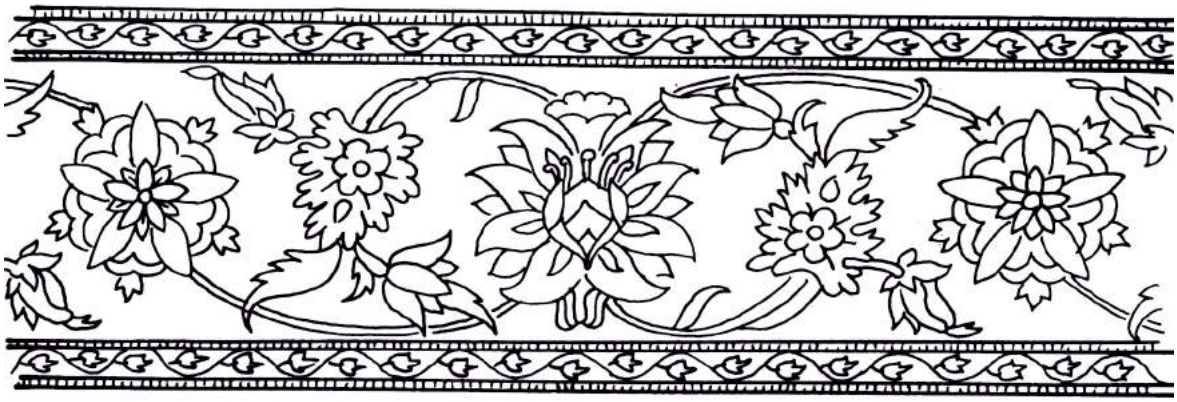
Composing Music Based on Carpet



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Abstract

This dissertation is concerned with composing music based on carpets as a pre-existing visual phenomenon. The main objective is to extract noteworthy features of carpets and apply them in the process of composing music. It is accomplished by exploring different aspects of carpets, such as aesthetics, concepts, and visual features and investigating all the possible ways of bringing these into music. It should be noted that a direct sonic translation of a carpet is not intended, but rather that I observed key elements of carpet designs, and tried to create an analogy in music. During this research, questions and problems related to correlation between the visual and the sonic domain will be discussed, and some different approaches in form of a series of composition projects will be explained.

Acknowledgments

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Contents

Introduction

Figure 1.1 Kerman Carpet, Iran, Early 17th century

Before starting this research at the institute of Sonology, I was already concerned with this idea of deriving music from carpet design. I even composed a piece, being inspired by the idea, which was a duet for Iranian traditional instruments. At that moment the idea was quite vague and abstract for me.

After finishing the one-year course, I found the Sonology Master's to be a great opportunity to fulfill this idea in depth with all the interesting possibilities that electronic music offers. When I started working on this project, I realized it is not an easy project at all. The subject immediately suggests some ways of dealing with this matter, but in practice it is quite challenging. The old story (maybe not very old) of translation between different media: how would an image sound? What are the colors of a piece of music and how would you interpret an image into sounds and eventually music? Many experiments have been done in the area of audiovisual and it is getting more and more popular.

There are already many different programs to which you can import an image and convert it into sound by mapping certain elements (I will explain some of them in the second chapter).
In fact, I could already be done with my project now! If I had simply selected some carpets, imported their image into a proper application, and exported the sounds.
Not surprisingly, I did not find this approach satisfactory in accomplishing this project. I have been quite skeptical towards all these straightforward, or in other words *"one to one"* approaches (For instance, mapping one element of the image directly to one element of the music). First of all, I believe these elements are perceived in different ways, and we do not understand them in the same way in these two different worlds. I think that simply mapping one element from one domain to another domain does not necessarily say anything meaningful about that.

On the other hand, I believed that delving into an issue from a different world other than music could bring new and fresh ideas and aesthetics into the composition. In this regard, for me carpets have been an interesting, mysterious, and inspiring form of art that can lead me to new ideas. Working on carpets as resource for my composition is also related to my concern with my identify as an Eastern composer in contemporary music, and the role of tradition in my work. However, I believe as long as the composer is honest in his works, this identity emerges naturally in the result.

Furthermore, I immediately realized that what I want to do is not a sonic translation of a carpet, but rather finding interesting features and aesthetics in them and applying them in my compositions.

During this time, the key question for me was whether this interesting feature of a carpet would be also interesting in a piece of music?
Therefore, I tried to ask myself this question whenever I came up with a new idea.
I need to mention as a composer, the driving force for me has always been composing music. Different issues can be as impetus for composing a piece of music. Composers' curiosity, taste and tendencies grab their attention towards quite diverse directions. And I am not an exception. I would also like to mention that research is a tool for me to bring new ideas to my compositions. In other words, I am researching for my compositions, rather than composing for my research.

Consequently, the first step for me was to dig deeper and not only look at the mere visual appearance of a carpet, but try to find aesthetics and concepts behind it in order to have a deeper understanding of this visual phenomenon with its entire social and cultural context.
In each of my composition projects during this research, I addressed different issues that I came across in my exploration.

In Chapter two (next chapter) I will explain carpets in general. At the beginning I will talk about the history and origins, and later on I will discuss the interesting features of carpets and their possible connections with music.

In chapter three, I broach the issue of spatial-temporal relationships and their problems and possibilities in relation to my project. The second part of this chapter is an investigation into some applications and approaches in extracting sound from image. Chapter four is a brief exploration of Morton Feldman's works as an important composer who was inspired by carpets. It is a glance at his approaches and ideas in four of his pieces related to carpet.

In the last chapter, I will explain my own attitude and approaches in my compositions, and the ways that I apply these features in my own work. Also the pieces that I composed during my research project will be discussed individually at the end.

Chapter 2

Carpet features and music

Figure 2.1 Payzyryk Carpet, 5th-4th centuries BC, Hermitage Museum, Saint Petersburg

2.1 History and origins

The human impulse to put something pleasant beneath the feet must be almost as old as the one to erect shelter over the heads, and carpets have been lying around for at least 6,000 years. They also function as art, insulation, sound absorber, and a source of metaphors and symbols. Some of the carpets have great stories to tell.

The Pazyryk carpet, found frozen in the Altai Mountains of Siberia in 1949, is the oldest known pile carpet. This carpet is 283 by 200 cm and has 36 knots per centimeter squared ("The Payzyryk Carpet", 2001). The advanced weaving technique used in the Pazyryk carpet indicates already a long history of evolution and experience in this art. It is considered as the oldest carpet in the world. The original carpet is kept in the Hermitage Museum in St. Petersburg.

An interesting fact here is the relatively unchanged nature of carpet during centuries. The Payzyryk Carpet does not seem to be very different from recent ones, both in terms of design and its structure. This fact tells us about the steady weaving techniques and designs have been used in this field. Moreover, precision and fineness of the Payzyryk is quite remarkable.

Persian carpet is a very famous example in this field. What above all have given prominence to Persian carpet as a beautiful work of art are the patterns and its composition in a two-dimensional space. The diversity of patterns, use of deep and beautiful colors, good composition, harmony of colors, delicate and poetic composition are among the most outstanding features of Persian carpet (Mousavi Hejazi, Ansari, Ayatollahi, Pourjafar 2006, p.65).

> A really great carpet does not reveal its quality at once no matter how impressive at first view. In cost, in time, in effort they make real demands on those that would understand them. A systematic and detailed analysis which may subsequently be resynthesized into a moment of intense aesthetic emotion is the indispensable preliminary to the realization of their characteristic merits (Pope, 1945).

2.2 Persian Garden

Tracing back the origins of carpets, we should look at the word paradise. Paradise means enclosed park. *pairi-* "around" + *-diz* "to create (a wall) " According to Oxford Dictionary:

ORIGIN Middle English: from Old French *paradis*, via ecclesiastical Latin from Greek *paradeisos 'royal (enclosed) park,'* from Avestan[1] *pairidaēza 'enclosure, park.'*

The word paradise is closely associated to the Persian Garden. The origin of the Persian Garden may date as far back as 4000 BC; the decorated pottery of that time displays the typical cross plan of the Persian Garden (Talebian, 2010, p.37). The outline of Cyrus[2] the Great's garden, built around 550 BC, is still viewable today.

The concept of the Persian Garden, or Paradise, came to existence by the creation of Pasargadae[3]. Through the ages, it lived and developed according to the time, location, beliefs, and cultural traditions (Talebian, 2010, p.43). From the time of the Achaemenid Dynasty, (550 - 330 BC) the idea of an earthly paradise spread through Persian literature. As the word expresses, such gardens would have been enclosed. The walls protect the garden from the harsh environment. Therefore, the garden's purpose was, and is, to provide a place for protected relaxation, in spiritual and leisurely manner, essentially a paradise on earth. Iranians love of trees, water, and flowers has gradually turned into an eternal love, which has manifested itself in Persian Gardens (Pope, 1945).

These gardens were always divided into four sectors, with water playing an important role for both irrigation and ornamentation. The Persian garden was conceived to symbolize Eden and the four Zoroastrian elements of sky, earth, water and plants. They also feature buildings, pavilions and walls, as well as sophisticated irrigation systems. These gardens have influenced the art of garden design as far as India and Spain ("Persian garden", n.d.).

[1] Avestan Language, the language of the Avesta, the holy book of the Zoroastrians.
[2] (600 - 530 BC) was the founder of the Achaemenid Empire.
[3] Pasargadae was the first dynastic capital of the Achaemenid Empire, founded by Cyrus the Great, in Pars, homeland of the Persians, in the 6th century BC.

Figure 2.2 Fin Garden, Kashan, Iran

The Persian garden is the materialization of a whole, man-made ecological environment. It is born from nonexistence, and is tangibly different from its surroundings. They have been directly associated with many cultural developments, which are reflected in literature, poetry, carpets, miniatures, music, architecture decorations, etc. The Persian garden has been in direct, tangible connection with the events, traditions, beliefs, and artistic and literary masterpieces of the Iranians (Talebian, 2010, p.49). The carpet as one of the most important elements of Iranian art is no exception.

The significance of the concepts of the Persian Garden lies in the creation of an environment suitable for reflection, discussion, and composing poetry; a place where one can receive the inspirations of the spiritual world and reflect them in the mundane world. The metaphorical depiction of gardens is evident in works of poets such as Omar Khayyam, Saadi (1210-1292), and Hafez (1325-1390), as well as Ferdowsi (940-1020). The spiritual concept of garden is so tangible for the minds of the Iranians that major parts of literary works of the prominent poets is linked to description of gardens (Talebian, 2010, p.65).

Even more significant, in the Shah-Nameh (Book of Kings) by Ferdowsi, the entire land of Iran is referred to as one large garden, Saadi named two of his books as "Golestan" and "Bustan" ('rose garden' and 'flower garden'), which are indeed other terms to refer to the Persian Garden (Talebian, 2010, p.48).

'The garden in its infinite manifestations is the theme of most Persian carpets' (Pope, 1939).

In fact a carpet represents a garden, the utopian place of peace and balance. A world of perfect harmony where the climate is moderate, the flora is abundant and a smooth light always glimmers. This is the reason that the main theme of the carpet designs deals with depiction of a garden with all different kinds of trees, plants and flowers with pools and water streams.

