Pousseur ('polyphonic densities' and 'harmonic fields') and Cage ('superpositions').

- **(Dis)Order:** This parameter considers changes (Cage's term) in the listener's perception from totally recognizable to totally anarchistic sequences of musical events.
- **Energy:** Xenakis' special parameter for the combination of density + order.
- **Compositional Bearing:** Only Stockhausen has ordered the way one may compose a given work, beginning with fully rationalized (objective) works and ending with fully intuitive works (automatic composition?, composed after meditation). There are, of course, other points between these extremes.
- **Form:** Xenakis' outside-time phase and Cage's forms determined by random outcomes are analogous to a school of innovations formulated by Stockhausen, many of which go far beyond the scope of this article (e.g. see Stockhausen 1963: 222-258 and 1964: 130-134). A few examples: a scale ranging from determined form (precise notation) through combined form to open form (in which the player determines the order of score fragments during performance), a scale which deals with various techniques of musical collage and a number of other scales based on morphological relationships.
- **'Formel':** A super-term dating from the late 1970's unique to Stockhausen. In this case the first five parameters are molded into a new one which contains the potential of generating short phrases as well as an opera, *Licht* which, when completed, will last an entire week.

One can thus speak of the theoretical and practical liberation of the isolated sound (and its elements) as well as of the largest form. With his article 'Kriterien' (Stockhausen 1971: 222-229), the integration of anything 'micro' with anything 'macro' has become reality.

- A few Closing Words

In a 1984 article I definied experimental music as follows:

... music in which the innovative component of any aspect of a given piece takes priority above the more general technical craftsmanship expected of any art work.

The isolation of a single musical parameter means that in any event one measurable scale within a given composition is to be experimented with. Given the breadth and quantity of the (believe it or not incomplete) list of parameters above, one can conclude that this form of treating sound and morphological aspects one at a time is playing an enormous role in recent music-making. Avant-gardists* of the first half of the century dealt with the

* The term *avant-gardism* has pretty much been dropped in terms of recent music. There is little support for the idea of being 'before one's time' these days. Instead *experimentalism* has been adopted for seemingly equivalent searches for new musical frontiers. This is of course not only true in music.

germ cells which led to these later discoveries. Since the 1950's 'parametrics' have been formally added to existing compositional techniques.

Nevertheless, it would be incorrect to conclude that the isolation of parameters is an all-encompassing development in new music. One could equally write an article on 'Process in Musical Composition', call to the same three experimentalists for illustration and add important movements, such as minimalism, fluxus and concept music and performance. Some remarks would have nothing to do with musical dimensions in this case.

A final question: this form of almost scientific refinement and isolation which has penetrated new music; might it have its equivalents in the sister arts: dance, plastic arts, theatre and other visual media and even in literature? I for one can think of several examples of attempts, but leave the discussion of their success or failure to specialists in the sister fields.

Bibliography

Barlow, Clarence,
1980 *Busreise nach Parametron..., Neuland Jarhbuch* 1:114-118.

Benitez, Joaquim M.
1978 *Avant-garde or experimental? Classifying contemporary music, International Review of Aesthetics and Sociology in Music* IX/1:53-77.

Blumröder, Christoph von
1982 *Parameter,* in Hans Heinrich Eggebrecht, ed. *Handwörterbuch der Musikalischen Terminologie.* Wiesbaden: Franz Steiner (first printing-1972): 8pp.

Cage, John
1961 *Silence.* Middletown, CT: Wesleyan University Press.

Coenen, Alcedo
1986 *Het Seriële Paradigma,* unpublished thesis. University of Amsterdam.

Erickson, Robert
1975 *Sound Structure in Music.* Berkeley: University of California Press.

Häusler, Josef
1969 *Musik im 20. Jahrhundert.* Bremen: Schünemann.

Hiller, Lejaren, jr. and Leonard M. Isaacson
1959 *Experimental Music. Composition with an Electronic Computer.* NY:McGraw-Hill.

Landy, Leigh
1984 *Das Studium der experimentellen Musik an der Universität Amsterdam: Befreiung oder Isolierung der neuen Musik?, Musik und Bildung* 10/Oktober, 1984: 693-694, 703 (English expanded version unpublished, 10pp.)

Meyer-Eppler, Werner
1953 *Elektronische Kompositionstechnik, Melos* 20 1/1953:5-9.

Schaeffer, Pierre
1957 *De la musique concrète à la musique même, Revue musicale* Nos. 303-305.
1966 *Traité des objets musicaux.* Paris: Eds. du Seuil.

Schafer, R. Murray
1977 *The Tuning of the World.* NY: Knopf.

Schillenger, Joseph
1941 *The Schillenger System of Musical Composition.* (2 vols.) NY: Carl Fisher (1978 repr. NY: Da Capo). (+ see also von Blumröder).

Stockhausen, Karlheinz
1963 *Texte 1 zur elektronischen und instrumentalen Musik (1952-1962).* Cologne: DuMont.
1964 *Texte 2 zu eigenen Werken-zur Kunst Anderer-Aktuelles (1952-1962).* Cologne: DuMont.
1971 *Texte 3 zur Musik (1963-1971).* Cologne: DuMont.
1978 *Texte 4 zur Musik (1970-1977).* Cologne: DuMont.

Xenakis, Iannis
1971 *Formalized Music.* Bloomington: University of Indiana Press.