Objects and Morphology

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Abstract

Chapter 1 projects a view on methods for deriving compositional rules and some abstract compositional methods, according to Koenig. These notions will be compared to some other similar idea's on composition. From there I will move towards the notion of field composition based on the extremes of system and chances composition.

Chapter 2 is a reflection on my own work, in which I will outline the compositional process of three different compositions created during the period of 2009 until 2011.

Chapter 3 presents a theory based on the Cologne aesthetics. Based on these conceptions a theoretical framework will unfold that is based on the idea of a single sound. This notion is compared to the concept of the sound object, in the Schaefferian sense. Through this framework I will move towards the Vaggionian concept of the object, in the digital paradigm. The concept of singularity in the musical composition will be presented. Furthermore, the idea of space through micro-temporal time-decorrelation will be discussed. And afterwards, the practical implications of these theories will be outlined. And finally, this chapter will end with a description of a piece created in 2012.

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Contents

0. Introduction

Since the late 40's, specially in the field of computer music, there has been the tendency to partly or totally formalize the compositional process. Many composers of the last century have practiced and written about their formalizations and compositional processes. In this text will not give a historic survey on formalization of the compositional craft, nor will I try too recapitulate the development of computer music, as there are already numerous articles and books that deal with these subjects. Instead I would like to give a overview of my research in the field compositional theory, which will unfold in a theoretical framework. For this framework, I will mostly rely on the theoretical thought of Gottfried Michael Koenig and Horacio Vaggione, whose texts and music have had an illuminating impact on my own music and understanding of the compositional craft. Further more, their theoretical thought have provided me with the opportunity and insight to reflect and elaborate on my own musical work. Even though, I am not going to sum up the history of formalization in the compositional craft, I will mention in this text some historical examples, that will give me the opportunity to further clarify the theoretical framework I want to unfold during this text.

Most of the formalizations rely on a particular systematic approach toward the compositional craft. These formalizations provide us with certain methodology and insight in the field of composition which has many advantages. First of all, formalization provides the composer with the opportunity to shift his or her attention towards a higher level of composition. It also provides a useful and efficient way to identify and compare aesthetic aims of particular composers and schools of composition. And furthermore, it enables us to relate the arts, sciences and technologies to their similarities and differences.

1. Composition Processes, Methods and Rules

1.1 Introduction

Formalization of composition is not something of only the last century. One of the earliest examples I found during my research, is that of the pioneer of western musical notation Guido d'Arrezo (Loy 2006, p.286). Guido d'Arrezo was already working according to a formalized system in 1026 A.D. Guido's first step was to construct a table of correspondences between the notes of the scale and the vowels in the sacred Latin texts. He extracted the vowels from each word in the text, which he translated to corresponding pitches. By following this procedure, he composed the melody for the entire text in which the pitch changed on every vowel. Mentioning this example has two reasons; the first reason is to stress that the corresponding pitches he derived from the Latin text, were according to self-constructed rules, or system we might say, by the composer himself; secondly, because inside the self-constructed, constrained system, the composer must exercise his subjective ability to develop a musically interesting line. Guido's formalized system or methodology, required two inputs for the realization of a compositional work. This first input is that of the vowels of the text, which are predetermined by the Latin text itself. The second input is that of subjective choices a composer has to make, which will work as another layer of "constraints" on the predetermined character of the text.

"Composer build musical situations by creating constraints that act as "reflecting walls" inside which a tissue of specific relationships is spun" (Vaggione, 2001a, p.57).

2.2 Musical Composition vs Composition Process

In this part of the text I would like to oppose two terms; that of musical composition; and composition process. If we talk about composition we could make a discrimination between musical composition and compositional processes. By doing so, I want to suggest that for me it is more relevant to talk about composition in terms of compositional processes instead of talking about a musical composition, because of the openness of with regard to the result. By musical composition we generally understanding the production of music, whether it is an instrumental score on paper or an electronic music piece on tape. In this notion, musical composition emphasizes more on the result of a composition. Koenig (1978) states that the concept of composition is "closed" with regard to the result, but “open” with regard to the making of a composition. With this statement he clarifies for me that musical composition, thus the “result”, tells us nothing about whether the preparatory work was essential or not. While the term composition process, has to do with description of preparatory work, which could be describes as choices of instruments, values for dynamics, durations, rules or rule-like processes, definitions of sounds in electronic music and invention of graphic symbols. A composition process could be formalized, broken down to de sequence of describable operations and result in a system. The composition process can offer means of abstraction and formalization, which could be “open” or undetermined with regard to the result. With “open” I mean to say, that without having any aim of predetermination, rules could be derived from these abstractions.

1.3 Deriving Rules

Deriving rules for compositional craft could take many different forms. Earlier we mentioned Guido's method of deriving self-constructed rules from sacred Latin texts. According to Koenig, from his article *Composition Processes*, compositional rules can be derived in three different ways; by *analysis*; *introspection*; and *description of a model*. The first way of deriving rules suggested by Koenig, is by *analysis* of existing music in the past and present. This means that the rules derived from this method are based on preceding rules from the past. Koenig (1978) states that analysis and synthesis do not cover each other perfectly up. By this, he means that the result of the analysis of pre-existing music, will not guaranteely lead back to significant music in the present. Furthermore, he clarifies that by stating that analysis proceeds from questions that are not necessarily that of the composer.

"The historical line of sight would at the same time be unhistorical, because it would ignore historical development and measure works from different periods by the same standards. One might also ask whether a composer who wants to create something new can benefit from frozen models from the past. In all this we must of course not overlook the fact that knowledge of compositional means as developed during the past centuries and exerting influence right up to the most advanced composing, is an absolute prerequisite." (Koenig, 1978, p.5)

A second manner of deriving rules is that of *introspection*. Here a composer analysis his own experience. The composer investigates whether and to what extend his way of composing is formed

by habits which can be formulated as rules. If we compare this with the previous manner of deriving rules by analysis, we could say that analysis is replaced by intuition: by introspection, analysis is replaced by the intuitive task of the composer to discover rule-like aspect in his own work. By formalizing these rule-like aspects, we could bring these to a higher level of generality.
Koenig mentions also the drawback of such a method, by saying that the act of introspection results in less, or no objectivity. We could ask the questions; to what extend choices of a composer must be objective? And is objectivity in deriving general rules a drawback at all? Less objectivity means also less analytical, which also could be of great advantage; the advantage of proceeding from more synthetic problems, which means that it is aimed at matters of compositional craft, and by that justice more to reality. I have to mention here that results derived from introspection still have no precedents to compare with, except those of the composers own work. By this, the results of such an evaluation, only could be useful when a composer wants to extend his own goals, and further elaborate on own ideals.

A third manner of deriving rules is that of *description of a model* remote from analysis or introspection, and emphasizes more on synthesis itself. Synthesis is here the result as a translation of the model. The results produced by the model cannot be compared with precedents or ideals. Systematic approaches toward composition with the model, will more likely translate itself as methodical experimentation. An experimentation in which repeated applications of the model, but under changed circumstances, will make the limits of the model clear:

"*Accumulation and correlation of the results cause the model to reveal itself and the same time the extend to which it coincided with musical reality. The analytical task - given the music, find the rules - is reversed: given the rules, find the music"*
(Koenig, 1978, p.6).

A great example of a composition in which rules are derived from a model remote from pre-existing music, is the piece *Pithoprakta* (1955 – 1956) by Iannis Xenakis. Xenakis used for this piece the model of the Brownian motion of gas particles, combined with Bernoulli's Law of Large Numbers. He used this model as the basis for the cloud pizzicato glissandi section in Pithoprakta. After calculating, statistically, over 1000 velocities of gas particles as instants of time, he graphed them in an X/Y-plane, and found ways of mapping these motions into 15 pitched sections (Fig 1).

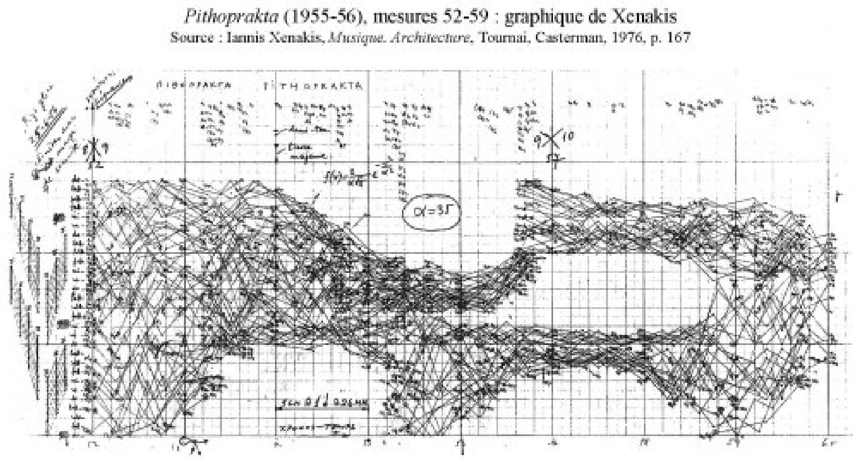

Fig 1, The composer's graph plotting paths of glissandi in "Pithoprakta," bars 12-60. Each line represents a string instrument named on the vertical axis, starting with the lowest register at the bottom to the highest at the top while the horizontal axis represents time.

The fact that Xenakis uses Brownian motion of gas particles as a model for synthesis, does not guarantee musical fertility. Only by methodical experimentation one could derive the musical relevance of this musically “remote” model. The quantity in which the results of the model can bring musical fertility cannot be compared with precedents, and therefore is subjected to the composers own goals. The results derived from the model, appeal to the evaluator's capacity for discovering what is special in what is general (Koenig 1978).

1.4 Compositional Methods

In the article *Composition Processes,* by Koenig, there are some general abstractions mentioned of composition methods. One could derive these methods by introspection (of own work), which in many times could result in a combinatory use these abstractions. Even though, any combination of these abstractions is possible inside a single compositional work, I will present them in an isolated view. These abstractions are specially useful in in the case of introspection and model construction, because of their high degree of generality. In many cases have these abstractions been useful for me to reflect on my own work as a composer.

The first method is that of *interpolation*, that presumes from a pre-conceived global plan, whose details are filled in by a later stage of composition. This method pushes forward from the outer limits of total form into the inner areas (Koenig 1978). If we think in terms of duration, this could mean the division of the total duration of a piece into group sections, sections in to groups of sound, groups into sub-groups en so on. The idea of a pre-conceived global plan correspondents also to the traditional idea of form in classical music, where formal schemes have been used by composers as molds. This kinds of formal schemes were criticized in the turn of the twentieth century by composers like Claude Debussy, who discarded what he called *"administrative forms"* (Roads 2001).

The second method is that of *extrapolation*, and is an contrasting approach compared to the above mentioned *interpolation*. Extrapolation proceeds from the interior toward the outside: *"...from individual sounds to group of sounds, thence to super-groups, via sections to total form."* (Koenig 1978). Edgard Varese also touches this subject in 1971 by stating that "*Form is a result - the result of a process."* By this he means that the total form only can constitute itself as the result of internal processes. This kind of germ-cell approaches to composition generally expand to larger structures by series of formula thought permutation and combination.
A similar approaches as that of *interpolation* and *extrapolation* are mentioned in the book *Microsound* by Curtis Roads, where he writes about the *design of macroform*. Here *interpolation* is described as "top-down" approach, and *extrapolation* as a "bottom-up" approach: *"...a strict bottom-up approach conceives of form as the result of a process of internal development provoked by interactions on lower levels of musical structure."* (Roads, 2001, p.13).

The fact that *interpolation* and *extrapolation* are two contrasting notions, doesn't mean that both methods could not work in complementary to form a piece: *"Both methods are concentric; the formal shells which so to speak enclose the nucleus of the form exist in ideal simultaneity; the form is not unfolded teleologically but rather pedagogically, the details being presented in such a way that the relation of the detail to the whole is always quite clear to the listener"* (Koenig, 1978, p.7). The idea of both methods being concentric also reflects back in the thoughts of the composer Horacio Vaggione, when he speaks of mediation between the "local" and the "global". Vaggione proposes that a mediation in the form of interaction can be redefined between the "local", driven by direct action, and the "global", driven by algorithmic calculation, by giving them the same status: that of compossable events (Solomos 2005). Also Curtis Roads mentions that these two contrasting approaches, which he calls "top-down" and "bottom-up", could work together to form a piece: *"For some, composition involves a mediation between the top-down and bottom-up approaches, between the abstract high-level conception and concrete materials being developed on lower levels of musical time."* (Roads, 2001, p.13)

Another abstracted composition method, is called the composition of *blocks*. By *blocks* we mean sections or parts of a structure which requires to be completed by other blocks to form a piece. Koenig (1978) mentions that it is easier to apply rules for individual blocks, than entire pieces, because they are of shorter duration and do not have to meet the demands made on pieces. This last notion means that each individual block is complete by itself, by applying independent rules for each block. The idea of constructing a composition from individual blocks, already existed in the classical era. An example is the *Musikalische Wurfelspiel* (Musical Dice Game) of the 18th century, which consisted of pre-composed blocks who's succession depended on a random choice, by the throw of a dice. The random order of the successions emphasized in a way the idea of interchangeability of the blocks, and at the same time articulates the independence of these blocks.