The presence of trees in the Persian Garden reaches beyond their main function in the vegetation, and reaches a mythical extent. Evergreen trees like cedar, which are depicted in the characters of the Persepolis, are considered to be symbols of eternal and sacred life as well, while on the other hand, deciduous trees like pine tree are representations of the afterlife. Yet another categorization of trees puts them into two classes of fruiters and umbrageous ones. (Talebian, 2010, p.64). Other types of flowers and ornamental plants, with their mythological concepts, plantation hierarchies, and conditions of preservation play a significant role in the overall order of the garden.

The representation of a garden in a carpet happens in different ways. It spans from a relatively realistic depiction of a garden (Figure2.3) to very abstract form (Figure 2.4). This abstraction has different levels and sometimes it results into purely geometrical shapes, lines and blocks of colors. The abstraction itself again emphasizes the spiritual mood of these gardens.

The concept of gardens and carpets as a place influenced my compositional ideas and has been one of the very important elements of my music. I tried to think of the idea of music as a garden, a place for the listener to wander and discover its different corners. In fact, I consider using this concept in my music, in line with other art forms influenced by the concept of the garden. I will describe this impact in Chapter five, when talking about my approaches and compositions.

Figure 2.3 Wagner Garden Carpet, North Persian, eighteenth century. Burrell Collection, Pollok House. Glasgow Art Gallery, Scotland.

Figure 2.4 Bakhtiari Rug, early 20th century, Claremont rug collection

2.3 The Life of a carpet

Nikos A. Salingaros (1952-), who is a mathematician and architect with a special interest in carpets, has been carrying out a long-term study on carpet designs and the general roles of a good design. In this field he has been in a close collaboration with Christopher Alexander (1936-), who is also an architect noted for his design theory and his famous book “A pattern language”.

Salingaros explains in his article “ The Life of a Carpet “ that, the greatest carpets project a very powerful presence.

> Differentiating space on the smallest perceivable scale creates "life" in a carpet. This is activated through the process of coupling mutually contrasting elements, both in terms of color and geometry. A carpet's large-scale coherence depends on arranging the small-scale elements symmetrically, and defining complex elements that could themselves be decomposed into smaller elements. The same rules apply to all types of carpets, regardless of provenance or age (Salingaros, 1997, p.1).

Salingaros suggests that old carpets have ‘life’, with the term life, he refers to a complex system, In order to grasp this complexity, we have to identify the different spatial scales in a design from the very small scales near the knot size, through all the intermediate scales, up to the overall size of the piece. A carpet, like any design, works on several different levels at once, posing a well-defined problem in hierarchical ordering (Salingaros, 1994).

The small scale is defined by contrasts, directional forces, and alternation. The large scale requires relationships, harmony, and balance, and depends on matching similar patterns and shapes to tie the whole together (Salingaros, 1994).

Basically, Salingaros believes in an active interaction between different elements of a design in a complex and multiple levels such as in a living creature. According to him, more interaction between the elements creates more life in a carpet and consequently results in a successful design.

> Another important issue is scaling and hierarchy. In a carpet, the scaling hierarchy is responsible for the most remarkable feature of a good carpet. Looking at any detail connects the viewer with a region on the size of a few knots; this then connects laterally with all similar and contrasting elements on the same scale, which are further connected vertically via the hierarchy onto all the successively higher scales. If the hierarchy works, a viewer will instantly connect to the whole carpet by picking any detail. Conversely, viewing the whole carpet connects a viewer to all one-knot details, if they are defined in the right way (Salingaros, 1997, p.11).

In fact, in a design we are dealing with a microscale and a macrocale. The microscale deals with the very small details and fundamental elements of a design. On the other hand, the macroscale deals with the bigger sections of the whole design. Nevertheless, these bigger sections are constructed out of smaller elements.

In Figure 2.5 you see the whole image of the carpet. Here we are dealing with the macroscale. We can recognize the main sections of the design such as borders and the central figures. At the same time we have the microscale aspect of the design, which is not really perceivable from afar. The microscale consists of very detailed and elaborated small elements. In Figure 2.6 and 2.7, we can see this level of the design with all its delicate and intricate elements. This aspect of the design is closely related to music.

Studying these aspects in a carpet gave me a deeper understanding of how the design elements work together, about how they interact and how at the end they create a coherent whole while having all internal contrasts. These considerations helped me a lot in organizing my materials in my compositions.

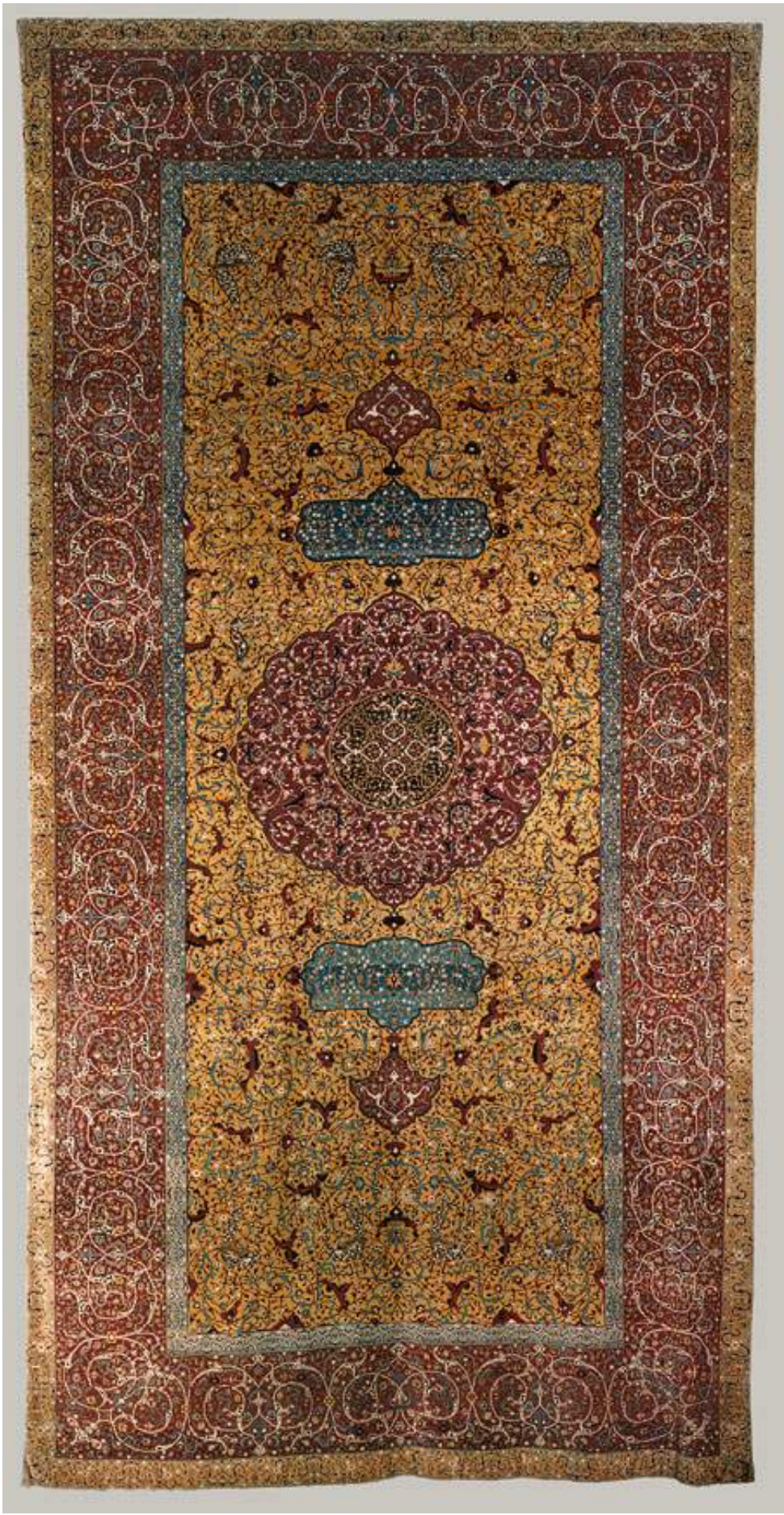

Figure 2.5 Anhalt Carpet mid-16th century, The Metropolitan Museum of Art, New York

Figure 2.6 Anhalt Carpet, a selected area

Figure 2.7 Anhalt Carpet, a selected area

2.4 (A) Symmetry

To mention one of the basic features of a carpet, we can talk about symmetry. A long tradition of the use of symmetry in carpet and rug patterns spans a variety of cultures. Many oriental rugs have intricate reflected centers and borders that translate a pattern. Not surprisingly, rectangular rugs typically use quadrilateral symmetry, which means, motifs are reflected across both the horizontal and vertical axes. (Figure 2.8)

Figure 2.8, Farahan- Sarouk, eraly 19th century, Claremont rug collection

> Every larger scale in design is defined through symmetries on all its different sub scales. The goal is to connect all points of the design through translational, rotational, reflectional, and scaling symmetries. The human mind perceives obvious symmetries - such as uniform scaling - instantly. More complex symmetries include conformal transformations, which describe stretching a design in one or more directions. The recognition of these in "uneven" village rugs provides intellectual interest and delight, as long as they are not overdone (Salnigaros, 1997, p.8).

In fact, symmetry is the main tool to establish different scales in a design by using very limited elements. Symmetry creates different relationships between simple elements in order to build new motifs on a different scale. Then these new motifs will be again subjected to new symmetrical strategies to form bigger sections of a design up to the overall structure of a carpet.

The very intriguing fact in this procedure is using one simple element and structuring new identities out of it, while all these new figures are interconnected to the initial basic motif. This fact brings a strong coherence to the whole structure of a design.

In Figures 2.9 you can see different ways of organizing new figures of a very basic element, which is letter " F " in this example. This concept inspired me in creating my musical materials and to think about different ways of using a very simple sound material to establish new identities and more complex textures.

