Architecture of Process

Towards a Theory of Interrelated Processes in Architecture and Music

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Personal Statement of Motivation

Through operating both within the field of architecture and electronic music, certain similar structures, hidden relations, started to become noticeable at certain moments in time but remained on a level which was not possible to grasp, because they already faded away at that very same moment. However, the affinity with this topic was reinforced through reading Henri Lefebvre’s *Rhythmanalysis* and Jaques Attali’s *Noise*, although with a totally different approach those books attempt to reveal those hidden relations. This opened up the way to this field of knowledge to explore.
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Introduction: Hidden Relationships

How could we grasp the complexity of interrelated processes in space and time in order to intervene in it? How to distinguish elements without losing their relation to others and the whole? These questions reach far beyond the field of architecture and music, however, the isomorphism between music and architecture could reveal some of this before mentioned complexity.

Bernard Tschumi argues: “There are certain things that cannot be reached frontally. These things require analogies, metaphors, or roundabout routes in order to be grasped. For instance, it is through language that psychoanalysis uncovers the unconscious. Like a mask, language hints at something behind itself. It may try to hide it, but also implies it at the same time.”¹ One may suggest that these hidden relations between things – not fixed things but rather processes – are isomorphic. They contain similar structures, inner relations, but have a different origin, a different matter. This isomorphism is never solely a translation from one system into another or others, it is always an interrelationship between them in both directions and the context in which the systems operate and develop.

Another example of revealing such hidden relationship is put forward by Jaques Attali in Noise: The Political Economy of Music, in which he analyses society through music. “Music, an immaterial pleasure turned commodity, now heralds a society of the sign, of the immaterial up for sale, of the social relation unified in money. It heralds, for it is prophetic. It has always been in essence a herald of times to come. Thus, as we shall see, if it is true that the political organization of the twentieth century is rooted in the political thought of the nineteenth, the latter is almost entirely present in embryonic form in the music of the eighteenth century.”²

Architecture and music in general both operate within radically different matter. Music is a structure of sound, noise and silence in time and is mainly directed to the ear.

² Jacques Attali, Noise: The Political Economy of Music (Minneapolis: University of Minnesota Press, 1985) p. 4
Architecture consists of concrete materials in space, however it is perceived an lived in time through movement and event. The aim of this text is not to put forward what the similarities are between architecture and music in the way it is perceived, which goes more to the direction of acoustics and the “everyday soundtrack,” rather the aim here is to reveal certain ways of understanding the complexity of interrelated processes in space and time through the isomorphism between architecture and music.

Could an organizing structure – whether it is an architectural object or a musical piece – be understood as an interrelated process rather than a fixed object in space and time? “Interrelated” is meant here to cover both relations within the process – its inner-relations – as well as relations with other processes and the whole. This goes beyond merely the architectural object and musical piece itself, it encompass their relation to their own modes of production, their relation to other processes within society, their relation to life.

The notion of “fixed object” applies to architecture in both a literal way – as the object itself is conceived as mostly fixed in space and time and consists of concrete materials – and an abstract way – as it is conceived as a fixed predetermined system or order. In a musical piece sound is always transmitted – whether it is performed or else – in time and sound itself is temporal vibration, therefore the notion of “fixed object” only applies to it in an abstract way.

To avoid any terminological confusion it is necessary to clarify that here the definition of “process” is not merely the process of composing or designing. Neither is it merely the process of performing a musical piece or the building process. Rather it is meant as the structure or work itself as a process together with the process which constitutes it.

Could the isomorphism between architectural and musical structures reveal how to understand an organizing structure as an interrelated process? In other words, the aim here is to reveal through isomorphic relationships between architecture and music a means of understanding, a tool of both analysis and design, subsumed here in the term “interrelated process.”

Could this notion of interrelated process become operative as an instrument of analysis of existing processes and relations, in order to reveal possible future ones and provide
alternatives? This implies both processes within the field of the disciplines themselves – its existing orders – and their relation to society.
Could this notion of interrelated process become operative in spatial design practice?

The approach followed in this study starts with the abstract level in order to arrive at a concrete level instead of beginning with results and concrete examples in order to reach a level of abstraction. Beginning with something specific already implies isolation from the whole, which could make it impossible to arrive at a theory which does not lose its relationship to others or the whole.

The first section “Isomorphism of Architecture and Music” focuses on the general concepts, the definition of specific relationships of architecture and music and is an attempt to define the theoretical framework.

The second section “From Harmony to Process” is a historical analysis which follows certain developments of music and architecture in relation to each other, based on the theoretical framework which is developed in the first section. It is not the aim here to provide a complete historical overview of the two art forms but will rather focus on specific issues which could reveal certain hidden relationships regarding a process-based understanding of structure.

The third section “Towards an Interrelated Process” is an attempt to arrive at a certain way of understanding organizing structures as an interrelated process. It is not the aim to provide a single-shot solution or final form, which will result in a closed system. Rather it could suggest a more poetical and open ended means of understanding, an operative theory, an instrument of both analysis and design.
1. Isomorphism of Architecture and Music

Architecture as the most concrete of the arts and music as the immaterial and most abstract of all arts share some aspects which are not present in art forms like visual arts – except film to some extent – and sculpture. The first aspect is that both music and architecture can only be experienced in time. Secondly, they both contain movement and event in time, either physically or immaterial. Finally, these before mentioned aspects manifest themselves through rhythm. In other words, architecture and music are both based on processes in space and time, interrelated processes.