Opposed to the methods of *interpolation* and *extrapolation*, is what Koenig (1978) calls the *chronological-associative* method. This means that the composing process unfolds along the time-axis, and by this the composer is put in the position of the 'ideal' listener. He also states that by such a method each event is given a 'irremovable' place in time. Stockhausen remarked that each sound had its own unique place in an electronic composition, and could never be used in any other place it was conceived for (Koenig, 1987). The reason for Stockhausen was the direct link between composing sound and composing form. We could look at this concept of the 'irremovable' place a sound occupies, in different perspectives; one could look at it from the notion of *interpolation* and *extrapolation*, in the sense of the germ-cell approach, in which a global form depends on lower musical structures. By this I want to suggest that the lower musical structures are 'irremovable' in relation to the perceived global form. Any change in the lower musical structures would have direct consequences for the global form, and the other way around, changes in the global form mean a different organization in local domains.

The *chronological-associative* method could be extended to the *goal-oriented* method by means of perceptual feedback (Koenig 1978). This perceptual feedback, has to do with the fact that in the *goal-oriented* method, the composer describes local strategies by objectives, with which local events are continually compared. This notion of local strategies within a perceptual feedback is quite similar with the idea of the *action/perception-feedback-loop* of Horacio Vaggione (Roads 2005; Solomos 2005). Instead Vaggione tries, by means of the *action/perception-feedback-loop,* to interpolate between local strategies on the one hand, and global on the other hand.
Koenig states that “this type of of method seems to approach most closely with the 'real' process of

composition, but it also involves the greatest difficulties of representation in program structures.” In my opinion, the difficulties with representation of this method, has to do with the local strategies and syntactic nature of decision making, involved in this method.

I would like to mention the piece *Terminus,* by Koenig, of which he gives a description in the article *Genesis of Form*. Koenig describes that the compositional principle of *Terminus* differs from his previous pieces (for example: *Essay*) in not being based on an overall form to be filled in with single sounds (Koenig 1987, p.170). For his piece *Terminus*, Koenig started experimenting with sinus glissandos, which then by transposition and cutting tape formed basis material for his piece. This basis material went through a sequence of mechanical deviation procedures (e.g. filtering, modulation, chopping or reverberation). In this fashion he created “generations” possessing degrees of kinship which grow weaker, the greater the distance between the generations. The reason I am mentioning this piece by Koenig, is because in the same article he describes the following form-problem he had to face:

“...neighbouring relationships are not formally established but appear as the derived material is presented...This shows the form problem in a very mediated guise, because the possible form-sections are closely linked, owing to their past history in terms of production technique, without having a goal-oriented relationship to each other.” (Koenig, 1978, p.170)

He describes here that the form-problem is caused by the 'lack' of goal-oriented relationships in the form-sections. Therefore he decided to have a overall form, in which he places the neighbouring relationships to unfold in the time-line: *“It is therefore feasible to present them in an order which places the existing neighbouring relationships at the service of an overall form unfurling in time.”* (Koenig, 1978, p.170). It seems to me, that in order to solve the form-problem, as he described earlier, he had to rely on the neighbouring relationships he could form with the material. By forming these neighbouring relationships, the overall form unfolds itself along the time-axis;*“...an overall form unfurling in time”*. This means that he had to lean more towards a method by applying local strategies, with the objective of forming neighbouring relationships, in which these local strategies need to be compared. As if he had to work in a method which he self described as an approach more closely to the 'real' process of composition, correspondingly the *chronological-associative* and, or *goal-oriented* method. Accordingly this means leaning towards the role of a composer as the 'ideal' listener.

1.5 'Field' Composition

With the arrival of a stronger tendency towards formalization, during the late '40s, the formalization of the compositional craft took two main courses; mainly *system composition* and *chance composition* (Koenig 1971). Many of the compositional practices do not comply strictly with one or the other, but nevertheless, we could discuss this mongrel 'field' in a more acknowledged fashion, by defining clearly the distinction between *system composition* and *chance composition*.

1.5.1 The Extremes of *System* and *Chance*

System composition could apply to the to two things; the composing of a system itself; composing with or according to the rules of a system. The larger the cohesion with which the system is planned, the less remains to be composed in the system. The gap separating the system from "Utopia" (Koenig 1971, p.9), is filled in by the composers subjective choices or reactions, mainly formed by certain aesthetics. Systems tend to be continuous, we could say that in a sense, they try to avoid chance or unpredictability. To further elaborate the meaning of "system" in this case, we could correspond this with what is called; composers who mistrust automation or chance, any try to control the process down to the last detail (Koenig, 1978, p.5). If we would like to translate this into a computer system, this would result in a elaborate dialogue between composer and computer, in which large input formats is needed for determining the details of smaller and smallest form-sections.

If we summarize *system composition*, we can say a composer composes a system, and composes according to the *system*. Within this *system*, a certain amount of freedom is available. In the case of d'Arrezos method (p.1), we can say that certain possibilities for the arrangement of the corresponding pitches is predetermined by the Latin texts. Inside this fabric, the composer still has an certain freedom to choose between different possibilities for pitches in which his own subjectivity is required. This freedom inside a system, could be to such an extend that we could interrogate the fact that we still talk of a system. Nevertheless, in a system which requires any amount of freedom, this freedom will not suspend, but rather be inherent to the system as a fulfillment. To sum things up, "system" here in the extremest case, has the meaning of total determinism, but in a less extreme sense, still can offer amounts of freedom.

In contrast, *chance composition,* could apply to the following things; composing chance itself, by giving chance the opportunity to become musically fertile; or composing conscious of the fact that

not all the details of a work are felt necessary. We could say that the composer wants to compose with the aspects of chance itself. Integrating aspects of chance in the compositional practice could have many reasons. In some cases, one might want to get an idea of how a aleatoric succession of processes could have musically potential implications, musical 'direction' or formal content.
The main idea or aesthetic aim of chance composition, is the aspect chance itself . On the assumption that chance does not confuse the musical idea, but rather expresses it. In the case of the *Musikalische Wurfelspiel*, we could say that the random arrangement of the pre-composed blocks, expresses the musical idea, by articulating the independence and the inter-changeable character of the blocks. To put it in the most extreme case opposed to the notion of
system composition, we could say that chance composition is total indeterminism in which all aspects are unpredictable. As Koenig states: *"Chance composition proceeds from incalculable sequences of events and constellations. "* (Koenig, 1971, p.21).

1.5.2 The Impasse of *System* and *Chance*

Now that we have defined the extreme's, there are some consideration we have to take into account, to understand the necessity for the notion of *field composition.* The first consideration has to do with the fact that between the main factors of *system* and *chance* there is a third factor: the composer, whom nobody forces to use either one way or the other (Koenig, 1971, p.19). The reason for mentioning this, is to point out that we need a indication for any mongrel form, in which composition is not based on a strict *system* nor *chance*. A second consideration, has to do with the fact that besides the likely choice for the integration of *chance* elements, in a compositional work, there is another 'force' working on the system; the composers psyche.

“A composer is more accustomed to being influenced by a spontaneous idea than by prepared plans; he decides and discards, writes down and corrects, remembers and forgets, works towards a goal; replaces it during his work by another—guided by criteria which are more likely to be found in psychology than in music theory.”
(Koenig, 1978, p.3)

Koenig emphasizes on the fact that, even though a composer might run though relatively fixed sequences of decisions, he is still under the impact of a certain musical tradition. These impressions, whether he is aware or not, will influence and deviate him from the *system*. *“The system in systematical composing, which...is the subject of compositorial considerations, can hardly be* *cogently derived from still earlier circumstances; it is arbitrary as are the rules of chance."* (Koenig, 1971, p.20)

1.5.3 The 'field'

When the extremes of *system* and *chance* meet, we can talk about *'field' composition*. *'Fields'* are actually "open" forms, and their content can depend on *chance* or *system* (Koenig 1971). Basically, *field composition* is an crossover form, in which *system* and *chance* elements are combined. If we once again recall the example of the *Musikalische Wurfelspiel*, we could say that each of the individual 'blocks' is created by a systematic, deterministic method, which was according to the classical style of a certain era. But the random arrangement of these individual 'blocks', collides with the system, and accordingly works as a 'force' on the system, creating the 'field'.

Fields can also be brought about by means of transformational processes. In such an case, for example, a systematic produced material could be subjected to transformational processes which posses random elements. These random elements will cause the material to deviate from its original system. The other way around, a chance based material could be subjected to a series of rigid systematic transformations or arrangements, which could make the characteristics of the chance based material more evident.

1.5.4 Sergio Luque - *¿Qué gigantes? (What Giants?)*

To further elaborate on the subject of *field composition*, I would like to focus on a particular aspect of the piece "*¿Qué gigantes?"* by the composer Sergio Luque. This piece has been a great source of inspiration for me in the understanding of the use of system and chance elements in the compositional process. To elaborate on the subject of *field composition*, I would like to present, in an rather dissected way, the *system* and *chance* elements of this composition, which will mainly focus on the first minute of the piece (CD track 1).

In the piece, durations are produced according to the geometric series. A geometric series, is a exponential function described by the formula below (Fig 2).

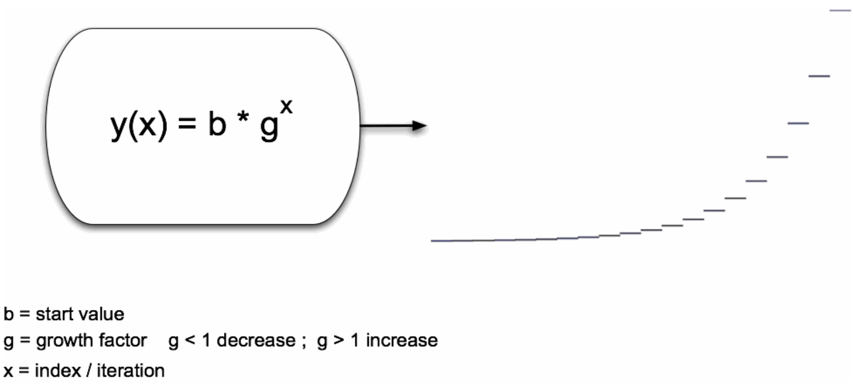

Fig 2, An exponential function with the plotted result in SuperCollider

As mentioned in Fig 2, the *b* is filled in as the beginning value of the geometric series. The value of *b* increases or decreases accordingly to the value of *g*, the growth factor. If the value for *g* is smaller than 1, this will cause the value of *b* to decrease, and if the value for *g* is larger than 1, this will cause the value of *b* to increase. The time-index *x,* increments with the value of 1 on each iterations, expressing the amount of iterations. We will call the number of iterations *n,* and will represent the number of steps. In this *system,* as soon as the growth factor (g), beginning value (b), and the number of iterations (n) is known, the succeeding values are determined. Each time, that I feed this *system,* with the same values, the successive outcome will be the same. In the case of the geometric series, we could speak of an rigid *system*.

In "*¿Qué gigantes?",* this geometric series is followed by another systematic operation; that of duplication, mirroring and agglomeration. The whole series produced, is duplicated and mirrored. The mirrored version of the original series, is then agglomerated to the original series (Fig 3).

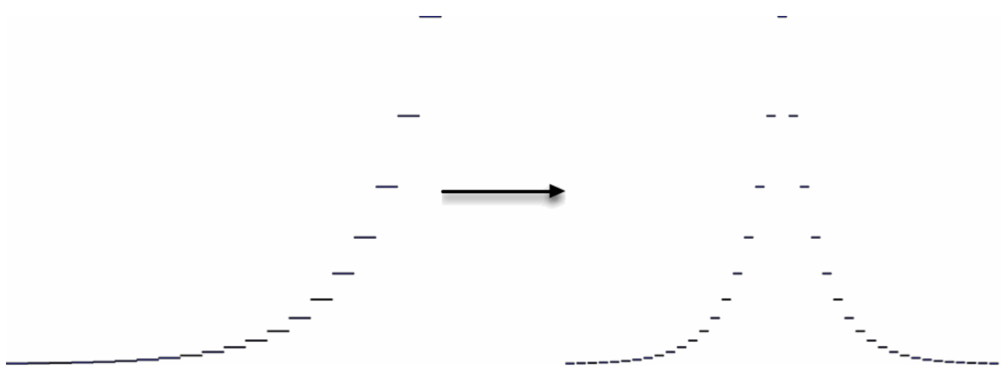

Fig 3, The result of a geometric series duplicated, mirrored, agglomerated, plotted in SuperCollider .

