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Aesthetics of Total Serialism
Contemporary Research from Music to Architecture

Contents

Common Principles - Divided Arts?

What is serialism? And what does serialism actually have to
do with architecture? A lot. Far more than can be said in a
small book.

First of all, serialism is a philosophy of life (*Weltanschauung*),
a way of relating the human mind to the world and creating a
completeness when dealing with a subject. If we want to cre-
ate something worth being created, we have to face the chal-
lenge of our raw material and the individual qualities of the
techniques we want to use. And if we strive for artistic cre-
ativity we must take on the responsibility of not being boring
but creating something perfect.

It is no accident that a consistent theory of serial thinking
emerged first in the field of music since music is among the
oldest disciplines and, because of its abstract material, has
the most refined system of theoretical organization of all the
arts.

Since Ancient Greece all arts have shared one common
principle: numbers. Though the raw materials were different,
the laws of harmonic proportions were generally accepted
as a basic and unifying bond. Counting, measuring and
numbering were the criteria used to judge all the arts.

This situation changed profoundly with the re-evaluation of
human senses.

Around 1750, Alexander Baumgarten first used the term
Aesthetica as the title of his most influential work, derived
from the Greek word *aisthenomei* which means to perceive
sensually, thus becoming the forerunner of the philosophical
discipline of aesthetics. For the first time, he posed equal
rights and dignity between empirical-sensual knowledge, at
the time considered inferior, and ratio-logical knowledge,
leading consequently to a hierarchy in the arts (now signifi-
cantly termed fine arts).

Sensual pleasure – a less and less important feature begin-
ning with Greek and medieval music theory, though Aristotle

and his student Aristoxenos did accent this aspect more than the influential mathematical theory of Pythagoras – now led to a ranking of arts and gave rise to a more or less openly hedonistic consideration of artistic effects.

Hegel and Schopenhauer's philosophies of art constructed a complex hierarchy of the fine arts and excluded or devalued disciplines like landscape gardening or ballet.

Deciding factors in this context were the different capacities of each discipline to convey a so-called spirit through a specific sensual reception. Music was considered at the top, but architecture – for long time an art on an equal plane – lost importance and was lowered (most architects since then have seemed to try and justify this judgment by claiming no interest in creating "sensual pleasure").

Functionalism became a bad word in art theory. Arts had to be "pure" and "absolute" to be artistic in the aesthetic sense of the word.

This concentration on sensual effects dominated the history of the arts during the 19th century and led to a dead end. The arts were separated in consideration of their capability to please and stimulate.

The worst is that artists have now become specialists and lost contact with related disciplines, as well as the sciences, to the extent that it has become impossible to re-establish their common features. Institutional organization reflects this situation: conservatories for composers and performers, art colleges for painters and sculptors, writers and poets only study in "creative writing" classes at universities, and architecture is a department in polytechnic universities.

Serial theory in music opened a new chapter in the history of the arts since, as in modern sciences, the main idea is universal and meta-theoretical which enables (and needs) all arts to be integrated into one creative concept.

But the "discoveries and inventions" (Stockhausen) in musical serialism not only cast new light on old similarities in the arts. They even close the gap between the underlying prin-

ciples of the physical and biological world and in turn between these and the arts.

In so many words, serial thinking is the concept of creating artificial forms based on a special relationship between individuality (uniqueness) and similarity, focusing on avoiding repetition, aiming for completeness, tending toward permanent innovation in both theory and practice, and revolving around the idea of structural mediation between different quantities, qualities, types and classes of elements; more than enough for any artist to work with in a never-ending spiraling movement up to infinite progress.

Beyond Words, Inside Terms

The German terms *serielle Musik* and *Serialismus* are very special words and confusion can be produced by translating them without explanation into English, French or Italian. A short survey of the development of the musical terms might be helpful in understanding the proper meaning in German
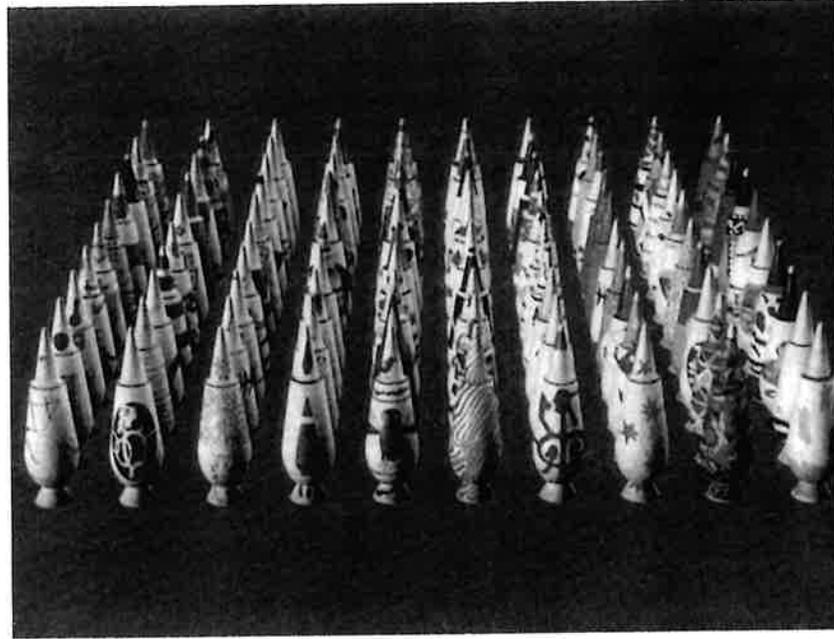
The term "serialism" in mass media and art theory is used to denote the standardization of several features in a series of products. In TV-series generally a set of protagonists and repeated elements in the structure of the plots and the different stories form the basic elements. In design, as in Alessandro Mendini's La fabbrica estetica (1992), serial production concerns the use of one shape and size for a group of several elements while their colors and patterns are in no case repeated. In both cases the term "serialism" is used to name a concept opposite to the musical idea of serialism which aims to avoid repetition on every level of construction.

and distinguishing the different connotations in other languages; this not only in the musical context, but also in the linguistic usage of other arts where the notions serial and serialism are also used to denote specific technical or stylistic features. Only the German terms have the specific technical meaning, as we will see, while in all other languages these words have a far broader sense and – especially in contemporary visual arts and design, as well as in media science – a quite different if not contrary meaning.

A starting point is seen around 1947 when French composer, conductor and theorist René Leibowitz coined the French expressions "technique sérielle", "oeuvre sériel", "principe sériel", "travail sériel", "composition sériel" and "musique sérielle" to designate the features of the dodecaphonic works of Arnold Schönberg since 1923 (the German *Zwölftonmusik* conveyed this meaning in around 1927). Thus the French "sériel" emphasizes the basic use of a premotivic series or row of pitches – in most cases necessarily twelve within the limits of an octave – as a compositional technique in contemporary music.

Pierre Boulez, having studied with Leibowitz and influenced by his vocabulary, picked up the term "sériel" but tried to expand the meaning of this word (parallel with the changes occurring in the usage of "série" and in line with his own musical developments) to designate, as early as 1951, the more general concept of pre-ordering not only pitches but also lengths, dynamics and attacks or "sounds" in the similar form of a series.

Karlheinz Stockhausen, having studied with Oliver Messiaen in 1952 in Paris, mentioned later that the expression "musique sérielle" was a widely accepted term used in Messiaen's class when speaking of the music of Anton Webern.

But continuing Boulez's broader notion of "sériel", he used the German term "serielle Musik" in 1953 to express the musical idea of a "universal composition with rows", former-

ly called in 1952 "through-ordered music" (*durchgeordnete Musik*), "'total' music" or "'total' tone ordering" (*totale Musik, totale Tonordnung*).

After these early attempts to find a label for the concept of this radical new music after 1950, it was the publication of the influential journal *die Reihe - Informationen über serielle Musik*, edited by Herbert Eimert and Stockhausen between 1955 and 1962 and published in eight issues, which helped to establish the term *Serielle Musik*, as opposed to traditional dodecaphonic music, as a designation for a new way of composing music that expands "rational control into all musical elements" as Eimert pointed out in the first issue.

It is interesting to note that as soon as the German expression was established and spread, the conviction was expressed that *serielle Musik* and *Serialismus* marked far more than merely a technical difference to earlier music.

In the first issue of the above mentioned journal, the opinion is expressed that serialism has a lot to do with Le Corbusier's concept of the *Modulor*.

It was the Swiss architect and composer Paul Gredinger, pupil of Max Bill, who stressed the relationship of the new ideas of musical serialism with Le Corbusier's way of thinking and who emphasized the extraordinary significance of serial thinking for all the arts, a point of view which had been reflected by Stockhausen in 1973 when he called the *Modulor* of Le Corbusier an important forerunner of serialism outside the field of music (Stockhausen, *Texte* IV, p. 402).

Thus while the German terms have quite a special technical and aesthetic meaning, emphasizing an essential distance from Schönberg's compositional technique, the corresponding English, French and Italian words are used in a broader sense insofar as they tend to make no difference between the dodecaphonic music of Schönberg, Berg and Webern on the one hand and new music after 1950 on the other.

These languages require more precise terms to make this distinction.

8-9 In the visual arts and design, as in the field of mass media, the idea of serialism is applied far more generally due to the different material to which the basic word "series" may be referred. The concept of series refers here to a number of art objects related by a general concept (structure, shape, content, etc.) but made individual by theoretically endless specifics.

An ideal type of this concept of serialism can be seen in a TV-series with one central plot-structure and protagonist(s). It can also be a number of pictures which depict one and the same object from different perspectives, moods and times or an everyday object produced in great numbers with the same form, size and shape but each with different ornaments, colors or applications.

Aesthetic Presence of Things Past: Ideologies and Techniques

The history of music in Europe is a succession of outstanding innovations. The emergence of serial music seems to be, at first glance, only one more step in this chain of inventions, only the latest (up till now) evolutionary step in a progress with its roots in Ancient Greece; a process that tends to include an increasing number of musical dimensions in a process of rationalization in order to expand the domains of creative control.

But a closer look at the historical situation indicates that the creation of serial music must be interpreted as a radical break with tradition (exceptions will be seen later) and a shift in historical development with no parallel in music history. (Even Schönberg's successful and influential break with tonality at the beginning of the century was only a partial rejection of traditions. This was the reason that the more radical Anton Webern was chosen as a leading figure and a precursor by composers of serial music.)

The end of the Second World War and breakdown of German totalitarianism strongly convinced young musicians (as well as other artists and intellectuals) born around 1925 that mental forces in all fields now had to be directed toward blocking the re-establishment of a comparable political system in the future. They saw their main goal as creating a musical language that was totally different from "romantic" music which had been entwined with the bourgeois and nationalistic mechanisms responsible for the past disaster in politics and history.

In understanding the underlying construction of the relationship between the musical and political situation, some technical features of the classic-romantic musical language should be mentioned along with the basic common features between modernism and tradition in the 19th century.

Progress and Historicism

Listening to music from the past as outstanding historical works started as a widely received conservative movement (in contrast to previous occasional private and professional study) with the re-performance and rediscovery in 1829 of Johann Sebastian Bach's *St. Matthew Passion* in Leipzig under the direction of Felix Mendelssohn-Bartholdy and in general with the works of the so-called classics: Haydn, Mozart and Beethoven. At that point, the previously quite natural replacement of past works through constant new aesthetic production of contemporary composers disappeared.

Since then, the "old" has been installed (and expanded subsequently by works from the 19th century) as a permanent presence in musical life and has attempted to drive out every effort to establish contemporary music. (The fruitless establishment of organizations to reinforce the distribution and reception of "new music" is a result of this situation and began in the 19th century, not the 20th.)

After a long period of living with art works created by contemporaries, the public was now for the first time in history confronted mainly with music from the past, whether in concerts, broadcasts or schools. Listening to current serious music (popular music is quite a different subject since it uses old techniques wrapped in the latest sound design) has become an exceptional situation for the mass audience.

Living composers who wanted to be heard had to accept a taste oriented towards a musical language and style similar to the "classics" and to write so-called "neo-classical" works, if not popular ones.

Overcoming the musical tendencies of restoration and conservatism was almost impossible. Composers like Arnold Schönberg, Charles Ives and Edgar Varèse, among others in the first half of the 20th century who insisted on developing their own musical language and conveying ideas from their own era, were considered outsiders. They did not serve the needs of the market. Producing "new" music – such a natural thing up till the 18th century that no special word for it was needed – was now considered boring and odd, if not threatening, by the masses. The "new" was no longer a natural part of the process of musical development. The dynamics of continual progress in music history since antiquity and medieval times had been replaced by the standstill of historicism (which, as in current popular music, evokes a permanent changing of superficial trends, while its technical and material substance remains the same).

The Curse of Success or the "End of Art"

Though explaining this development from progress to dead end is not easy, it needs an interpretation here. One of the most influential explanations is Theodor W. Adorno's view clearly expressed in his *Aesthetic Theory*. This attempt at an interpretation is influenced by Hegel's prominent dictum of the "end of art" postulated in his *Lectures on Aesthetics*. Adorno's philosophy of the history of art is furthermore based on Hegel's basic assumption of a rivalry between an artificial domain of art production and a more natural or naturalistic one. Rightly assuming the strong tendency of artificial constructions toward naturalism in the history of art (i.e. the artistic creation strives to be like a naturally produced object), Adorno sees a conclusive point in art history when creative techniques in art produce the disappearance of the differences between art and nature respectively when art is perfectly hidden by artistic features ("cacher l'art de l'art même", as Jean-Philippe Rameau pointed out in the 18th century, "to hide art through art itself").

In music this process started from the point of being similar to language in the broadest sense (and not restricted only to expressive inflections) and led to a strong development of technical features that disguised and minimized the rational and number-related sphere and in the end overcame the gap between the artificial fabric of music and the dynamic attitude of human emotions as the "language of the heart", as it was considered in the late 18th century.

Music had thus become almost similar to the human world of feelings or, as one of the fathers of European musicology, Hugo Riemann, puts it, music is, or has become, "a representation of movements of the soul in the form of effects" (*Riemann Musiklexikon*, Leipzig 1982, p. 696 b).

At present the ubiquitous phenomenon of "music" (whether so-called "classical" or popular) demonstrates that this art has finally managed to arrive at a state where it can potentially be understood emotionally without any process of transforming or deciphering; a valid process worth the effort under the conditions of art in general. The fact that we are not astonished at this situation is part of music history. "Music" as something to understand directly even if the listener is not trained to deal with the underlying technical features, the result of a process which started in the 18th century with the period of *Empfindsamkeit* (the Age of Sensibility) and continued to our present era of surrounding sound events, either from the past or newly created from the same fabric for film, advertising and popular entertainment.