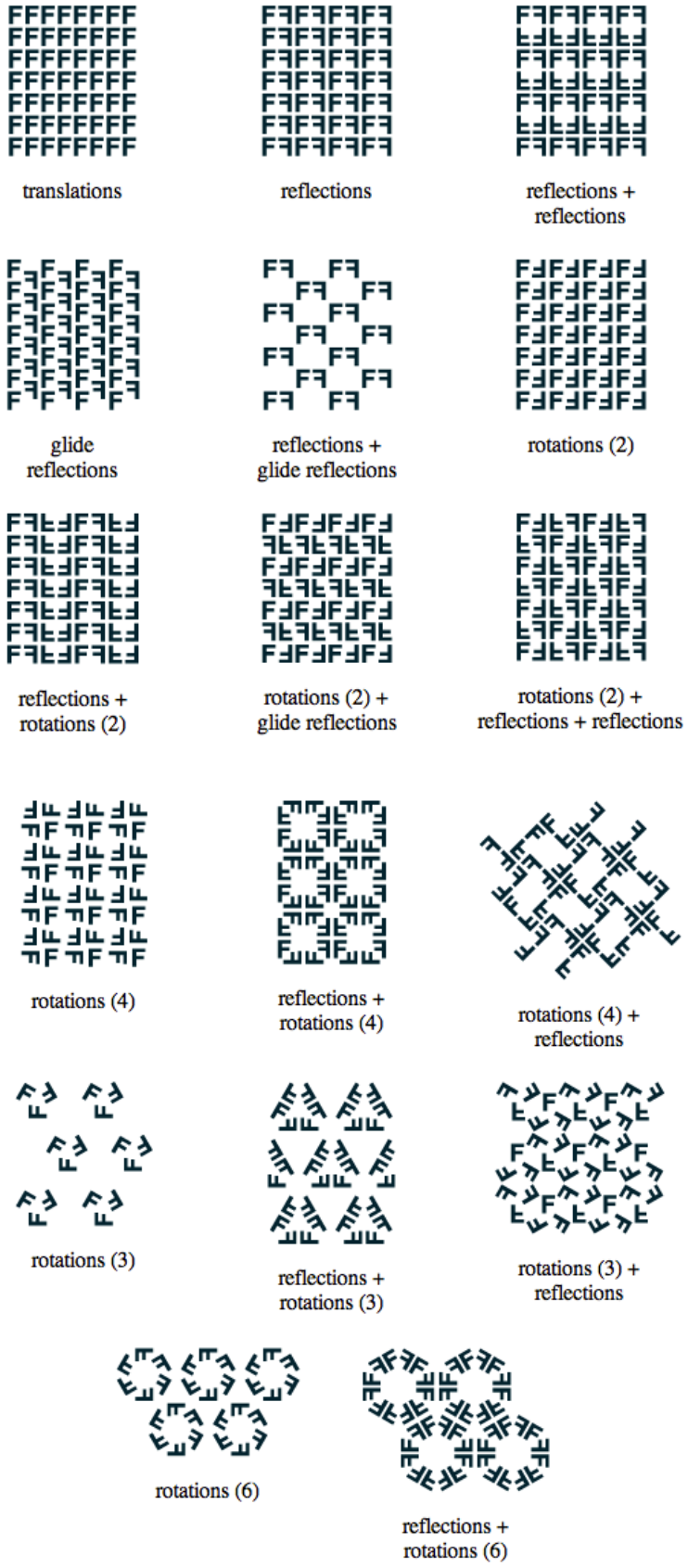

Figure 2.9 different types of symmetry and their combination

On the other hand, one of the prominent features of a carpet is the simultaneous symmetry and asymmetry. The phenomenon that Morton Feldman calls “crippled symmetry”.

While carpet designs are largely symmetric, due to the nature of handmade crafts and the quality of materials, the final product is at times less than symmetric. The symmetrical structure of carpet pleases the viewer’s eyes, yet a close observation of the carpet gradually reveals a startling asymmetry not noticeable at first glance.

Basically, these asymmetrical aspects are found more on the microscale in contrast to the symmetrical organization of the macroscale. This fact creates an interesting contrast between the two scales.

One of the reasons of this asymmetrical aspect is weavers mistake, which is one of the interesting characteristics of a carpet. This fact gives a unique identity to each carpet even ones based on a same design plan. It also happens in an intentionally manner. While having an overall plan of the design, the weaver starts to improvise on making the details. This fact creates an interesting effect by juxtaposing of order and randomness. Nevertheless these differences most of the times are quiet subtle that whiteout a careful observation would be almost unnoticeable.

Using symmetrical strategies in spatialization is one of the very important aspects that I have tried to explore in my compositions. One of the main concerns for me has been applying these symmetrical features in a way which is more connected to spatiality rather than temporal aspects of the music. However, I also applied temporal symmetry along with my spatial symmetry in order to have a polyvalent result.

2.5 Complexity

Generally, the complexity in carpets is the result of superimposition and juxtaposition of multiple networks of patterns and their relationships. This complexity is quite different from the obvious symmetry of the general format, so that there are surprises, arrangements that are not at all obvious but have the random irregularity of nature.

> This is accomplished by a combination of three or more different and apparently similar vine systems, in different scales, each with its own character and function. Each system has its own framework. Furthermore, each system has its own implied rate of motion and its own implied weight and energy, but all move in concord, as with designer's pre-established harmony; contributing, blending, colliding, but not extinguished by the other related systems (Mousavi Hejazi, et al. 2006, p.71).

In spite of the complexity and number of themes, the carpet's design remains a two-dimensional object so that the sense of underlying surface is always present. This is mainly due to the use of balance, symmetry and repetition together with growth, complementary and equivalent colors and generally a proportionality and order in the work as a whole. Thus, the complexity of patterns is in fact a result of the plurality of orders, which have created harmony and coherence through the coupling of balanced opposites all over the levels of multiple systems of designs.

Since this complexity works in different levels and scales simultaneously, we can also talk about their interconnections. Generally, Something that is simple is also symmetric, so the smallest building blocks should be symmetric. More complex shapes are going to be built from these, so we do not want the smallest elements to be complex themselves (Salingaros, 1997, p.7). We are left with a choice of elementary forms, such as triangles, diamonds, and squares, and their symmetric combinations. The smallest elements may exist separated, as in many tribal weavings made up of small elements in the field, or combined in sophisticated ways into larger wholes of increasing complexity.

Figure 2.10, Kashan, late 19th century, Claremont rug collection

The complexity of a carpet is closely related to wholeness. Wholeness is a quality, which appears in most of eastern arts. In fact this is the consequence of the artist ideology and believe which results to this aesthetic.

> The greatest carpets-the ones, which are most valuable, most profound-are, quite simply, the carpets which achieve the greatest degree of this wholeness within themselves. The degree of wholeness which a carpet achieves is directly correlated to the number of centers which it contains. The more centers it has in it, the more powerful and deep its degree of wholeness (Alexander, n.d.).

According to Alexander, a *center* is a particular identified set, which appears within a larger whole as distinct and noticeable part. This concept is exactly comparable to music. It reflects the idea of plurality and unity. Here we can again see this contrasting duality.

The experience of standing before a great carpet like the one in Figure 2.10 and observing all these complicated connections have been a quite overwhelming experience and inspiring for me. This experience made me to think about creating a similar quality in music. The way of organizing different and contrasting elements while concerning their internal relationships has been one of my approaches in composing music.

In doing so, I tried to create a balance between independence and connection and the coherence of the overall result. This complexity is created for instance, by giving each element of the music a specific frequency range. In this way, each material has its own territory. At the end, different layers occupy almost the entire frequency range. In fact this is a spatial distribution of materials in the frequency domain. Consequently, Interaction of these layers results in the quality of complexity.

2.6 Simplicity

Simplicity is not so simple to achieve; it is only when simplicity encompasses richness that it counts as a quality (Alexander, n.d.).

In contrast to the complexity in royal carpets, we have tribal nomadic carpets representing a great simplicity.
One of the famous examples in this field is *Gabbeh*. It is a hand-woven pile rug of coarse quality and medium size characterized by an abstract design that relies upon open fields of color and playfulness with geometry. We can consider *Gabbeh* to be the most intimate and personal form of a carpet since everything is normally done by one person. It is a humble rug reflecting very personal wishes with spontaneous decisions in choosing color and very basic design and subtle rare patterns. Nevertheless these two extreme types of carpet share some basic features such as border, which is prominent in both.

The borders are symbolizing the walls of the garden creating the enclosure. In Figure 2.11, this feature, along with a central pool, once again is reminiscent of the basic idea of garden and paradise, which still is traceable in both extremes of complexity and simplicity.

This startling difference made me think of a contrasting approach in my compositions. I tried to do something very different concerning all aspects of the basic aesthetics. I will talk about this approach in chapter five, where I explain my composition projects.

Figure 2.11 Gabbeh Bakhtiari, early 20th century (Tanavoli, 2004)

2.7 Randomness

Another interesting feature of a carpet is randomness in contrast to very carful arrangement of the details. Random colors and arrangements break both the hierarchy and the local symmetries, while their interaction generates higher harmonics that define smaller scales. Random spacing interferes in the visual field to create a wealth of virtual patterns on many smaller scales (Salingaros, 1997, p.12).

In music I found this idea very interesting. Of course there has been a long history of using randomness in music. Nevertheless, the area of using that is very vast and any parameter of music could be subjected to randomness. In case of carpets, the randomness, especially in organizing small details, creates a vibrant quality and as an interesting contrast to the carefully designed parts. In these situations, the exact and ordered arrangement of materials has less importance and instead, the overall quality that comes out as a result becomes consequential. In my music, this randomness has been applied on different parameters, such as pitch organization or distribution of tiny constituent elements in creating a dense texture. Once again this randomness would be limited to certain areas, where their overall effect has importance rather than the exact ordering.

Figure 2.12 Gabbeh Bakhtiari, (Tanavoli, 2004)