The *chance* part of the piece, consist of a number of nested chance operations, for determining the growth factor (*g*), beginning value (*b*), and number of iterations (*n*). The chance operations are initialized each time the whole *system*-part is repeated. I would like to focus one particular chance operation that is nested in the collection of chance operations. This chance operation is a *beta* distribution, which determines the number of iterations each time the procedure (Fig 3) is repeated. For the understanding of a *beta* distribution, it is perhaps useful to understand that with a *white* distributions, we mean that all possibilities have a equal chance to occur. In a *beta* distribution there are two values defined, the minimum (*A*) and the maximum (*B*). In what way the distribution between *A* and *B* takes shape depends on the probabilities *p1* and *p2*. In this case, *p1* determines the probability for the minimum (*A*), and *p2* determines the probability for the maximum (*B*). For the probability close to 0, like for example 0.01, the chance is the greatest for the distribution to fall close on the minimum and/or the maximum, with very little chance for values between *A* and *B*. The more the probability gets close to 1.0, the less chance for the values to fall on either *A* or *B*. With a probability of 1.0, we could speak of a *white* distribution between *A* and *B* (Fig 4).

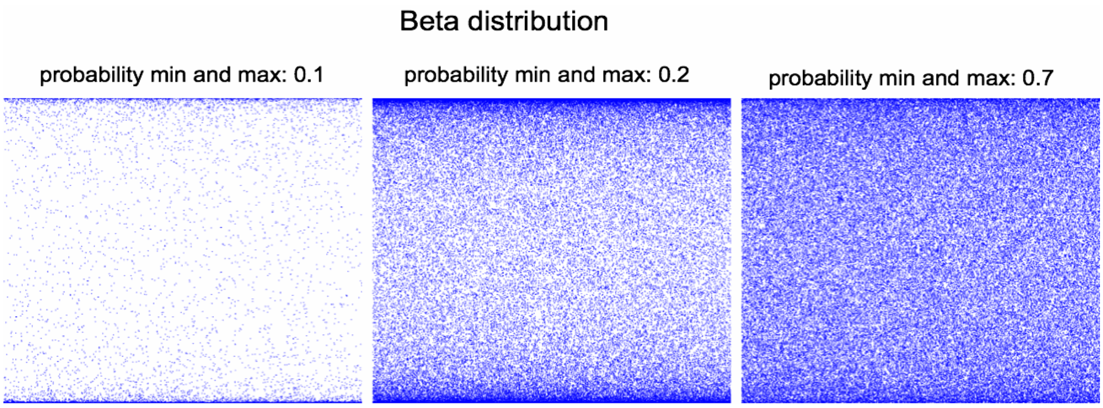

Fig 4, Beta distribution with the probabilities: 0.1, 0.2, 0.7 plotted in SuperCollider.

As I mentioned earlier, this *beta* distribution determines the number of iterations (*n*), time the *system*-part (Fig 3) is evaluated. This results in an sonic “bursts” of exponential expanding of the durations, which either are very short in its total duration, or contrastingly long. The *beta* distribution (*chance)* operation is working as a 'force' on its particles, which are the (*system*) produced geometric series.

2. Reflections

2.1 Introduction

In this chapter, I will give a description of my own reflections and compositional processes of the past. This includes sources of inspiration, choices and aesthetic considerations, expectations, failures and difficulties, and how this translated itself into certain methodical workflow, descriptions in code, sound experimentations and graphical plots and representations.

In this chapter, I will describe the workflow of three compositional works that I made during the period of 2009 – 2011; *Fradatha* (2009), *Xurd-o-Xakshir* (2010), *Airyana-Vaeja* (2011).
The theoretical framework that is unfolded in chapter 1, mainly based on thoughts of G.M.Koenig, has given me the knowledge and insight to reflect on my own work. During this reflections, I will frequently refer back to the theoretical thoughts of chapter 1. I have to mention here, that I wasn't fully familiarized with this theoretical framework, at the time that I was making this three compositions. In most cases, it was during the reflectional process, that I have recognized many similarities in idea's, that I had at the time, and found back in more recent familiarized theoretical thoughts. This connecting factors, between my own intuition and the later acquired framework, will be the main material of this chapter.

2.2 *Fradatha* (2009)

This piece started with the methodical experimentation of doing FFT (Fast Fourier Transform) and phase vocoding transformations of concrete source materials. In mathematics, the Fourier transform is an operation that transforms one complex-valued function of a real variable into another. The new function, often called the frequency domain representation of the original function. This notion is in a similar spirit to the way that chords in instrumental music can be described by separate individual notes. In effect, the Fourier transform decomposes a function into oscillatory functions which are the individual partials of the frequency domain. Accordingly, a Fast Fourier Transform (FFT) is an efficient algorithm to compute this procedure, and its reverse process. Therefore the FFT process allows you to make a analysis of a sound-file, and transform the function from the time domain into the frequency domain. Contrariwise, the FFT process allows us to make a re-synthesis of the original sound-file. At the heart of the phase vocoder there is the FFT process. Typically things you can do with the phase vocoder are transformations as time expansion, time compression and pitch shifting.

I used a particular phase vocoder that enabled me to transpose the sound-material, at the re-synthesis process, with the option of defining a variable point in time for the desirable transposition to take place (Fig 5).

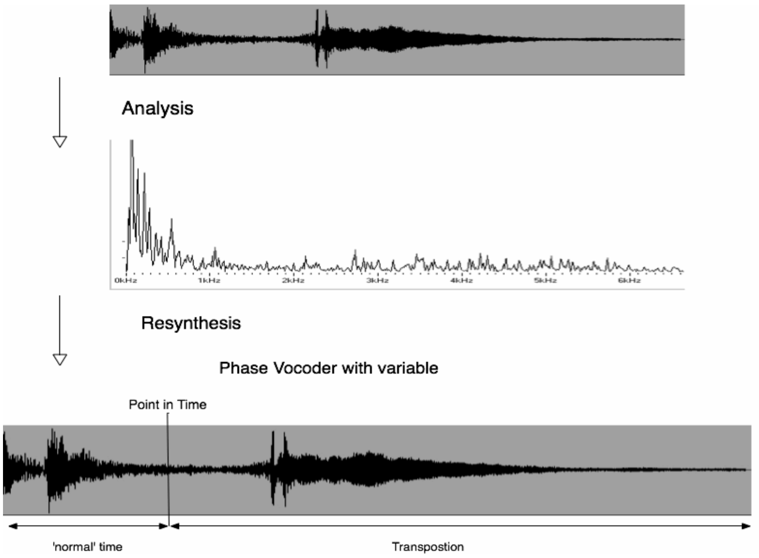

Fig 5, The process of analysis into the frequency domain, and the re-synthesis process; The picture at the bottom shows the re-synthesized material with the variable point in time for the transposition.

The title of my piece "Fradatha", means "growth" in the Avestic language, named because of the extensive use of geometric shapes in the piece. For this piece I was very much inspired by the idea of geometric progression according to Sergio Luque's "*¿Qué gigantes?*". Therefore, I started to do methodical experimentations with the geometric function, applying different values for the growth-factor (*g*), begin value (*b*), en number of iterations (*n*). This values then determined the duration of the grains, that contained the transformed sound material. Beginning with very small begin values (*b*) for the durations, this experimentation resulted in short sonic bursts. This resulted in defining ranges of values with random distributions for the arguments of the geometric function. The use of ranges with random distributions caused the systematic character of the geometric bursts to deviate on every execution. One of the first things that I discovered, during this experimentation was the realization that very short grains resulted in "noisy" bursts, and as the durations expanded in larger quantities, the quality became more and more a "pitchy". Accordingly, the inner material started to unfold itself.

The pioneer of sound quanta, Dennis Gabor, mentioned that at least two mechanisms are at work in detection of micro-events: one that isolates events, and another that establishes their pitch. The human hearing mechanism needs time to process audio signals. Human beings have a minimum threshold in order to establish a substantial sense of the identity and properties of a micro-event. In granular synthesis, individual grains that have a duration of less then 2ms, sound like clicks, with a wide frequency band leaning toward noisy sounds. It is at the threshold of around 5ms that a vague sense of pitch starts to become audible (Roads 2003). The longer the grain, the more clearly, the ear can hear its identity and pitch.

I ended up using different ranges of possibilities for growth factors (g), and iteration numbers (n), for these were very important parameters to control the range of possible textures. For example, if the growth factor was relatively large, but the iteration number was kept small, this resulted in a more random texture. As the possibility for the maximum of the iteration number would increase, the geometric shape became more evident and varying (Fig 6).

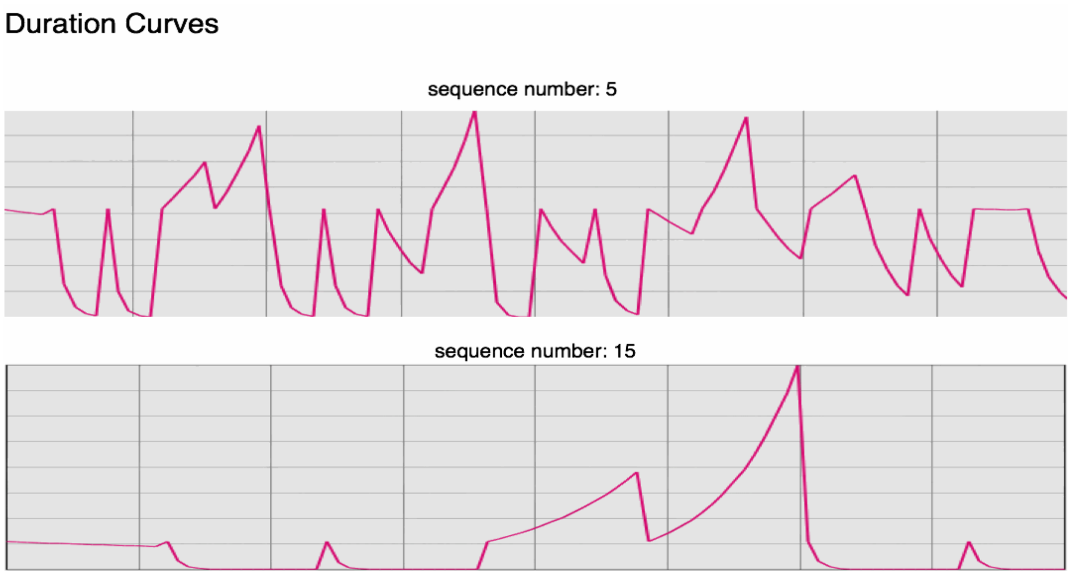

Fig 6, Upper plot; shows duration curves with iteration maximum number 5. Lower plot; shows duration curves with a maximum iteration number of 15. Vertical axis: duration, horizontal axis: time.

My objective for this piece was to build larger and larger structures based on these geometric sonic bursts. I imagined that larger masses of meso-structures could be build on the basis of these geometric figures. This idea that I had corresponds very well with the germ-cell approach suggested in chapter 1, as the "bottom-up" approach or the notion of "extrapolation". For example, this first part of the piece start with individual geometric sonic bursts. As time passes, the quantity of these geometric bursts start to increase in an exponential fashion. Here I tried to find cohesion between the exponential function that forms the individual sounds (the sonic bursts), and the technique that would form larger form-structures. The phase vocoder allowed me to transpose the material up to 70 semitones, and down to 20 semitones. In this piece I used the full range of possible the transpositions. The way that I approached pitch, was based on the timbral qualities that the different ranges of transpositions exerted on the masses of grains. Different ranges of possibilities for transpositions, created different timbral qualities. This resulted in four different tendency masks which I drew by hand (Fig 7).