Architecture and Music

Although in contemporary field of architecture the notion of “process” in space and time is already emerging through, amongst others, architects as Bernard Tschumi and philosophers as Henri Lefebvre, the architectural object is still mainly conceived and represented as a mere material and static object. In maps and plans, space is represented through top down views, sections and “surface” representations which lack any trace of movement and event of everyday life and other processes. James Corner describes that, “Ideas about spatiality are moving away from physical object and forms towards the variety of territorial, political and psychological social processes that flow through space. The interrelationship amongst things in space, as well as the effects that are produced through such dynamic interactions, are becoming of greater significance for intervening in urban landscapes than solely compositional arrangement of objects and surfaces.”

Architecture is appropriated through “habit” rather than merely “optical reception,” as Walter Benjamin already expressed. “Thus the [architectural] object…would be defined now not by how it appears, but rather by practices: those it partakes of and those that take place within it.” Therefore, one could argue that for architecture it is of great

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relevance to be not conceived, designed and represented as an end product, a static object, but rather by how it is perceived and lived in time through movement and event. Corner argues that “contemporary design techniques more generally have yet to find adequate ways to engage creatively with the dynamic and promiscuous character of time and space today.”

Departing from the idea that music itself is an immaterial time-based process it could reveal certain approaches which are relevant for spatial design methods. Towards a more dynamic notion of spatial practices and possibility of including movement and event into design, it is significant to identify certain practices and theoretical approaches where an isomorphism between architecture and music is evident. A relationship which is not based on resemblances, like the "harmonic ratios" of the renaissance architects, but rather on similar structures within different origin, different matter, where both art forms, or rather structures, are not conceived as objects but rather as processes within time and space.

Music, the immaterial and most abstract of all arts, covers a rich field: the relationship of music with society, economy, power and technology. The economy of music, its modes of production and distribution are always strongly related to that of society. The technology of printing, recording, musical instruments, radio and so on, had a great impact on music, society and their relation. The function of music as “an attribute of power” is evident through, for instance, its attempt to make people belief in order, through harmony, argues Attali. The field of music also implies its genesis and development in relation to the history of people, the development of music itself as a discipline and so on. Because of its variety it is impossible to give a single definition of music and it is certainly not the purpose to provide this here. However, music encompasses perceived sound – the phenomenological field – as well as the organization of sound in time– the structural and relational field – and makes the combination of these often separated fields audible.

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7 Jacques Attali, Noise: The Political Economy of Music (Minneapolis: University of Minnesota Press, 1985) p. 23
“Firstly, no sound event, musical or otherwise, can be isolated from the spatial and temporal conditions of its physical signal propagation. Secondly, sound is also shaped subjectively, depending on the auditory capacity, the attitude, and the psychology and culture of the listener. There is no universal approach to listening: every individual, every group, every culture listens in its own way.”

Attali describes how, because of its immateriality, music transforms much faster than the material environment and therefore has a foreshadowing character. “It makes audible the new world that will gradually become visible, that will impose itself and regulate the order of things; it is not only the image of things, but the transcending of the everyday, the herald of the future.”

Interrelated Process

The complexity of spatio-temporal processes and the relationships between them is not easily revealed and will never be completely revealed because it is in a continuous state of change. It can only be grasped with theories which remains open ended. However, it may be relevant to distinguish the following issues, in order to get a grip on this complexity.

Movement and Event

“Tactile appropriation is accomplished not so much by attention as by habit. As regards architecture, habit determines to a large extent even optical reception...For tasks which face the human apparatus of perception at turning points of history cannot be solved by optical means, that is, by contemplation, alone. They are mastered gradually by habit, under guidance of tactile appropriation.”

- Walter Benjamin, “The Work of Art in the Age of Mechanical Reproduction”

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Tschumi puts forward that “architecture – its social relevance and formal invention – cannot be dissociated from the events that “happen” in it.”¹¹ This notion of event is directly related to the understanding of an architectural structure through the interrelated processes which take place within it. “Yet architecture is inhabited: sequences of events, use, activities, incidents are always superimposed on those fixed spatial sequences.”¹² A spatial sequence is always related to movement of the one who experience it in time. It happens gradually, rhythmically. Tschumi describes that this spatial sequence is “like a series of frozen frames.”¹³ On the contrary one could argue that by dividing the sequence into “frozen frames,” one could lose the relation to the whole, the continuous flow through space in time. Arie Graafland and Deborah Hauptmann put this forward when they discuss Bergson’s argument about cinematographic illusion: “we try to comprehend movement by slicing time into a sequence of static moments, or immobile cuts, and then somehow we try to meld them back together again. The point being that the moment we apply a principle of measurement to a singular act, the moment we dissect it and then reconstitute it by stringing the ‘snap shot’ views back together (immobile section + abstract time), then we have lost the movement as a whole.”¹⁴ Also the notion of “frames” may imply that a certain viewpoint, a certain perspective is taken and therefore exclude the whole.

The notion of event and movement within architecture and music cannot be seen separately from our conception of time, in relation to our everyday life.

