

Structures & Spectra

A Critic on
Spectral and Minimalist
Music Composition Methods
from a *Structuralist*
Point of View

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Abstract

More or less recent trends in musical composition seem to turn into obsolescence one long lasting quest of all great composers of all times: the need for structural integrity in a musical composition.

From Bach to Boulez, the structural integrity in a piece of music was always considered to be the first requirement for a consistent and interesting musical composition.

Following the *Darmstadt* school and their integral serialism methods and polemical style, some kinds of “anti-intellectual” currents in music started to emerge.

Probably due to the use (and abuse?) of numbers methods in advanced-integral serialism where all elements and parameters were forced to be expressed by numbers and fractions, many have found more relaxing to work on “inspiration alone”...

Besides this, all kind of extra-musical parameters were sought after to be used in music composition. Those were ranging from more or less higher mathematics (probabilities, stochastic procedures etc.) to the recent scientific discoveries like the fractals and genetical algorithms up to more obscure numerology or even occultism.

One common aspect of those currents in music is their lack of a solid knowledge base. They were all in one of two extremes: placing the value of the so called “free-inspiration” above any organizational procedures or denying any of the composers freewill by creating a “system” and transcribing the musical score from it.

Another common aspect is that the “intellectual” background, esteemed of being of outmost importance in the act of musical composition not only by the *Darmstadt* school but also by most composers of the past, was relegated to a “meprisable” level, instead so called “simplicity” and so called “free inspiration” was considered to be more important.

Among these, “minimalism” and “spectral composition” seem to be in favor and “sound *hip*” those days.

This paper attempts to show those methods and concepts’ inconsistencies and tries to set the value of structural integrity in musical composition.

Structural integrity, even though most composers and musicologists agree on its value as a *sine qua-non* requirement for, if not “good” at least a “decent” musical composition can not be created by the use of common minimalist or spectral composition methods.

Recent advances in Digital Signal Processing (DSP) and recording technology in general made “fashionable” looking at alternative methods for analyzing music. Among them spectral analysis and some other technologies based on the recorded sound seemed to be new and valid analytical tools, besides if not instead of the musical score, for investigating into a musical compositions’ inner workings (structures).

Those methods and tools are inadequate and erroneous in any attempt to reveal any musical structure. This is not due to the current state of technology but, more radically, to a very important and radical difference between a score and the sound of it; the “written” music and the “sounding” music.

Darmstadt School

The “Darmstadt School” designates a group of composers attending the “Darmstadt International Summer Courses for New Music” from the early 1950’s to early 60’s.

The denomination, coined by Luigi Nono¹ has become synonymous with uncompromising serial techniques and (almost) a “harsh” modernist attitude by composers like Pierre Boulez, Bruno Maderna, Karlheinz Stockhausen², Franco Evangelisti, Luciano Berio, and Henri Pousseur.

By 1961, the “weakened” Darmstadt School dissolves due to musical differences.

The “school” attempted to create a new musical discourse based mostly on the works of Anton Webern, but also Edgar Varèse. And considered Olivier Messiaen’s “Mode de valeurs et d’intensités” (from the *Quatre Etudes de Rythme*) as their “flagship” composition.

The “school”’s publications and ideas were soon criticized by many composers with Hans Werner Henze (whose music was regularly performed at Darmstadt in the 1950s) among them for the “totalitarian” language. Effectively, young composers were almost forced to compose in total dodecaphony or they were ignored or ridiculed.

Pierre Boulez wrote³:

In our days, a composer who’s not composing with serial methods
is useless

Henze recalls student composers rewriting their works on the train to Darmstadt in order to comply with Boulez’s expectations (Henze 1982, 155). One of the leading figures of the Darmstadt School itself, Franco Evangelisti, was also outspoken in his criticism of the dogmatic orthodoxy of certain zealot disciples, labelling them the “Dodecaphonic police” (Fox 2006). Another member of the school, Konrad Boehmer, states

There never was, or has been anything like a “serial doctrine”,
an iron law to which all who seek to enter that small chosen
band of conspirators must of necessity submit. Nor am I, for
one, familiar with one Ferienwoche schedule, let alone concert
programme, which features seriality as the dominant doctrine of
the early fifties. Besides, one might ask, what species of seriality
is supposed to have reached such pre-eminence? It did, after all,

¹in his 1958 lecture “Die Entwicklung der Reihentechnik” (Nono 1975, 30; Fox 1999)

²the three composers Nono specifically names in his lecture, along with himself

³Pierre Boulez, *Par Volonté et par Hasard*,

vary from composer to composer and anyone with ears to hear with should still be able to deduce this from the compositions of that era. (Boehmer 1987, 45)

The denomination “Darmstadt School” was even used by commentators like Dr. Kurt Honolka (a 1962 article is quoted in Boehmer 1987, 43) to describe any music written in an uncompromising style.