Aesthetic products for musical illiterates. Everybody "understands" music in general (especially if it is not too old or too new). Everybody can listen to music without getting the feeling of not being included into the inner circle of connoisseurs. There is nothing to understand or "read"; only listening to and feeling what is produced by the acoustic substance. But there is no reason for argument here; this state of the art is the "wonderful" result of the process of art history. It is like the invention of perspective in painting or the developments of pseudo-realistic features (e.g. the plot in literature), a fulfillment of specifically European tendencies in art and its history.

But being a highly complex development based on technical innovations, the process inevitably turned into the curse of historicism since the signs of artificial production were increasingly hidden; this form of musical expression seemed to be the "second nature" of this art and was widely regarded as the only original state of music. All other manifestations of music seemed to be lacking, not really music in the strict sense of the word.

Simulation, Real Life,
and the "Counter-world" (*Gegenwelt*)

Tendencies of this kind were dominant in all the arts in the 19th century and led to their culmination in the musical, visual and literary structures of the widely consumed genre of the Hollywood movie, just to name the most popular example of this development. (Occasional counter movements like symbolism or futurism had more or less no effect in terms of mass reception.)

Generally speaking, these trends can be considered attempts to simulate the "real" world of the human being (including the inner world of emotions and feelings).

In music, the development in the 19th century of techniques appropriate for this simulation of emotive dynamics (not generally to be identified with emotions themselves) progressed alongside the elevation of music as an "art religion" in a secularized and industrialized society.

After a long "pre"-history, music in the 19th century possessed more than just the ability to manipulate motor and body functions. Music could now be used as a narcotic to induce different moods and feelings not triggered by real events.

By using music to escape the world of work, the world of everyday life, it became possible to be immersed in a different sphere corresponding with quasi-religious and, at the same time, libidinal desires while listening to it (consider for example the figure of the Kapellmeister, Kreisler, in E.Th.A. Hoffmann's writings).

The difference between Wackenroder's romantic figure of Berglinger, who is consoled and comforted only by music, and the employee listening to radio music in the car on the way to his office trying to escape the emptiness of his job, or the shopper in the department store who is stimulated by some "nice" music to buy more superfluous things (to name only a few common situations), is minor if not non-existent even though the circumstances may change. In all these examples, music is creating manipulation through subconscious stimulation and not through an act of concentrated listening. And this is commonly accepted as the real function of music.

In postulating such effects of musical power, we must admit there is not only a quantitative difference to music from former times but also a qualitative difference, overpowering the way it was seen by the Ancient Greeks with the mythical figures of Orpheus and Amphion.

Music and Feelings:
The Techniques of Manipulation

In trying to give a short overview of the essential technical features responsible for the musical capability for simulating feelings, I will concentrate on three main devices that are easy to recognize but very often underrated in their function for the power of simulation, whether in classical or popular music. In the following chapters we shall see that composers of serial music tried to avoid working with precisely these features so as not to produce structures related to this type of music. These technical mechanisms evolved more or less independently in the 18th century. But it was mainly Haydn and Mozart who put these features together and Beethoven who synchronized the resulting structures and directed them to one overwhelming musical effect.

The first, and seemingly trivial, feature was the artificial use of a very old organization of time: *Meter*. While metrical structures in music can be traced back to medieval dance music, the integration of meter as a pivotal element in art music can be first distinguished in the symphonies of G. Sammartini and later on as a central aspect of composition in the works of Haydn beginning in 1750. Metrical organization of musical time is something quite different when compared with pulse or rhythm since it works with a succession of repeated emphasis values on different levels. This succession is structured hierarchically in levels from light to heavy. In short, it enables composers to work with a recurrent, empty time-space (indicated by time signatures at the beginning of a piece, e.g. 4/4, 3/4 or 6/8) with fixed and qualified positions of different emphasis values. These values influence, in a remarkable way, the real notes arranged in this image scheme. Notes of equal duration but at different positions between the two bar lines are given a different weight or value and are influenced differently by what comes before and after, both on the harmonic and melodic

level of composition. A comparison with former organizations of musical time – e.g. the thematic subject of a fugue which is independent from its position within the bar – makes it clear that this repeated scheme of a metrical bar (or a succession of 2, 4, 8 or more bars) offers the possibility of working within a new musical dimension. The musical fabric is entered by the powerful force of the human experience of quasi-spontaneous body-expressions. Compared with an artificial baroque dance from a suite like the Sarabande with its slow beats of equal weight, one can imagine how this element enriches the musical experience and liberates the earlier collective choreography of body-control into a more direct motor response even while listening (and not dancing) to music.

The second – similarly trivial – feature consists in building up dynamic processes with peaks of outbursts which, in the second half of the 18th century, replaced more and more balanced structures in music. I will focus here on the infinitely variable transition of loudness, even if dynamic processes also influenced the tonal language and phrasing as will be seen later on in an example from Beethoven. Developed around 1750, the new method of working with the dynamics of soft and loud sounds, respectively with "crescendi" and "decrescendi" or the introduction of "sforzati" (to use the technical terms), replaced the older way of composing distinctive steps, without transitions in loudness, only with the help of different instrumentation. The first, simple but systematic use of this technique in the symphonies by the Stamitz brothers at the Mannheim court seems to have been an overwhelming experience for contemporary listeners. But later on it enabled composers to create dynamic structures which until then would have been impossible to work out.

The third and last feature mentioned here could be judged as the central one. As an integrating principle, it exists on the highest structural level and could be called the synchronization of different parameter functions.

The Scherzo from *Joseph Haydn's String Quartet, op. 33, No. 5, written in 1781 (Hoboken III: 41) illustrates how the concept of meter is included in the compositional idea. Especially the bars with rests in all parts are used to play with the listener's expectations.*

In Contrapunctus I *from Johann Sebastian Bach's* Art of the Fugue *(1742–1750) meter is of no importance for the musical information. The barlines do not indicate a hierarchical order of gravitational values. Here it is the succession of consonances and dissonances which regulates the musical information and is responsible for the interaction of the melodic lines of the parts.*

Sarabande

The beginning of the Sarabande *from Johann Sebastian Bach's* Partita *in B flat major BWV 825 (published in 1731) reveals the choreographic attitude in Baroque court dances which is the starting point for Bach's composition.*

Synchronization means that a certain group of dimensions in a musical structure or fabric are directed toward one central, sensually perceivable effect. Since the integration of this decisive feature in the second half of the 18th century, melody, harmony, phrasing (periodicity), meter and the dynamics of loudness – to name the important ones for classical music – are no longer used on different levels in a composition but bound together to create a more powerful whole compared with the sum of the parts. A lot of work was done, especially during the 19th century, to develop this technique to outstanding heights. Seen from the perspective of a composer dealing quite naturally with this feature and compared with music from earlier times, it is synchronization which empowered music with the hitherto unknown quality of simulating the emotional dynamic.

Work in this new field of expression can be illustrated by two short examples, one from Beethoven and one from Wagner. The opening 8 bars of the first movement of Beethoven's first 26 piano sonata, op. 2 No. 1 in F minor, give a hint of the tormenting impact of the calculated interaction of all musical parameters. In a continually increasing dynamic process, a rising 2-bar theme (starting on the up-beat with the base note of the C dominant as a driving tonal force) with an emphasized target note (the third of the minor tonic on the first and strongest beat of the bar) is successively moved step by step upwards and shortened (2 bars with an up-beat; 2 bars without an up-beat; twice 1 bar long and once 1/2 bar long with simultaneous transformation of the rising line into appogiaturas and finally into an arpeggio). At the same time, the starting soft volume (piano) has gradually developed into an exploding fortissimo which is immediately softened back to piano.

In contrast to Beethoven's energetic and impulsive dynamic movement, with a climax and release that marked a new level of composition in music history, the very beginning of Wagner's Prelude to his opera *Tristan and Isolde* shows a 27

Ludwig van Beethoven's First Piano Sonata in F minor Op. 2, No. 1 (1790–95), beginning of the first movement, opens like a fanfare with a breathtaking process of shortening the initial two-bar motive, and reaching out step by step to the upper register while increasing the loudness from ''piano'' to ''fortissimo'' marking a starting point for the upcoming ''dynamism'' in music in the 19th century.

further elaborate example, developing an emotional state of unfulfilled longing created with the intentional interaction of dynamic, metrical and tonal forces. This musical fabric illustrates, by purely musical means, the central feeling that underlies the opera – love, desire and sexuality unfulfilled (even the indication ''Langsam und schmachtend'', ''Slowly and languishing'', underscores this subject).

An opening melodic line of the cellos opens the tonal space. Marked by an up-beat to the strongest position of the bar, the resulting interval of the minor sixth remains tonally unstable for the long period of five quarter notes while the volume increases softly.

The melodic line is finally resolved into the fifth forming the major-minor frame of a tonic in A. But this happens on the weakest position of the bar, which serves again as an up-beat (marked by a phrasing symbol) to a strong beat. A dissonance is positioned on this which needs harmonic resolu-

The piano reduction of Richard Wagner's Prelude to Tristan and Isolde (premiered in Munich in 1865) illustrates how Wagner realizes the central feeling of love, desire and sexuality unfulfilled in the very beginning of the opera by purely musical means.

tion. But this time, as well, the tension is held and ''resolution'' is reached only in the form of a suspended dominant chord.

The musical resolution of harmonic, metric and dynamic tension is never given; note the perfectly timed rest after the first three bars, long enough to create the deception of a never-arriving ''regular'' chord in A minor.

Wagner's example cannot depict anything like love or desire. (No music or art can do this.) But his music can reproduce, through solely technical means (without words) and by dealing with the synchronization of time and tension in music, the emotive "flow" of a human world of feelings. To put it more precisely; it is not reproducing something that makes the *Prelude* work. There is nothing to "read", to decipher or understand.

Let us call it a sort of parallelism that is responsible for this effect of manipulating the listener. A physicist would call it induction. But there was no reason for young composers after 1950 to refine and deepen this compositional technique. The dimensions of bodily experiences and emotional feelings were not interesting enough for further work. The depiction of the psychic world, of sorrow and joy, through music had come to an end. The cosmos of the human subject had been discovered, no more blank areas could be found. And after the catastrophes of the Second World War, the human being, responsible for the disaster, could no longer be a worthy subject in composing music. The younger generation had another message to express.

"Quoth the Raven: 'Nevermore'" Composing New Music after 1950

It is intriguing to abandon the conviction that music which does not please us at first or second listening is created not by composers unable to give us the pleasure we desire but rather by composers who do not want to do so.

The idea that music or art in general is or should be more than hedonistic pleasure is common place after Hegel's lectures on aesthetics. And the development of music especially after 1830 – Beethoven died in 1827, Schubert in 1828 – with its dominant tendencies to stimulate the capabilities of the listener's affective reception, that reached a peak in Wagner's operas, led to numerous though weak reactions against this concentration on pure sensual effects which were considered by some critics as dangerous manipulations and polemically called music for the "nerves" or later on, music for the "lower abdomen".

Starting with Hanslick's popular book, *Das Musikalisch-Schöne* (1854), directed against program music, at the end of the century movements became stronger which tended to reactivate the musical capabilities of conveying more spiritual meanings or to convey religious or philosophical messages (*Weltanschauungsmusik*).

It was particularly Gustav Mahler who shocked his audiences with symphonies and song cycles that showed not only the "counter-world" (*Gegenwelt*), the world of positive feelings and consolation in contrast to the harsh reality of the contemporary secularized and industrialized society, but also the opposing negative elements of social life. War, loneliness, death and disillusion became a central part of his musical message, sharply contrasting with the capabilities of the human individual to suppress these constituent parts of modern living – very often without any possibility of either escaping into a semi-religious paradise or being led finally into a reconciliation of both sides.

An admirer of Mahler's work, Arnold Schönberg went further. He tried to break through by recognizing that major-minor tonality (composition based on the installation of a central tonic) was mainly responsible for the aforementioned entry of "negative" or hedonistic tendencies into musical material – judged as the penetration of the "collective unconscious" so to speak into the compositional language which made it almost impossible to control the resulting effects of the intended work.

At first – in 1908, after the composition of some successful works in the tradition of late romanticism – he started avoiding using central notes, or tonics, in the organization of the harmonic and melodic fabric, introducing a set of pitches with equal importance; in the beginning, he did this through pure "feeling". But in the early 1920s he systematized this method through the invention of composition with 12-note rows which enabled him to control the distribution of pitches, so there was no longer any preponderance of one specific note and no major-minor tonality or tonal gravity. The development of this technique of composing with twelve-note rows or series marked the end of the long period of major-minor tonality and the beginning of a different musical language.

While Schönberg's reaction also had a strong foundation in his political attitude against nationalistic and warlike tendencies, which he saw as a parallel to the subject-centered trends in art – an opinion he shared with Sigmund Freud, Karl Kraus and numerous other intellectuals around 1900 and later – it was the shock of Fascism and the Second World War initiated by Nazi Germany that led to further consequences in musical composition and other arts.

Similarly, after 1950 some young composers in central Europe, where barbarism had left a devastated civilization, critically reflected the political and social situation, sometimes more from the religious and sometimes more from the Marxist point of view, strongly influenced by Theodor W.

Adorno's *Philosophy of New Music* (published in 1949), Hermann Hesse's *Glasperlenspiel*, Heidegger's philosophy or works by painters like Paul Klee, Piet Mondrian and others (Gottwald 1998, p. 110). After early attempts in 1945, particularly by Pierre Boulez and Karel Goeyvaerts, in Olivier Messiaen's class at the Conservatoire in Paris, to further develop the musical ideas of Anton Webern, the most radical of Schönberg's pupils, serialism as a thoroughly conceived musical theory emerged in a small German town called Darmstadt and became established as a new musical concept in its own right. Founded in 1946 as a way to re-animate the contemporary music scene and bring together the intellectual forces in Germany after the Second World War, the "Internationale Ferienkurse für Neue Musik" in Darmstadt is an annual, three-week summer camp (after its cancellation in 1971, it has been biennial since 1972) where composers, performer, critics and theorists come together to discuss the latest currents in modern music (Boria - Danuser 1997).

In the summer of 1951, Stockhausen was participating in the "Internationale Ferienkurse für Neue Musik" for the first time. If one likes concise points in historiography, this event could be seen as the seminal period in the development of serial music (Bandur - Misch 2001).