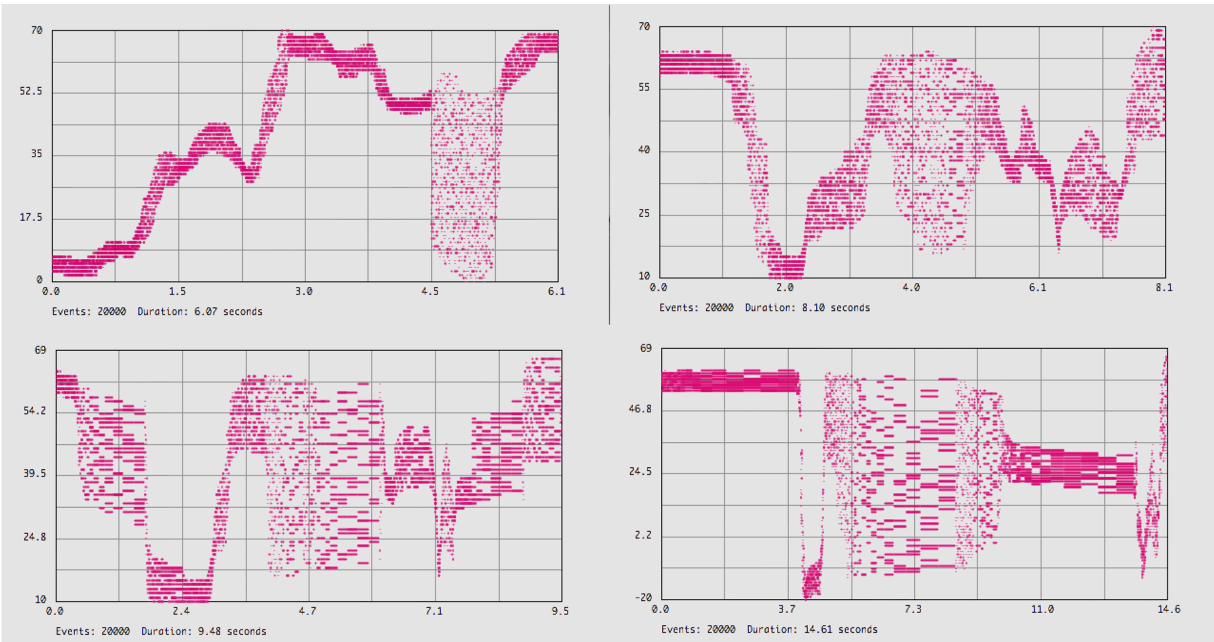

Fig 7, The plotted result of four possible tendency masks, determining ranges of transpositions for larger meso-structures, vertical axis: transpositions values in semitones, horizontal axis: time in seconds

These four tendency masks had some similarities in common; first of all, they use almost the full range of possible transpositions during their progress; secondly, they are based on an overall *common shape*, in the sense that they are variants of each other. Their variations is exerted on them by the process of rough sketching of the *common shape*. By citing this, I want to emphasize on the fact that the process of creating rough sketches, is part of a sequential procedure that applies deviations in a predetermined way. Here I would like to suggest that, the fact of drawing tendency masks completely by hand, is a systematic approach because of the determinism involved in sketching the progression of the shapes. But the random distribution between the borders of the masks, causing a crossover between *system* and *chance*. If I would execute this process with exact the same tendency mask, the random distribution between the border of the tendency mask would cause the result to deviate from the previous one. We could also say that a tendency mask in this case is a '*field'* where the borders are moving over time. Another aspect that would cause the result to deviate from its previous executions, is the randomly distributed defined ranges exerting on the arguments of the geometric function.

2.3 *Xurd-o-Xakshir aka Ultra Grinder* (2009)

This piece actually came about, by introspection of my own previous work *Fradatha* (2009). I deliberately decided to keep the habit of geometric progression for duration values, and make use of the same source material as the previous piece. This had to main reasons; I wanted to extend the previous generalities of the interplay between noisy textures and pitch; secondly, I was already familiarized with the characteristics of the previous source material and I didn't want to let myself be distracted by other unfamiliar characteristics.

My objective for this piece was too reduce handwork, by applying more automation and more higher level of control. The reason for this was to extend the previous idea, and to explore all the possible textures, constrained by the idea of geometric progression and the characteristics of the same source material. For the higher level control I was very much inspired by *set theory*. Set theory is a branch in mathematics that studies sets, which could be a collection of objects or possibilities. The possible collections in set theory are expressed in a Venn Diagram (Fig 8).

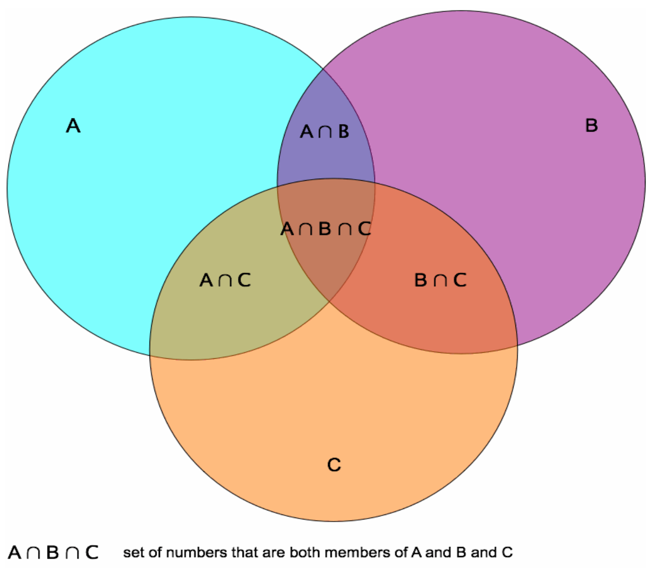

Fig 8, Shows a Venn Diagram, with the collections A, B and C. In which A ∩ B: set of numbers that are both members of A and B etc.

This notion of set theory, brought me to the idea of creating collections of possibilities for the necessary parameters; growth factor, begin value, number of iterations and transpositions.
The approach that I had towards the Venn diagram was quite different from the original idea, in which each of the circles represents a whole collection. In the way that I made use of the Venn diagram, these collections (A, B, C..etc), were not collections, but possible outcomes. Each of these possible outcomes would have a probability value that determines the chance of occurrence.
In this case, the whole Venn diagram would represent a collection of possibilities applied on one parameter. Just to give a brief example, lets say I have a Venn diagram for determining pitch; if A is the possibility for a C-sharp, and B was to be the possibility for a G-sharp, then
A ∩ B would be the outcome of C-sharp and G-sharp both having a probability to occur.

For the growth factor values I created a collection (A, B, C.. etc) of possibilities in which each possibility represents a range with defined borders. In between this range with defined borders the distribution is random or white. Each possibility also possessing a weight that determines the chance for occurrence. So for example, inside the collection of possible growth factor values; if possibility A, that represents the range between 1.01 and 1.11, has a certain probability to occur; and possibility B, which ranges between 1.12 and 1.19 also has a probability to occur, then this is represented by the A ∩ B area in the Venn diagram (Fig 9). Accordingly, the A ∩ B area would mean that the range of possibilities is expanded. For practical reasons I represent the collections in the schematic illustrations as if there were tree possible outcomes. The collections were larger in reality, but this would take much more complex Venn diagrams to represent them.

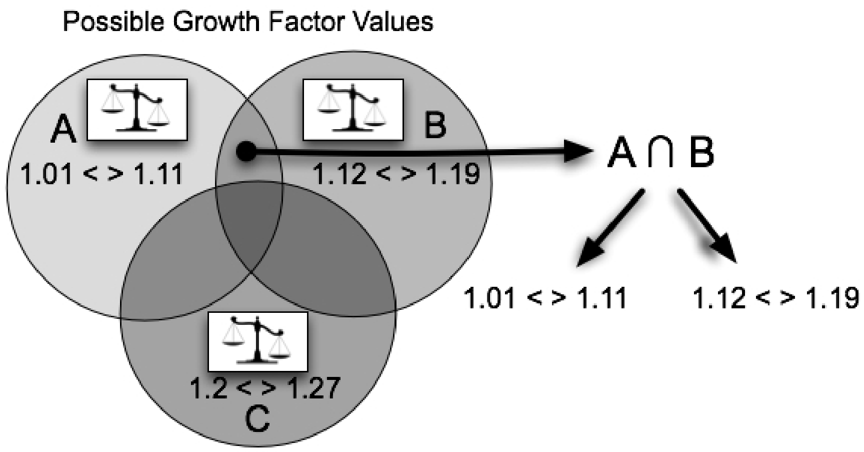

Fig 9, Collection of growth factor values, with each possessing a certain range and probability.
A ∩ B represents the new possibility of ranges when A and B both occur.

The same procedure, as described above, was also done for the other arguments that determine the durations; begin value, and the number of iterations. For the transposition, I wanted to reduce the handwork of drawing tendency masks individually by hand. Nevertheless, I wanted to have some control over the the overall behavior of the shape. I chose to let the shape of the masks be determined by $1/f^{\phi}$ fractional noise. By changing the value of ϕ, the shape of the noise could interpolate from brownian motion to white noise. This enabled me to determine the amount of chaotic behavior of the tendency mask. Thus, I created also a collection for possible outcomes for the magnitude of chaotic behavior of the tendency masks. For the distribution between the borders of the tendency mask, I used a *beta* distribution (p.9), which could change from probabilities 1.0 to 0.01 during the course of the tendency mask (Fig 10).

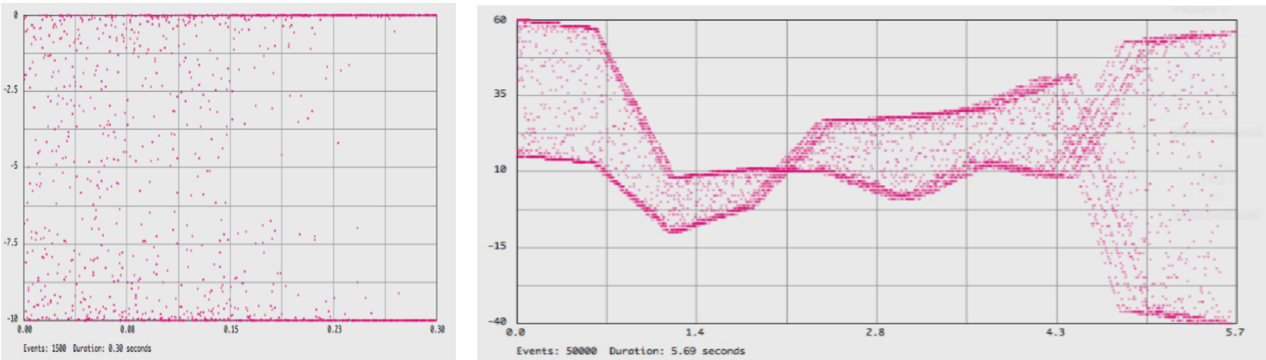

Fig 10, Left: beta distribution probability moving from 1.0 to 0.01. Right: beta distribution applied to a fractional noise tendency mask.

The beta distribution opened up a new window of possibilities for the interplay between pitch and noise. The tendency mask could not only change from more static to chaotic in behavior, but also could change from a white distribution between the borders, towards a distribution with more definition around the borders. White distribution resulted in more turbulent sounds, as more definition around the borders resulted in more pitchy sounds.

For each of the collections of possible outcomes for the parameters, I made a categorization. This categorization was based on the characteristics of the resultant sound. Durations produced with a small iteration number, for the growth function, resulted in a random texture towards a more evident geometric texture for larger quantities. Ranges with larger values for growth factor, resulted in textures that would reveal more the identity and characteristics of the source material. This categorization was necessary to get an overview of the possible ranges of textures (Fig 11).

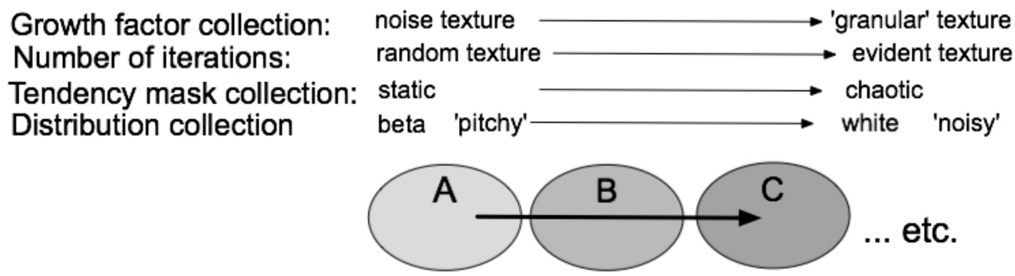

Fig 11, Overview of the categorization of the separate collections for parameters.

The whole process that is described above enabled me to create scores. Each score was the result of a combination of possibilities of the different arguments for the parameters. For each new score, the whole process is repeated, in which the resultant texture depends on the nested combination of probabilities (Fig 12).

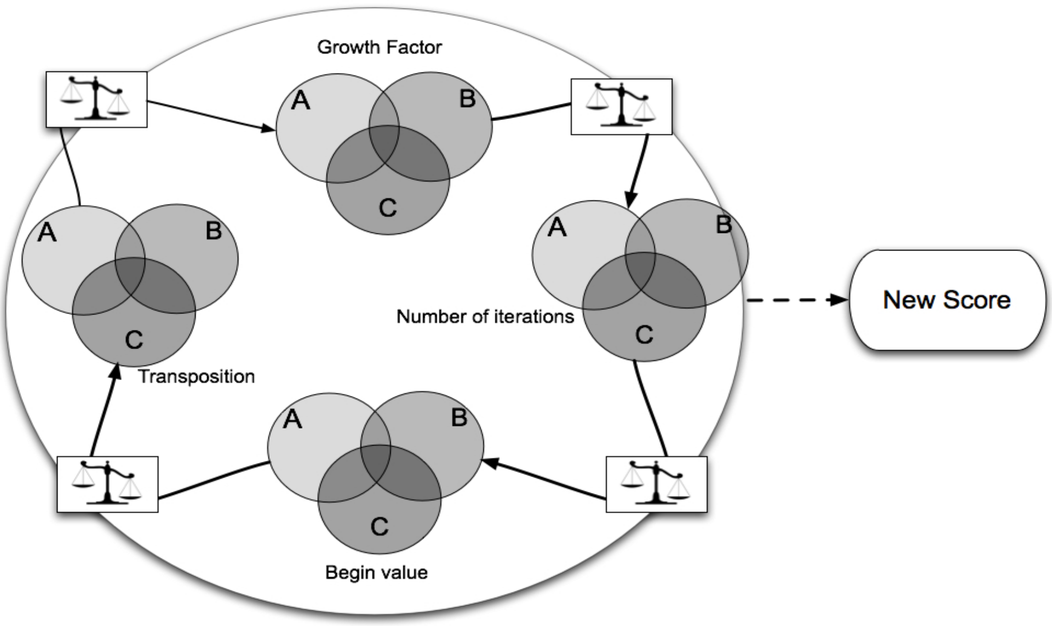

Fig 12, Flowchart that shows each parameters as a separate Venn Diagram. Each new score is formed by the combination of possible outcomes.