However one should bear in mind that composers such as Boulez, Stockhausen, and Nono were composing their music soon after World War II. The dominant German music, like Richard Strauss or Richard Wagner has been extensively politicized by the Third Reich.

In an attempt to avoid this again, and to keep art for art’s sake, the “Darmstadt School” attempted to create a new, para-national style of music to which no false meaning could possibly be attached.

Critique of Total Serialism

On comparing the writings of Boulez spanning to some 50 years, for example *Penser La Musique Aujourd’hui*¹ and *Leçons de Musique*² we witness an interesting shift in the polemic. The inadequacies of the total serialist methods, specially when applied to dynamics and partly for durations (rhythms) as well were sharply mentioned by the author.

In *Leçons de Musique*³ he wrote:

We have been applying almost blindly series to dynamics, articulations and instrumentation without taking into account the specifics of each instrument and the we faced many problems by having parts covered by other parts or by having impossible rhythms. . .

Creating series “in the abstract” for parameters like dynamics, articulation and instrumentation lead to many dead-ends. Some articulations were not possible in some dynamics, *tempi* and ranges, assigned dynamics were conflicting between instruments and instrument groups so that in the performance parts were covered by each other.

Iannis Xenakis⁴ and György Ligeti⁵ soon discovered that an “hyper-organization” of the sound-space when the density of events increased above some discernable-

¹Mediations, Éditions Gonthier, ©1963

²edition?

³kitab...

⁴*Musique Formelles*

⁵His analysis of *Structures* Book 1 by P. Boulez, published ...

perceptive level resulted in a “chaotic” sounding environment and first Xenakis sought after methods for organizing that “chaotic” environment without the trouble of getting through series.

Thus were developed the “nuages” of Xenakis and the (to some extent) the “micropolyphony” by Ligeti.

Boulez, himself soon recognized the fact too. But he never gave up the sharp structural way of thinking of music. His roots were too deep into the French Cartesian philosophy and his life-long references to Baudelaire make him remain in the structuralist field.

I can also add to this, Boulez’s high degree of “metier” and “savoir-faire”(know-how) on the art and craft of composing, probably never equaled by any living (or recently dead) composer of today, comparable only to Anton Webern in some sense, and his unrivaled precision of musical “écriture” skills is an important factor in his keeping his position against tendencies he considers, I believe rightly, “intellectual laziness”

In his book, cited above, *Penser La Musique Aujourd’hui*, 1963 depicting the various “methods” based on numbers which flourished after the *Darmstadt School*’s last years and its dispersion, he wrote¹

[...] The “dilletantism” was justified under a new pretext, by a sort of pact renewed with mental laziness and intellectual inconsistency.

One was updating the most degenerated myths of a cheap romanticism: by re-establishing the supremacy of the “fantasy”, of the “inspiration” one was letting oneself slide into and being absorbed by the “event” by the “revelation”

This statement, formulated in 1963 stands very true today! To better understand this position we must first define its principal target: minimalism in music.

Minimalism

An euphemism for “minimal intelligence created music”?

The word “minimalism” first used in music in 1968 by Michael Nyman in a review of Cornelius Cardew’s piece *The Great Digest* was later expanded by Nyman himself in his book *Experimental Music: Cage and Beyond* (1974).

¹*Penser La Musique Aujourd’hui*, 1963 page: 24, translated from the French original by M. Okonşar.

Tom Johnson, one of the few composers to self-identify as minimalist, also claims to have been first to use the word as new music critic for “The Village Voice.” He describes “minimalism”¹:

The idea of minimalism is much larger than most people realize. It includes, by definition, any music that works with limited or minimal materials: pieces that use only a few notes, pieces that use only a few words of text, or pieces written for very limited instruments, such as antique cymbals, bicycle wheels, or whiskey glasses. It includes pieces that sustain one basic electronic rumble for a long time. It includes pieces made exclusively from recordings of rivers and streams. It includes pieces that move in endless circles. It includes pieces that set up an unmoving wall of saxophone sound. It includes pieces that take a very long time to move gradually from one kind of music to another kind. It includes pieces that permit all possible pitches, as long as they fall between C and D. It includes pieces that slow the tempo down to two or three notes per minute.