At first, Stockhausen, then a 22-year-old composition student, formed a friendship with the Belgian composer Karel Goeyvaerts, a pupil of Olivier Messiaen in Paris, who presented in Darmstadt his *Sonata* for two pianos that further developed musical ideas from the late works of Webern. Goeyvaerts so thoroughly explained the concept of his work and all that he had learned from Messiaen that Stockhausen was able to participate in the performance of this piece and teach it to the students in Theodor W. Adorno's composition class, who had replaced Schönberg for a short term when he fell ill.

Secondly, Stockhausen got to know more of Webern's works, mostly unknown to him up till then with the exception of one

Left: Anton Webern (1883–1945). Right:
Olivier Messiaen (1908–1992).

Darmstadt (here view of the town center in 1945), where the younger generations of
European composers met in the years after 1946, belonged to those towns in Germany which suffered severe damage in World War II.

The ''Internationale Ferienkurse für neue Musik'' in Darmstadt from the outset provided a central meeting point for young composers to discuss new developments.
Left to right: Pierre Boulez, Karlheinz Stockhausen, Luigi Nono, Karel Goeyvaerts and
Bruno Maderna in 1952.

Anton Webern's Variationen *for piano op. 27, 1935–36 (second movement shown),* *where the dissolution of melodic lines and the concentration of "pointillist" complex-* *es of notes were seen by serial composers as an important step in music after 1950.*

of Webern's early compositions. Thirdly, he listened several times to the gramophone recording of Messiaen's *Mode de valeurs et d'intensités* for piano (written in Darmstadt during the summer of 1949 with part of his *Quatre Etudes*) and studied the score of this work intensively with Goeyvaerts. It is not exaggerating to say that all this changed his way of composing and thinking about music.

After this summer course, Stockhausen decided to continue his studies with Messiaen in Paris which he did in 1952. In his early letters to Goeyvaerts just after their meeting, one can catch an glimpse of Stockhausen's emotion in having now found a new way to make the music he wanted. In a letter dated August 8, 1951, he wrote:

> What we call *Zeitgeist* is our truth, is truth completely; *Zeitgeist* is existence itself, that changes by itself with the currents of time without ever leaving itself. And I believe I can say that alarmingly few composers are seeking the truth. Language: that is being itself, that is genuine and unconcealed truth. To speak in a language today which misses the truth, which is dead, a pretense of sound, I think that means to write "dynamic music", romantic music in the historical and individual sense.

More than 30 years later, a statement by Stockhausen in a 1988 radio interview explains precisely what was meant by this general notion:

> The period of depicting human feelings and emotions in art has now gone on long enough. We have a sufficiently large spectrum of works which represent the human being suffering between the animal and angel. That has finally come to an end and, in my opinion, we have had enough of it too. It makes the spectrum no larger if more excesses of the extreme utterances of men, of extreme situations of joy or suffering, of rejoicing or being tortured are expressed in art. (Stockhausen, *Texte X*, pp. 27 f.)

This turning away from the central aesthetic paradigms and musical techniques ("dynamic music") of the 19th century was more than just an internal affair in music history. It was in the beginning connected with the consciousness of the relationship between music, listening and society, as well as with the consciousness of the total break with hedonistic traditions in listening to music. In Paris, Stockhausen wrote in 1952:

Ce morceau utilise un mode de hauteurs (36 sons), de valeurs (24 durées), d'attaques (12 attaques), et d'intensités (7 nuances). Il est entièrement écrit dans le mode.

Attaques: (avec l'attaque normale, sans signe, cela fait 12.)

Intensités: *ppp pp p mf f ff fff*

Sons: Le mode se partage en 3 Divisions ou ensembles mélodiques de 12 sons, s'étendant chacun sur plusieurs octaves, et croisés entre eux. Tous les sons de même nom sont différents comme hauteur, comme valeur, et comme intensité.

Valeurs:

Division I: durées chromatiques de 1 à 12

Division II: durées chromatiques de 1 à 12

Division III: durées chromatiques de 1 à 12

Au total 24 durées:

Voici le mode:

I (la Division I est utilisée dans la portée supérieure du Piano)

II (la Division II est utilisée dans la portée médiane du Piano)

III (la Division III est utilisée dans la portée inférieure du Piano)

Olivier Messiaen's Mode de valeurs et d'intensités, *written in Darmstadt in 1949 (left: first page; above: the composer's explanations): a forerunner of serial music and an example of "static" music, which impressed composers after 1950 although Messiaen mentioned later that he could not understand the impact of this "study" he composed.*

STRUCTURES

Pierre BOULEZ

I a

Pierre Boulez's Structures I for two pianos, *1951–52 (above: first page), underwent a detailed analysis by György Ligeti in 1958 (in the periodical* die Reihe *IV), that shows for example the schematic transposition of rows (right). This demonstration has contributed to the wrong assumption that serial music has to do with numbered squares, mechanical permutation of numbers, and in general a sort of automatism in composition.* Structures I, *by the way, as a sort of salute departs from Messiaen's* Mode de valeurs et d'intensités, *and is composed intentionally with a lot of mechanical procedures.*

R											
1	2	3	4	5	6	7	8	9	10	11	12
2	8	4	5	6	11	1	9	12	3	7	10
3	4	1	2	8	9	10	5	6	7	12	11
4	5	2	8	9	12	3	6	11	1	10	7
5	6	8	9	12	10	4	11	7	2	3	1
6	11	9	12	10	3	5	7	1	8	4	2
7	1	10	3	4	5	11	2	8	12	6	9
8	9	5	6	11	7	2	12	10	4	1	3
9	12	6	11	7	1	8	10	3	5	2	4
10	3	7	1	2	8	12	4	5	11	9	6
11	7	12	10	3	4	6	1	2	9	5	8
12	10	11	7	1	2	9	3	4	6	8	5

U											
1	7	3	10	12	9	2	11	6	4	8	5
7	11	10	12	9	8	1	6	5	3	2	4
3	10	1	7	11	6	4	12	9	2	5	8
10	12	7	11	6	5	3	9	8	1	4	2
12	9	11	6	5	4	10	8	2	7	3	1
9	8	6	5	4	3	12	2	1	11	10	7
2	1	4	3	10	12	8	7	11	5	9	6
11	6	12	9	8	2	7	5	4	10	1	3
6	5	9	8	2	1	11	4	3	12	7	10
4	3	2	1	7	11	5	10	12	8	6	9
8	2	5	4	3	10	9	1	7	6	12	11
5	4	8	2	1	7	6	3	10	9	11	12

Music today is consumed in musical request programs. Listening has become listening according to desire. Music without content, with which human desire could align itself (man does not desire just anything, but rather something specific) will remain unheard until desire-listening becomes reflective listening [*meditatives Hören*]. This is a possible result of self-discipline. One can recognize in the nature of the youngest [latest] music a re-orientation from desire-listening to reflective listening, included in the general spiritual transformation from an extremely individualistic character to a personal but also collective type. (Stockhausen, *Texte* I, p. 17)

A recollection by the similarly influential French composer Pierre Boulez in 1963 reflects the necessity for the new beginning and for regaining a musical language purified of traditional elements when he speaks of the concept of his first strictly serial composition *Structures I for two pianos* (1951–52):

My plan was based on the following idea: I wanted to blot out every trace of the traditional in my vocabulary, whether it concerned figures, or phrases, or developments, or form; I want-

ed to re-conquer, piece by piece, element by element, the different phases in such a form so that a perfect new synthesis would emerge, a synthesis that, since its beginning, had not been tainted by foreign matter – stylistic remnants in particular. Secondly, I pursued the thought of standardizing those aspects of language that up to that time had remained in a state of conflict, something I found most unpleasant; it bothered me to pick up a pitch system from one composer, a rhythmic principle from another, a formal idea from yet another. Under these conditions, it occurred to me that the most urgent requirement was the unity of all elements of language – run together in a melting pot of identical organization that would be responsible for the existence, development, and changing relations of the elements of language. (Boulez 1985, p. 40)

Avoiding "Subjects",
or the Achievements of Musical Serialism

For most music-lovers a repertoire is the result of survival of the fittest in music history. But the most innovative pieces developed at a certain time will not automatically be integrated into this imaginary museum of works. Very often it is just the opposite. What we appreciate is not what we possibly might like to listen to, since we only know the music we listen to. We cannot perceive the blind spots in our ears. The antidote is curiosity.

Serial techniques led to a period of faster progress in music than ever before. In the 50 years since the beginnings in Darmstadt almost every dimension of music has been examined thoroughly for the purposes of suitability and further development. The total set of musical dimensions like melody, harmony, rhythm, meter or bar (to name only a few important ones) was strictly restructured and partially taken out of service if not adequate for the realization of new ideas. But also the concepts of work and form, performance and improvisation, notation and instrumentation – dominant features in the music of the 19th century – had to change in a far-reaching way. After the standstill of music tradition stuck in historicism, a strong dynamic of innovation arose. Almost every five years a new development led to further exploration of unknown fields or previously unconsidered technical principles.

These discoveries, and the invention of "white" areas, are principally connected with the name of Karlheinz Stockhausen, one of the most prolific composers in music history. Since all important and influential steps in music since 1950 are the achievements of his compositional work, a survey of serialism in music mainly deals with his work (cf. Bandur - Misch 2001).

After the shock of confrontation with the formerly unknown world of "purified" and static expression seen in Webern's

last works – though young composers may have over inter-preted Webern's music – and realized in another fashion in Messiaen's *Mode de valeurs et d'intensités*, as a first step young composers concentrated on working out a radical concept of the musical note or tone.

A note or tone was no longer considered a functional part of a melodic line or chord, but was seen as an individual element that could (and should) be determined with the utmost precision.

Each note or tone-"point" now received individual settings of all parameters. Each was linked not only to pitch, but also to a fixed and correspondingly different duration value (or a point of entrance in musical time after the preceding one), with a certain loudness and mode of attack or sound characteristics.

Through this method each note was individualized so that no two notes within the range of an octave had the same settings. Called *punktuelle Musik* ("pointillist music"), this technique was a consequent continuation of the achievements of dodecaphonic music by applying the idea of ordering pitch to three other characteristics (cf. Stockhausen, *Kreuzspiel*, 1951, *Punkte*, 1952, *Kontra-Punkte*, 1952–53, *Klavierstücke I-IV*, 1952–53; Boulez, *Structure I*, 1951–52).

Parallel to this development, and in a certain way due to the apparent difficulties in the performance of such "pointillist" music but also related to the idea of a super-human music, serial composition in the first half of the 1950s resulted in a strong development of electronic features which, though not totally new after 1945, had progressed since then through innovations in electronics.

The installation of electronic music studios in broadcasting corporations in Europe was a consequent step in realizing new musical ideas in sound and space, as well as a reason to deepen the experiences within this media (cf. Stockhausen, *Konkrete Etüde*, 1952, *Studie I*, *Studie II*, 1953–54, *Gesang der Jünglinge*, 1955–56).

Karlheinz Stockhausen, Klavierstück III *(1952).*

ABWÄRTS

Spiele eine Schwingung im Rhythmus Deiner Glieder
Spiele eine Schwingung im Rhythmus Deiner Zellen
Spiele eine Schwingung im Rhythmus Deiner Moleküle
Spiele eine Schwingung im Rhythmus Deiner Atome
Spiele eine Schwingung im Rhythmus Deiner kleinsten Bestandteile
zu denen Dein inneres Ohr noch reicht

Wechsle langsam von einem Rhythmus zum anderen
bis Du freier wirst
und sie beliebig vertauschen kannst

RICHTIGE DAUERN

Spiele einen Ton
Spiele ihn so lange
bis Du spürst
daß Du aufhören sollst

Spiele wieder einen Ton
Spiele ihn so lange
bis Du spürst
daß Du aufhören sollst

Und so weiter

Höre auf
wenn Du spürst
daß Du aufhören sollst

Ob Du aber spielst oder aufhörst:
Höre immer den anderen zu

Spiele am besten
wenn Menschen zuhören

Probe nicht

Text order-number	Title	Scoring	Process-type	Typography	Date
1	RICHTIGE DAUERN	c. 4 players	Pointillist	Centered	May 7
2	UNBEGRENZT	ensemble	Pointillist	Centered	
3	VERBINDUNG	ensemble	Scale	Left margin	
4	TREFFPUNKT	ensemble	Refrain	Centered	May 8
5	NACHTMUSIK	ensemble	Mediation	Centered	
6	ABWÄRTS	ensemble	Scale	Left margin	
7	AUFWÄRTS	ensemble	Mediation	Centered	
8	OBEN UND UNTEN	theater piece	Mediation	Centered and Left margin	
9	INTENSITÄT	ensemble	Pointillist	Centered	May 9
10	SETZ DIE SEGEL ZUR SONNE	ensemble	Mediation	Centered	
11	KOMMUNION	ensemble, at first 3, then 4, 5, 6, 7	Scale	Left margin	
12	LITANEI	"to the player" [speaker or choir]	Non-Process	Left margin	May 10
13	ES	ensemble	Pointillist	Centered	
14	GOLDSTAUB	small ensemble	Pointillist	Centered	
15	ANKUNFT	any number of musicians [speaker or speaking-choir]	Non-Process	Left margin	May 11

Karlheinz Stockhausen, Aus den sieben tagen (1968): Abwärts and Richtige Dauern (Kohl, 1981, p. 241) has shown that serial thinking even in this text-based composition is a relevant feature.
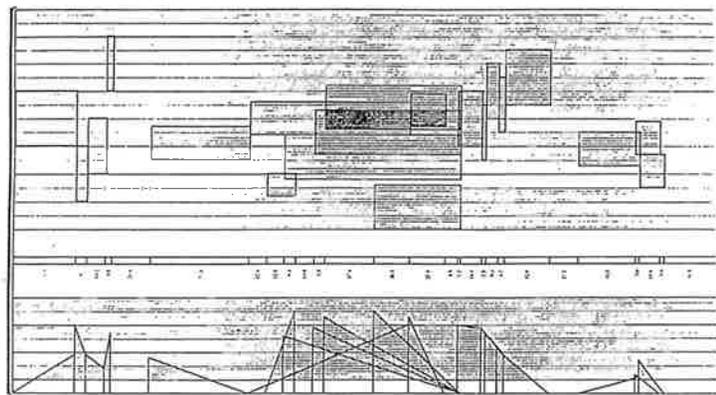
Karlheinz Stockhausen, one page of Studie II *(1954). Upper diagram shows the frequencies, the lower gives the dynamics.*

One could now work with musical material physically, as it were, without the limitations of human performers, in creating differences in pitch, sound, attack, duration values and sound location.

Starting as taped music, electronic music has undergone certain changes since then through the invention of digitized information processing and is now an integral part of new music (cf. the three-dimensional sound-movements in space in Stockhausen's *Oktophonie* from *Tuesday of Light*, 1990–91).