Experience of Time

“Each thing, may be said, changes and arrives in time, yet the posture of externality that permits precise measure and perfect mastery can be struck and assumed only in space…”15

- Sanford Kwinter, Architectures of Time

In order to grasp our contemporary conception of time, and its relation to our everyday life and the dominant mode of production, it is necessary to briefly overview how the notion of time shifted throughout history.

In the pre capitalist society, agriculture was the main mode of production. According to Guy Debord, “The agrarian mode of production in general, governed by the rhythm of seasons, was the basis of cyclical time in its fullest development.”16

The way of experiencing time was based on a cyclical repetition. Times could last for a period and restart, therefore “time was not something passing but something returning.”17 The cyclical “originates in the cosmic, in nature: days, nights, seasons, the waves and tides of the sea, monthly cycles, etc.”18 During this period in history, the cyclical rhythm dominated the society. Mankind was still bound to the environment, to nature, and was not alienated in that sense. Time was measured through the cyclical rhythms of nature and one’s own bodily rhythms. The relationship between body, space and time was present.

A more precise measurement, or rather more abstract measurement of time emerged after the invention of the mechanical clock, around 1271.19 This notion of time is detached from the experience of time itself and becomes a separate entity. Looking from outside creates the possibility of conceiving time within a certain historical frame, a more linear way of understanding time.

15 Sanford Kwinter, Architectures of Time: Toward a Theory of the Event in Modernist Culture (London: MIT Press, 2001) p. 4
17 Ibid. p. 93
18 Henri Lefebvre, Rhythmanalysis: space, time and everyday life (London: Continuum, 2004) p. 8
“It is clear, however, that the idea of modernity could be conceived only within the framework of a specific time awareness, namely, that of historical time, linear and irreversible, flowing irresistibly onwards.”

After industrialization, the linear, ongoing repetition of production dominated society. This historical shift in the dominant mode of production transformed the notion of time within society. The way of conceiving time shifted from cyclical to linear. This linear time became an “infinite accumulation of equivalent intervals.”

The linear notion of time implies the rhythm of consuming images, the “rapid telescoping of changing images.” This constitutes the ever lasting desire for the new, or rather a simulation of it, instead of the returning, the linear instead of the cyclical. Through this constant consuming of images “all that was once directly lived has become a mere representation.” This is clearly visible in contemporary architecture through its modes of representation (which is dominated by an overkill of images, mostly in the form of “surface” representations) and the main focus on form, façade and appearance – as an end product – instead of the inner workings and experience in time. In music this desire for the new is often clearly expressed in music related to mass culture, consisting of merely a succession of climaxes and spectacles, which is no more than a repetition of already often used tricks.

The conception of time and its relation to our way of living could lead us to rhythm, in other words structured time.

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22 Georg Simmel, “The Metropolis and Mental Life,” (Blackwell publishing, 1903) p.11
Rhythm

“Everywhere where there is interaction between place, a time and an expenditure of energy, there is rhythm.”

- Henri Lefebvre, *Rhythmanalysis*

Henri Lefebvre introduces in his last work *Rhythmanalysis: Space, Time and Everyday Life*, which is considered as the fourth part of his *Critique of Everyday Life*, rhythm as a powerful means of understanding daily life. The significance of rhythm as an instrument of analysis is first of all that it approaches space not as absolute, fixed and abstract, but always in relation to time, through the processes which take place within it. Secondly, it reemphasizes on the direct relationship between the human body, space and time, but does not exclude the body in relation to other bodies – social relations – and history, which is often the case within phenomenology.

Although Lefebvre’s *Rhythmanalysis* is directed toward the urban, in its plurality, and music, while this study focuses more on the architectural object, or rather structure, and music, this means of analysis remains relevant because it is applicable to all scales, to the polyrhythmic whole as much as the rhythms within it.

Lefebvre argues that rhythm always contains repetition in space and time, which could be events, movements, differences or anything else. It involves “interferences of linear and cyclical processes” and the presence of “birth, growth, peak, decline and end.”

There is a relationship between the cyclical and the linear in the fact that they can be measured through each other. An example might be that certain era’s in history – which is linear – could be measured through the number of summers which passed – which is a cyclical repetition. Rhythms always contain a measurement in time (duration): “We know a rhythm is slow or lively only in relation to other rhythms (often our own: those of

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26 Henri Lefebvre, *Rhythmanalysis: space, time and everyday life* (London: Continuum, 2004) p. 15
walking, our breathing, our heart).” 27 One could recognize a rhythm through the duration in-between the beats, rather than the beats itself. The before mentioned elements supply a theoretical framework in order to detect certain notions of polyrhythmia, eurhythmia, arrhythmia and isorhythmia. Polyrhythmia is always present in the body and in everyday life; this is the state in which different rhythms simultaneously take place. Eurhythmia is the unity of rhythms in a healthy state. Opposite to the latter there is arrhythmia which is characterized by the disruption of rhythms and is present in a pathological condition, a state of illness. Finally there is isorhythmia which stands for the equivalence of rhythms. While using rhythms as a way of understanding processes in space and time, one should be in full consciousness of its own bodily rhythms which are the main reference, the key tool for measuring other rhythms. One’s own body fulfills an elementary role in the experience of space and time.