Each score was able to produce larger meso-structures with durations that could range from 2 to 10 seconds. This meso-structural level is a very important, for it is at this level where sequences, combinations and the musical idea unfolds. By changing the weights of the elements in the collections, I could get a wide range of possible textures. In this manner I created a sequences of scores in which combinations of larger meso-structures formed *blocks* for my composition. Each of these *blocks* formed a large part of the piece. The piece itself is formed by applying different probabilities for each *block* of the piece (CD track nr. 2 - 5).

As I mentioned earlier in chapter 1 on compositional methods, compositions that consist of blocks with individual rules applied on them, could have the feature that each block is being complete by itself. Even though the piece is formed by applying separately different probabilities for each block, and each block forming a large part of the piece, there was also a certain sense of goal orientation. My goal orientation was that during the course of the piece, the blocks would become more and more chaotic in behavior, with more evident geometric textures, and more unfoldment of the characteristics of the source material. This sense of goal orientation means that the structure requires to be completed by other blocks. In this sense, the individual blocks are not interchangeable, and also not independent or complete by themselves.

2.4 *Airyana Vaeja* (2011)

The title of this piece, “Airyana Vaeja” is the name of the aryan homeland that appears in Iranian/aryan mythology. In ancient times, different aryan tribes shared common features in language, religion, art and culture. During the aryan migration process these tribes became more and more dispersed from on another. As a result of this process, similarities in language, religion and culture started to deviate more and more. Even though, the differences became more evident during time, many of the different kingdoms kept referring to their “source” which was the utopian Airyana-Vaeja. Many scholars today believe that this aryan homeland was located in what was once “Greater Khorosan”, which includes mainly parts of Iran, Afghanistan and Tajikstan.

The idea for this piece was to create a “source” material based on the “Utopian” concept of system composition. With “Utopian” I mean that the cohesion with which the system is planned is to such an extend, that there is nothing to be filled in by the composer. What I also mean by this is, is that the source material is produced in a deterministic way in which repeated execution of the system would produce exactly the same material. In chapter 1, I mentioned that a systematic produced material could be subjected to transformational processes with arbitrary elements, which will cause the material to deviate from its original systematic intensions. For this piece I wanted to create new material out the source material by exposing the material to transformational processes that contain random elements.

For the source material I used the additive synthesis of hundred sine oscillators with fixed frequency values. I created a movement that would last for 42 seconds, which consist of 3 shorter movements. The large movements consist of; a first movement that lasts 8 seconds; the second movement lasts 14 seconds; and the third movement lasts 20 seconds. These 3 short movements had the same sine-shape amplitude envelope in common, which increased in amplitude on each new movement (Fig 12).

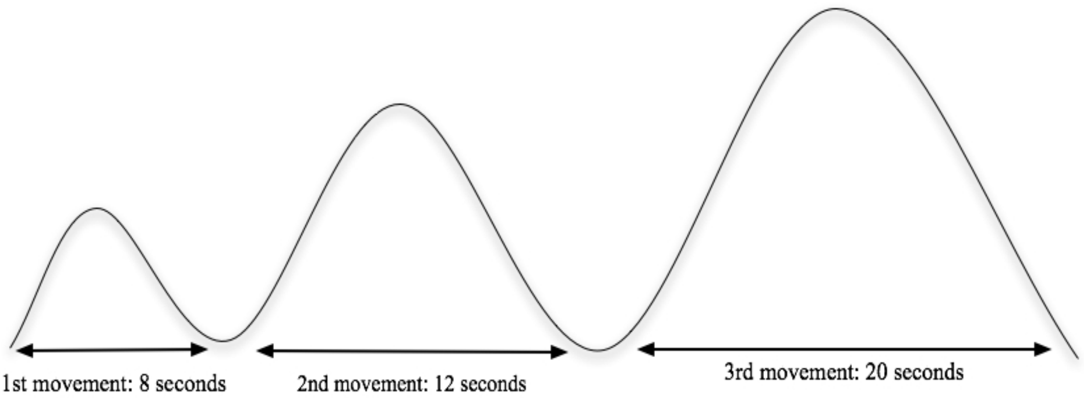

Fig 12, A schematic representation of the overall amplitude shape of the source material.

For the first transformation I wanted to create a rhythmic material out of the source. I did this by applying amplitude modulation (AM), for which the frequency of the modulation was controlled by the shape of the amplitude of the source material itself. This process resulted in rhythmic accelerandos and rallentandos according to the overall shape of the material (Fig 12). The mapping of the amplitude shape to the frequency of the AM was done with random ranges for the maximum frequency. I executed this process several times until I had a series of material that had a common rhythmical progression exerted by the amplitude shape. The deviation among the materials caused here because of the random distributed range for the maximum AM frequency. We could state that the arbitrary elements in this transformation are colliding with the systematic progression of the amplitude shape, forming a 'field', which causes a deviation among the materials. At this stage of the transformation process I created two different branches of material. One branch that is amplitude modulated by regular rhythmic patterns, and the other branch by irregular random generated patterns. These to branches are expresses by *T1v1* and *T1v2* in Fig 13, which shows a part of the transformation flow until the third transformation (expressed by *T3*). The other transformational processes exerted on the materials, were; several versions of filtering with arbitrary selected frequency bands (*T2v1, T2v2*); automated superpositions with randomly chosen transpositions and amplitude values (*T3v1, T3v2, T3v3*); chopping and reverberation with random envelope durations, etc. These transformations were executed a several times in order to create different versions for each of the materials with slight deviations among each other.

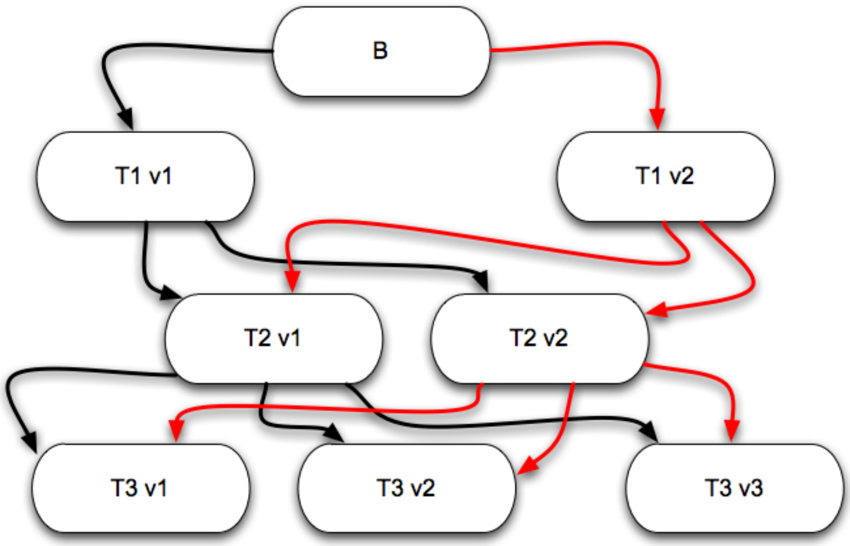

Fig 13, Shows a rough scheme of the transformation flow (T1, T2, T3...etc) of the source material (B).

For the construction of the piece, I wanted to depend on neighbouring relationships among the different materials. In order to form these neighbouring relationships, I wanted to draw different pathways through the different generations of transformations. This would mainly result in juxtaposed material of the different generations, with no exclusion of overlapping materials and superpositions. During this process, I came to the discovery that these overall common progression of the different materials, caused by the kinship to their source, resulted in relationships that were very predictable in their nature. This was a form problem that could have to main reasons; the progression of the source material was to predictable and repetative; the transformations exerted on the source material didn't cause the original material to deviate to such an extend that it would deconstruct the this cyclical progression.

To solve this problem I had to find a method to deconstruct the overall shape that all the generations contained, and construct new shapes with different progressions. To construct new progressions I used a similar technique described by Koenig (1971, p.48) as synchronization patterns. This idea of synchronization patterns were used by Koenig in his piece *Klangfiguren*. He used these patterns in order to superposition and arrange transposed material (Fig 14). He describes four main synchronization patterns; sounds that begin simultaneously; sounds that stop simultaneously; symmetric superposition; and serial distribution of entry points.

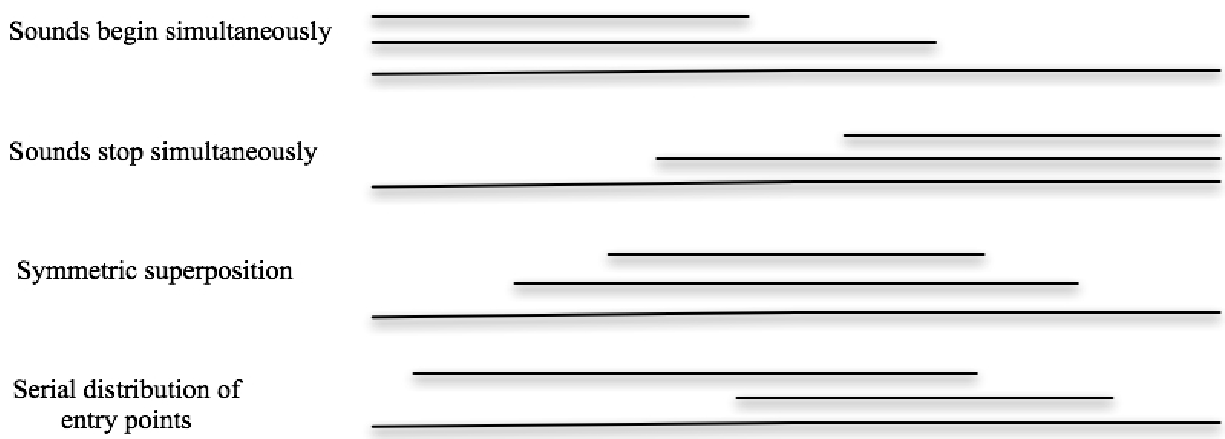

Fig 14, Shows four different synchronization patterns for transposed materials, proposed by Koenig,

I took this as a main idea for constructing different *blocks* for my piece in which the following tree combinations of superimposed parts of my material were possible (Fig 15); superposition and transposition of the same part of the material and of the same generation (Fig 15, A); superposition of different parts of the same generation of the material (Fig 15, B) ; superposition of different generations of which the same parts of the material are transposed (Fig 15, C).

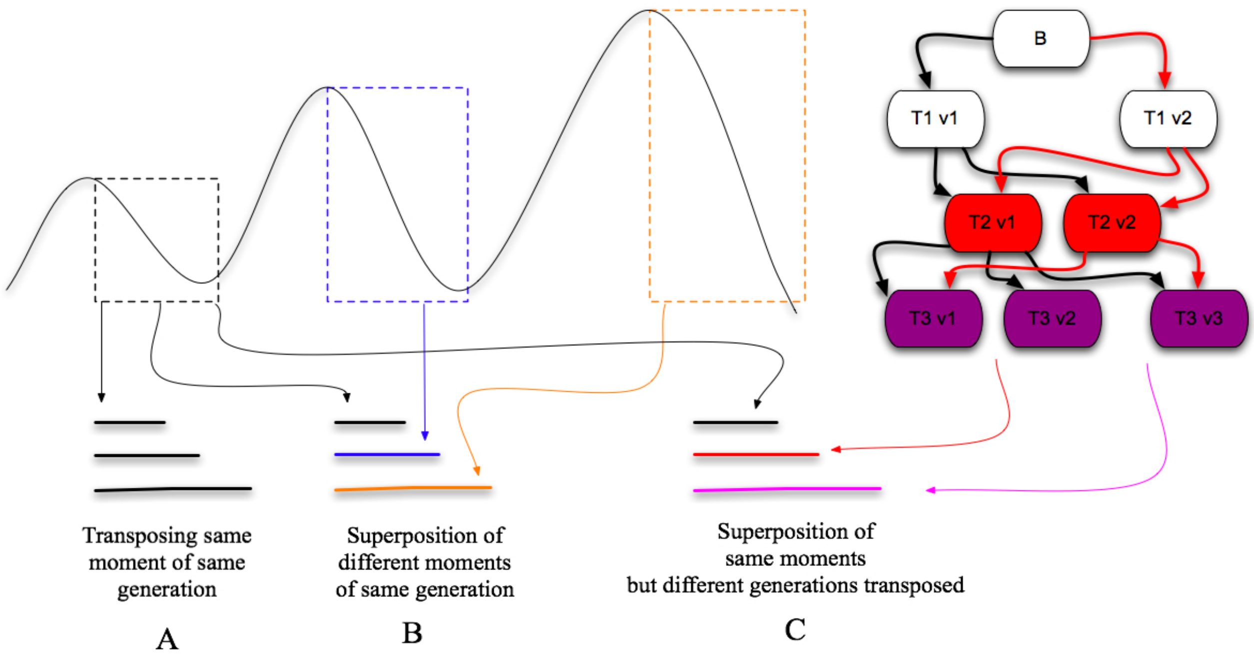

Fig 15, Possible combinations (A,B,C) of material for superpositions

With this tree possibilities of combinations, I created synchronized patterns which were a combination of the four patterns described by Koenig (Fig 14). By combining and agglomerating different synchronization patterns I created larger structures that formed individual blocks for my piece. Fig 16 shows some rough sketched examples of these individual blocks that were created. Block number 1, is an example of a pattern in which sounds begin simultaneously with slight deviations in entry points (CD track nr. 6). Block number 1 and 2 are examples of blocks in which a combination of simultaneous starting sounds and ending sounds are combined and agglomerated to form larger sections. With almost al the synchronized patterns there are slight deviations of entry points (CD track nr.7 – 8). Block number 4, is an example of mainly serial distribution of entry points deviating to such an extend that we can speak of juxtaposed materials with overlap (CD track nr.9).