The opportunities offered by these machines helped create a new consciousness for sound in general and helped develop a very different world of sound production, whether for traditional instruments such as the piano (Stockhausen, *Klavierstücke V-X*, 1954–55, 1961) or in further exploring the richness of sounds which were formerly

bound to a certain function, as for example percussion (Stockhausen, *Zyklus für einen Schlagzeuger*, 1959) or on quite a different level such as using over-tones in the voice (*Stimmung*, 1968).

Around 1955, the limitations of pointillist music were seen as a burden in working out fuller and more connected musical structures. The period of total determination of one note was taken over by techniques which determined greater complexes of several notes with a common determination on a higher level at a certain time.

The theory of groups and fields emerged which allowed the overall setting of musical dimensions in a chosen formal section where the composer could handle the individual realizations more freely (Stockhausen, *Zeitmaße*, 1955–56, *Gruppen für drei Orchester*, 1955–57).

At the same time, the relationships between the different musical dimensions (pitch, duration, loudness, attack or sound) were taken into consideration. The concept of unification in musical composition was no longer managed through the more or less arbitrary assignment of certain settings by numbers.

The coherent determination of the different musical parameters as parts of one whole became the subject of theory; for example, pitch and rhythm were seen as related expressions of one concept of time.

Another step forward was made in the second half of the Fifties by trying to overcome the limitations of fixed structures while creatively integrating the performer and using his individuality for creating the musical piece. The idea of "open form" or aleatoric music arose and led to several works whose formal plans were designed to bring out the utmost intensity and variety in every performance.

Several ideas emerged from this concept, such as a form with a fixed beginning and ending and a certain set number of ways between these two points or a more open concept which sets no starting and ending points, leaving the deci-

sion of where to start and where to end to the performer (see for example the difference between Stockhausen's *Klavierstück XI*, 1956, and Boulez's unfinished *Sonate pour piano Nr. 3*, 1955–57–…).

Additionally, the system of notation was reconsidered and supplemented by the introduction of new symbols designed for the precise determination of previously un-established instructions. Graphic elements were inserted, either in combination with traditional notation or alone, as a stimulus to improvisation.

The ideas of serialism were even used in composing texts or poems which served as a starting point for improvised music (Stockhausen, *Aus den sieben Tagen*, 1968, and *Für kommende Zeiten*, 1968–70).

In terms of the ideas that influenced traditional musical work, serial composition expanded the concept of a closed form with a beginning and end and fixed "content" not only by introducing aleatoric elements in particular, but by inventing a new model of musical form in general.

Stimulated by the experience of musical performances in non-European cultures, several ideas of creating music arose which transcended traditional works. For example, a piece of music could now be a never-ending soundscape where listeners could enter and leave the stream of musical information whenever they wanted. In order to "understand" the musical meaning, it would no longer be necessary to know what had gone on before and what was coming next. Form, in the aesthetic meaning of the word, changed through these concepts which tried to realize musical ideas in a way which made partial listening to it meaningful. Every time-period, every moment in the current of musical flow had to be similarly meaningful and rich in information to be perceived (Stockhausen, *Momente*, 1962–64–1969–…).

A far more radical consequence of the escape from traditional work concepts can be seen in the production of "drafts" for composing.

This means that the creative procedure tries to set a meta-compositional matrix which contains all the information necessary to produce a correct composition in the next step. In Stockhausen's composition *Plus-minus*, 1963, for example, a set of symbols on seven sheets of paper (to be combined freely) are the blueprint for another composer to start composing. While following a certain plan, thought out and calculated by the meta-composer with reference to an intended range of formal results, the realizing composer is free to choose the shape of the basic musical elements and how they change to form the final musical process.

Redefining the European idea of a work of art, it followed logically to question the interdependence of music and culture in general.

Quite different from the introduction of non-European music as an exotic element in European music since the beginning of the 20th century (with unique predecessors in the 18th and 19th centuries), composers of serial music developed an idea of world music that took into consideration the closer contact of cultures through modern media.

The abstract principles of serial thinking logically resulted in a system of integration which made it possible to see cultural styles and methods of performance as a central part of musical substance (Stockhausen, *Telemusik*, 1966, *Hymnen*, 1966–67, *Kurzwellen*, 1968; Boulez, *Rituel*, 1974–75).

The idea of integration (we will explain its far-reaching effect on serial thinking in the next chapter) allowed working with heterogeneous musical material of all kinds (instrumental sounds - electronic sounds; European music - non-European music; composed music - *objets trouvés*). Integration arose in the end as one of the key concepts in serial thought. It is thus not surprising that the latest achievement in serial music is the integration of all techniques developed up to this point. Stockhausen's latest product, *Licht. Die sieben Tage der Woche* (started in 1977 and planned as a work in progress for 25 years) is the sum of serial thinking in music. This work

will include all the achievements from the preceding 25 years (1952–1977) in one opus unified with the help of one musical substance called the super-formula (in itself a three-part composition lasting one minute) which contains all of the central elements that unfold into seven "operas" covering over 20 hours of scenic music.

Serial Thinking

The preceding summary of achievements in serial composition, showing the range of innovations, may be confusing at first since a common denominator seems to be missing. What does pitch organization actually have to do with aleatoric formal plans or the distribution of sounds in space with the integration of non-European music?

But a closer look at the underlying ideas of these achievements reveals related concepts in all of the cases that share a single principle in the ordering of the specific elements (pitches, sound-structures, positions of sounds in space, types of cultural styles, degrees of mixture between them and so on).

As we will see in this chapter, this principle is a general one; it is not restricted to music, but is common to all types of formal organization, whether with a natural or an artificial structure, although for a long time the arts have focused on different concepts.

Directed by the motivation to find a new language, musical serialism thus only integrates certain features that are at hand whenever forms of whatever character and dimensions are to be constructed.

From this point of view, conventional forms of organization in arts – quite apart from the concentration of the capability for depicting or the question of content – must be judged as too simple.

Demonstrations of Application
In anticipation of the more detailed technical presentation, some examples will illustrate the range of serial principles existing in natural phenomena or applied to arts outside the field of music in general. They can help us understand the global concept, even if all the mentioned examples share the common feature that they are not explicitly labeled serial.

The creation of living things in nature can be seen as a

Max Bill, Rhytmus in vier Quadraten, *1943.*

prominent and important serial technique. Each living thing is an element in an infinite series of beings with a typical relationship between individual and generic characteristics like color, size, shape, capabilities or aptitudes and so on. While created unique on the level of degrees and mixture of generic features, this individual equipment nevertheless has typical forms and limits of range.

In this case, serial is the non-repetition on the level of individual characteristics which are, on another level, simultaneously typical for a species (e.g. number of limbs, capability to act instinctively or to learn).

One of the first examples in literature that could be called serial is the formal plan of Donatien-Alphonse-François de Sade's *120 Days of Sodom* (1784). In this unfinished work, De Sade outlines a closed system of all possible combinations concerning human sexuality, operating within a matrix which contains as parameters the body orifices and the number and characteristics of participants (single-group, old-young, male-female, heterosexual-homosexual, human-animal, living-dead).

(While the construction of the system and the inclusion exactly once of every possible combination is closely related to serial thinking, the plan of his work that dynamically progresses from simple and accepted forms to more and more "perverse" realizations is not serial.)

In focusing on layout, Raymond Federman wrote, or rather

Paul Klee, Monument an der Grenze des Fruchtlandes, *1929–40.*

designed, *Double or Nothing; A Real Fictitious Discourse* (1971) with each page different in style and concept, going through "all" the possibilities typography makes possible.

Related to De Sade's formal concept is George Perec's *La vie mode d'emploi* (1978) that narrates the different lives of all the people in an apartment house each designed with a different combination of characteristics and special events in their lives in different pasts, intentionally attempting to exhaust the sphere of human life with the help of complicated sketches in the form of a matrix to avoid redundancy and repetition.

Quasi-serial styles in painting have been common since the 1940s, attempting to. avoid repetition and symmetry on all structural levels and working with a limited number of elements, thus coming close to the concepts of serialism (e.g. 52-57 Paul Klee, Piet Mondrian, Theo van Doesburg, Bart van Leck, Josef Albers, Georg van Tongerloo, Max Bill, Richard P. Lohse or Burgoyne Diller; cf. Lohse, *Standard, Modul, Serie: Neue Probleme und Aufgaben der Malerei*, in Kepes 58 1969, p. 128 ff.). However, it was Rainer Fleischhauer and Jörn Janssen who developed a plan concerning the construction of a new city with serial techniques published in 1960 in the seventh issue of the influential periodical *die Reihe. Informationen über serielle Musik*, edited by Herbert Eimert and Karlheinz Stockhausen (*Hochbau für 200 000 E*).

After Le Corbusier, whose technique of the *Modulor* was called a forerunner of serialism outside the area of music, Fleischhauer and Janssen could be considered as the first architects who intentionally transposed serial principles in a building plan which paid special respect to Stockhausen's theories of time and space in music postulating that "similarities of structure are visible in music, literature, painting, science and technology" (VII, p. 73).

Basics: Element and Form

The above mentioned examples give a first hint that serial thinking works on a special level of integration, particularly

developing further the important conventional, artistic and formal principles of repetition and variation (derivation) as well as contrast and symmetry. Repetition and contrast are the basic ideas of connecting two or more elements together; the first by means of identity, the second by absolute difference. Symmetry and variation work with identity and difference at the same time; in the case of symmetry, accentuating more the moment of a non-representational identity (e.g. left and right hand), but combined and improved with difference (related to their presentation in space – less in time); in the case of variation, accentuating more strongly the moment of difference while working with an underlying connective link of identity which ensures the effect of the resulting difference.

Serial thinking has to be seen in relation to these four principles since serialism tries to develop a much stronger connection between the fundamental concepts of identity and difference in generating substantial relationships among the elements of a formal plan.

While symmetry and variation absolutely need the "real" unfolding of at least two elements following one another in time or space in order to be perceived by the senses, serialism integrates the qualities of identity and difference in each of the formal elements related to one other. Each element of a serial plan thus contains the characteristics of identity simultaneously with difference (which would not work in only one part of a symmetrical arrangement or in one part of a succession of variations). It is the pre-ordering of a matrix in serialism that abolishes the direct phenomenological connection between elements, but which functions as the abstract foundation of the specific quality of each element defined through the matrix.
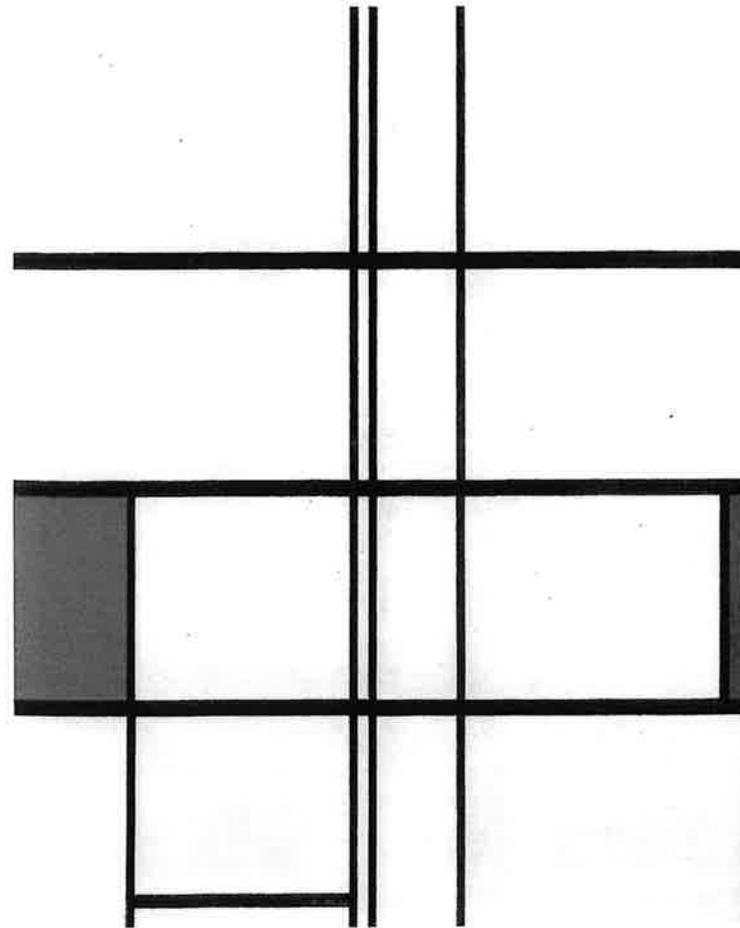
Apart from this way of generating the substantial parts of any formal plan as a first and central step in serial thinking, the composition with (and arrangement of) such elements in any material is subject to similar reflections. Utmost variety must
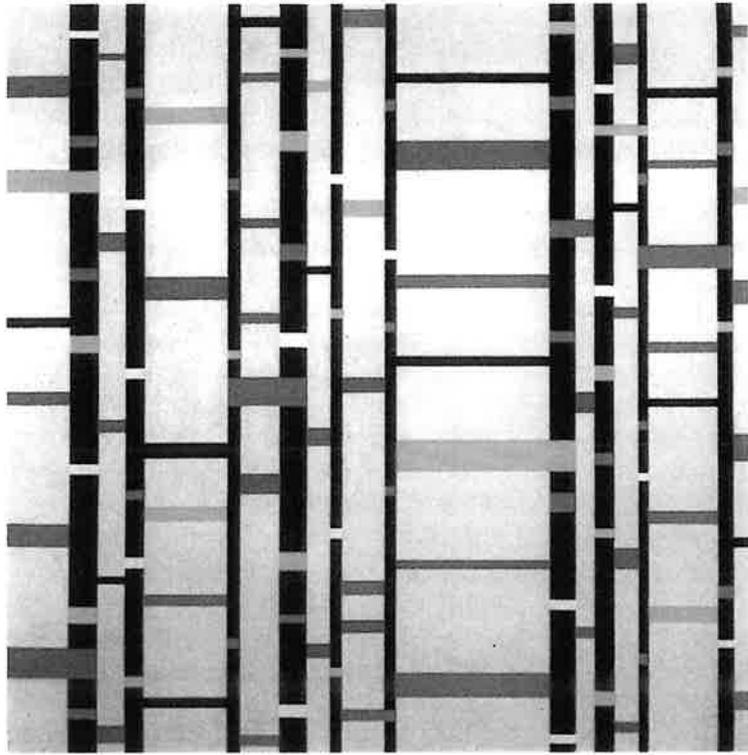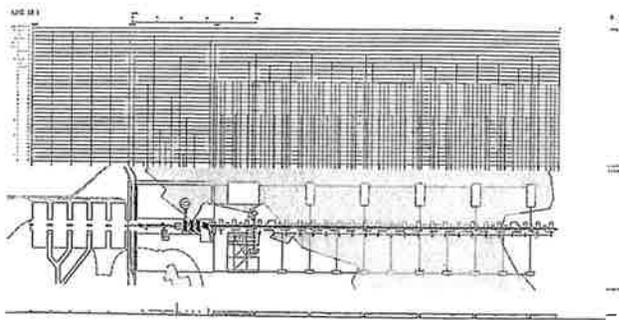
Burgoyne Diller, Drittes Thema, *1946–48*.

always be the goal, both on the first level of formal design based on simple elements as well as on the higher levels of superstructures built up of several lower structures.