“Rhythm reunites quantitative aspects and elements, which mark time and distinguish moments in it – and qualitative aspects and elements, which link them together, found the unities and result from them.” 28

Rhythm makes possible to distinguish elements without losing their relationship to others and the whole. It opens possibilities to grasp the totality of different processes and relations, a polyrhythmic whole. As Sanford Kwinter describes, “Rhythms…do not stand alone; they pick one another out, cut across one another, focus one another, and make one another be “heard.” Rhythms are responsive and reciprocal.” 29 Therefore it is a strong means of understanding which contribute to reveal the complexity of interrelated processes in space and time.

27 Henri Lefebvre, Rhythmanalysis: space, time and everyday life (London: Continuum, 2004) p. 10
2. From Harmony to Process

Before we enter more specific cases, where an isomorphism between architecture and music might be relevant regarding the notion of interrelated process, it is necessary to give a brief overview of where the relationship between architecture and music was based on before the shift to a more process based understanding.

Harmony and Universal Order

Relationships between architecture and music were already fully present during the renaissance, where architects made “use of a universal harmony apparent in music,”\textsuperscript{30} describes Rudolf Wittkower in \textit{Architectural Principles in the Age of Humanism}. These “harmonic ratios” and proportions, of a certain “cosmic order,” were based on the ancient theories of Pythagoras, who discovered the octave by the measurement of tone in space, and Plato’s \textit{Timaeus}. After the rediscovery of those ancient theories during the renaissance, Alberti declares: “the numbers by means of which the agreement of sounds affects our ears with delight, are the very same which please our eyes and our minds.”\textsuperscript{31} Remarkable for this era is Attali argument that “The entire history of tonal music, like that of classical political economy, amounts to an attempt to make people believe in a consensual representation of the world.”\textsuperscript{32} Music has the role of an instrument of power to “proof” a certain universal order through tonal harmony.

Whilst the fact that this relationship is based on belief in a certain universal truth, it became criticized, further in time, by the doubt of a resemblance between the audible and the visual. “To refute the notion of resemblance between musical proportions and those of architecture, it might be sufficient to observe in general, that the one is addressed to the ear, the other to the eye; and that objects of different senses have no resemblance, nor indeed any relation to each other.”\textsuperscript{33} This statement of Lord Kames

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\textsuperscript{30} Rudolf Wittkower, \textit{Architectural Principals in the Age of Humanism} (New York: W.W.Norton, 1949) p. 111
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\textsuperscript{31} Leon Battista Alberti, quoted in Rudolf Wittkower, \textit{Architectural Principals in the Age of Humanism} (New York: W.W.Norton, 1949) p. 110
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\textsuperscript{32} Jacques Attali, \textit{Noise: The Political Economy of Music} (Minneapolis: University of Minnesota Press, 1985) p. 46
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\textsuperscript{33} Lord Kames, quoted in Rudolf Wittkower, \textit{Architectural Principals in the Age of Humanism} (New York: W.W.Norton, 1949) p. 152
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illustrates that the architectural object at this time was mainly conceived through contemplation, by its appearance, rather than something which was lived and perceived in time – with all the senses – by those who where within it.

In general, the notion of tonal harmony continued to be the base of structure in music till it starts shifting around the beginning of the twentieth century. It is not the aim here to provide a historical overview of the development and transformation of the tonal system. Rather it may be relevant to mark some specific cases which are of importance for the shift towards notions of structure based on time, rather than proportion, within both the field of music and architecture, and how those two are related to each other and society.

Those changes in the conception of organizing structures could not be understood separately from the processes within society. Therefore, significant relations are put forward. To begin with a technological invention, at the end of the nineteenth century, that had a radical influence on music and society: the ability to record and reproduce sound.

**Emerging Noise**

The Italian Futurist movement shifted their attention from musical sounds to noise, the non-musical sounds of everyday life in urban and industrial environments. Luigi Russolo declared in “The Art of Noise: a Futurist Manifesto,” written in 1913, that “Every manifestation of life is accompanied by noise.”

Attali states that it was not by chance “that noise entered music...just before the outbursts and wars of the twentieth century, before the rise of social noise.” This social unrest was already forecasted through music.

Noise contains a great variety of rhythms, always with a “predominant pitch” and a “predominant rhythm.” In order to compose noise it is necessary to “understand the different rhythms that compose them” Although this can be seen clearly as a shift from

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previous conceptions of tonal harmony towards one that is based on the infinite variety of dissonances, namely noise, it is still based on the notion of a “predominant pitch,” which is again a tonal structure, based around a central tone, or tonic.

**Shift to Structure in Time**

Although Arnold Schoenberg with his 12-Tone-Technique already attempted to break away from tonal harmony, based around a central tone – by considering all twelve notes of the chromatic scale as equal – was John Cage the first one who radically changed the notion of form and structure within music. He shifted from tonal structure to a structure as “the division of the whole into parts,” one that is based on division of sounds and silences in time. For him structure exists solely in time, therefore he breaks away completely from the fixed conception of structure, from tonal harmony.