The most prominent minimalist composers are John Adams, Louis Andriessen, Philip Glass, Michael Nyman, Steve Reich, Terry Riley, and La Monte Young.

Deliberate “poverty” of the material and again deliberate “poverty” of its treatment stand as an absolute refusal of all canons of the Western world’s “art-music” concepts. In this sense minimalism can be looked at as a truly revolutionary way of music composing, at least much more revolutionary than the music and theories by Arnold Schoenberg or Anton Webern.

Some examples of minimalistic music is enough to prove that point.

The first identifiably minimalist work is probably the 1958 String Trio by La Monte Young. The piece is written using twelve-tone technique, but the notes are extended to tremendous length of time; the first note is sustained (at the notated tempo) for four minutes and 33 seconds. Subsequent to the String Trio, he began making other musical works based on long drones and harmonics played above them, culminating in his improvisation group The Theater of Eternal Music.

In 1960, Terry Riley wrote a string quartet in “pure”, C major. In 1963 Riley made two electronic works using tape delay, *Mescaline Mix* and *The Gift*, which injected into minimalism the idea of repetition. Next, Riley’s piece

¹Johnson, Tom. 1989. *The Voice of New Music: New York City 1972-1982 A Collection of Articles Originally Published by the Village Voice*. Eindhoven, Netherlands: Het Apollohuis. ISBN 90-71638-09-X.

In C (1964) made persuasively engaging textures from repeated phrases in performance. The work is scored for any group of instruments. The idea of repeating patterns was probably deemed very effective and very easy to set into work. In 1965 and 1966 Steve Reich produced three works *It's Gonna Rain* and *Come Out* for tape, and *Piano Phase* for live performers that introduced the idea of phase-shifting. This is two nearly identical phrases or sound samples at slightly differing lengths or speeds repeating and going slowly of phase with each other. Starting in 1968 with *1 + 1*, Philip Glass wrote a series of works that incorporated additive process: forms based on sequences such as 1, 1 2, 1 2 3, 1 2 3 4... into the repertoire of minimalist techniques; these works included *Two Pages*, *Music in Fifths*, *Music in Contrary Motion*, and others.

As it can be seen from those (illustrious) examples we have perfect samples of what Boulez was calling “addiction to numbers”, “mental laziness” and “intellectual inconsistency”.

Spectral Music

When the composer “refuses” to compose and let the compositional decisions to be made by the analysis of sound spectra we get Spectral music.

By having computer spectrum analysis widely available this very fashionable style emerged with all the shine of a “newly discovered music composition technique”.

Again numbers rushed in to rescue the helpless composer which had to map them into musical components such are pitches, durations and other.

Numbers provided by Fast Fourier Transform¹ provided the so-called “new” and, to some extent “scientific” base our “labeling-obsessed” society was looking for.

As a side note, I may add that this obsession with labels was nicely called “the attitude of a grocery shop keeper for filling display shelves” by Boulez again in his *Penser La Musique Aujourd'hui*, 1963.

This particular style of composition originated in France in the early 1970s and the techniques were primarily developed, and later refined, at Institut de Recherche et Coordination Acoustique/Musique, Paris, by composers such as Gerard Grisey and Tristan Murail.

One must however acknowledge Murail who has described Spectral music as an attitude towards composition rather than a set of techniques, an “aesthetic” rather than a “style”.

¹FFT analysis

Paraphrasing Molière, “everyone who is talking is making *prose*, one can say every composer making sounds is actually making “spectral music”. In that sense composers as varied as Messiaen, Varèse, Jolivet, Scelsi have been considered by some making “spectral music”.

One key-word Spectral composers were referring to is “structural timbre” or timbre as a structural element. Before dissecting on this we must first look on what is a “structure”.

What is a Structure?

Jean Piaget, from the Faculté des Sciences de Genève, in his book *Le Structuralisme*¹ starts by first defining what is a structure.

A structure is a system of transformations, who has laws in itself as a system (as being different from the properties of its constituent elements), who remains itself or grows by those laws without metamorphosing itself to something else².

Following this principle, Piaget enumerates three essential properties of a structure: totality (self-containment); transformations and self-regulation.

Another very important deduction from the above statement is that a structure can be and must be “formalizable”. By this he means a structure can be described as a set of formal rules.

Totality

A structure is a self-contained entity. That is it is enclosed on itself and does not require other attributes, foreign to its nature for being grasped.

It is most important to understand that the structure has rules which characterize the system as it is, and this is independently from the constituting elements or their own “rules”.

Those rules are different from the usually found *associative* rules or any cumulation of them. They thus give the ensemble (structure) properties which are distinct from its elements.