But although both systems – the characteristics of a group of elements and the "composition" of the formal structure – have to be considered independently, it should be stressed that at the same time the highest coherence must be main-

Piet Mondrian, Komposition in Weiß, Rot, Blau, *1936*.

```
 II  z+p  1  Büros
     z+p  2  Personalräume
     p    3  Versuchslaboratorien usw.
III  z    1  Büros
     z    2  Personalräume
     z    3  Säle — Gericht, Parlament usw.
G  I z    1  Versorgungszentrale — Lagerräume, Milchzentrale, Schlachthof, Lebensmittel-
                verteilung
     p    2  Verkaufsräume
     p    3  Einrichtungen des täglichen Bedarfs, Dienststellen usw.
     p    4  Restaurants, Schnellrestaurants, Speisesäle, Cafés usw.
     p    5  Verkehrsräume, Einrichtungen für senkrechten Verkehr, Installationsschächte,
                Bedienungsräume, Kraftunterverteilungen, Heizungen usw.
     z    6  Großkaufanlagen
   II z+p 1  a) Räume für vorwiegend akustische Mitteilung
                b) Räume für vorwiegend optische Mitteilung
                c) Räume für vorwiegend sprachliche Mitteilung
     z+p  2  Ausstellungsfläche in geschlossenen Räumen — Museen, Depots, Archive
                Bibliotheken, Lesesäle usw.
     z+p  3  Versammlungsräume verschiedener Größen
     z+p  4  Sportanlagen in geschlossenen Räumen — Bäder, Turnhallen, Hallensport-
                plätze usw.
     z    5  Post- und Fernmeldezentrale
     z    6  Rundfunk, technische und Studio-Räume und Einrichtungen
     z    7  Fernsehen, technische und Studio-Räume und Einrichtungen
     z    8  Presse
     z+p  9  Freiflächen für Sport und Spiel, Messen, Parkanlagen
  III  p   1  Kinderkrippen, -gärten, -horte
     p    2  Grundschulen
     z    3  städtische Fortbildungs- und Fachschulen
     z    4  überregionale Schulen, T. H., o. ä. — Lehr-, Versorgungs-, Unterbringungs-
                und Arbeitsräume
  IV  p    1  Arzträume, Unfallstationen, Apotheken
     z    2  Krankenanstalten
     z    3  Spezialkliniken
     z    4  Anstalten, Sanatorien, Heime
     z    5  Friedhof
G  V z+p  1  Hotels
W  I p    1  Wohnungen
```

Abbildung 2: Stadtplan in Grund- und Aufriß mit Diagramm, das die Anordnung des architektonischen Materials zeigt.
Das Material ist links in der senkrechten Spalte durch Ziffern dargestellt. Jeder Pfeil trifft eine zugehörige Linie dort, wo die betreffende Einrichtung vorgesehen ist. Die horizontalen Intervalle korrespondieren mit dem darunter befindlichen Stadtplan.

Reiner Fleischauer's and Jörn Janssen's blueprint of a reconstruction of Karlsruhe after World War II was printed in the leading periodical of musical serialism die Reihe *VII, 1960. The authors mention the ideas of Karlheinz Stockhausen as a starting point for the basic considerations.*

tained between the "pre"-ordering of elements and their arrangement in formal plans in terms of the relationship of their ruling principles.

Orders in simple progression or in repetitive or symmetrical ways are managed by the principle of finding the richest source of aesthetic information and using all possible combinations (for example, in terms of repetition, a twelve-note series should avoid the simple structures of a scale whether chromatic or based on the occurrence of another repeated interval; not only should all elements occur before repeating one of them, but also all possible relationships regarding intervals should be used to construct at least a richly varied succession of elements in line with the requirements of the creative plan).

This distinction between the pre-ordering of the formal parts, or elements themselves, and the arrangement of these elements is fundamental in serialism and is responsible for the permanent justification and self-reflection of artistic creativity, stimulating the never-ending search for the best structural relationship in composition and construction.

(This specific pre-ordering of a group of elements for only one single composition has given rise to the objection that serialism has abandoned the fundamentals of art by leaving an inter-subjective "language" of music. This accusation confuses the eminently historical fundamentals of music theory — especially the development of a so-called language aspect — with the special timeless quality of music for itself, parallel to an anthropological constant of understanding music.)

Fundamentals: Scales and Steps

One specific aspect concerning basic musical material is crucial for the development of serial thinking in music — aside from the importance of this feature for music and music theory in general: this is the undeniable perception of a recurrent similarity or equality in pitches, called octave identity.

The concentration of the consequent ordering of the twelve pitches within the range of an octave as the center of the dodecaphonic technique invented by Arnold Schönberg (more exactly the ordering of the twelve different pitch qualities within an octave range independent of their position in the different octave registers) was the model for serializing musical parameters in the early years after 1951. Lengths, dynamics, attacks/sound characteristics were laid out in a structural form focused around the number twelve, rebuilding the method of organizing a twelve-tone row.

Soon, and especially with the further integration of new dimensions such as layer densities, positions in space, transposition into octave registers, proportion of formal parts and so on, composers had to realize that the phenomenon of octave identity did not correspond to a similar structure in the perception of time, loudness or sound characteristics – not to mention positions in a three-dimensional space or the parameters of vocal-instrumental-electronic sound. They became aware that they had to invent new principles to organize the distribution of elements different from pitches and that they could not trust a similar foundation such as the perception of pitch. All this resulted in a strong awareness of the specific characteristics of the different musical parameters and led to a concentration of different numbers of elements corresponding to the specific range of perception.

A significant step in escaping the limitations of pitch organization transposed as a principle to other parameters was the new way of considering the idea of a scale.

A fundamental example is the chromatic scale of twelve notes. The basic principles of this scale can be seen first in the distinctively perceptible and equal step-building between each of the elements (here a minor second). Secondly – connected with the building of steps – the arrangement of elements in a stepped way with increasing or decreasing values; and thirdly the fixing of a certain range (here any of the closest two notes related by octave identity).

Logically, serial composers in the beginning tried to find out how to invent scales which would correspond to the specific modes of the different fields of perception. This became one of the primary features of serialism: for each parameter used in composition, one has to find the specific range of perception and additionally the necessary number of equal steps between the ends of the scale. The size of the specific step can not be too small because perception of the difference of such steps is not possible, but on the other hand the size of the step can not be too large, for one could not realize it belongs to a scale.

(The chromatic scale of pitches is a good example because it demonstrates the orientation towards the abilities of human perception; a scale with glissando-like elements would no longer be a scale, while a scale with a step of an interval of a major second or higher could not or hardly be perceived as a scale apart from the missing possibilities to be appropriately differentiated.)

Additionally, it is only a logical consequence that a scale must be built up with at least 3 elements. In the works of the early 1950s, one finds the results of this consideration in serial works based on only 3 grades of dynamics or on 5, 6 or more elements in the scales of attacks or others depending on the musical functions and specific modes of perception.

The notorious numbered squares used in the process of serial composition, which very often led to the opinion that serial music was only a sort of mathematics, look different when seen against the background of serialized scales. They become a bare tool to distribute musical elements, obtained with the help of scales, in an always new constellation.

Basically, they have nothing to do with higher mathematics in the proper sense of the word, but are reduced to simple or more or less complicated numerical permutations that help find all possible arrangements or constellations and avoid repetition and monotony in the succession of elements in all musical dimensions.

Elaborations: Quantities, Qualities, Integration and Inter-modulation

A further step to free the serial composer's mind from the limitations resulting from an over extreme orientation towards the characteristics of the chromatic scale of pitches was the discovery in the 1970s that building scales was more than just a feature essential for controlling the so-called quantitative parameters, i.e. the musical dimensions of elements that can be measured or counted.

Scales have also been applied since then for finding a maximum number of elements in the qualitative dimensions of music. In other words a scale with the ends of silence and musical sound can be ordered with the help of quantitative degrees of measuring loudness in the form of decibel values or – more traditionally – by indicating dynamic signs from *pppp* up to *ffff*. But it is also possible to create the steps between silence and musical sound in the form of a progressively arranged scale of different types or qualities of "sound" according to their tendency towards the characteristic of being a musical sound.

With such a scale representing a sort of ontology of perceptible acoustics, the distribution of "nothing" (rest, total silence, "colored" silence, echoes), noises of different kinds, types of human vocal expressions, and "pure" musical sound can be ordered in an appropriate manner and used in a constructive way to integrate the whole realm of the audible (for example in Stockhausen's work *Licht*).

Similarly, it is possible to work with musical events in a new way, constructing scales of musical information (individual and original elements, repetitions, improvisations, contrasting types, elaborations and so on) without relying merely on pure feeling. Furthermore, these scales can be used to design transitions between the different levels of hitherto distinguished parameters.

With reference to these concepts, in 1974 Stockhausen wrote:

Understanding the spirit of serial composing means knowing that this spirit has brought to consciousness something that cannot be undone: to achieve the equal rights of all elements in a composition while respecting the law of natural differences. […] Composition with rows of proportions has for several years not only been applied to single notes but also groups and collections. Further on, composition as a quantitative serial technique has changed little by little to order qualities and not only quantities of perception. […] What was the hierarchical thinking in all fields of music has now been expanded to serial thinking and will be decisive for many centuries.

Since the nature of noises as well as the methods for reasonably integrating noises seem to have become clear, it is now possible to once again consider the characteristics of natural intervals in composition. "Tonality", in the sense of functional harmony and melody, will be valid as a special case like classical mechanics. In all compositions in the future, moments will be reached from time to time of using the quite simple and pure relationships of oscillations. But the new task is to relate these simple relationships and their functions to all grades of non-periodic phenomena. That means that all notes have to be related to all noises and sounds selected for a composition and that all traditional elements of style and form have to be combined and modulated with all newly discovered elements of style and form. Order and chaos are no longer incompatible opposites but rather there is a continuous scale in the transition between them, and in a universal conception of form one is the cause of the other. (*Darmstädter Beiträge zur Neuen Musik XIV*, Mainz 1975, pp. 19-20)

With this fundamental organization of elements in the form of scales, an appropriate method of systematic distribution in an always varied arrangement is strongly connected first to the idea of an integration of different kinds of musical (or generally aesthetic) characteristics; second, the concept of unification of all dimensions based on a theory of proportion valid for all fields of musical phenomena; and third, the above-mentioned need for permanent consideration con-

cerning the coherence of the resulting structure on all levels of composition leading to the extension of creative control step by step with increasing categories of organization.

While as a consequence serialism is changing the idea of music into a systematic and broad concept of sound perception tending to integrate all acoustic events, all modes of aural human perception, and all audible phenomena, the fundamental principles of serial music are no longer specifically musical in the sense of the term used as part of the fine arts. In serialism, music is only one system of ordering elements for human perception while structurally related to all other forms of perception.

A horrifying idea for most music lovers who do not want to give up the old concept of music as sensual pleasure and relief, serialism opens the way to a unified theory of the arts based on the idea of the human capabilities of sensual perception. At the same time, serialism is a revival of ancient Greek theories postulating the whole world as harmony and music as its most significant expression.

"Plug & Compose": Electronic Music

The relationship between serialism and electronic (or rather: electroacoustical) music – whether taped music, live-electronic music, *musique concrète* or computer music – is a complex one (and quite different from using computers and mathematical operations as in the work of the late Iannis Xenakis, architect, composer, and Le Corbusier's long-time assistant, who rejected serial composition).

Firstly (the "science fiction" aspect), the will to overcome psycho-dynamic tendencies in music resulted in the early 1950s in the exploration of new worlds of hitherto unheard sounds which were no longer characterized by the standardized and effect-loaded colors of musical instruments used in the past, but instead marked by a more neutral and technical atmosphere.

Secondly (the machine aspect), the integration of electroacoustic equipment was able to realize the highly complex structures in serialism directly in the form of tapes, thus eliminating problems with the technical limits of human performers or the capacities of musical instruments.

Thirdly (the "super-human"-aspect), the adequate representation of certain new features in music which became, as a logical consequence, an integral part of serial composition, such as the distribution of sounds and their movements in space or the technique of inter-modulation (dealt with below), has been created only with the help of this equipment.

And lastly (the symbiotic aspect), electronic music escaped out of the sphere of exotic colors and strange sounds and developed into a world in its own right through the techniques of serialism because these machines could only be handled and used in a constructive and creative way with the deeply considered techniques of serial thinking.