Chapter 3

Image to Sound

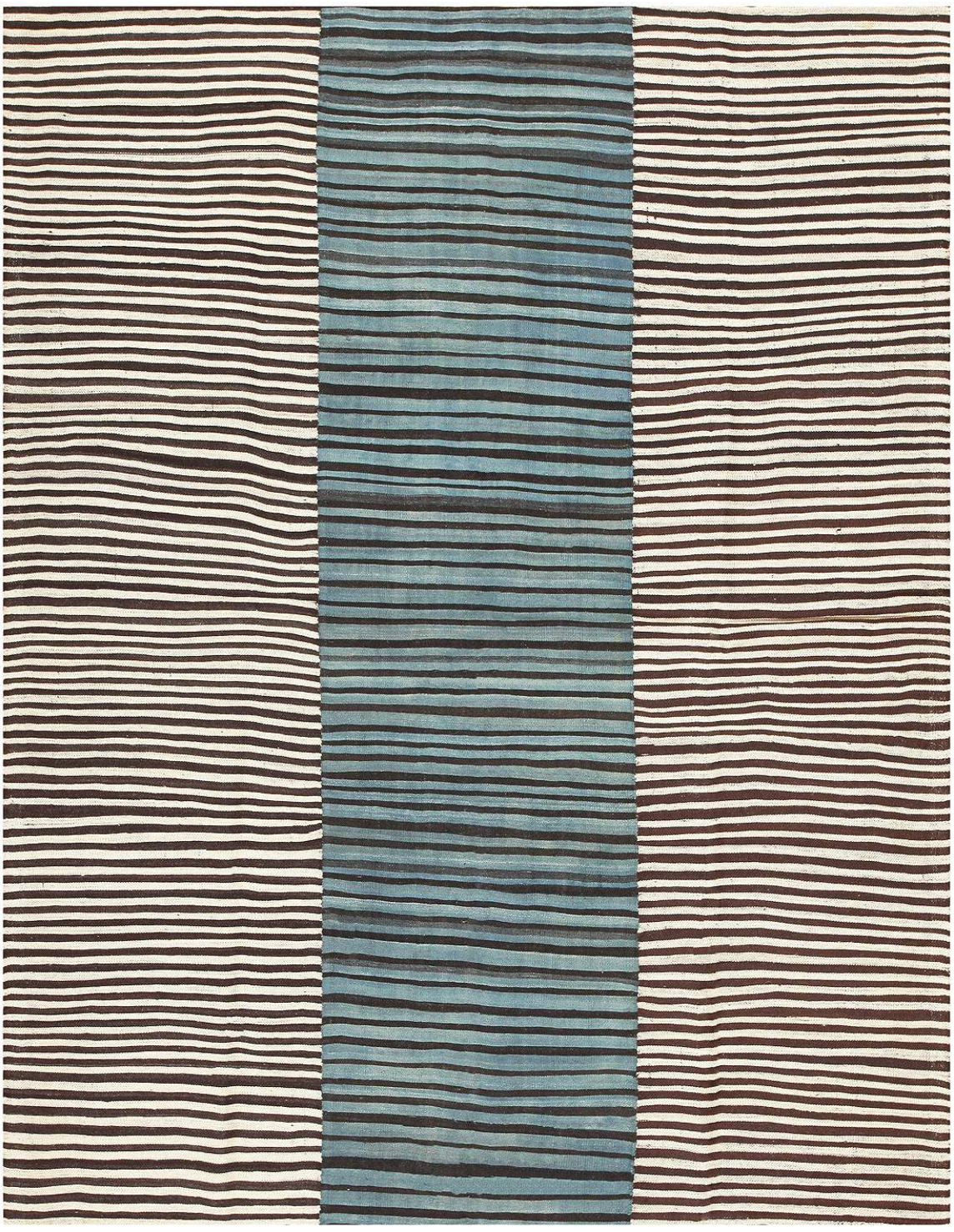

Figure 3.1 Antique Mazandaran Gelim, North of Iran, Early 20th century

3.1 Spatial versus Temporal

The very problem of going from visual to sonic relates to the correlation between spatial and temporal realms. 'Listening draws the world into the mind, contrary to vision, which has a tendency to draw mind out in the world' (Christensen, 2012, p.12).

Music by nature is a temporal phenomenon and the visual domain by nature spatial. Salvatore Sciarrino (1947-), Italian contemporary composer, in his book "*Le Figure Della Musica Da Beethoven A Oggi*" talks about visual arts in different forms from painting and architecture to even carpets. He discusses interesting features of those works and then he starts to make connections to music. However, he emphasizes that he does not believe that the visual should be placed side by side (compared) to the sound (Siarrino, 1998, p.90).

Our perception of these two territories is quite different and we have different ways of grasping their meaning. I believe the very first problem arises here. The act of assuming a similar perceptional manner in these two areas is something you can notice clearly by having a look on the applications developed in order to translate an image to sound (they will be discussed in short later in this chapter).

Recently, through the advent of new technology, the translation between these two areas has been an attention-grabbing subject.

Even though I had my doubts about this direct translation, I decided to explore this area, even if never applying them in my works. At least I could make sure, that I know what exactly I am not doing.

In the forthcoming section of this chapter, I am going to talk briefly about some theories and ideas related to the connection and relationships between different domains of our perception. Deeper exploration of this subject would be beyond the scope of this research.

> Sound compared to vision, has an extra different quality. When you compose or listen to music you manipulate more abstract notion than those of visual world. The visual world has a problem. We are dominated by the eyes which are more down-to-earth more tuned into reality than the audio sense. You can make visual abstractions of your immediate surroundings but it is much more difficult … they are tainted by everyday life. Whereas in music sound works on a deeper level. It manipulates in other ways owing to the structure of our ears (Xenakis, 1989).

3.2 Cross-domain mapping & Conceptual Models

Cross-domain mapping is a process through which we structure our understanding of one domain (which is typically unfamiliar or abstract) in terms of another (which is most often familiar and concrete).

> For example, one way to think about the elusive concepts of electrical conductance is in terms of a hydraulic model: flipping the light switch turns on the juice, and electrical current flows to the light bulb to light the room. By this means we take what we know about a fairly concrete and familiar source domain - the flow of water and other liquids - and map it onto a rather abstract and unfamiliar target domain: that of electricity. As a wealth of research on analogy and metaphor has shown, the process of mapping structure from one domain to another is basic to human understanding (Zbikowski, 1997, p.200).

As an example, consider the way *up* and *down* are used to characterize emotions, consciousness, and health:

EMOTIONS:

I'm feeling *up*. My spirits *rose*. I'm feeling *down*. I *fell* into a depression. My spirit *sank*.

CONCIOUSNESS:

Get *up*. I'm *up* already. He *rises* early in the morning. He *fell* asleep.

HEALTH:

He's at the *peak* of health. She's in *top* shape. He came *down* with the flu.

This model involves concepts about objects in physical space, which are in specified relationships that rely on the concepts of linear measure and verticality. In each, the concept of linear measure is relatively weak - that is, we do not normally keep in mind a detailed representation of gradations of emotions, consciousness, or health.

The basic notion of a conceptual model is of a relatively stable cognitive structure that is used to guide, inference and reason. In its simplest form, a conceptual model consists of concepts in specified relationships, pertaining to a specific domain of knowledge. The conceptual models are stored in memory as a unit, and recovered in its entirety in response to environmental cues or stereotyped reasoning situations (Zbikowski, 1997, p.201).

> Image schema is one of the famous examples of this. An image schema is a dynamic cognitive construct that functions somewhat like the abstract structure of an image, and thereby connects up a vast range of different experiences that manifest this same recurring structure (Johnson, 1987).

Image schemata are by no means visual - the idea of an image is simply a way of capturing the organization inferred from patterns in behavior and concept formation. By definition, image schemata are preconceptional: they are not concepts, but they provide the fundamental structure up on which concepts are based.
As an example of an image schema, we can talk about verticality. This is an experience we are involved in our everyday life. The Figure 3.2 is representing it in a very general form.

> An image schema is a recurring, dynamic pattern of our perceptual interactions and motor programs that gives coherence and structure to our experience. The VERTIVCALITY schema, for instance, emerges from our tendency to employ an UP-DOWN orientation in picking out meaningful structures of our experience. We grasp this structure of verticality repeatedly in thousands of perceptions and activities we experience every day, such as perceiving a tree, our felt sense of standing upright, the activity of climbing stairs, forming a mental image of a flagpole, measuring our children's heights. The VERTICALITY schema is the abstract structure of these experiences, images, and perceptions (Johnson, 1987).

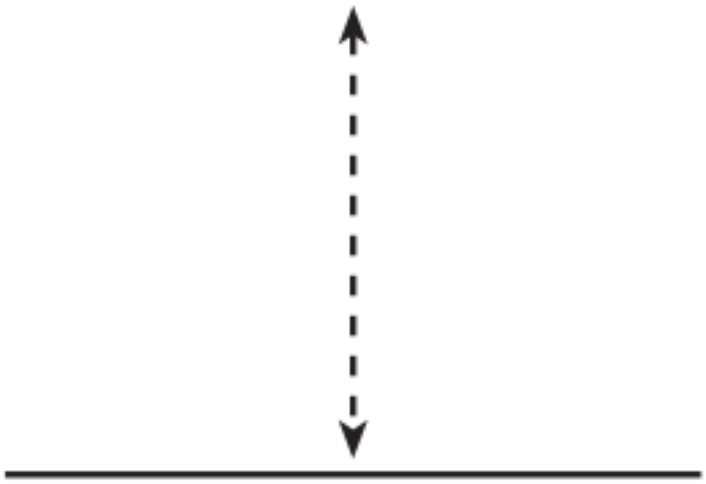

Figure 3.2 VERTICALITY schema

> We also map up down onto the domain of musical pitch: we typically speak of "high" notes and "low" notes. We needn't look far to find a correspondence of up-down in our experience of musical pitch: when we make "low" sounds, our chest resonates; when we make "high" sounds our chest no longer resonates in the same way, and the source of the sound seems located nearer our head. The "up" and "down" of musical pitch thus correlate with the spatial "up" and "down" - the vertical orientation – of our bodies. Mapping up down onto the domain of musical pitch preserves the image-schematic structure of our embodied experience of musical pitch, and imports the spatial orientation of the underlying VERTICALITY schema in order to provide a coherent account of this experience (Zbikowski, 1997, p.203).

When the mapping of up down on to pitches combined with the interpretation of pitches as objects and the division of the frequency continuum into discrete slots, almost the Entirety of the conceptual model for height can be applied to music. A visual manifestation of this model is provided in the western system of notation of pitch. (Figure 3.3)

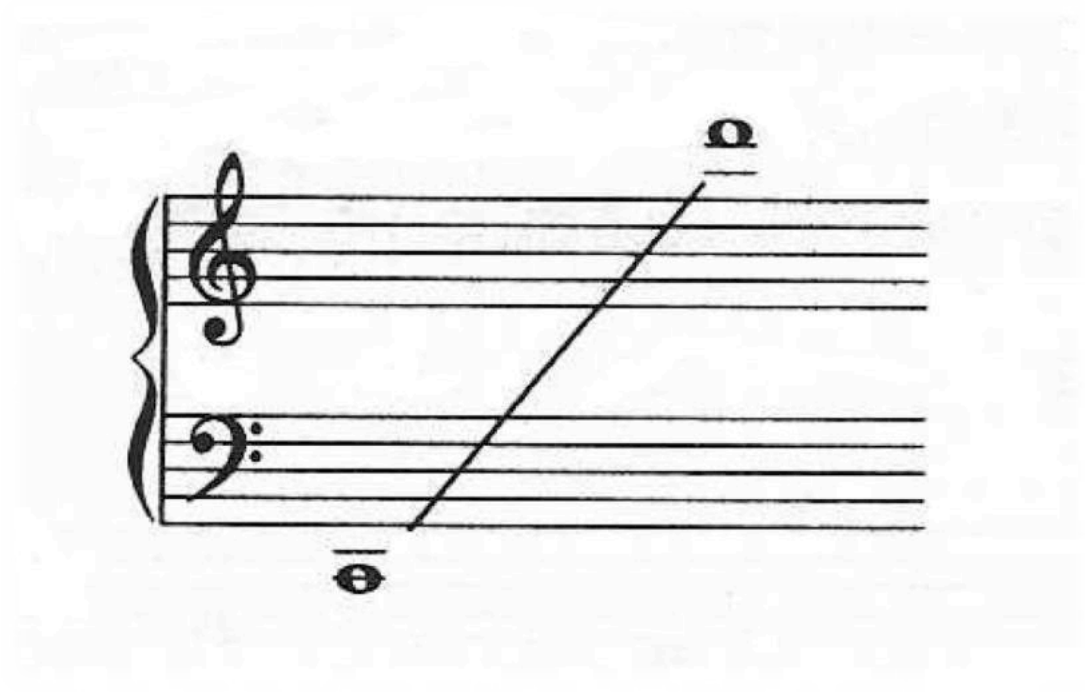

Figure 3.3

From these brief studies we can conclude some general relationships between visual and sonic realm. Considering the fact that visual world is very tangible and more preconceptional for humans than any other area. The examples such as, correlation between spatially higher positioned objects and higher frequencies and vice versa. In the same manner, in terms of size, smaller objects relates to higher frequencies and vise versa. In fact we can understand pitch in terms of size, given that small things typically vibrate more rapidly than large things. This is in fact how pitch is characterized in Bali and Java: pitches are not low and high but large and small. This is a very natural attribution, which can be found in our everyday experience. For example, we never expect a low sound projecting from a very small object or the other way around.