**Process of Production**

“THE PRINCIPLE OF FORM WILL BE OUR ONLY CONSTANT CONNECTION WITH THE PAST. ALTHOUGH THE GREAT FORM OF THE FUTURE WILL NOT BE AS IT WAS IN THE PAST, AT ONE TIME THE FUGUE AND AT ANOTHER THE SONATA, IT WILL BE RELATED TO THESE AS THEY ARE TO EACH OTHER: THROUGH THE PRINCIPLE OF ORGANIZATION OR MAN’S COMMON ABILITY TO THINK.”


John Cage hints in his essay “The Future of Music: Credo,” written in 1937, towards a composition which is not based on principals of a tonal harmony, the appliance of some law of a certain pre-given “universal order.” Could his notion of “THE PRINCIPLE OF ORGANIZATION” or “MAN’S COMMON ABILITY TO THINK” already hint to a new form

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38 Ibid. p. 178

39 John Cage, “The Future of Music: Credo” Christoph Cox and Daniel Warner (eds.), *Audio Culture: Readings in Modern Music* (New York: Continuum, 2004) p. 27-28 (note: this part of the text is meant to be in capital letters)
of composition? Later in his essay “Composition as Process: Indeterminacy,” Cage defines a process-based way of composition which leaves a certain freedom to the performer in the way the work can be performed. A strong example, which he and Umberto Eco both described, where this freedom of choice for a performer is present is in *Klavierstück XI*, composed by Karlheinz Stockhausen in 1956. The composition consists of a series of fragments from which the performer can choose a preferable sequence of parts. This creates a certain unique musical form or “morphology of continuity.”

A composition with the character to accomplish “the considerable autonomy left to the individual performer in the way he chooses to play the work” is termed by Umberto Eco as “The Open Work.” "The possibilities which the works openness make available always work within a given field of relations … What it does imply is an organizing rule which governs these relations.”

A work which has this indeterminate and flexible character needs to have a strong organizing structure in order to keep its strength as a whole and will not become a random combination.

How to develop an architecture which facilitates a process based structure that anticipate possible changes in time and provide inhabitants and people that are placed within it certain autonomy in making choices? Could architecture provide a condition where the people can employ their capability to act and think for themselves.

Yona Friedman’s concept *La Ville Spatiale*, from 1958-1962, goes, amongst projects from many other contemporaries, into this direction. It consist of a predetermined infrastructure, fixed in space and time, a three dimensional grid positioned above an existing urban fabric, which facilitates a structure which allows individuals – inhabitants and the people which take place within it – to organize their own spaces within this structure. “La Ville Spatiale, or rather the infrastructure, comprises a very large number of individual messages. La Ville Spatiale forms a blank sheet on which to create a work.

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42 Ibid. p. 172
In this way La Ville Spatiale is a living work of art” Yona Friedman explains.\(^{43}\) Contrary to this, one might question if the infrastructure itself not needs to change in time rather than being fixed. If an organizing structure is adaptable to changing ways of life, the structure itself needs to be a process, structured in time.

In a plan for Tokyo Bay Area in 1960, Kenzo Tange together with his group of Metabolists, tried to adapt the notion of change into the organizational structure of a city based on tertiary, service-oriented, economy. “The architects tried to provide a linear, open system which could accommodate the different rates of fast metabolic change common for tertiary economy…The same separation of metabolic rates can be seen in the office and residential areas where all the functions with the same life-span are grouped together,” Charles Jencks describes.\(^{44}\) Although the structure itself can adapt changes in frequencies, changes in the ways of life, one could question if a megastucture, one single system built at one moment in time is not determining life instead of providing possibilities for change. Jencks argues that such a megastructure, a megastructure in general, is tyrannical and strongly based on centrality, related either with fascism or bureaucracy.\(^{45}\)

Also from this point of view one could argue that a fixed structure, which is itself not structured in time can not accomplish to provide a degree of autonomy or the ability to allow change because the system itself remains unchangeable.

**Gradual Process**
Steve Reich shifts from the notion of the process of composing towards the structure itself as a process. He describes: “I do not mean the process of composition, but rather pieces of music that are literary processes.”\(^{46}\) He understands it as “perceptible processes” which is “happening throughout the sounding of music.”\(^{47}\) This notion of

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\(^{47}\) Ibid. p. 304
“perceptible processes” is highly significant for architecture as well, because the architectural object is always perceived and lived gradually in time.

Reich’s critique on Cage compositional process is that: “The compositional processes and the sounding music have no audible connection.” In other words, the process based and indeterminate approach in composition is not audible throughout the process of listening to the musical piece itself. The process of the musical piece itself and the process which constitute it are not related. He states that this critique was also valid for Serialism and Schoenberg’s Twelve-Tone Technique, because tone rows of which the structure consists of, where often not audible.

Opposed to Cage, Reich declares: “What I am interested in is a compositional process and a sounding music that are one and the same thing.” In other words, simultaneous the structure or work itself as a process and the process which constitute it.

The musical piece will be a gradual process, “a process happening so slowly that listening to it resembles watching a minute hand on a watch – you can perceive it moving after you stay with it a little while.”

His music could be listened to as an attempt to break away from a merely linear experience of time, towards a renewed notion of the cyclical, a renewed relation with the body – although his conception about the “gradual process” is not meant like this. It may be not a coincidence that Reich is influenced by Balinese Gamelan and African drumming music from Ghana, which have its origins in pre capitalist society and a cyclical conception of time.