In 1955, Herbert Eimert pointed out, in the first issue of the journal *die Reihe. Informationen über serielle Musik*, that

The Philips-Pavilion at the World Fair in Brussels (1958) was sketched by Le Corbusier and planned in detail by Iannis Xenakis, who referred in this construction to principles he used for his composition Metastaseis (1953-54). See also next pages.
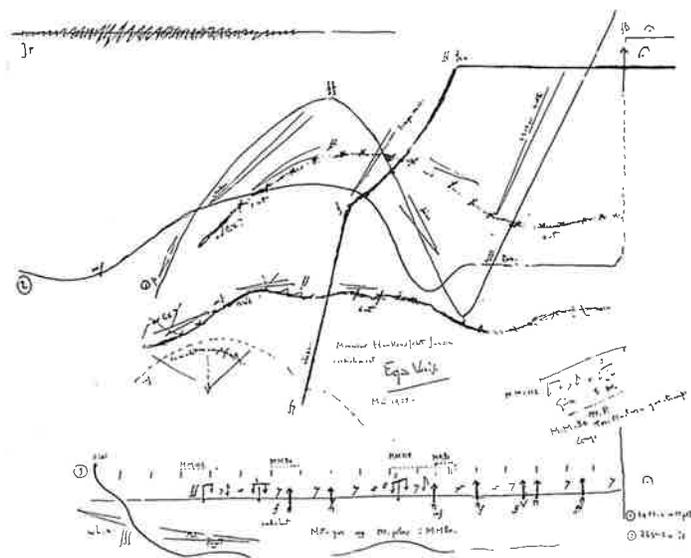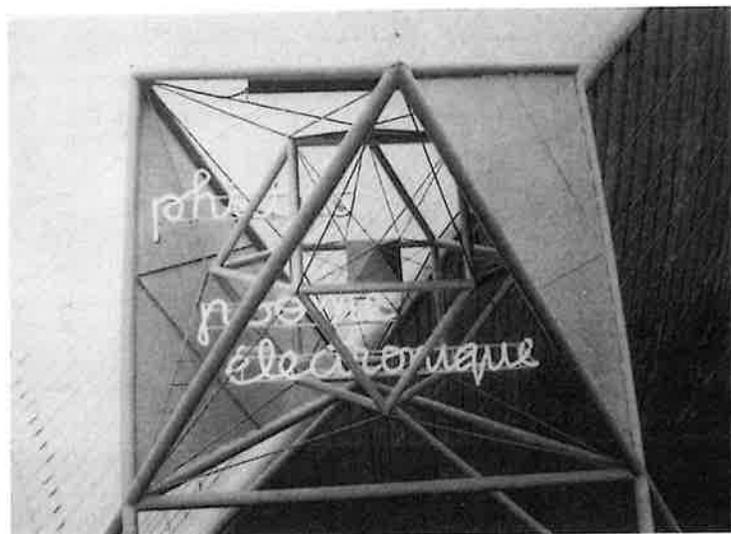
Son et Choeurs

POÈME ELECTRONIQUE

Henri TOMASI
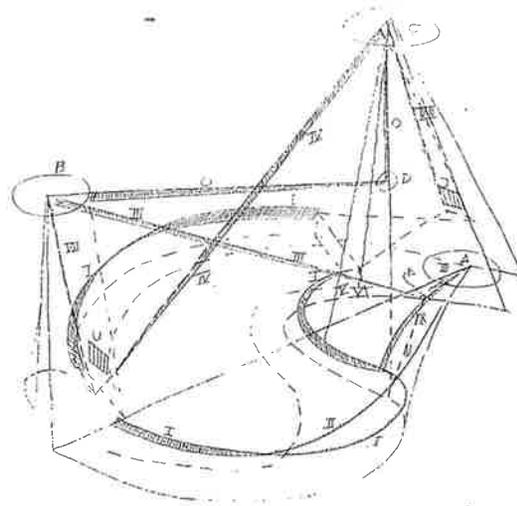
($\downarrow$ = 54)

Basse Solo

pp Ah!

Baryton Solo

Ah!

Ténor Solo

Ah!

Route I horizontal
II I ▸ A
III B ▸ E ▸ A
IV U ▸ C
O B ▸ D ▸ C
VI along the warped surface
VII B ▸ U
VIII C ▸ J
IX A ▾

PLAN OF THE INTERLUDE
120 secs duration

End of the Poème électronique					Start of the Poème électronique
	5 to 15 sec.	10 to 15 sec.		5 sec.	
of Absence. Silence - Reflections of still, diffused light which allows the audience to move in the darkness	A voice announces the presentation in over-ordering the audience to leave the halls in a quite sharp yet normal voice in French or English	90 to 100 sec.
Clouds of intermittent sounds, varying in density and intensity, and moving within the space of the pavilion		of a rhythmic signal understandable by an international audience for example the blows of a hammer which announce raising the curtain at the theatre	

The first page of Poème électronique *by Edgar Varèse, performed inside the Philips Pavilion.*
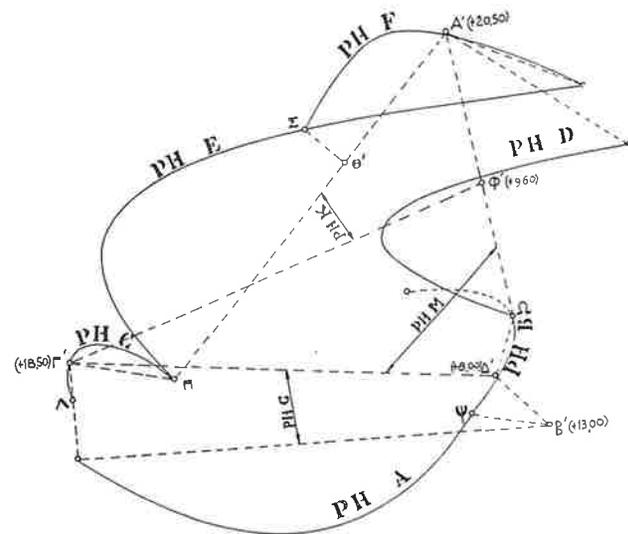
"electronic music is not 'also' music, but serial music", and claims in 1962 in line notes that only "through the strict compliance with exact serial methods have we finally established the compositional moment at all" in electronic music.

Three examples will illustrate the far-reaching influence of electronic equipment since 1950 on music in generating and distributing sound and the exploration of creating radical new musical "events".

The first is the most precise creation of sound ever possible in music history.

Differing from earlier ways of using electronically generated sounds since the 1920s, for example traditional concerts with instruments like the Theremin or later the Ondes Martenot, and differing also from so-called *musique concrète*, marked by the use of basic (concrete) sounds from everyday life merely processed and manipulated with electronics, serial thinking integrated the consequent structuring of purely artificial sounds into the traditional concept of composition. Sound is as important as pitch or duration and no longer something arbitrary which depends on the choice of instruments or capabilities of performers or ideals of interpretation. Electronics allows the composer to "enter" the world of sound and determine exactly which qualities and characteristics a sound shall have. Moreover, it enables the composer to transpose his creative ideas into the microdimension of a note and create greater coherence on all levels of composition.

Correspondingly, with electronics the integration became possible of spatial sound-production in serial planning. A similarly neglected field in music for centuries (like sound), location and movement of sounds in space were upgraded to prominent features in music.

Although certain times and styles in music history focused on the aspect of music in space, like the Venetian Mehrchörigkeit, the realization of sounds moving in space with traditional instruments was restricted to simple order of
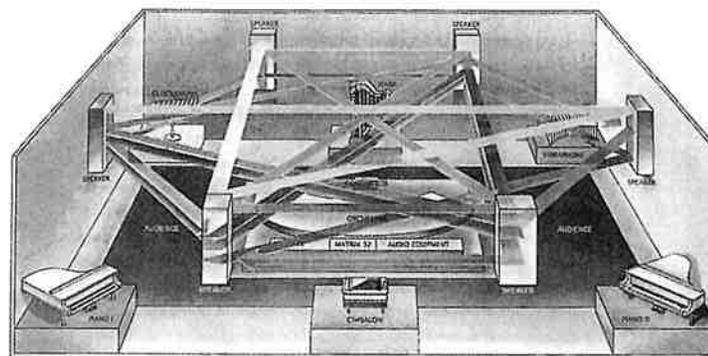
Diagram of the sound projection in Pierre Boulez's Répons, *1982.*

events (cf. Stockhausen's *Gruppen für 3 Orchester* with simple rotational movements). A highly complex composition with real sound movements in space, which delivers more than plain effects and integrates spatial information into the overall formal plan, is only possible with electronic help. Electronic works like Boulez's *Répons* for 6 soloists, chamber ensemble, computer-sounds and live-electronics (1981), or Stockhausen's *Octophony* from the early 1990s shows the intensity of composing space music with digital equipment.

In *Octophony* the listener sits in the middle of 8 loudspeakers arranged in the form of a cube. The work is composed of 8 layers of different sound information. Each sound information has a specific movement of its own sound and can clearly be distinguished from the others. The spatial information here is as important as the parameters of pitch, duration or others and is similarly studied.

Finally – not to mention the development of live-electronic music, the integration of electronics into live-performance common since the 1960s – electronic equipment enabled musical serialism to exceed the firm border established between the different parameters in traditional music: char-

Dienstag, 26. Mai 1953, 11.00 Uhr

MUSIQUE CONCRÈTE

Pierre Schaeffer (Paris)   Einführung und Beispiele

ELEKTRONISCHE MUSIK

Werner Meyer-Eppler   „Die akustischen Grundlagen"

Fritz Enkel   „Die technischen Grundlagen"

Herbert Eimert   „Die kompositorischen Grundlagen"

Herbert Eimert
Robert Beyer   Vier Stücke
   Klangstudie I
                            Klang im unbegrenzten Raum (drei Sätze)
                            Ostinate Figuren und Rhythmen
                            Klangstudie II

Technik: Fritz Enkel, Winfried Bierhals, Heinz Schütz

The program of the first concert of electronic music, May 26th 1953 in Cologne col-
lected examples of Pierre Schaeffer's Musique concrète *and works produced in the*
newly founded Studio of Electronic Music of the Westdeutscher Rundfunk Köln,
where Stockhausen worked for several years.
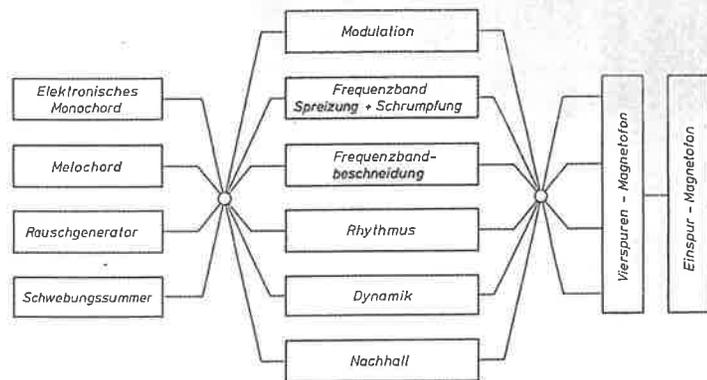
In 1954, the broadcast company NWDR (Nordwesetdeutscher Rundfunk, Köln und
Hamburg) published a Prinzipschema *which shows the basic equipment of the*
Studio of Electronic Music.

acteristics of melody, rhythm or harmony as determinations
of musical shape could now modulate respectively, influenc-
ing quite a different musical parameter.

With the technical help of inter-modulation, it is possible to
create musical phenomena which are marked in a certain
field through the moment of another, for example a rhythm
modulates a melodic line or vice versa (cf. Stockhausen's
tape-music *Telemusik*, which shows good examples of these
techniques in working with music from different cultures, and
Hymnen, which focuses on the different national anthems -
both examples of Stockhausen's concept of World Music
which transposes the fundamental idea of integration to the
level of different civilizations with respect to different musical
and even historical styles).

This device, made possible through electronics, had unfore-
seeable consequences for the concept of music since the
traditionally separate fields of melody, harmony, rhythm and
so on now began to mix and give way to new possibilities in
musical composition.

Arts under Deconstruction

Features of serial thinking are prominent even in fields where the term is not common. A lot of parallels exist between music and architecture concerning the results and appearance of serial concepts. As opposed to traditional types of influence – for example simple analogy, whether with the help of music as a bare source of inspiration or the help of mathematical operations as in the case of Iannis Xenakis' construction of the Philips-Pavilion in Brussels in 1958 which shared central ideas of construction with Xenakis' composition *Metastaseis* (1953–54) – in architecture the integration of principles related to (musical) serialism is far more abstract and even seems to lack sometimes any relationship to music. What is more, in several cases it is not even clear whether there is a direct or indirect influence of avant-garde music or only an accidental parallelism, however striking this may be. The same problems may lead to the same techniques of solutions and, insofar as music and architecture have much in common (for example in terms of the question of order and proportion in material or the individual and social relationship between work and human beings), it may seem reasonable that some features are similar or comparable.