This area of study is very broad and closely related to psychology. For this research my aim is to demonstrate some issues related to the perception of each domain and their possible connections. I also used some of these attributions in my compositions.
However, for this project, my goal is not an exact translation of a visual phenomenon into sound. Nevertheless, I found it very useful to study this area of knowledge and to have a general understanding of that in order to have a wider perspective.

Two different applications

In this part I am going to talk about different approaches in making music based on visual objects. We can distinguish two main directions in using visual (graphical) means in order to make sound:

1. Graphical Interfaces
2. Image Sonification

3.3 Graphical Interfaces

In the first approach the aim is to use graphical means in order to create an easier environment to work with electronic sounds both in terms of synthesis and controlling them. In other words, creating a friendly interface in order to make it easy to work with abstract sounds, even by people with no musical background.

During 1950s, a tendency to use graphical notation instead of the traditional notation started to grow. There were different reasons behind it, such as; finding new approaches to the music and trying to get rid of the rhetoric of traditional composition or the limitations that traditional notation imposed on expressing new ideas. Graphical notation can also create a situation which provides some freedom for the performer. In other words, it makes the performer as the interpreter of the graphical information. This fact adds a new dimension to the performer's role.

In electronic music of course there is no such a thing as a musical score in the classical sense. The diversity of electronic sounds and the vast range of possibilities, as well as the elimination of the role of the performer (in tape music) made it unnecessary to have a score as we do in instrumental music. Nevertheless, visualizing electronic music became a tool to manifest the abstract nature of the electronic music. In the case of Ligeti's *Articulation*, this function is descriptive in contrast to the normal prescriptive nature of musical scores. Nevertheless, Stockhausen's *Studie II* is considered to be the first electronic music score, which can be both prescriptive and descriptive, since it woks also as a step-to-step guideline for the reproduction of the piece.

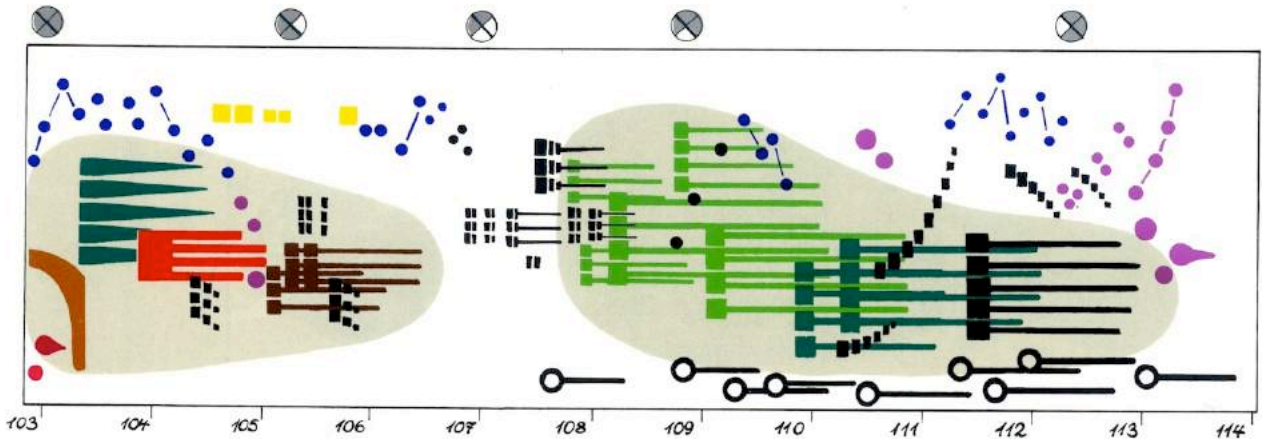

Figure 3.4, Ligeti, *Articulation*

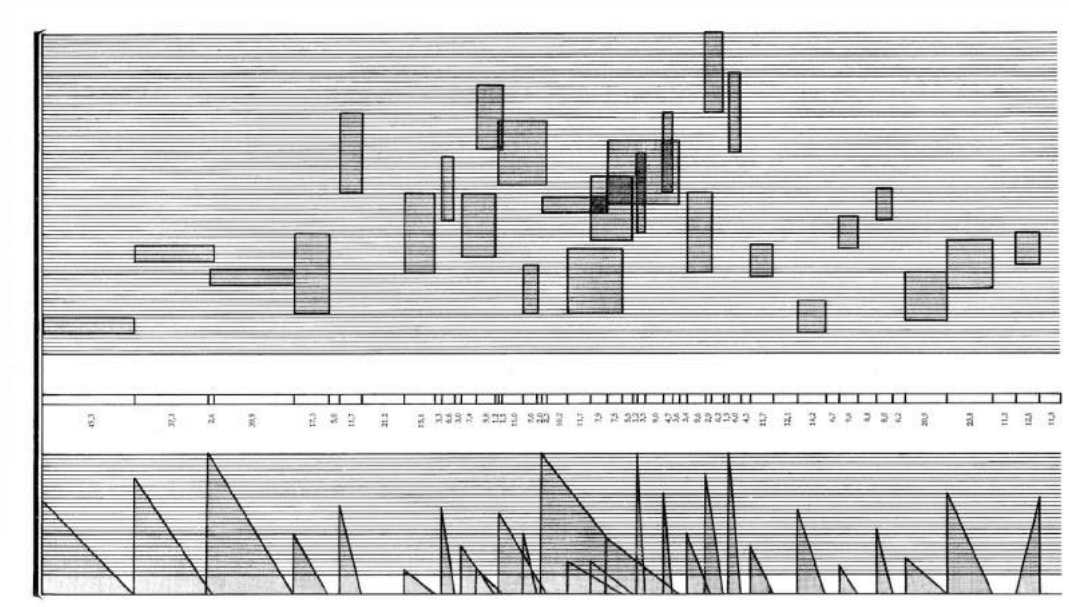

Figure 3.5, Stockhausen, *Studie II*

UPIC

The attempt to create an easy interface to compose and control sound resulted in using visual elements, as they are most direct and tangible for human.

> The idea of the UPIC system goes back to 1953-54, when Iannis Xenakis wrote music for orchestra, using graphic notation for representing musical effects that were too complicated to be specified with traditional staff notation. The work *Metastasis* (written in 1953-54 and premiered at Donaueschingen in 1955) makes systematic use of glissandi. Xenakis drew the glissandi as straight lines in the pitch-versus-time domain (Marino, Serra, Raczinski, 1993).

Writing the glissandi in sixty-one different orchestra parts by hand was quite difficult. Xenakis had then to transcribe the graphic notation into traditional notation so that the music could be played by the orchestra. At this time, he came up with the idea of a computer system that would allow the composer to draw music. Indeed, graphic representation has the advantage of giving a simple description of complex phenomena like glissandi or arbitrary curves. Furthermore, it frees the composer from traditional notation that is not general enough for representing a great variety of sound phenomena.

The UPIC is a composition tool that offers the musician a notation based on a set of graphic objects. All of them are made of one or several graphs, depending on the type of object. Each object type has a specific function in the sound synthesis carried out by the machine. No other hidden object or parameter is used for this calculation, so that the composer has full control of the synthesis process. Some object types, as the envelope or the wave table, are well known to the composer accustomed to electro-acoustics; other object types, such as the page or the frequency table, present an analogy with notions (score and musical scale) used in traditional notation, which make them easily understandable to all musicians.

In UPIC composing happens on a pitch-versus-time-space page. The page is a set of pitch-versus-time graphs (Figure 3.6): time is represented from left to right, and pitch from bottom to top. Depending on the composition method, different meanings may be assigned to these graphs. Here, the visual quality of the work is not an important factor. In fact, it is merely a tool order to control different parameters (Marino et al. 1993).

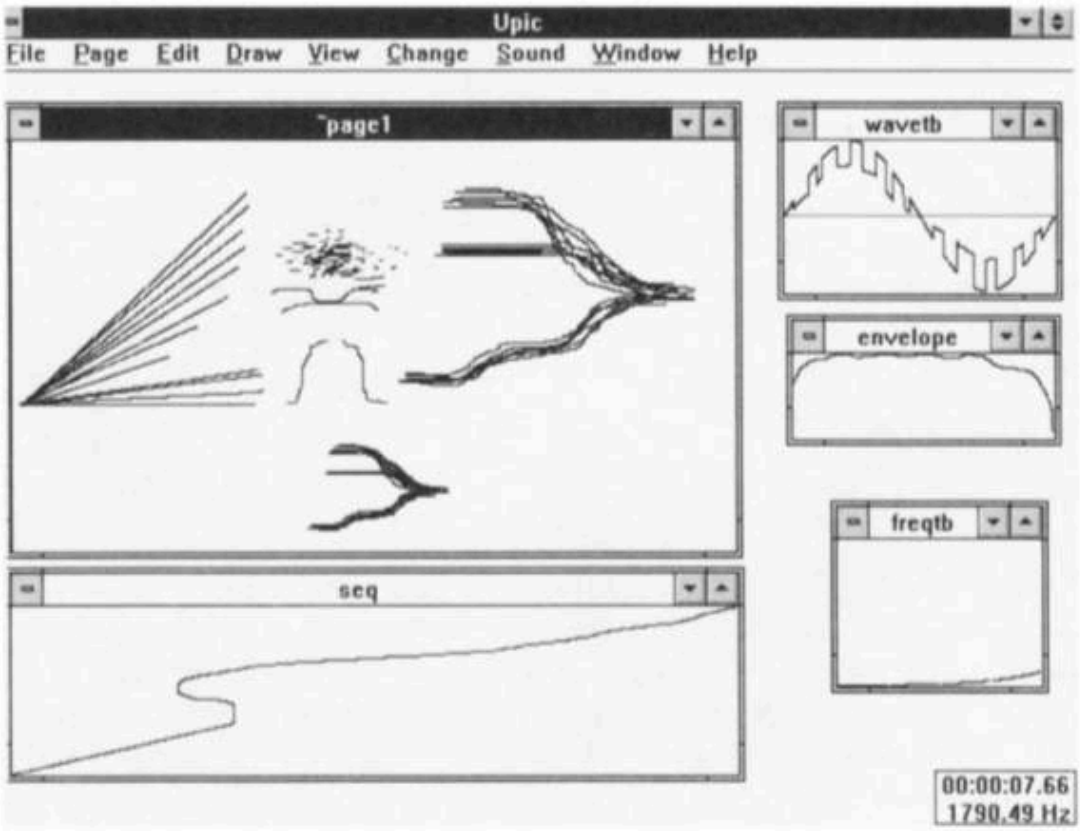

Figure 3.6 UPIC Object

Mycenae-Alpha is an electroacoustic work that Xenakis composed in 1978 as part of an installation of lights, movement and music that took place at Mycenae Acropolis in Greece. *Mycenae-Alpha* is also the first work to be composed entirely on the UPIC system. In this regard, Xenakis explains the advantage of using hand in drawing music.