“The distinctive thing about musical processes is that they determine all the note-to-note details and the overall form simultaneously. One can’t improvise in a musical process – the concepts are mutually exclusive.” One can argue that this is again a closed system. The structure is predetermined and fixed in time. Another problematic thing about Reich’s musical process may be that it refers only to itself, there is no

49 Ibid. p. 305
50 Ibid. p. 306
51 Ibid. p. 306
relation with something else than its own structure. These problematic aspects are also the main relation with Minimalist architecture, which is in addition to this literary understood as fixed object. This makes a comparison between those two structures not relevant regarding the notion of a process-based understanding.

However, it is valuable to think of an organizing structure itself as a process, rather than providing a fixed structure which facilitates different possible changes or possibilities as in the work of Cage, Friedman and others.

One might conclude from this that neither a fixed structure in time which allows changes within the limits of the structure, nor a structure which is a process itself is able to be indeterminate and able to adapt change. One may argue from this point on that an architectural structure as an interrelated process, needs to anticipate on and respond to existing processes, providing an alternative rather than providing a limited freedom within a determined static structure. One might suggest this as providing a process – which cannot solely consist of a material, therefore fixed structure – but need to contain structured time, a rhythmical structure.

Spatio-temporal Process

The notion of architecture and music as a dynamic process in space and time is manifested in the work of Iannis Xenakis. Working for Le Corbusier between 1951 and 1963, as an assistant, he contributed to his late design projects. In his musical and architectural design work throughout his life, Xenakis developed a strong sense of isomorphism between architecture and music which is related to the notion of process in time and space.

For the World Exhibition of 1958, Le Corbusier was approached to design a pavilion commissioned by Philips. Le Corbusier cooperated with Iannis Xenakis, who was mainly responsible for the design of the pavilion itself, and Edgar Varèse, who developed the music for this synthesis between architecture and music: Le Poème
Electronique. The film work which was projected within the pavilion was done by Philipe Agostini.\textsuperscript{52}

According to Maarten Kloos, the “spatial evolution” of the pavilion, in other words the flowing from one space into the other, is directly related to Xenakis’ notion of the \textit{glissandi}, the flowing from one mass of sound into another, in his work “\textit{Metastasis},” from 1953-1954.\textsuperscript{53}

\textit{Metastasis} was composed for a sixty-one instrument orchestra, each with their own speed and pitch, creating a mass of sound which is in continuous state of change. The musical composition, amongst other of his works, manifests “intense movement of sound materials by carrying large bodies of sound to a diversity of points, in a fluid and dynamic manner,” Brandon LaBelle explains in \textit{Background Noise: Perspectives on Sound Art}.\textsuperscript{54} Important tools within this movement are the glissandi. One could describe that Xenakis’ glissandi consisted of several sounds with different pitches which each flow into other pitches within different temporalities. “The glissando is a straight line slanted in space…it is pitch and time rolled into one. The points marking time and pitch are ordered, which means they can be transcribed onto an oblique straight line,” Xenakis explains.\textsuperscript{55}

\textsuperscript{52} Le Corbusier, Jean Petit and Iannis Xenakis, \textit{Le Poème Électronique Le Corbusier} (Eindhoven: Philips Press, 1958) pp. 16-18
\textsuperscript{53} Maarten Kloos “Iannis Xenakis: muziek, architectuur, ruimte,” \textit{Wonen TABK} (1984#2) p. 19
\textsuperscript{54} Brandon LaBelle, \textit{Background Noise: Perspectives on Sound Art} (London: Continuum, 2007) p. 184
\textsuperscript{55} Iannis Xenakis, quoted in Brandon LaBelle, \textit{Background Noise: Perspectives on Sound Art} (London: Continuum, 2007) p. 185
Graphical representation by Xenakis of the glissandi in composition “Metastasis” Time is structured vertical, pitch horizontal, every straight line represents a slide from one pitch into the other by a single instrument. (source: glia.ca)

“In the Philips Pavilion I realized the basic ideas of Metastasis: as in music, too, I was interested in the question of whether it is possible to get from one point to another without breaking continuity. In Metastasis this problem led to glissandi, while in the pavilion it resulted in the hyperbolic parabola shapes,” Xenakis describes.56 This notion of continuity in movement, contrary to the division into “frozen frames,” may be of relevance in order to grasp movement as a whole.

The pavilion and *Le Poème Électronique* in its totality is based on experience of space in time by the visitors, the ones that are placed within or move through this space. Therefore the pavilion both facilitates space for these rhythmic visual and audible processes to happen and its material structure is a manifestation of these processes itself. One may argue that the formal analogy of the geometrical shapes between the glissandi and the material structure of the pavilion may be problematic because it

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relates back to the “universal harmony” present in music and architecture, which was already criticized for the doubt of a resemblance between the audible and the visual.

“The curved planes used in the Philips Pavilion introduce a new element in modern architecture, by their form which complete the plane and straight line, but also by their characteristics of resistance, which is the translation of their geometry.”