It is striking that the greatest efforts to overcome the aesthetic tendencies of the 19th century have been made in architecture and music. At the same time as Schönberg and Webern's experiments in atonality at the beginning of the 20th century, a critical debate started on trends and objectives in architecture. The ideological positions of the programs were different and included objectivity, functionality and industrial standardization on the one hand and more humanistic, metaphysical and symbolic or religious targets on the other, to name the extremes. The starting point however was the shift away from 19th century architecture – characterized as anti-human and at the same time egomani-
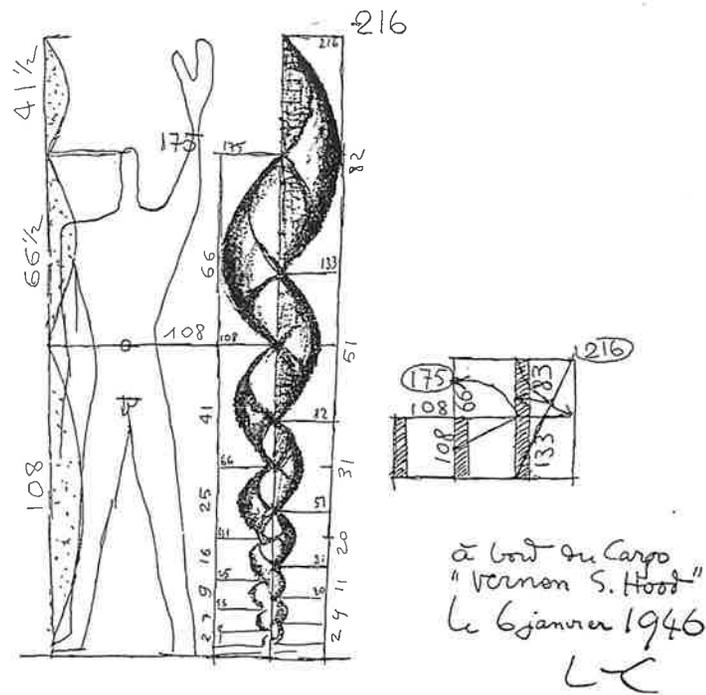
With the Modulor *Le Corbusier created a system of measurement based on human proportions. Stockhausen counts Le Corbusier's* Modulor *among the forerunners of serial thought outside music.*
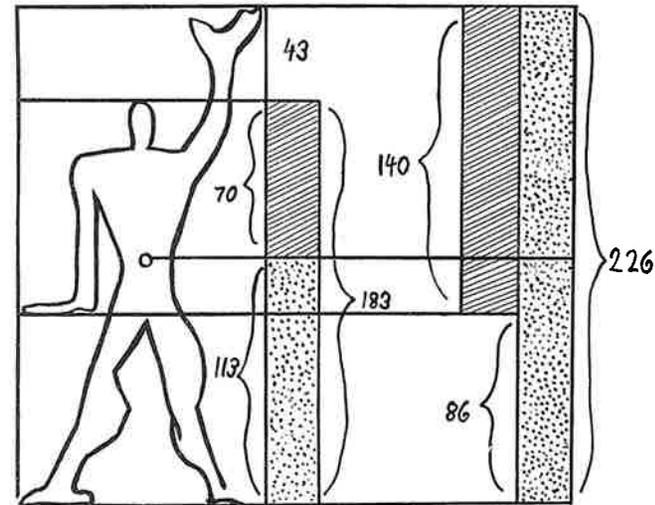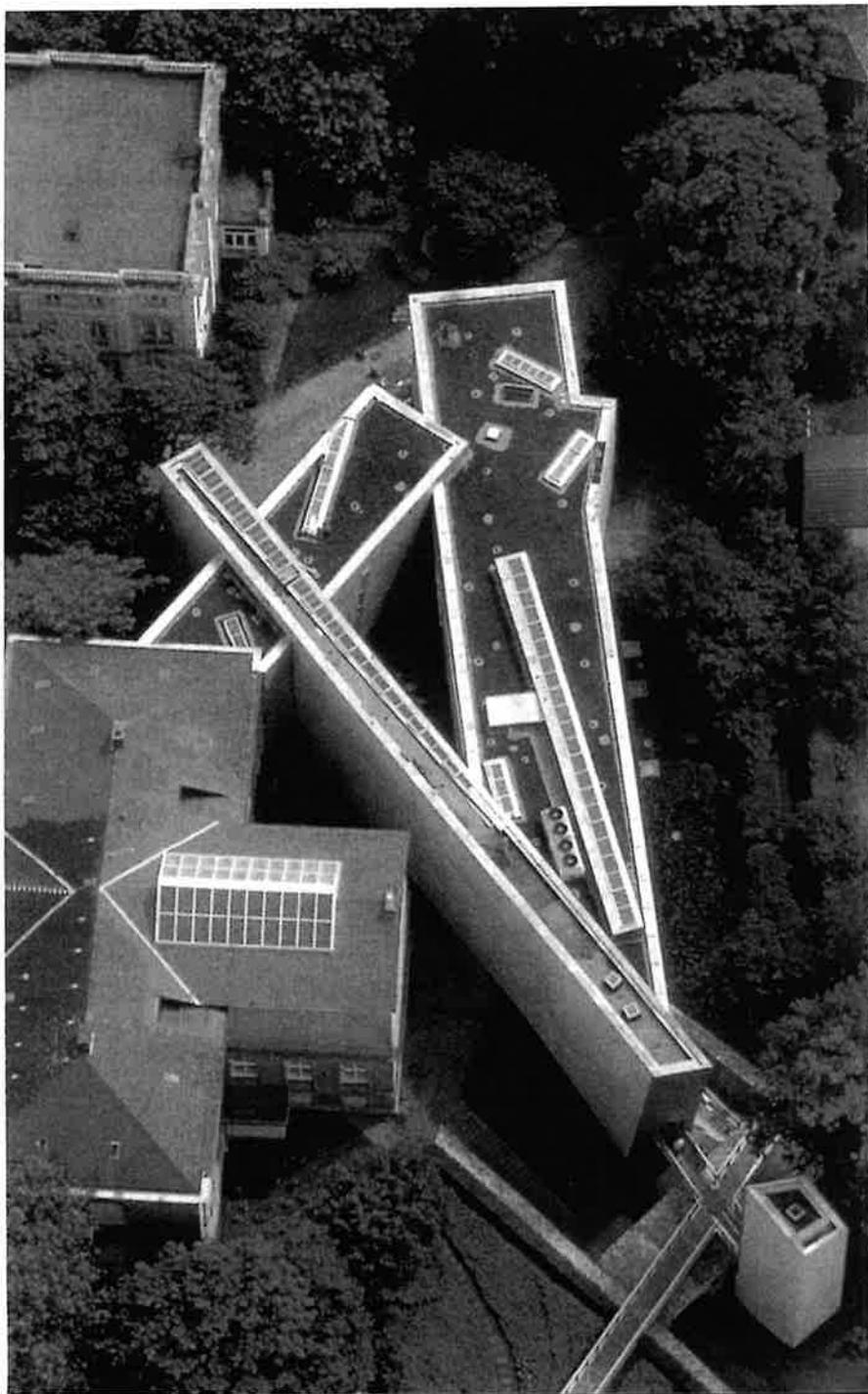
Daniel Libeskind, Felix-Nussbaum-Haus of the Kulturgeschichtliches Museum Osnabrück.

acal and egocentric, monumental and showy, as well as hostile to growth, progress and development – and the conviction that a breakthrough to new values, forms and styles would be one of the central questions, realizable only with the concentration of human values, sincerity and real "truth" in content.

Hans Poelzig mentioned in 1906 (*Gärung in der Architektur*, quoted in Conrads 1964, p. 13), that the "new movement wears the flag of Sachlichkeit [objectivity] against old-fashioned and empty forms which have become a frozen scheme", and claims for a consequent, purified language of architecture without fashionable mannerisms. Similarly, Henry van de Velde pointed out in 1907 (*Credo*; ibid., p. 14), that the functional aspect of the material has to be considered primarily in design and construction, while Adolf Loos in 1908 (*Ornament und Verbrechen*; ibid., p. 15 ff.) wanted to banish every non-functional element from architecture.

Daniel Libeskind, Jewish Museum, Berlin, ground level plan. Below: model.
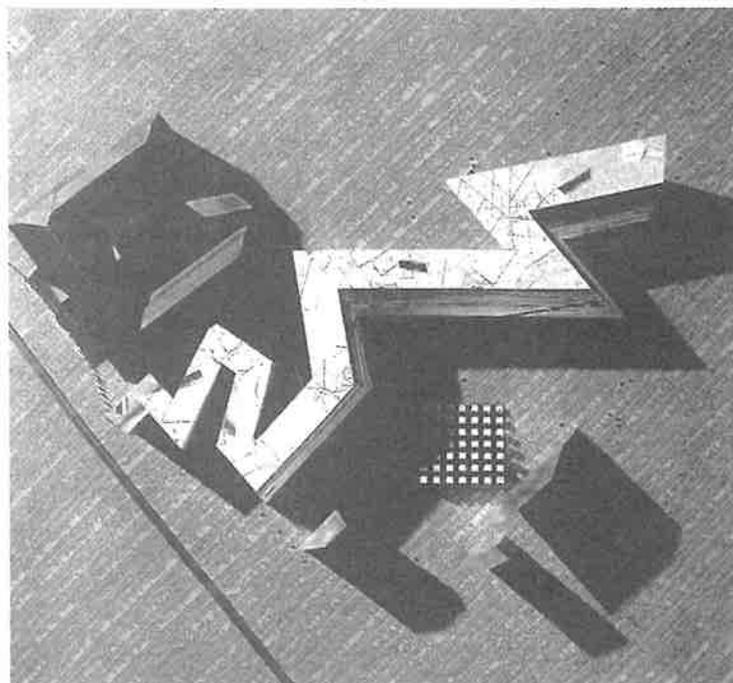
The page from Moses und Aron by Arnold Schönberg used by Daniel Libeskind as a starting point for the design of the Jewish Museum in Berlin.
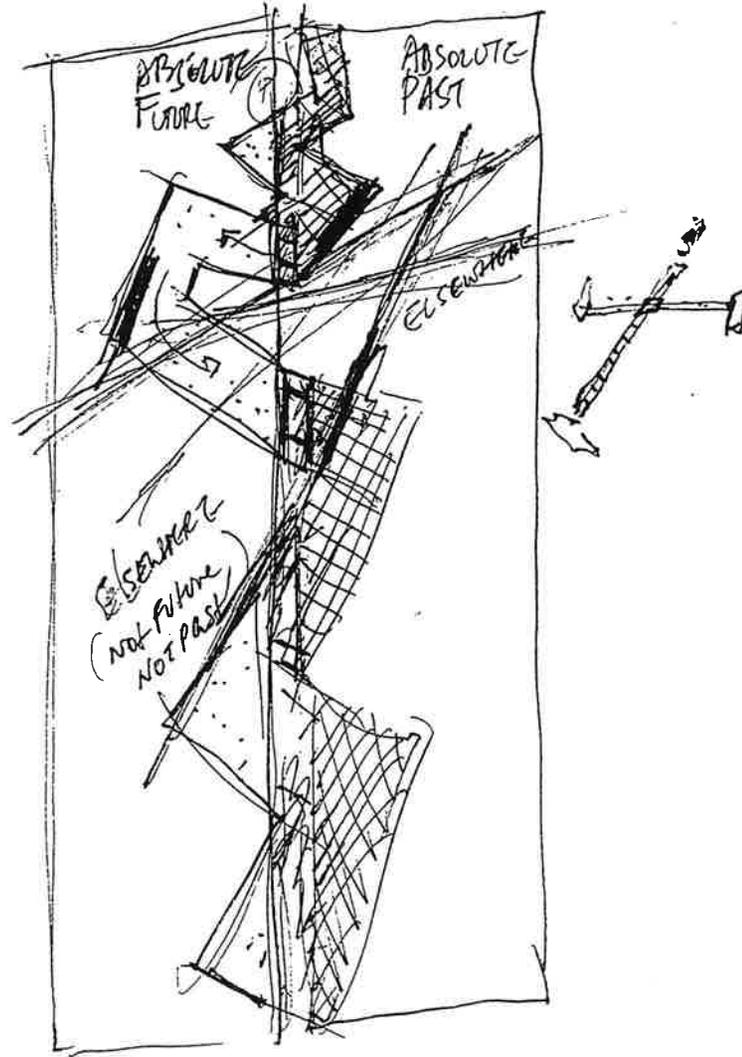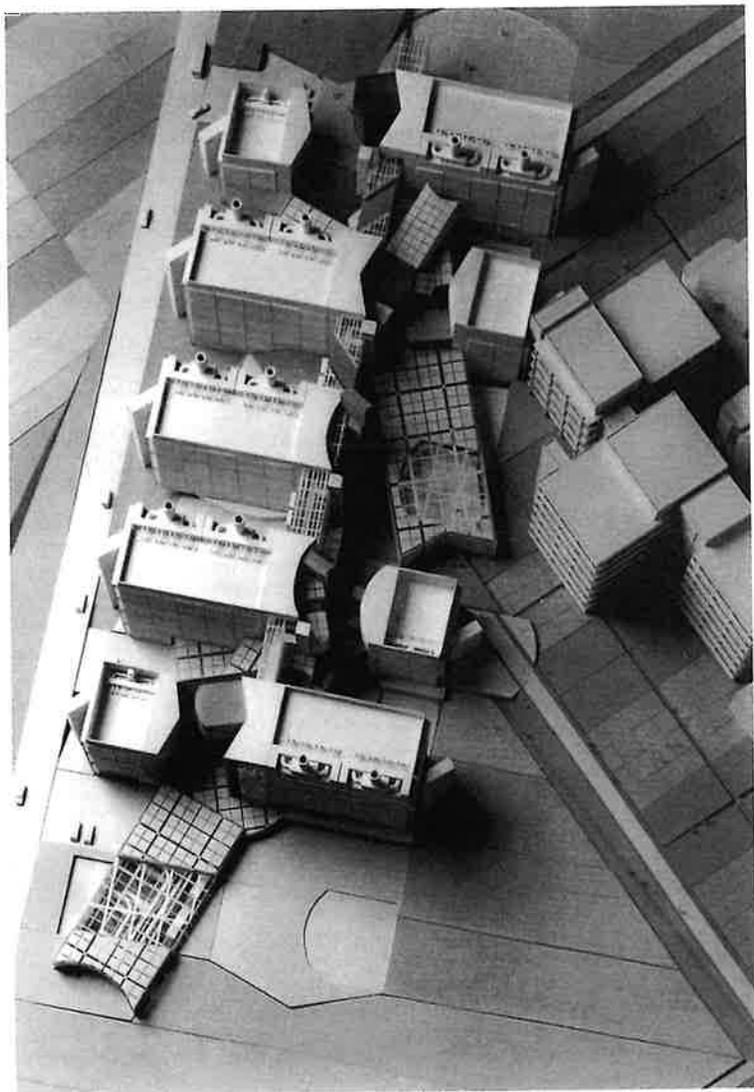
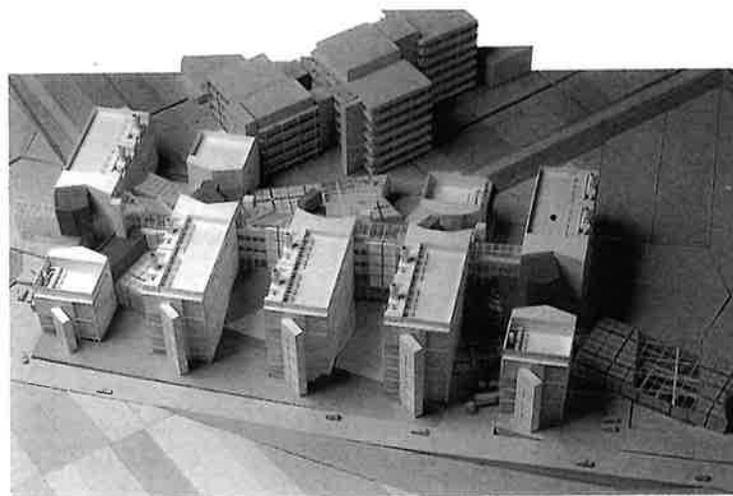Daniel Libeskind, Jewish Museum, Berlin. Left: the ''serial code'' of the building. Above: sketch.
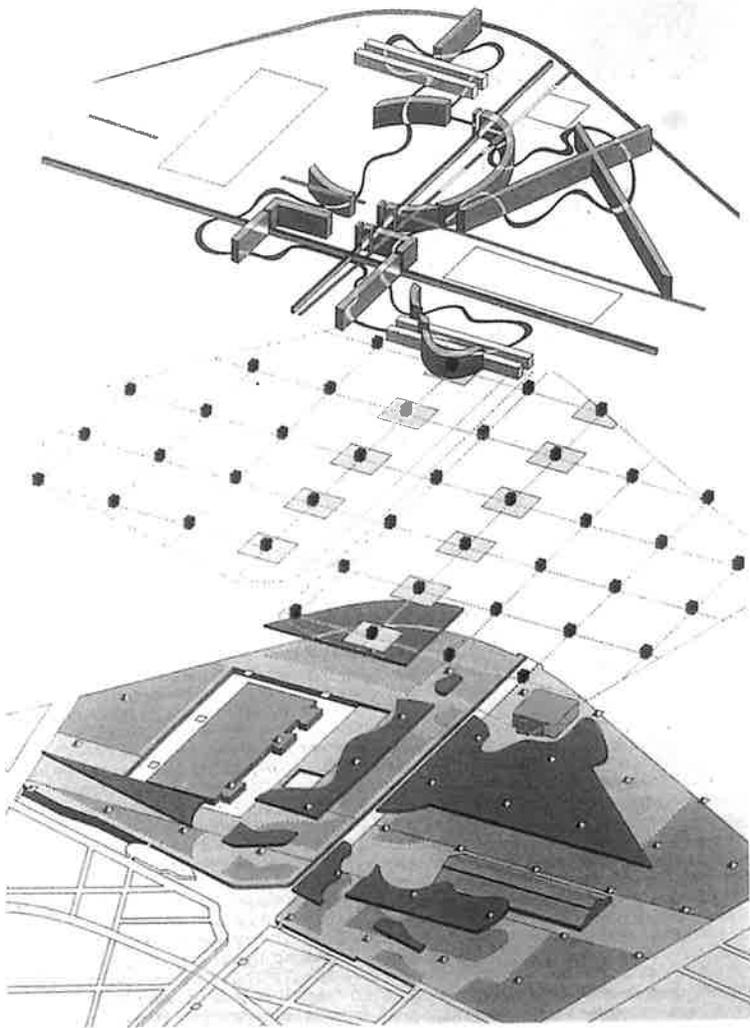
*Above and front page: Bernard Tschumi, Parc de La Villette, Paris, 1982–85.*
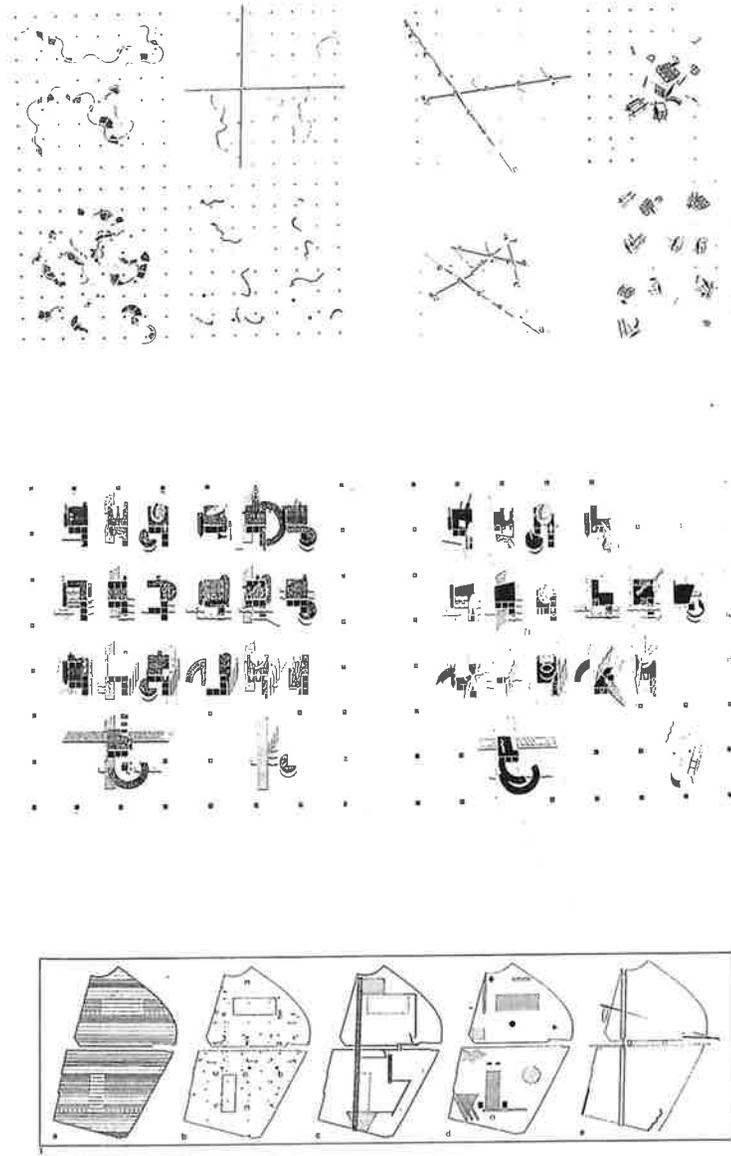
*Above and next page: Peter Eisenman, Bio-center of the University of Frankfurt am Main, 1987, models.*