> What is obtained by calculation always has limits. It lacks inner life, unless very complicated techniques are used. Mathematics gives structures that are too regular and that are inferior to the demands of the ear and the intelligence. The great idea is to be able to introduce randomness in order to break up the periodicity of mathematical functions, but we're only at the beginning. The hand, itself, stands between randomness and calculation. It is both an instrument of the mind-so close to the head-and an imperfect tool.
>
> The products of the intelligence are so complex that it is impossible to purify them in order to submit them totally to mathematical laws. Industrialization is a forced purification. But you can always recognize what has been made industrially and what has been made by hand. Industrial means are clean, functional, and poor. The hand adds inner richness and charm (Xenakis, 1987).

Figure 3.7 Xenakis & UPIC

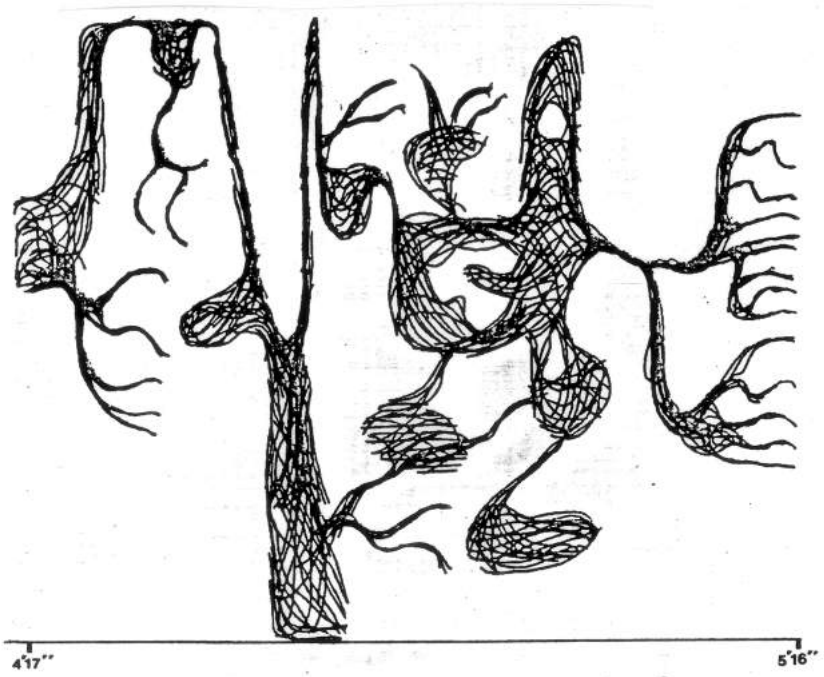

Figure 3.8 Xenakis, Mycenae Alpha, 1978

Iannix

IanniX is a program developed by the La Kitchen Company, the development of this program started in 2001 with Adrien Lefevre. IanniX can be considered as the new generation of UPIC. 'It is a graphical open source sequencer, based on Iannis Xenakis works, for digital art' ("IanniX", 2011).

IanniX allows people to control multi-dimensional abstract objects that can be parameterized to run concurrently with various behaviors. IanniX syncs via Open Sound Control (OSC) events and curves to your real-time environment ("IanniX", 2011).

Obviously advances in new technology has made it possible to develop an idea like UPIC, to be much more sophisticated. IanniX provides a big range of possibilities to create a multifaceted environment for controlling different parameters. The only difference is that unlike UPIC, IanniX does not compose the sound itself. It only sends the values, which can be used in any different way.

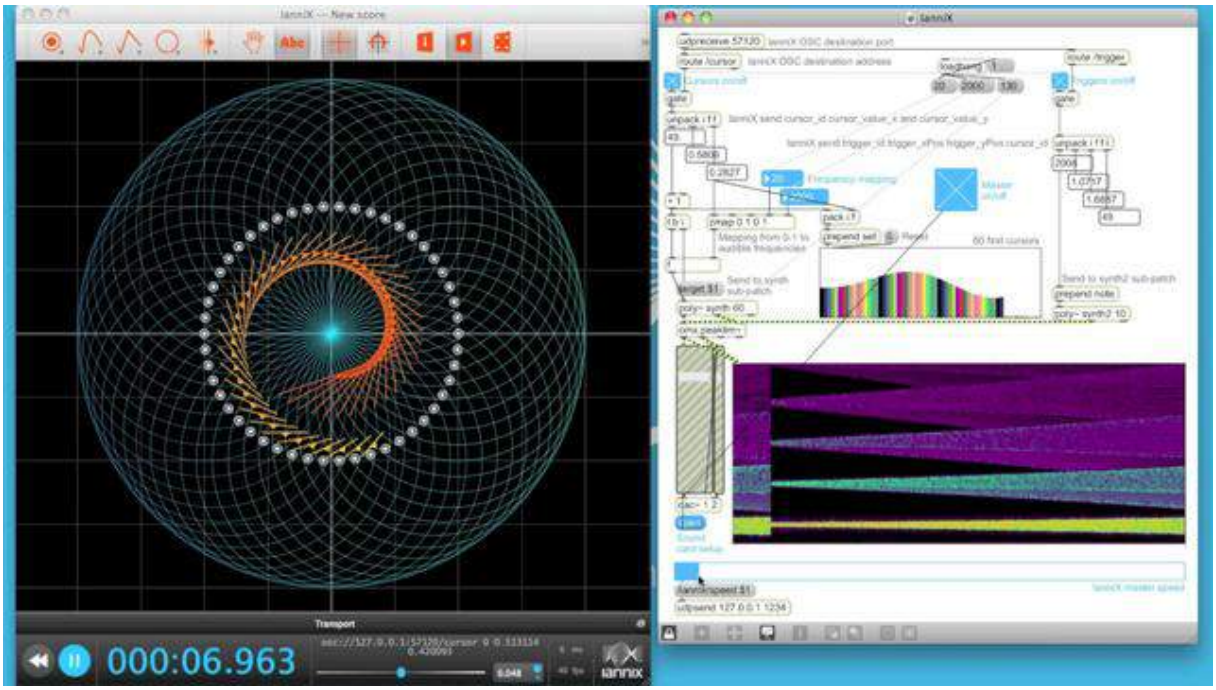

Figure 3.9 IanniX

3.4 Sonification

Sonification is a mapping of numerically represented relations in some domain under study to relations in an acoustic domain for the purpose of interpreting, understanding, or communicating relations in the domain under study (Scaletti, 1994).
This is a very broad and scientific description. Recently, in the science world, this area has been of much interest. The application of translating information into sound can be very vast. Any kind of information can be represented in the auditory scene. For instance, it is possible to translate the visual information to sonic information in order to help visually impaired people to perceive the information by ear, which they cannot acquire via the eyes.

It could also be interesting for people to hear what a photo would sound like, or similar less serious areas. Not surprisingly, there are different programs out there to which you can import a photo and listen to how it sounds. Each one has its own strategy in implementing this idea, but almost all of them work based on scanning the photo from left to right. Usually, the vertical axis represents pitch and horizontal axis represents time. As a general rule, the frequency range is ordered in a way that low to high frequencies correspond to the bottom to top of the image. It relates to the generally accepted idea of pitch representation in a spatial arrangement.

Apart from those scientific and fun applications, there are some examples in using this approach to make music. Here I would like to concentrate on artistic approaches of image sonification.

Before talking about the implementation of image sonification, I would like to mention an example of composing music based on an image but not necessarily by using image sonification software.
In fact this is image sonification but in a compositional and artistic framework as intended by the composer.

Clarence Barlow (1945-), who studied composition under Bernd Alois Zimmermann (1968-1970) and Karlheinz Stockhausen (1971-1973), is a universally acknowledged pioneer and celebrated composer in the field of electroacoustic and computer music. He has made advancements in interdisciplinary composition that unite mathematics, computer science, visual arts, and literature. As a composer, he has had a long-time fascination for the link between sound and image and working on the idea of composing a piece of music based on an image or visual information and vise versa.

He believes that image sonifcation could be the pleasure of extracting convincing music from optical sources, a comparison of source and result adding to the enjoyment. 'In multimedia, such as film, it could be the counterpoint of sound and image that pleases, especially if these are clearly bonded to another as when sound visualization or image sonification is involved' (Barlow, 2004).

Kuri Suti Bekar (1998) for piano

Written for the pianist Kristi Becker on her 50th birthday, *Kuri Suti Bekar* consists of a Prelude and a Chaconne.

The Prelude, lasting twelve seconds, is a sonic translation of the pianists name written in Japanese script the sounds *ku-ri-su-ti bek-ka-(ro)* are the closest one gets here - the right hand plays *ku-ri-su-ti* and the left hand *bek-ka-ro* simultaneously, the vertical graphic axis being pitch and the horizontal time.
A similar graphic pitch/time representation of the Chaconne reveals ten successive "pictures" corresponding to ten pages (at sixteen seconds each) of the score. A superimposition of these ten images mirrors a scanned photograph of the pianist's face: the choice of pitches derive harmonically from one of the composer's piece which can optionally be played synchronized with the Chaconne. Another pitch source was the phonetic analysis of the title of the piece (Barlow, 2004).

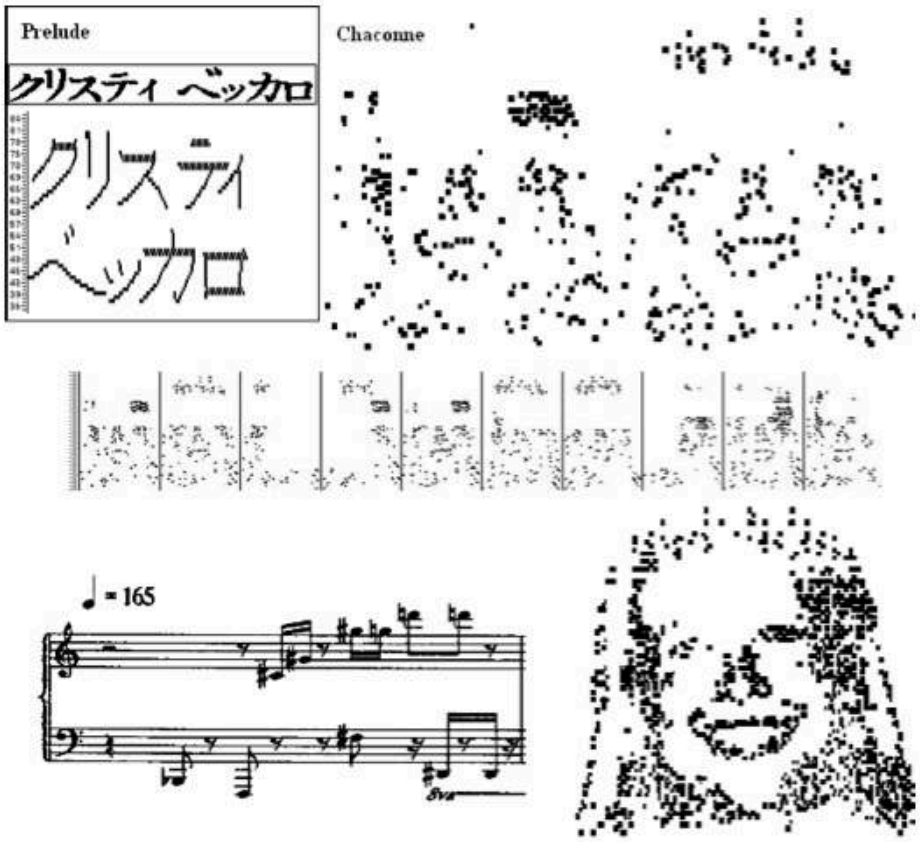

Figure 3.10 *Kuri Suti Bekar* (1998)

Le loup en pierre (2002) for two organs

This piece ("The Stone Wolf") was composed for the two organs in St. Peter's Church in Leiden, the mean-tone-tuned Van Hagerbeer organ with A=419 Hz and the equal-tempered Thomas Hill organ with A=440 Hz. The first section of the piece involves a signification of a sketch of the church building, calibrated to the so-called Bark scale of subjective pitch (see the upper picture): the pixels in the sketch are allocated to those keys on either or both organs, the Bark pitches of which are the closest. The building, graphically rescaled to the MIDI-scale (see the lower drawing), now provides the first 97 chords, initially filtered by a horn shape centered on pitch no.68 = A-flat, the only note common in pitch to both organs. Starting with this pitch, the range gradually widens to large microtonal clusters engendered by the central Gothic window (Barlow, 2004).