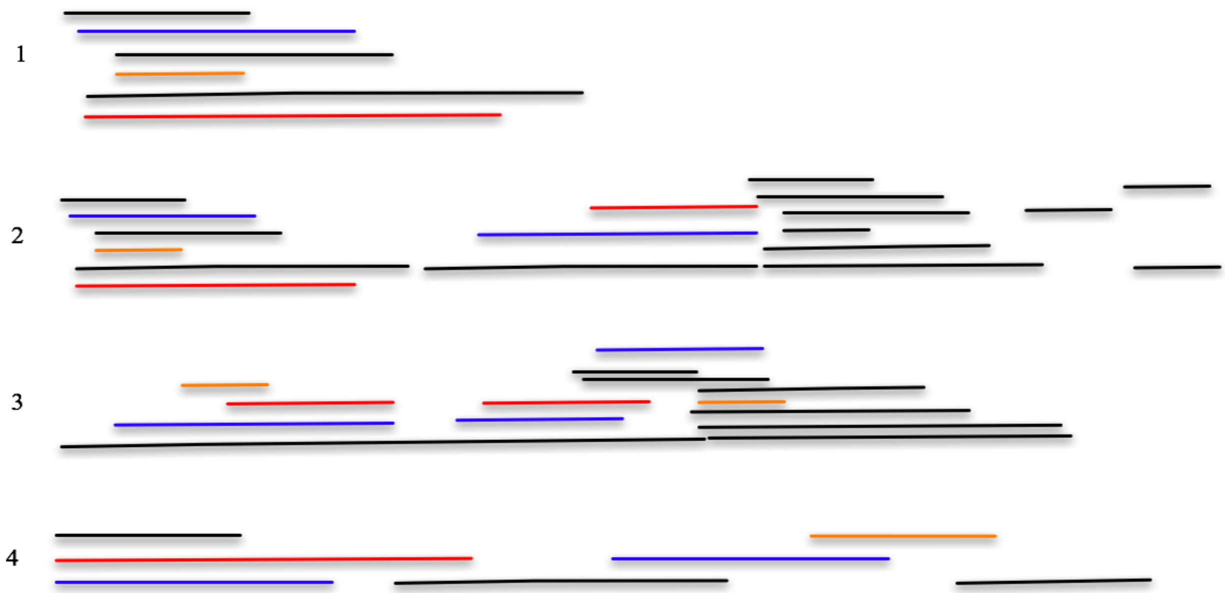

Fig 16, Rough sketches of four different blocks.

3. Sound Object and Morphology

3.1 Introduction

Koenig (1978) raises the question of what a single sound is in relation to a composition, especially in the field of electronic music. In the early days of electronic music in the Cologne studio, the notion was stressed that not just a work but each of the individual sound had to be composed. This resulted in a certain method of working in which the form of the piece and the form of its materials were connected: *"The proportions of the piece should be reflected as it were in the proportions of the individual sounds"* (Koenig, 1978, p.1) In this notion the materials are not only sounds, but also methods; the methods in which they are treated and combined. Koenig (1987, p.166) mentions one of the reasons for this: "*What we wanted to avoid is form as the reflection of bourgeois concert culture which we regarded as passe."* This means that the form should not depend on external factors which will place the sounds out of the context of the material itself.

3.2 The single sound and sound object level

With the notion of individual sounds as a method towards the form, it is possible to talk about the composition of single sounds. This raises the question of what a single sound is?
The term, single sounds, comes from instrumental music, where it has to do with questions of performance technique and notation. Koenig (1978) gives a rough description of the definition of a single sound by saying that a single sound is characterized by an unmistakable start ("entry"), an unmistakable end, and consequently by an unmistakable duration. Furthermore, he describes that a single sound contains a uniform pitch, loudness and timbre. With this definition of a single sound, we can only talk about a single sound in terms of instrumental music only; the note. Koenig states that in electronic music, instead of talking in terms of single sound, it is better to speak of sound-events, since sound-events could contain more than just the uniform pitch, loudness and timbre. The term "sound-event" here is used to describe any other single sound that does not contain the uniform characteristics that the concept of the note in instrumental music notation encloses. A similar concept to that of the "sound-event" is the notion of "sound object" (*objet sonore*), proposed by Pierre Schaeffer. The definition of the sound object by Schaeffer is as follows; a basic sound event, isolated from its original context and examined for its innate characteristics outside the normal time continuum (Manning 1985). In addition to the notion of "sound-event", the "sound object" also provides an extension to the homogeneous brick of conventional music architecture; the note. The idea of the "sound object" allows any sound from

any source. Curtis Roads (2003) mentions the opposition between homogeneous notes and heterogeneous sound objects. He states that the sound object time scale is the same as that of traditional notes, and what distinguishes notes from sound objects, is the *homogeneity* versus the *heterogeneity*. Homogeneity and heterogeneity are concepts relating to the uniformity and lack thereof in objects (Fig 17). Objects that are homogeneous are uniform in character. The properties of homogeneous objects can be compared on a side-by-side basis, because they share common properties. While heterogeneous objects lack uniformity, and do not share common properties.

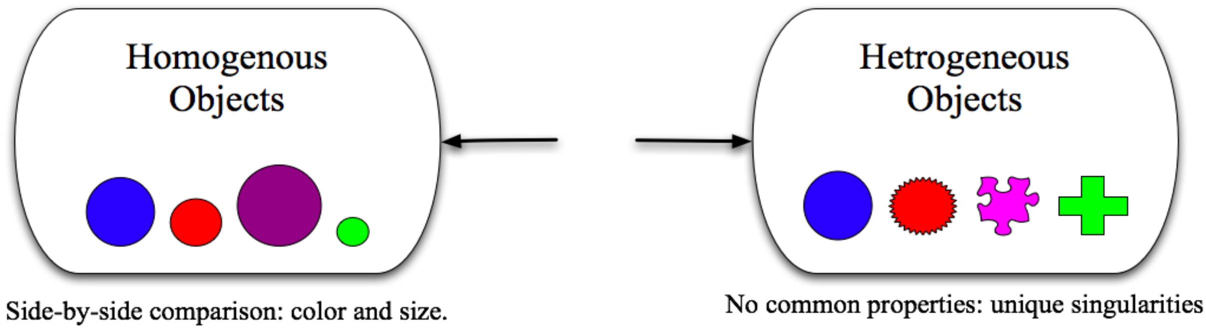

Fig 17, Shows a distinction between homogeneous objects versus heterogeneous objects.

Homogeneous notes means that every note can be describes by the same four properties; pitch, one of the twelve equal-tempered scales; timbre, one of the twenty different instruments for a full orchestra; dynamic marking, one of the ten different relative levels; duration, which is generally ranges in between a thirty second notes to a two tied whole notes. The properties of a pair of notes, can be compared on a side-by-side basis. *Heterogenous* sound objects means that the sounds do not share common properties. Their structures are different, and we can only understand them through the properties that they do not have in common. Certain objects may function as unique singularities, for which entire pieces may be constructed from nothing but such singularities (Roads 2003).

3.3 Sound Object Morphology

Morphology is a term that Pierre Schaeffer borrowed from the sciences. The word “morphology” is from the Greek, in which “morphé” refers to form, and “lógos” to study or research. In the sciences, it refers to the study of form and structure (of organisms in biology or rocks in geology, etc.).
The desire to understand the range of possible sound objects led Schaeffer to classify them in the early 1950s (Roads 2003). His book, *Traité des objets musicaux*, which appeared in 1966, introduces a notion in *sound object morphology*, which makes a comparison between the shape of a

sound objects, and its evolution. This led him to diagram the sound shape in three dimensions (*plans de référence*), which had a lasting significance which extends beyond the limit of *conret* composition, and relates to any psychoacoustic study or synthesis of sound material. Schaeffer diagrammed the sound shape as follows; the melodic (*plan mélodique ou des tessitures*), the evolution of pitch parameters with respect to time; the dynamic (*plan dynamique ou des formes)*, evolution of intensity parameters with respect to time; the harmonic (*plan harmonique ou des timbres)*, the reciprocal relationship between the parameters of pitch and intensity represented as a spectrum analysis. Schaeffer's attempt was to make a abstraction of events such as natural sound sources, to provide components for qualification of musical material, which were compatible with the principles of post-Webern serialism (Manning 1985). These three dimensions could be diagrammed as seen in Figure 18.

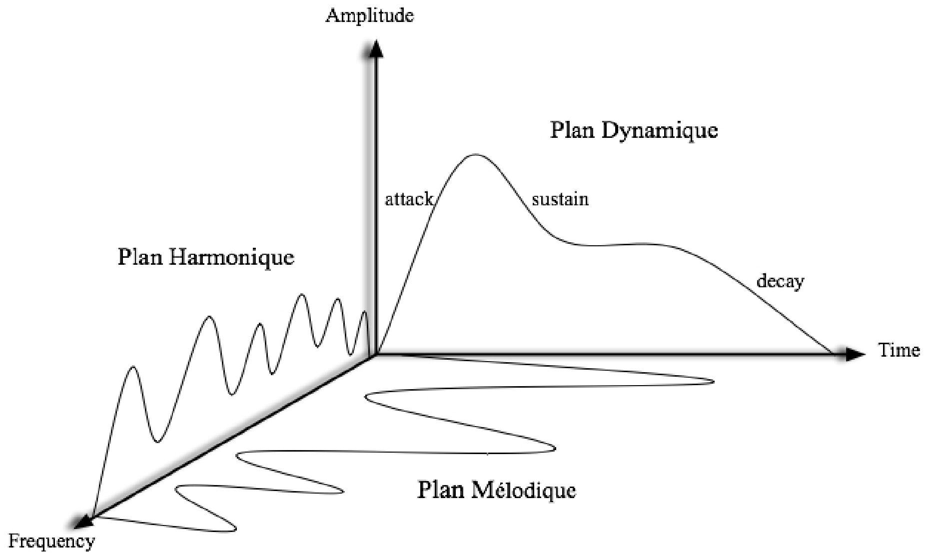

Fig 18, Schaeffer's three dimensions of the sound shape

Schaeffer's diagram of the sound object, could also be seen as an attempt to break open the sound object into components (pitch, melody, intensity). These components could allow the parameterization of the sound object, and therefore make the sound objects suitable for composing in the post-Webern serial sense. In this Schaefferian sense, the composition could consist mostly by composing with the sound object at the macro-time level. This notion of composing with the sounds contradicts the idea of the Cologne aesthetics, in which we talk in terms of composing of the sounds, instead of composing with the sounds. Vaggione (1996, p.34) expresses this notion when he talks about the early stages of computer music and musique conrète: *"When computers were first introduced, the musical field was concerned only with composition at the level of macro-time – composing with sounds, with no attempt to compose the sounds themselves. This holds true, even in* *the case of early musique conrète, ...".* The parameterization of the sound object, could also bring forward suitable transformational processes exerted on them by analogue means. For Schaeffer, many of the possibilities for transformational processes in the analogue studio were not adequate. He concluded that techniques such as as playing recordings at different speeds or in reverse, and the use of elementary montage, failed to remove or alter significantly many of the peculiar characteristics of his sound sources (Manning 1985). The limited possibilities of the analogue studio are expressed by Vaggione (1996, p.34): *"....even in the case of early musique conrète, which basically consisted of selecting recorded sounds and combining them by mixing and splicing. Operations on the spectral domain were reduced to imprecise analog filtering and transposition of tonal pitch by means of variable-speed recorder, which never allows the separation of the time and spectral domains, and only attains spectral redistribution in a casual way."*