Frank Lloyd Wright argued against superfluous and arbitrary elements and groups in 1910 (*Organic Architecture*) while after World War I in 1918 the "De Stijl" group (Theo van Doesburg, Robert van't Hoff, Piet Mondrian, G. Vantongerloo, et. al.) in *Manifest I* saw a necessity to leave "individualism", strongly connected with the "old" consciousness of time, and strive for "universalism" as a central part of the "new" consciousness of time. "Tradition, dogmas and the supremacy of individualism are hindering the realization of the new consciousness of time". And in 1924 Doesburg for example emphasized the move away from symmetry and repetition (*Auf dem Weg zu einer plastischen Architektur, ibid.*, p. 74 f.):

> The new architecture has turned off monotonous repetition as well as the strict regularity of two halves – the mirror image, symmetry. There is no repetition in the time, no frontage, no standardization [...] Instead of symmetry, new architecture allows a balanced relationship between different parts, that
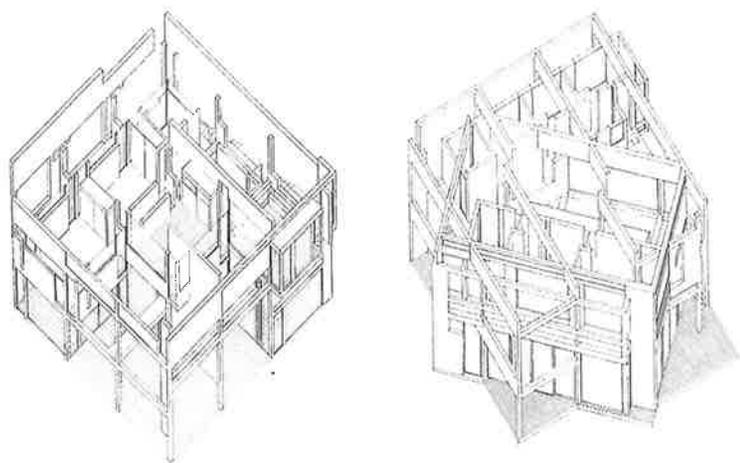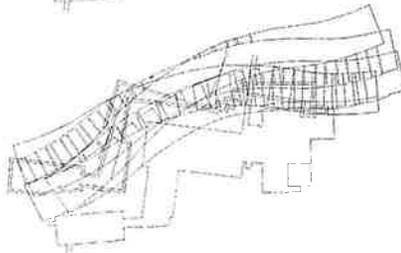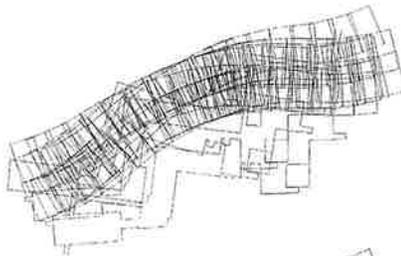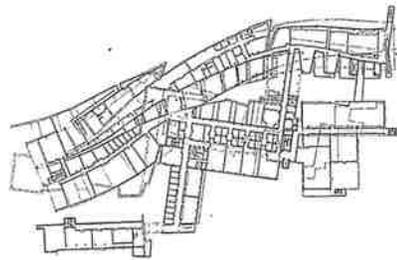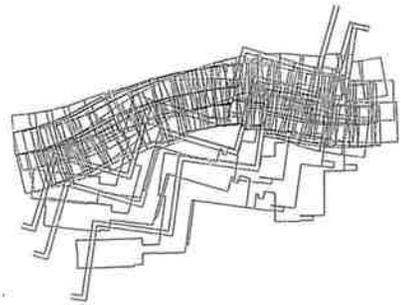
Peter Eisenman. Left: House II *(1969-70). Right:* House III *(1969-71).*
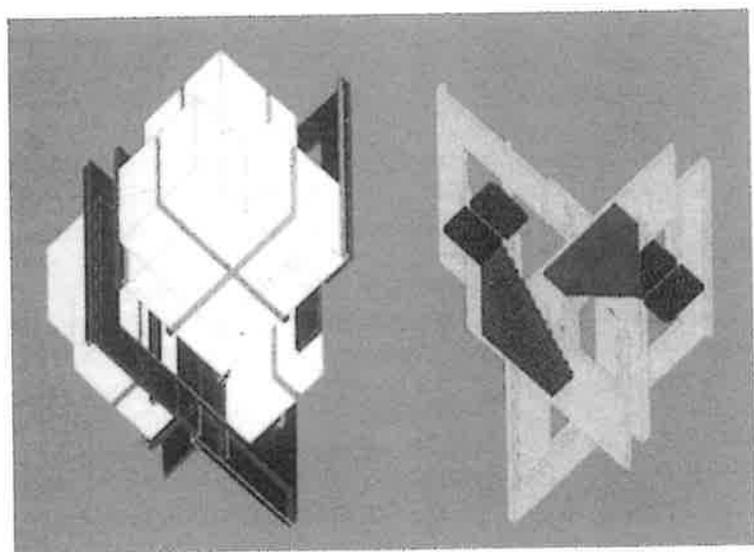
Peter Eisenman, House VI *(1976). Next page: Guardiola House, 1990, blueprint.*
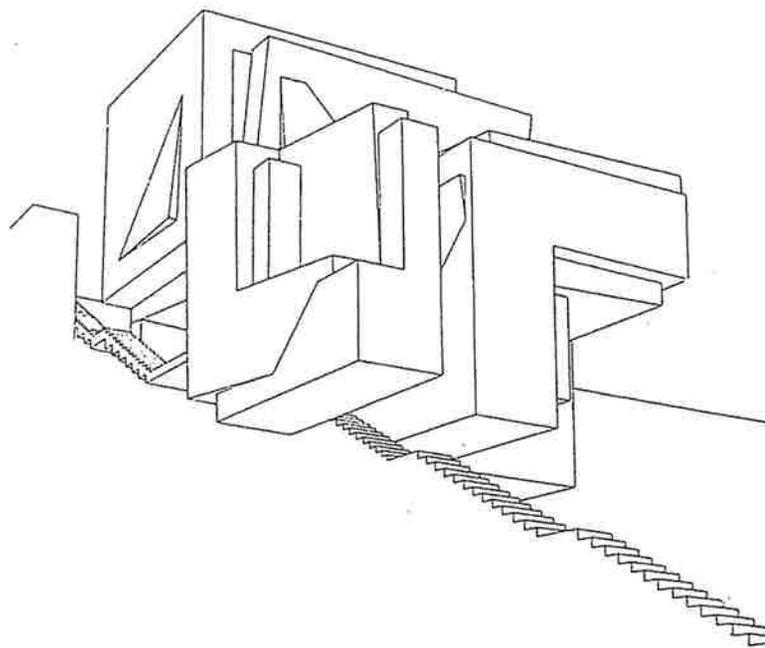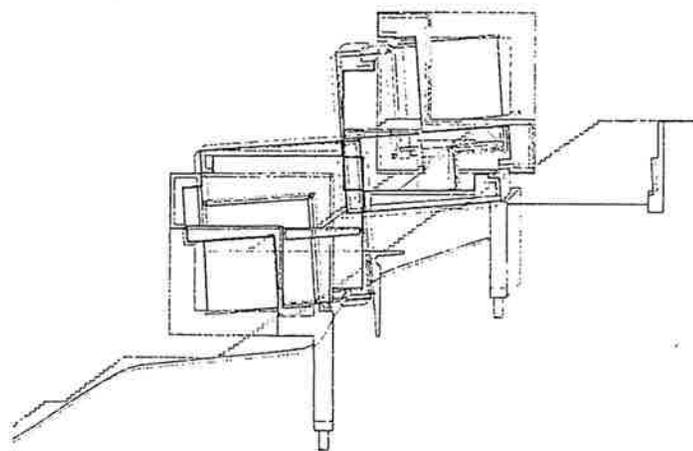
Peter Eisenman, Cincinnati University, School of Architecture, 1988-1991.

means such parts which, in the light of their functional characteristics, differ in position, size, proportion and situation.

All this sounds familiar and recalls the initial position of musical serialism after World War II: the austerity concerning the responsibility of the creative subject whether artist or technician, the integration of the aspects of material, the move away from meaningless and dysfunctional ornaments, the concentration on purified and "true" expression that had to be legitimized.

It is not surprising that in 1950 Le Corbusier compared his invention of a system of "harmonic" measure based on human dimensions with musical concepts; helping to realize the works of this new architecture and in particular to avoid arbitrary and non-human proportions and measurements. The *Modulor* was presented as "a tool, a scale to compose [75] with [...] a whole series of constructions, and also to arrive at large building-symphonies with the help of unity" (Le Corbusier 1950, p. 180).

But quite apart from the austerity and seriousness of proclamations and ideologies and differing from Le Corbusier's influential way of creating unity through proportional relativity, it is the similarity of the aesthetic appearance in musical serialism and deconstructivist architecture that is astonishing (for example, the works of Tschumi, Libeskind, Eisenman). [76-88] Not only is the avoidance of symmetry and repetition comparable with musical serialism but also the conscious turning away from automatically accepted features of tradition, whether common sense concerning the aspects of functionality or the unconsidered continuation of architectural fundamentals as well as the expectations of the users. It opens the way to breaking the rules in using styles and forms as elements of composition, in integrating them systematically into a larger concept of architecture as art instead of merely quoting them as in so-called postmodernism. The technique is also developed of leaving "open" certain fields of techni-

cal definitions of application (quite different from the post-modern aspect of playing with them) and reversing the order and hierarchy of dimensions.

The freedom of "reading" a building is left to the users just as the final formal design in aleatoric compositions is left to the performers (or in literature to the readers as in Andreas Okopenko's *Reise nach Duden, a dictionary-novel*, not to mention James Joyce's *Finnegans Wake* where even the meaning of the words is a result of the reader's work). Further on, the transition of separate dimensions and functions of architecture connects the deconstructivist buildings with the qualitative aspects of musical serialism.

However, the application of serial principles to architecture has not yet come to an end. The aesthetic and social targets in today's architecture are too complicated and have to satisfy too many expectations on different levels, so that architects cannot rely (anymore) on pure feeling or simple measurement.

The control of imagination, the integration of most of the parameters taken into consideration, and the general consideration of the relations between construction, functionality and aesthetics (respectively sensual pleasure and "meaningfulness") may be possible with different tools. The theory of serialism might be the most effective one.

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