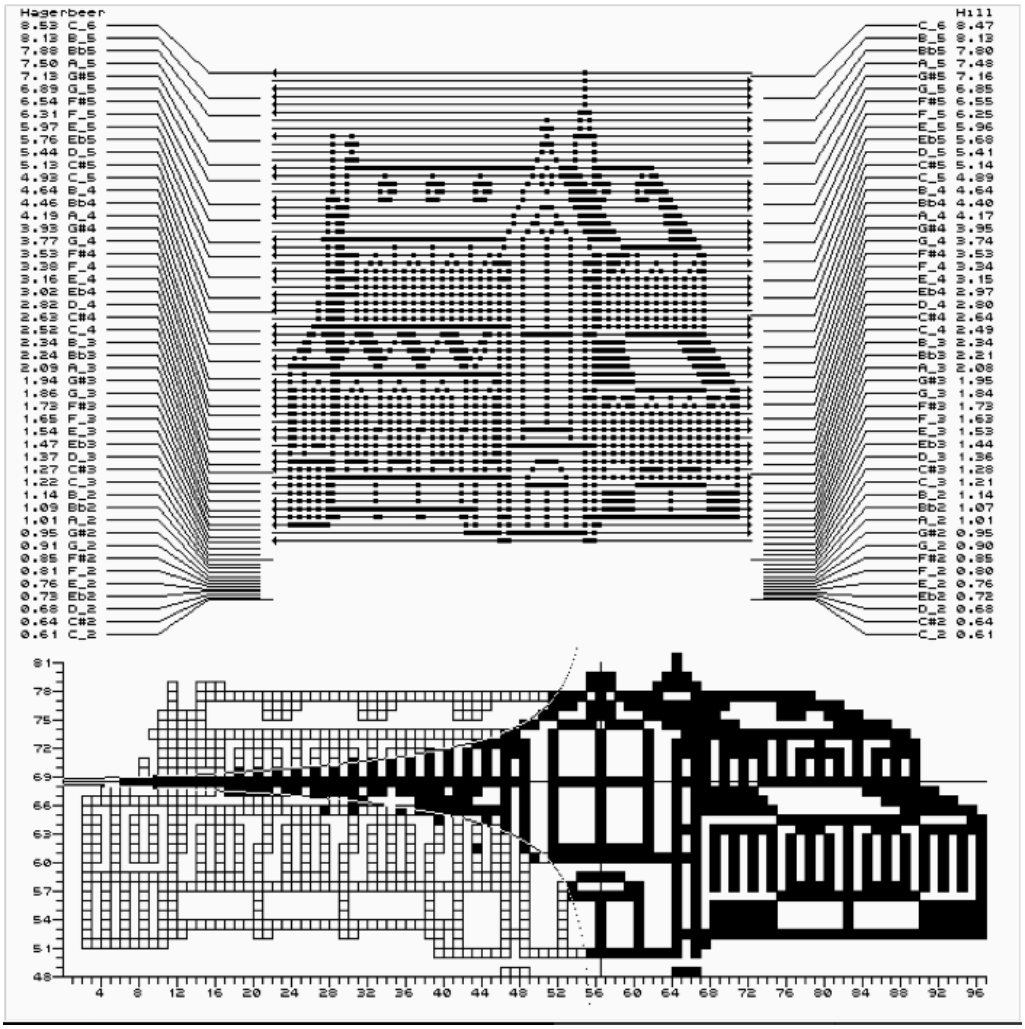

Figure 3.11 *Le loup en pierre* (2002)

I need to mention that in the examples from Barlow, I actually do not see a relative relationship between the image and the music as the result. For instance, in case of *Le loup en pierre,* I think the image in Figure 3.11 does not really say something about the church also the pixelated image of the pianist face or her name written in Japanese script in case of *Kuri Suti Bekar*.I would rather consider it as a compositional system, which the composer defines as a framework for his music.

3.7 Sonification implementations

MetaSynth

MetaSynth is an application for the Macintosh operating system that allows the creation of sound from images. The primary concern of the program MetaSynth is sound synthesis.
Its interface allows a range of graphical manipulations (including the use of images) to control a frequency additive synthesis. In contrast to the UPIC, MetaSynth offers instantaneous audio feedback of the sketch drawn. The graphical functionalities of the program enable people to create original sounds, but these are constrained by the additive synthesis method used to sonify the images. Time is represented on the horizontal axis, while the vertical axis represents pitch. The vertical axis is scalable, supporting the representation of linear, logarithmic or harmonic scales. But in the end, the user draws more or less a spectrogram which limits the originality of the sounds created, a disadvantage shared with the UPIC system. MetaSynth can also fall into the first category of using visuals in order to synthesize and control sound.
The software is a whole package, containing sound synthesis and sound sequencer. You can draw your sounds in a same way as in UPIC or import an image or even do spectrum manipulation.

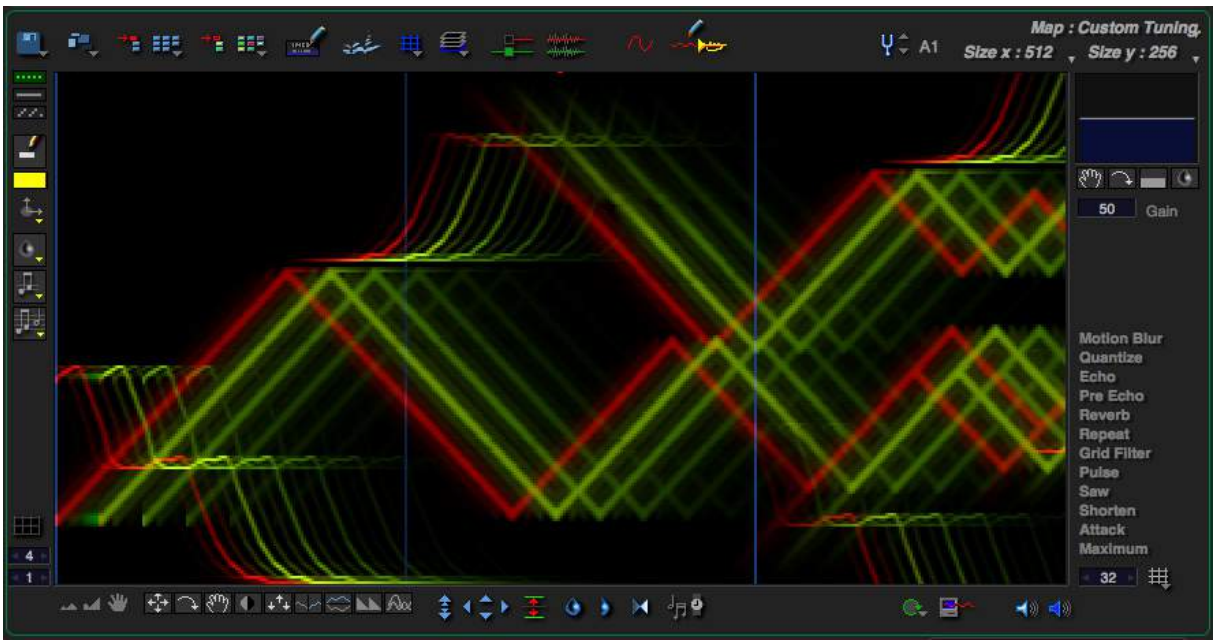

Figure 3.12 MetaSynth

VOSIS

VOSIS is an interactive image sonification interface that creates complex wavetables by raster scanning grey scale image pixel data. Vosis was developed at the Media Arts and Technology University of California, Santa Barbara. A number of image filters controlled by multi-touch gestures add variation to the sound palette. On a mobile device, parameters controlled by the accelerometer add another layer expressivity to the resulting audio-visual montages (MacGee, 2013).

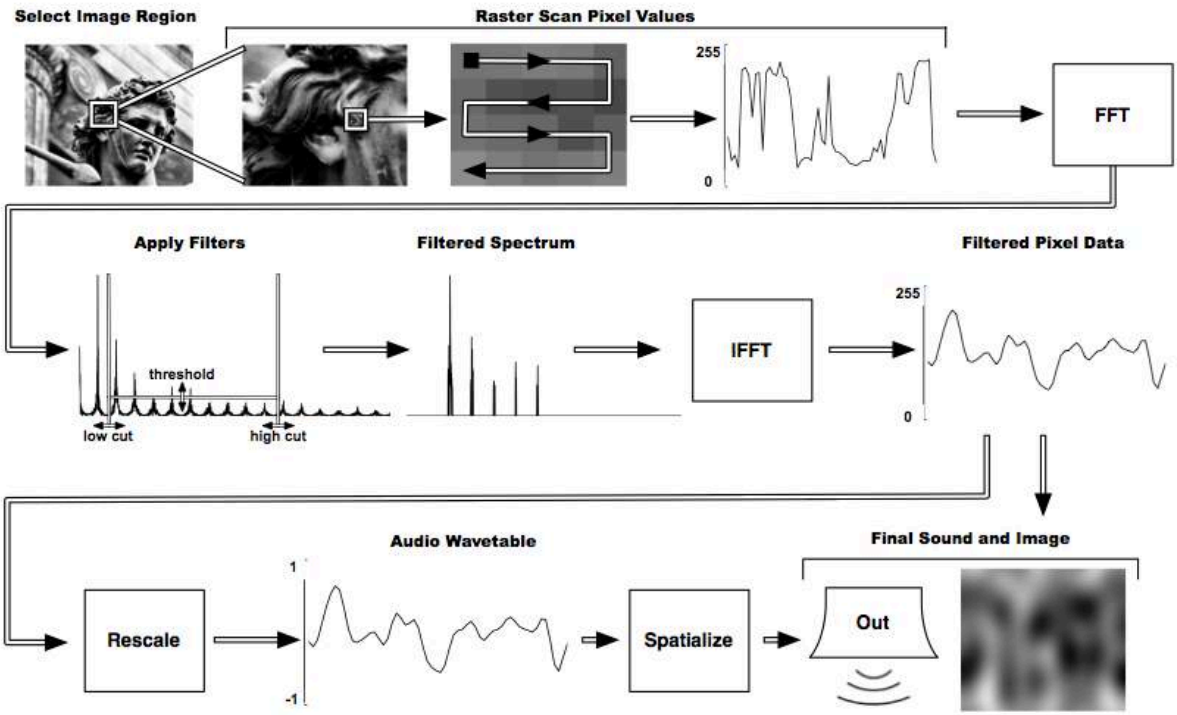

Figure 3.13 image-to-sound synthesis algorithm in VOSIS

VOSIS is designed to be used with any image– moving, still, live, or recorded. For still images, the image itself is the "master" image, while for recorded or streaming video, the master image changes at the frame rate of the video or camera. Grey-scale pixel values within a region of the master image are read into an array, filtered, drawn as a new image, and read as an audio wavetable. Regions can be selected either by drawing rectangular boxes on the screen or simply by touching

> an area of an image with a selectable region size. Each region can be thought of as a note with its frequency dependent on the frequency content of the pixels within that region of the image and the rate at which the image pixels are scanned.
> Chords can be formed by selecting multiple regions at once. There is also a segmentation mode which subdivides large regions and plays them back as a sequence of notes. Consideration was taken for real-time manipulation of region locations and sizes during a performance or installation without introducing unwanted audio artifacts (MacGee, 2013).