For example integer numbers constitute a structure, a group which is distinct and does not have the properties of each of its constituent elements may have. They are not “discovered” one by one and then put in a “group”. The set of integer numbers is a structure which exists only as such and does not have the properties like odd or even, prime or not-prime that each of its members may have.

¹Collection “Que Sais-je?”, Presses Universitaires de France, 1974

²op.cit. pages: 6-7. Translated by M.O.

This implies formal rules on which the structure is based and those rules actually and precisely defines if and how the constituting elements are part of or do not belong to it.

Transformations

All strictly non-empirical philosophical theories are included in the Structuralism. This goes from Platon to Husserl and specially refers to Kant.

One fundamental aspect of structures which sets them apart from the concept of “group” or “set” is their ability to transform while keeping their “structural integrity”.

Piaget goes even further and defines a “structuring act” as “creating a system of transformations”.

In the above example of integer numbers a transformation like a simple addition of two such numbers does not change the structure of integers because the result remains an integer. However division may create another kind of number (a real number) which is foreign to the structure of integers. This simple example denote the extend to which structure can carry transformational operations.

Auto-regulation

This fundamental concept is the result of the example given above. One shall say “the set of integers are auto-regulating under the operations of addition, multiplication and subtraction but not under division”.

Another important concept emerges here: it is that of a sub-and-super structure.

While the structure of integers numbers are not self-regulating under division they can be seen as part (sub-structure) of the super-structure of real numbers where they “transform” to when divided under certain circumstances.

This “annexing” of a sub-structure into a “super-structure” is not an assimilation because the sub-structure retains its properties. To quote Piaget: “it is more like a con-Federation rather than a straight annexing”

Musical Structures

This concepts translate and enlighten points of view and compositional techniques when applied to music.

First the concept of “totality” or “self-countenance” is interesting from a musical view. Lets take a musical structure, which may be thought of like a “theme”.

In the tonal domain this can not be considered as a *structure* because the relationship of its constituting elements (i.e. notes) is *associative* inside a tonal, that is pre-established, set of relations, it is better called as it has always been: a “theme”. On the contrary, in a dodecaphonic environment the structure is created based on formalized rules which are not associative, that is the series or whatever organizational principle the composer has set. This clearly establishes the structural way of creating music as it is done specially in the serialistic way of composing.

As to the second principle: transformations here the tonal grammar has a very similar looking procedure which is transposition. However under close examination is the tonal transposition a transformation in a structural sense?

Tonal transposition is actually not a transformation but rather a “transposition” in the mathematical sense of the word. Adding a constant to a set of integer numbers actually do not “transform” them in a structural sense. Post tonal and specially serial composition techniques are a true *transformation* in a structural sense. The basic serial manipulations like inversion, retrograde are more like it. May be the closest things to this are the contrapuntal and canonic operations as they were used in pre-Baroque and Baroque eras and this may explain why the Second Vienna school composers have those procedures in such favor.

In the domain of transformation, one even more important aspect of the musical structure is that the *structure* if it is really a structure carries “in itself” its transformational possibilities.

Specially the way serial composers handle horizontal and vertical aspects of their music is revealing on this respect. A typical series can be stated horizontally and vertically and in any combination of these. This point is of outmost importance when considering the structural aspects of serial music as compared to tonal grammar. In a tonal but also any modal or poly-tonal/modal music the “motives” are “groups” (sets) made of elements of associative relationships and cannot be used as structures in horizontal and/or vertical ways.

The last characteristic of “self-regulation” can be partly seen in the tonal grammar. When parts are made of “motives” when they integrate into larger parts one have something close to the sub and super-structure concept. However there is still no structures but “motives-ensembles of associated elements”.

Probably the most advanced of such an integration in the tonal domain is the *Sonata* op.1 in B minor by Alban Berg. There every element in every

part during the whole work is “almost” structurally connected. After this the tonal grammar was unable to “hold” such density.

Minimalism and Structures

From the examples and definitions above it is clear that Minimalism can not be seen as a structural way of making music.

This can be detailed in several statements:

- The “structures” of minimalistic music are too simple to be considered as structures. They can not have the “totality” requirement for a structure to be satisfied. By the same way they can not have formalized rules describing and differentiating them.
- The “transformational” quality is not sought after by the composers. Even more the whole minimalist approach is against the transformational property of the musical structure. This simplistic and static nature, deliberately created by the minimalist composers is actually an impoverishment of the musical expression and language.
- The natural result of the above statements is that there is no “self-regulation” in a minimalist “structure” if there can be a thing like a minimalist structure.