Xenakis also worked on Le Corbusier’s Couvent de St Marie de la Tourette (1957-1960) and designed the west wing façade. His design consisted of a four floors façade, where the glass is divided with concrete stanchions in different rhythms per floor, certain tensions and relaxations. Drawn from my personal experience of this extraordinary place, reviewing it through Lefebvre’s before mentioned notion of “rhythm” the following rhythmical processes became evident. From the exterior the façade is manifested in several layers (floors) of rhythms forming a polyrhythmic whole, graphically one could read it as a musical score.

Experienced from the interior the façade projects a dynamic rhythm of light and shadow, changing over time during the cyclical repetitions of days and seasons. These cyclical processes are experienced by the body, with its own bodily rhythms, that of the heart, breathing and the linear process of moving through the building. Here architecture creates, in a very poetical way, a condition of eurhythmia, a unity of body, space and time though a notion of rhythm. It places itself carefully in its context, considering the rhythms of nature and the body, the cyclical. And create a condition in which the cyclical and the linear do not interfere with each other.

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58 Visited by thesis author in 2007
In his musical composition *Terretektorh* (1966), Xenakis interwove audience and orchestra into each other. Hence everyone within the audience has a different spatial position within the musical composition, experiencing a movement of sound from for instance from a position in the middle of it or from further away. Therefore the audience is not a listener or spectator from outside but experiences this spatio-temporal process from within. One could suggest that this is an intertwining of space, time and body, which can be seen as a central element in Xenakis’ work. According to LaBelle, "Xenakis activities are...based on designing not only music but also an architecture in which all the senses can merge."\(^{59}\)

Although Xenakis developed systems which cover space and time, within both the field of music and architecture, he had a strong urge to encompass the whole with single mathematical laws – Le Corbusier’s Modulor, based on the Fibonacci series – which firstly, encompass all in a universal law, excluding possible alternative hidden relations.

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\(^{59}\) Brandon LaBelle, *Background Noise: Perspectives on Sound Art* (London: Continuum, 2007) p. 188
Secondly, as mentioned before, the resemblance between the audible and the visual is doubted. Contrary to Cage and other contemporaries he determined the complete musical piece within his score. By determining everything it leaves out any possible interaction between musicians as well as audience and musicians. However, he anticipates on possible movement and event in a very sensible way, for example through the movement of visitors in the Philips Pavilion, and the eurhythmic assembling of rhythms in Couvent de St Marie de la Tourette. His modes of notation are also of great relevance in order to grasp and represent movement in its continuity, without slicing it into static pieces, both in music as in architecture.

The Potential of New Instruments of Composition
Attali analyzes through music the dynamic relationship between music and power throughout history and attempts to foreshadow with the revealed relationships from the past a possible future order. He distinguishes this in stages, namely “ritual power” in order to make the people forget about daily miseries and violence, “representative power” to make people believe in order and harmony and “bureaucratic power” silencing the opposition by repetition. The latter has its origins with the invention of means of mechanical reproduction, the record, and is still characteristic for the present day condition, where music has become a stockpiled commodity. What is remarkable is the final stage after repetition, in which he foresees a possible new order, namely “composition,” which is “not a new music, but a new way of making music”

“If representation is tied to printing (by which the score is produced), and repetition to recording (by which the record is produced), composition is tied to the instrument (by which music is produced). We may take this as a herald of

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The predictions of Attali – which he already put forward in 1977 – start to become evident in certain forms of present day music. In a concrete form, the emergence of new musical instruments – mainly electronic tools like synthesizer and computer software – fades away the division between composer, musician and listener. Composers simultaneously become musicians and could directly exchange musical work with listeners. Those musical instruments contain new parameters, new structures, which are not based solely on proportion, like tonality, but interrelated variable parameters where the value of one influence the other or others in time.\(^6^3\)

Attali argues that “composition” will meld production and consumption together; it provides the possibility for people to compose themselves. “The bulk of commodity production then shifts to the production of tools allowing people to create the conditions for taking pleasure in the act of composing.”\(^6^4\) Also here Attali prediction starts to become reality. Numerous compositional soft- and hardware instruments are available on the market, many containing pre-set structures and values, simulating the real ability to compose. Achim Szepanski argues in “A Mille Plateaux Manifesto” that “One has to discuss the medial conditions of digital music, the more user-friendly the software, the less transparent the medium itself; i.e. the more transparent the functions of the computer or synthesizers (i.e. with the use of preset sounds), the stronger the medium proves as non-transparent.”\(^6^5\) Therefore could be argued that it is of great relevance that composers have the possibility to control, compose, modify or produce their own instruments, both concrete and theoretical. In concrete, the use of self-built instruments by, amongst others, artists and groups as Merzbow, Aphex Twin, Pan Sonic, and labels as Mille Plateaux are potential examples regarding this. Circuit-bending – the

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\(^6^3\) For example in a modular synthesizer, the values of parameters of an *envelope module* could influence the values of the parameters of a *filter module* throughout time, or the values of the parameters of an *LFO module* could influence the values of the amplification levels and so on. The relations between those modules are dependent on the connections made by the composer/musician.


modification by creating short-circuits in electronic devices as for instance found objects like old toys, keyboards or else – and the writing of new software are examples of the making of self-built instruments. The exchange of the musical work is often self-organized as well, physically through events like Free Festivals or virtual though virtual networks. However the latter still contains some centralized power.