3.4 'Open' Sound Object

We could state that in the context of the analogue studio, the sound object was of a closed and opaque nature. This had to do with the limitations of the analogue studio that allowed to compose with the sound object on the macro-level, and never allowed the separation of time and spectral domains. Schaeffer's attempts to "open" this closed nature, awakened many composers like Vaggione to the energetic character of sound in respect to time, as Schaeffer insisted on the morphodynamical character of the sound object (Sedes 2005). But it was only the development of digital synthesis that finally allowed composers to reach the level of micro-time, which means to have access to the internal structure of sound (Vaggione 1996). Vaggione sets out from digital capabilities, in which anything can be represented as digits and thus adapted through the logic of various treatments provided by computer programming. This led to an approach to the sound object that differs from that of Schaeffer. In the context of Schaeffer, a sound object is difficult to manipulate, while in the digital context of Vaggione, a sound object is "open" and transparent to reveal its methods and its code. The Schaefferian concept of the sound object is only located in the domain of macro-time, while Vaggionian sound objects can be found at any timescale (Solomos 2006). Vaggione assumes that the sound objects morphological richness, functions as morphological reservoir, that can be articulated in different temporal timescales. For Vaggione, all timescales exploit morphologies; a sample, a waveform, figure composed of few grains, and global form. Uniting the computer's computation capabilities with the digital representation of sound, allows material and form to be treated similarly. Informatics creates a continuum between microstructure and macrostructure, and thereby creates a bridge between material and structure (Risset 2005). With this approach, Vaggione states (as cited in Solomos 2005, p.318) that the basic principle of material as: "*...that minimum units ("blocks") do not exist to me assembled at will into some combinatory play that produces abstract "forms" (i.e. totally autonomous in relations to the material)."* In this digital paradigm of Vaggione, the idea of a minimum unit, as in instrumental music with "notes", does not apply. For a "note", could be seen as a chunk of multi-layered events, covering many simultaneous temporal levels, each one having its own morphological features. As all timescales exploit morphologies and thus "forms". With this assumption, these units cannot be treated separate as a pallet of sounds, that can be agglomerated with no connection to the material. This approach seems to be very similar to that of the Cologne aesthetics, in which the form of the piece, and the form of its materials should be connected. This means that forms cannot exist autonomous in relation to the material. Koenig (1978, p.1) expresses a similar idea towards sound data in relation to structure: *"The proportions of the piece should be reflected as it were in the proportions of the individual sounds. It is better to call a list of sound data having no direct connection with the structure of a piece a description of sounds."* Similar to Vaggione, the idea is expressed that structure of the piece, should reflect structure of the material and vice versa. Sound data with no connection to the structure contradicts these aesthetics, and treats material as a homogenous brick of conventional music architecture; the note.

3.5 Singularity

The morphological approach towards the sound object brings forward the concept of "singularity". The word "singularity" has a broad meaning in the sciences, for my purposes I would like to reduce the meaning of it to the musical domain. In the musical domain, specially in the words and thoughts of Vaggione, there are different terms used to refer to singularities, like; "detail", "nomads", "saliences" or isolated sounds. Singularity could be defined as a state or quality, which stands out relative to its neighbours. To place it in the context of the morphological singularity, this means that, as the material evolves in time, at one moment or another, "outstanding" characteristics are produced (Solomos 2005). I would like to present three different approaches towards the singularity, in which the different notions might partly overlap in some aspects; singularity as a "catastrophe"; singularity as a pure subjective choice; and singularity as a "private rule".
First of all, singularity as an "catastrophe" is expresses by the mathematician René Thom (as cited in Solomos 2005, p.319): *"If the singularity consists of a 'catastrophe', it can only be measured*

with regard to the continuum that it fractures." In this sense, it means that the interpretation of a morphology, consist of determining the discontinuities and the stable part of these discontinuities. Pierre Schaeffer seems to touch this subject in his *À la recherche d'une musique conrète,*
in which he gives classifications for the sound object. In one of the classifications appears what he calls *Monophonie*, which means*:* associative elements isolated by the ear from an accompanying texture (Manning 1985). Schaeffer seems to relate this with the subjective ability to identify a singular elements in an polyphonic texture. Which brings us, to the the second definition of the singularity; singularity as a pure subjective choice. Even though, the concept of the singularity as an "catastrophe", seems to be an straight definition, it still challenges the neutrality of sound. It still demands subjectivity in order to determine discontinuities. A state or quality that stands out, could be completely subjective judgement. What might seem to be a "singularity" to one person, could be an continuity for another person. In this broader sense, the singularity is an isolated sound, a "nomad", exposed to the subjectivity as the only valid criteria. The third perspective of the singularity, as a "private rule" has more to do with the context in which singularities are placed. This concept assumes that for singularities to stand out, they need to be inserted into a context which, subjectively, is not a sum of singularities, but includes less singular elements. To further elaborate this idea, we should consider that singularities could be brought forward by, what Vaggione calls, "direct action". A "direct action" or "direct intervention" could be seen as an manual intervention on algorithmically produced morphologies. In which the algorithmically produced material, is governed by "global" laws, which are "rules". What a "rule" is in this case, is expresses by Bouveresse (as cited in Vaggione 2001a): *"To be considered rightly as such, a rule must necessarily be followed many times. A private rule is already in a certain sense a contradiction in adjecto."* On the other hand the composer can interact with algorithmically produced morphologies and create exceptions on the "rule", that act as "private rules". As Vaggione (as cited in Roads 2005) describes, this can be done by purely manual and interactive operations, that can bring forward singulaties : *"A composer knows how to generate true singular events, and how to articulate them in the larger sets without losing the sense (and control) of these singularities."* In this case, a singularity has the meaning of being an exception, "private rule", on a common thesis, which is the "rule".

3.6 Objects and Networks

The Vaggionian concept of the “object” is borrowed from informatics: it refers to object-oriented languages that were developed in the 1980s, which were an alternative to linear programming. Objects can be functions, algorithms, lists of parameters, scores, scripts, transformational procedures, and even a chain of actions that need to be undertaken. We could say that a sound object could be integrated within a network, and circulate within a network of operations, which are objects. Here I deliberately make a distinction between the “sound object” as a sound, and the “object” as an operation. Vaggione (as cited in Sedes 2005) goes further by giving the sound object, and the object the same status; the object. *“The object, as I see it, is an operational category, that is, a technical concept produced in order to find a criterion of mediation, a tool capable of encapsulating different temporal levels into a plural entity with defined borders, and hence able to be manipulated from within a network”.* The object here is presented as an plural entity that could be an operation, or a sound object as well. Vaggione (as cited in Sedes 2005) tells that this has to do with the transparency of the sound object within this digital domain: *“When we say that the digital sound object is transparent, we mean not only that this object manifest itself as a closed entity, but also that it is able, essentially, to reveal its methods and its code.”*

This enables both the sound and the “score” to be encapsulated. With the concept of the “object”, we could manage to bridge the gap between the traditional duality of sound and structure.

The notion of “network” is bound to the object, in the sense that an object can consist of a network of different operations, or a network of operations could be an object. In other words, the composers handles networks of objects, in which each object is itself could consist of network of objects (Sedes 2005). The concept of 'network' also refers to the situation in which a multiple of points and multiple pathways are possible: *“it presents any state of a mobile situation.”* (Vaggione as cites in Solomos 2005).

3.7 Motivation for Granulation

The digital paradigm opened a new field of scientific research in the micro-temporal behaviour of transients and phases in relation to the identification and timbre of sound. Specially the work of Jean-Claude Risset has been of historical importance for highlighting the micro-temporal articulation of sounds. In this work, trumpet tones were analyzed and synthesized by clustering of segmented amplitude envelopes (Sedes 2005; Vaggione 1996). Vaggione
(Budón 2000, p.10) expresses how sensitive he was for Risset's scientific work:
“Musically I would say that the work of Jean-Claude Risset has been for me of the most influential,

as it opened a huge continent to explore; it was actually through Risset's work that I became aware of the importance of clearly defining microtime scales in composition."
In this context, sound is no longer assumed in terms of periodicity or repetition, as defined by the classical acoustical model of Helmholtz., but more as an corpuscular, dynamic phenomena. This explains Vaggione's interest for granular synthesis: a technique based on this corpuscular notion of sound (Solomos 2005). The choice for granulation, or the fragmentation of sound is therefore a way of defining and articulating the micro-temporal elements of material. As granulation makes it possible to sort elements within a certain scale, while it allows individual elements to be grasped (Risset 2005). Another technique closely related to granulation is micromontage. The term "montage" derives from the world of cinema where it refers to cutting, splicing, dissolving and other film editing operations. And the term "micro" refers to the manner in which a composer can position small sound particles, beloning to the micro-time domain (<100ms), in the time domain (Roads 2005). Micromontage and granulation techniques share many similarities. The best way of making a distinction between the two would be by saying that granulation is automatic process, and micromontage is a manual process. But in the case of automatic micromontage, or micromontage by script (Roads 2001), I would like to suggest that micromontage and granulation are the same kind of operations.

3.8 Space by means of micro-temporal decorrelation

A technique which is often used by Vaggione (2001b) for creating a sensation of space, is that of micro-temporal decorrelation. This technique consist of creating replicas of a waveform, and proceed to desynchronize their phase relationships within a micro-time scale. In the context of digital mixing this means to create a very slight local phase desynchronization to produce the sensation of directions locally on the plane of the azimuth. This technique creates a sensation of space intimately linked to the morphology of sound. Vaggione (as cited in Solomos 2005) states that space is part of the morphology of sound, and if this morphology does not have relative autonomy, this is as a morphology *"which will modulate and be itself modulated by other morphologies."*
This means that when a sound shares common characteristics in morphology with the other sounds (not having relative autonomy, e.g. phase decorrelation), the slight differences in morphology will cause a modulation, that creates a sense of space. In this context, space is not seen as a parameter, this is the reason why the use of standard techniques like reverberation and panning are not adequate, because they have no relationship to the morphology inherent to the sound. They are just spatialising in the sense, that they are added to the sound.

3.9 Practical Implications

The notion of the sound object as a morphological reservoir, that can be articulated in different temporal levels, and the redefinition of the object, as an encapsulated entity between the digital sound object and the operational categories, has first of al inspired me, and has led, as a consequence, to a certain workflow that differs from my earlier approaches toward composition. In this part of the text I would like to give an description of my practical implications of the following subjects; micro-temporal behavior of sound, singularity, objects and networks, micro-temporal decorrelation; and finally, how this led to the creation of the piece
Antarat (2012).

3.9.1 Granulation and Singularity

Granulation is a process that very clearly reveals the micro-temporal elements and particularities of a sound material. With particularities, I mean special qualities and characteristics, that take place at transients and phases. The process of granulation, allows particularities of material that normally would lay in in a very short timescale, to be to be grasped and articulated. Specially by doing this process manually by moving trough the different sample positions allows to get hold of the characteristics outside normal time continuum of the material. These characteristic that are unfolded could be exposed to the subjective mind, and be selected as singularities. I would like to elaborate this by the following example. In this example I granulate a sampled kick-drum, by moving through the different sample positions manually by hand (CD track nr.10).

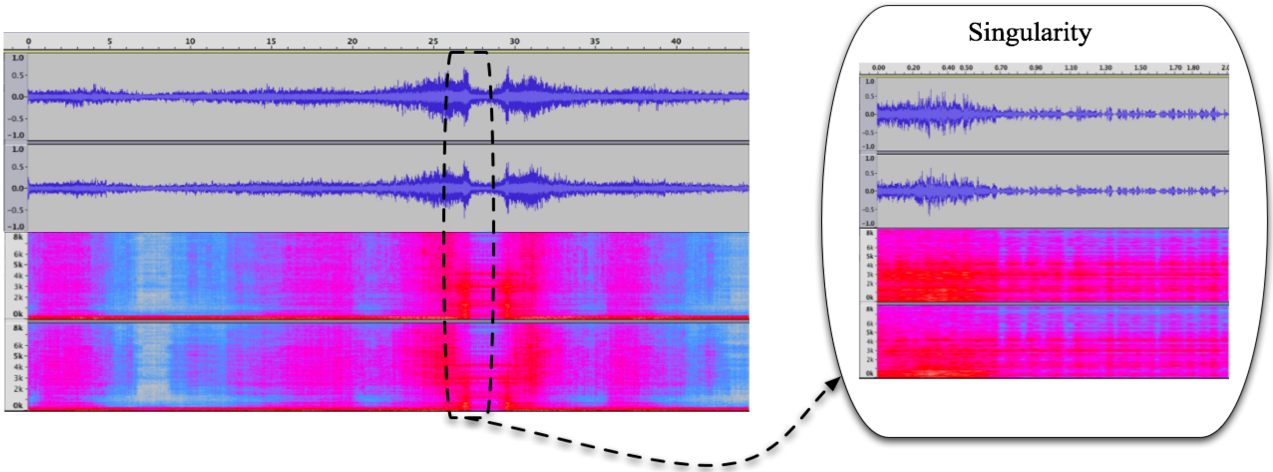

Fig 19, Left shows the waveform and spectrum of the granulated kick-drum. Right shows the selected singularity.