One other point may need clarification. The so called “complex” or “super-structures” resulting from the compositional devices commonly used by minimalist composers such as phase-shifting of repeated more or less identical sequences and so on, also fail to be structures in any real sense of the word. This for two reasons, first their constituent structures are not proper structures but elements with too weak organizational principles to “hold them together”, second the resultant stacking of them is not obeying formalized laws in its organization.

Spectralism and Structures

Spectral music faces somewhat different structural problems. For the spectral composers’ attempt to justify their approach and compositional techniques with numbers extracted from FFT analysis is more than questionable. No music need “justification” by a set of numbers or any other data nor formula foreign to music.

The spectrum of a sound is not a structural entity, it is the sound itself. The properties of a sound can not be considered its structural elements. It may be argued to this that in Spectral music we consider one (complex) sound as others consider a “theme” or “motif” and we do work on that and generate developments, variations etc.

This argument does not hold for several reasons. In order to develop on something this brut musical material has to have characteristics as a structure. That means, in music, properties which are quantifiable on some given scale. Pitch and rhythm are those properties. They are quantifiable, can be precisely measured and they are expressed in such ways that one can define structures with them, those structures may have formalized rules of organization and then we can derive other structures from them and also integrate them in larger structures or break them into smaller ones.

Timbre is not such a component of a musical composition. It is not quantifiable as such, independently from other components. Naturally a spectrum analysis can give some “objective” information about a timbre and its constituent partials. But there are serious problems with this. First the spectrum analysis is highly dependent on dynamics, range and articulation as well as on the surrounding acoustics. Second, this data is not scalable.

Any attempt to create a coherent structure by those methods are simply a way to hide behind some numbers and give one’s music an aura of novelty and “objectivity” which are not needed in any way and can not be used for an excuse for a poorly organized composition.

Analysis Tools

Spectral composers often refer to newly developed tools. Spectrum analysis is one such tool.

A deeper investigation in the DSP technologies will reveal that those tools are only rough and blind ones. First the spectrum analysis, as it is stated above, is very dependant on dynamic, range and surrounding acoustics. Two recordings of the strings sections of the same orchestra playing the same piece in the same way in different acoustics will reveal different spectræ, two similar strikes on two different *tam-tams* will give quite different results and under some circumstances and with little trickery from the orchestra and the conductor a section of a Mozart Symphony and an extract from a Xenakis’s orchestral work may look very similar in spectral analysis!

Even simple monodic pitch recognition in computer DSP software is and will remain very elementary. This is due to the impossibility of discriminating “hearing” in a computer. Imagining the digital technology can or will one day

be able to distinguish things in a musical performance is naïve science-fiction.

Without discrimination the data output by the computer can not be of use for a composer.

The “Written” and the “Sounding” Music

The written music actually differs from the sounding music, in the way it brings us information about the work, in a radical way.

Written music is not simply a set of instructions from the composer to the performer. If it was so, then the functionality of a score would end with the first recorded “perfect” performance. Is there a “perfect” performance? For most of the classical repertoire, yes. In the absurd assumption of the end of the functionality of a musical score following a “perfect” rendition of it, following performers and researchers (analysts) should have to refer to that “perfect” rendition instead of the score.

Of course this is not the case. Even though today a certain lack of creativity in musical performance is certainly due to the increasing use of recordings as musical references instead of the score this is not the point here.

The written music is “the” music as the composer thought of it, while its rendition is “a” rendition of it, by some musician (which can be the composer himself).

Basing a compositional theory on the music “as it sounds” is therefore a big mistake.

Conclusion

A structural approach to the act of composing music is a very important requirement for if not “good” at least a “working” composition.

During the last years and following the demise of the *Darmstadt School* several compositional trends appeared with one common aspect: the refusal of the serial techniques.

Paradoxically, while they were accusing the *Darmstadt School* to be too much “mathematically” oriented, those groups, minimalists and later on the Spectral composers actually made more effort to base their workings on numbers.

Refusing a structural approach the resulting music, even coming from very talented composers, never attained a highly conceptualized level and led to dead-ends. Dead-ends in the sense that this offer very little to analyze

and therefore fails to create a long lasting “spark” so as to fertilize other works and other composers.

The capital importance of the written score as a working tool for study, analyze and performance, as opposed to the “sounding” music has been questioned for some time or may be it is still. This was possibly due to childish wondering in front of “new” technological tools. It is hoped that this bewildering has faded and the inadequacy for musical composition or analysis of tools like spectral analyzers has been understood.

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