“Composition – a labor on sounds, without a grammar, without a directing thought, a pretext for festival, in search of thoughts – is no longer a central network, an unavoidable monologue, becoming instead a real potential for relationship. It gives voice to the fact that rhythms and sounds are the supreme relation between bodies once the screens of the symbolic are shattered. In composition, therefore, music emerges as a relation to the body and as transcendence...An exchange between bodies – through work, not through objects.”66

The new relation, put forward by Attali, between bodies, through rhythm rather than object, relates to Lefebvre’s notion of rhythm as an instrument of analysis, which might become a potential means of understanding interrelated processes. Attali conceptualizes the shift from the pleasure provided by the object, the stockpiled commodity related to the society of repetition, to the composing itself as pleasure. Composition melds together production-consumption, which becomes a continuous process. Thus one could suggest that composition interweaves the process of production and the structure or work itself as a process. Could this foreshadow new theoretical instruments?

3. Towards an Interrelated Process: a Conclusion

A theory of Interrelated Process is never finished. It continues to reveal new hidden relationships, new instruments. Although it can crystallize at a certain moments in time and becomes materialized in space, it continues to transform.

Music and Architecture: an Interrelated Process

One could conclude from the analysis in the previous section that musical structure, through Cage, shifted from tonal harmony, based on proportion, to structure based on time, “the division of the whole into parts” which results in a form, a “morphology of continuity.” This notion of a time-based structure opens up to a new field of possibilities to explore – in the field of music as well as architecture and their relation with society.

The search for structures which allow certain autonomy to the people to complete a work, led in the field of music to several open, indeterminate structures, a “composition as process” rather than object, in which the musician had a certain freedom to choose how to finish it. The process of production, how the music was performed, was not completely determined by the composer. This resulted in several structures, with different degrees of freedom, which always consisted of a rule which organized the choices which could be made.

In architecture this led to designs for fixed structures, megastructures, in which possible future transformations were possible. Examples were Friedman’s infrastructural grid in which inhabitants are allowed to organize their own living spaces, or the Metabolist’s linear infrastructural organization which should be able to adapt fast changes. In both cases the structure itself is fixed, meant to be materialized at one single moment in time, which in both cases not happened. Jencks critique was that such megastructures are tyrannical and centralized, related either with fascism or bureaucracy. From this point

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68 Ibid. p. 176
of view, one might argue that a structure which could adapt changing ways of life needs itself to be a time-based structure, an interrelated process.

Through Reich and Xenakis who had this sense of a time-based structure, one might argue that such structures always determine processes because it is exactly time which they structure.

One might conclude from the different examples of an isomorphism between architecture and music, that neither a fixed structure in time which allows changes within the limits of the structure, nor a structure which is a process itself is able to be indeterminate and able to adapt change. One may suggest that an organizing structure as an interrelated process, needs to anticipate on and respond to existing processes, providing an alternative rather than providing a limited freedom within a determined fixed system. This may lead to an organizing structure which provides a process – which cannot solely consist of a material, therefore fixed structure – but need to contain structured time, a rhythmical structure.

One might argue that the predictions made by Attali, namely the formation of a new order which he termed “composition,” after the age of repetition, the stockpiled commodity, partly starts to emerge. It relates to the invention of new instruments and consists of a new relation between bodies based on work through rhythm and sound, rather than objects. This could be related to Lefebvre’s notion of rhythm as means of understanding. Therefore one might put forward rhythm as potential tool of analysis and structural instrument within the notion on interrelated process.

Attali argues that production and consumption will meld together into a continuous process, an interrelated process. One might argue that in a continuous state of change, the main structure is rhythm, structured time.

One may understand the interrelated process in a twofold way. First, as an instrument of analysis, revealing hidden relationships, here through the isomorphism between music and architecture, which reveals the second, namely interrelated process as an instrument of practice. Both are responsive to one another and remain in a continuous state of change.
Interrelated Process: Instrument of Practice

One may conceptualize now an organizing structure which anticipates on existing processes in order to structure an interrelated process, an alternative, rather than providing a fixed structure. This might generate an interrelated process, which can be adapted by future processes or transformed into others.

An organizing structure – whether it is architectural or musical – as interrelated process implies its inner-relations as well as its relations with the complexity of interrelated processes. In other words, it implies the relations within the structure itself and the relations between the structure, others and the whole.

If an organizing structure is understood as an interrelated process, the structure itself cannot remain fixed in time. Therefore one may suggest the subdivision into rhythmical structures, which imply the immaterial structures throughout time, and material structures, which cover the crystallization of the concrete structure and its modifications in space at specific moments in time. The material structures are ordered around the rhythmical structures. The material is responsive to the rhythmical and visa versa, this could be conflictive or reciprocal, arrhythmic or eurhythmic.

The rhythmical structures cover the organization of movements and the succession of events in space, time and intensity. Those structures contain perceptible processes perceived by the body, the inner workings or inner-relationships within the structure, as well as the production processes which constitute the material structures and the relations with other rhythms and the polyrhythmic whole. The material structures imply the organization the concrete structure's crystallization and its modifications in space at certain moments in time.

“…there will still be hidden instruments playing.”

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Architecture Theory
Music theory

Theory on Space-Time

Historical context and contemporary condition