The result of this process was a sound object with a duration of 45 seconds, that reveals the micro-temporal characteristics of the chosen sound material. Subsequently, I made a selection (CD track nr.11) which for me had particular characteristics that were outstanding compared to the neighbouring textures. The consequence of such an evaluation results in the selection to be labelled as a 'singularity'. I would like to emphasize here, that this is an subjective choice made by auditory evaluation, and that another person might find other singularities. But if we take a look at the waveform, and the spectrum of the selected material, we could say that it shows characteristic that are outstanding compared to the neighbouring shapes. The spectrum shows a stronger level of intensity in the higher regions, compared to the overall spectrum of the material. And the amplitude level shows a strong increase with a high intensity, followed by a strong decrease. Thus, we could state that on a more objective level the selected material shows singular elements.

3.9.2 Micromontage, Objects and Networks

The idea that granulation and micromontage are processes that allow individual characteristic to be grasped, and the notion of the digital object as a transparent entity, for me shed light on the possibilities for transformational processes. In this paradigm, I started to realize that the sound objects could be seen as a system itself. This is emphasized by the idea of Vaggione, to encapsulate the sound object, and the operational category (the 'score') by giving them the same status: the object. A transformational process on the sound object would therefor mean a 'collision' of two systems (objects), resulting into another system or object. This also means that each sound object, thus each system, requires its own approach. There is no objective generality that would guarantee a successful 'collision'. By a successful 'collision', I mean that micro-temporal particularities are articulated as such, that they result in a musical fertility. This resulted for me in the creation of a network of granular and micromontage processes, in which my sound objects would circulate and create new morphologies. The choice and motivation to use in general only granulation and micromontage techniques as the only possible transformations, comes from the idea that these techniques allow individual characteristic to be grasped in the micro-temporal domain. Another motivation for this choice, is the fact that I see these techniques as transformational processes that do not add anything to the sound: they decompose the internal morphology of the material. Here I would like to give another example in addition to the previous example, in which I selected a singularity out of the sound object. In this example, the singularity is exposed to a automated micromontage process that decomposes the internal morphology of the selected singularity (Fig 20, CD track nr.12). This results in a new sound 'object', which could again bring new singularities forward.

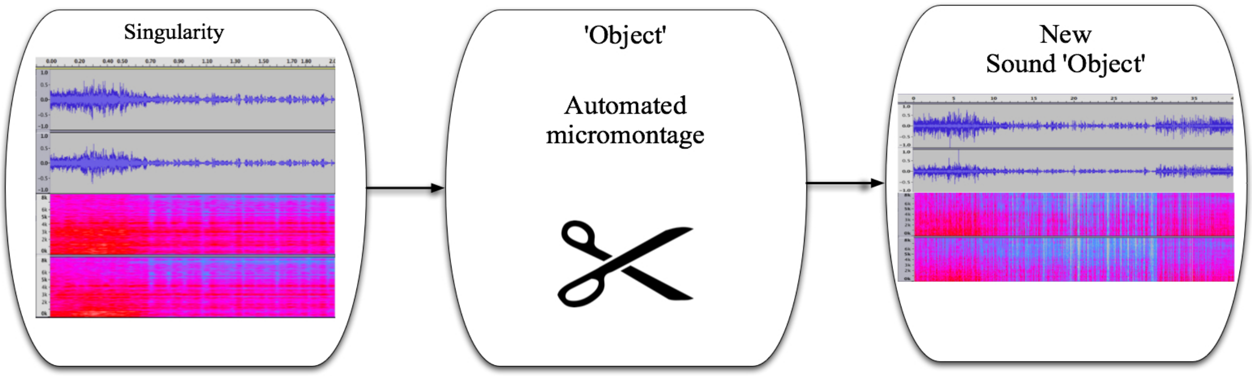

Fig 20, Shows a selected singularity exposed to automated micromontage resulting in a new sound 'object'.

3.9.3 Micro-temporal decorrelation

The technique of micro-temporal decorrelation was something that I used extensively in my former piece *Fradatha* (2008). During the production of the piece, I was not aware of the in paragraph 1.6 postulated technique. Nevertheless, desynchronizing the phase of replicated materials, was something that I did intuitively, with a similar goal in mind: creating the sensation of space, without adding anything to it, like reverberation and panning. Specially in the last section of the piece, the result is very good audible (track nr.14, 03:42 – 05:08). Another way of creating the sensation of space other than phase desynchronization, is for example, by creating variants of the same material with slight deviations and placing them differently in the horizontal azimuth.

Besides the objective of creating space, there is another feature that I would like to mention. This feature occurs around the treshold of being able to hear two separate auditory events or perceiving the sound as one auditory event. Perceptually it seems that around this treshold two separate auditory events, could fuse into one auditory event, placed in the horizontal azimuth. This is caused by the modulation in the amount of desynchronization in phases. By modulating the amount of phase desynchronization, a perceptual fusion and de-fusion of sounds occurs around the treshold. Superficially this is as if a polyphony fuses into a monophony, and vice versa. This notion inspired me to integrate the modulation of phase desynchronization into the granular processes. On example that I would like to give, is caused by the process of feedback between two separate low frequency oscillators (LFO) that control the rhythmical progress of a two similar granular processes (Fig 21).

The result of one granular process is placed on the left channel, and the other is placed on the right channel (CD track nr. 13).

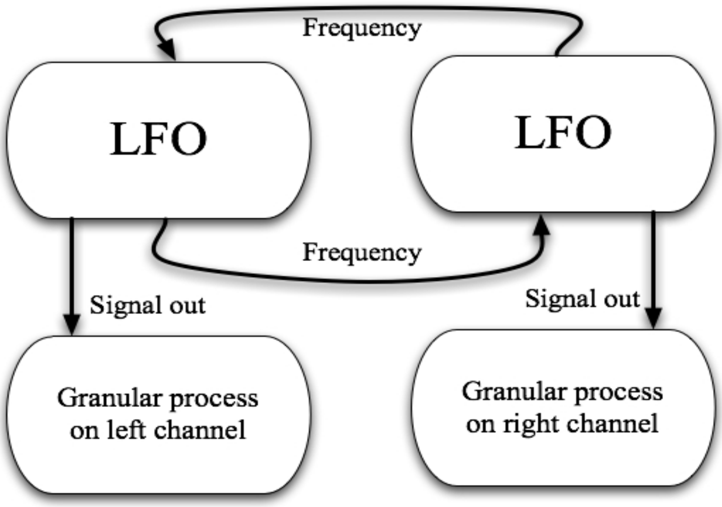

Fig 21, Shows a schematic of a two similar granular processes with feedback among the frequencies of the LFO's.

3.10 *Añtarât* (2012)

In this part of the text I would like to give a description of the compositional process for creating the piece *Añtârat*. The title of the piece means 'interior' in Avestic language. I named it after the process of exploring inner morphological characteristic of sound material.
For this piece I used the same kick-drum sample that I have used in my auditory examples in the previous paragraphs. To addition, I also used a sample of a single shake on a maracas.

The first step during the compositional process, was to search for particular morphological characteristics in the micro-temporal domain, by the use of granulation. In this process I was in the search for values in the sample position of the material in order to get hold of these characteristics. By subjectively making selections of these characteristic in the material, I defined the singular and less singular elements. These selected singularities were accordingly integrated into a network of different operations, that consisted mostly of automated micromontage processes. I could categories these into two different kind of micromontage techniques; micromontage techniques that created short phrases, that consisted of a 10 to 100 grains, and could last for around a 2 seconds to 8 seconds; micromontage techniques that created continues streams of deconstructed morphologies that could last for as long as necessary. What specially was very fruitful was the interplay between these two different categories, in which short granular phrases could be integrated into micromontage techniques that created long continues streams out of these short phrases. These long

continues streams, then articulated the morphological progression that these short phrases contained. This process could than again bring forward material with singular elements, which then again could be selected, and be integrated into the network of operations.
Articulating different temporal levels of a certain singularities, were done by exposing the same singularity to different micomontage operations. Each of these operations would scatter these characteristics on a different time level. By the selection and superposition of these results, they were composed in a polyphony, which would articulate the same singular elements in different timescales. What was appealing for me, with this method of working, was the amount of freedom caused by the different possible pathways inside the network of operations. There was a large quantity of flexibility in selecting different part of materials, and scattering their morphological characteristics in time. Another element that contributed to this flexibility, was the manual interaction that I allowed myself to have with the automated processes. For example, some of the parameters of the automated micromontage techniques were controlled manually by hand. This allowed me to generate singular events, that were an exception on general rule with which the montage took place. Many of these singular events were placed into a context in the piece, where they functioned as transient parts between different sections.

Finally I want to add, that because of the flexibility in different pathways within the network, and the possibility for manual actions, the overall form of the piece unfolded in the timeline.
The form was not created though a pre-conceived global plan, but rather in a chronological-associative method or goal oriented method, in which I compared neigbouring events. The generation of new material also unfolded in the timeline. This is different from my earlier works, in which I first generated all the material before I worked on the overall form. Through manual gestures I was able to create material with more control in over the goal orientation or direction. Accordingly, I could create an accompanying layer, that would put the same material in a different time scale. The creation of this piece, was the first attempt to work in such an method. More experience through this method is needed for further conclusions. So far, I would like to conclude for myself, that this method leads to a way of working in which the form unfolds during the timeline. Consequently, the materials were generated during the unfoldment of this timeline, through the use of partly manual gestures, that resulted in more “lively” results.

Conclusion

Both Koenig and Vaggione seem to have similar idea's about the relation between material and form. We have seen that from the Cologne aesthetics point of view, sounds are not only sounds, but also a methods, accordingly the methods in which they are treated. And we have seen a similar notion from the Vaggionian point of view, in which sounds just cannot be assembled autonomous in relation to the material. We have seen that according to the Cologne aesthetics, it is better to speak of sound-events, which was to extend the homogeneous brick of conventional music, the note. And we have seen how Vaggione bridges the gap, in the digital paradigm, between score and structure, by encapsulating them in the object as a multiple unit. They both tend to deal with composing of the sounds, instead of with the sounds. We could state that Koenig and Vaggione both have a similar objective in mind: to bridge the gap between material and form.

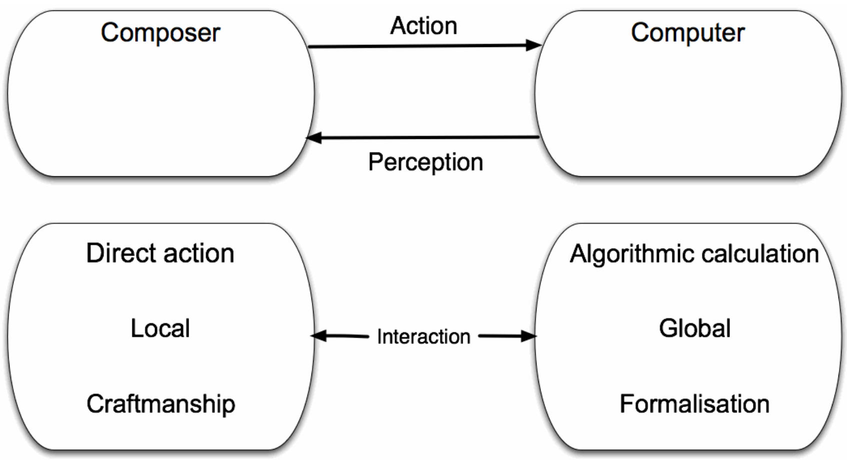

Figure 12

In the first chapter I have mentioned some abstract compositional methods of which the chronological-associative method, and goal-oriented method were accompanied by a perceptual feedback, according to Koenig. In the context of Koenig, this perceptual feedback has to do with the local events and strategies that unfold along the the time-axis, in which neighbouring relations need to be compared. We have seen a similar concept been postulated by Vaggione as the action/ perception feedback loop. Instead for Vaggione, the action/perception feedback loop, causes an interaction as a point of mediation, between local strategies and the global level. For Vaggione, local strategies have to do with actions taken on the local level, in the form of 'direct actions' and 'interventions'. These direct actions, have to do with craftsmanship, and are in interaction with the global level. To put it differently, we could say that local actions, and direct interventions definitely have the possibility to be integrated in an algorithmic process. The other way around, the product of algorithmic procedure, can be locally transformed by direct actions. If we recall the compositional method of *extrapolation*, we could state that direct local actions, have consequences on a global level. And on the other hand, if we recall the method of *interpolation*, we could state that our local actions are guided by the results of algorithmic procedures. It is through interaction that a mediation is possible between the local and the global, between craftsmanship and algorithmic processes, between the rational and the irrational. And it is at the point of interaction, where perception validates action, through the action/perception feedback loop (Fig 21). In my opinion, the concept of the singularity has to the with perceptual subjectivity, and subjective actions. As it is that through the subjective perception, singularities come forward, and through singular actions that new things are created.

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Appendix

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