Figure 3.13 outlines the image-to-sound synthesis algorithm in VOSIS. It only deals with grey-scale images, and any color or other format images imported to the software will first be converted to 8-bit grey-scale. Once a region is selected, the synthesis algorithm begins with a back-and-forth, top-down raster scanning of the grey-scale pixel values, which range from 0 to 255 (black to white respectively). Simply scaling these values to obtain a waveform of floating-point audio samples in the -1.0 to 1.0 range results in harsh, noisy sounds without much variation between separate regions in most images. These initial noisy results were not at all surprising given that the grey-scale variation of an arbitrary image will contain a dense, broad range of frequencies.

I found this method of directly extracting a waveform from pixels, interesting and different from other examples such as Metasynth. Nevertheless, I did not find it appropriate and meaningful for my project. In the case of Vosis, I believe a raster scanning does not give meaningful information about a motif in the same way, as we perceive a pattern in the visual world. It simply gives some data. It would be even less relevant in projecting interconnections of a design and its elements. Obviously we do not perceive an image pixel by pixel from top to bottom.

Chapter 4

Morton Feldman's carpet compositions

Figure 4.1 Morton Feldman at *Persepolis*, Iran, photo by Jan Williams, 1977

> My past experience was not to "meddle" with the material, but use my concentration as a guide to what might transpire. I mentioned this to Stockhausen once when he had asked me what my *secret* was. "I don't push the sounds around." Stockhausen mulled this over, and asked: "Not even a little bit?" (Feldman, 1983, p.131).

In this chapter I would like to talk about Morton Feldman (1926–1987), as an important composer inspired by carpets. A major figure in 20th century music, associated with the experimental New York School of composers also including John Cage, Christian Wolff, and Earle Brown. Rejecting the most basic tenets of conventional musical discourse, he moved toward a creative stance in which sounds appear to move freely in time and space without the interference of any compositional rhetoric or a *priori* procedures (Delio, 1996, p.39).

During the last decade of his career he developed a special interest in nomadic rugs. Morton Feldman was also a carpet collector. He talks about the interesting features of those carpets and what he learns from them. At the same time his music became highly repetitive and quite lengthy. He was really concerned with visual arts in general. The main reason was his close contact with the abstract expressionist painters. He found himself more attracted to the way painters worked than the way most musicians did. He became friends with Philip Guston, Franz Kline, Mark Rothko and Jackson Pollock. He explains: 'the new painting made me desirous of a sound world more direct, more immediate, more physical than anything that had existed heretofore' (Feldman, 1983).

Another influence on Feldman's late music - or 'permission' for it, to use his own word - came from Oriental rugs, which he collected' (Griffiths, 2010, p.280). In an essay called "crippled symmetry" written in 1983, he talks about his interest in middle eastern rugs and the way he relates them to his musical ideas and interests.

> Like that small Turkish "tile" rug, it is Rothko's scale that removes any argument over the proportions of one area to another, or over its degree of symmetry or asymmetry. The sum of the parts does not equal the whole; rather, scale is discovered and contained as an image. It is not form that floats the painting, but Rothko's finding that particular scale which suspends all proportions in equilibrium (Feldman, 1983, p.137).

The compositions under the influence of carpet:

Spring of Chosroes, for violin & piano, (1977), 15 minutes
Why Patterns?, for flute, percussion and piano, (1978), 30 minutes
Patterns in a Chromatic Field, for cello and piano, (1981), 80 minutes
Crippled Symmetry, for flute, percussion and piano, (1983), 90 minutes

We can specifically distinguish four compositions of Feldman between 1977 and 1983 under the influence of his ideas related to carpets. A chronological comparison shows a noticeable increase in duration, relating to his concern about scale. The titles are already implying the connections to carpets.

Spring of Chosroes, for violin and piano is written in 1977. The title is referring to the anecdote about a historical carpet called Baharestan. The Baharestan carpet (meaning *the spring carpet*) was commissioned by Sasanian Shahanshah Chosro I, Woven of silk, gold, silver, and rare stones, the carpet depicted a splendid garden akin to Paradise. In 637 CE with occupation of Iranian capital, Ctesiphon, the Baharestan carpet was taken by the Arabs, cut into small fragments and divided among the victorious soldiers as booty ("Baharestan", n.d.).

In this piece, there are some highly symmetrical aspects in chordal arrangements. Figure 4.2 shows the first chord on the piano, which consists of two groups of three notes. The interval structure of the chords is mirroring alone the horizontal axes of G.

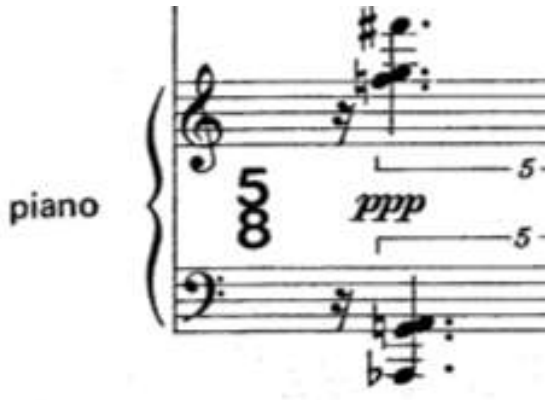

Figure 4.2 *Spring of Chosroes,* 1977

Why patterns? Is a chamber piece composed in 1978 for flute piano and glockenspiel. The score of *Why patterns?* is metrically unaligned and patterns in each performer's parts unfold completely independently until the final brief section. This very close, but never precisely synchronized, notation allows for a more flexible pacing of three very different colors Feldman, 1983, p.127).

> WHY PATTERNS? ... The instrumentation is very important. WHY PATTERNS? Is one of the few pieces that I ever wrote where I was actually inspired by an extraneous idea, outside of the music itself. As I mentioned a few times I'm involved with a certain area of oriental rugs, older rugs, with old colors, and I had a rug and I happened to catch, well actually it was an interesting rug because there was no field in the rug. The rug was made up of just a series of borders. Just like a Jack in the Box, just getting, some were wider, some were, ... and rugs are no different for example than musical scales. For the most part a lot of them, at least the ones I like, only have about seven or eight possible ... basic colors. There's a variation of colors, it's called "abrash", that is - the dyes are done in small batches and what happens is that the color, the gradation of the color changes, sometimes imperceptibly and sometimes quite noticeably. It adds to the rug especially in the refraction of the light on it. And that's what I caught, looking down just haphazardly at this rug of just patterns, and how the patterns are just going around, and what's interesting about these particular rugs is that the pattern repeats itself, but it's never really exact. It's as if every time they do it again it's done idiomatically. It's quite different. In fact I actually measured one pattern that seemed the same all over, and it was different. And the color actually changes, because of this dying thing, this "abrash" (Feldman, 1983).

Patterns in a chromatic field, another piece of this series, is written for cello and piano in 1981 and has a duration of over 80 minutes. The patterns aspect of the title is straightforward description of the motivic content and the relationship with carpets. During the course of the composition each instrument runs through over one hundred patterns. The score is metrically aligned and in most cases, when pattern motive changes in one part, it changes in the other part at the same time. Feldman sustains the listener's attention through this lengthy work in various ways. Fast-paced, busy pattern areas in the composition are broken up by the use of less active patterns or patterns with thinner textures (Gelleny, 2000).

Crippled symmetry, the longest composition of these series is composed in 1983 and lasts approximately 90 minutes. Also written for flute, piano, and glockenspiel, it is notated as well for the inclusion of vibraphone and celesta. The score of *Crippled symmetry* is metrically unaligned in its entirety and the concurrent patterns in the different performers' parts unfold completely independently of one another. He drew inspiration from metaphorical extrapolation, staring at paintings on his wall or rugs on his floor; thinking hard about how they worked, and then experimenting endlessly with how such ideas might be translated into sound. Shared characteristics of his later work, of which *Crippled Symmetry* is a fine example, are: extreme length, hushed volume, precisely colored sonorities, and slow tempos (Rockwell, n.d.). The title explicitly manifests his concern about symmetry and its deviation in carpets.

He explains that: 'A growing interest in near and middle eastern rugs has made me question notions I previously held on what is symmetrical and what is not' (Feldman, 1983, p.124). He believed that music and the designs or a repeated pattern in a rug have much in common (Feldman, 1983, p.124).

He was specifically interested in Anatolian rugs. In Anatolian village and nomadic rugs there appears to be considerably less concern with the exact accuracy of the mirror image than in most rug-producing areas. The detail of an Anatolian symmetrical image was never mechanical, but idiomatically drawn. On these carpets, the pattern motives are rectilinear forms constructed out of simple geometric shapes such as triangles, hexagons, squares and lozenges (Gelleny, 2000).

In Feldman's compositions, the pattern motives are also based on simple musical ideas: a single note, two or more consecutive notes grouped together, a solid (non-arpeggiated) chord, or two or more solid chords grouped together. Feldman liked to refer to his patterns as either "linear" or "vertical" in their orientation.

> The most interesting aspect for me, composing exclusively with patterns, is that there is not one organizational procedure more advantageous than another, perhaps because no one pattern ever takes precedence over the others. The compositional concentration is solely on which pattern should be reiterated and for

how long, and on the character of its inevitable change into something else. For me patterns are really self-contained sound-groupings that enable me to break off without preparation into something else […] Rugs have prompted me in my recent music to think of a disproportionate symmetry, in which a symmetrically staggered rhythmic series is used: 4:3, 6:5, 8:7, etc., as the point of departure. I enjoy working with patterns that we feel are symmetrical (patterns of 2, 4, 8, etc.) but present them in a particular context: (Figure 4.2)

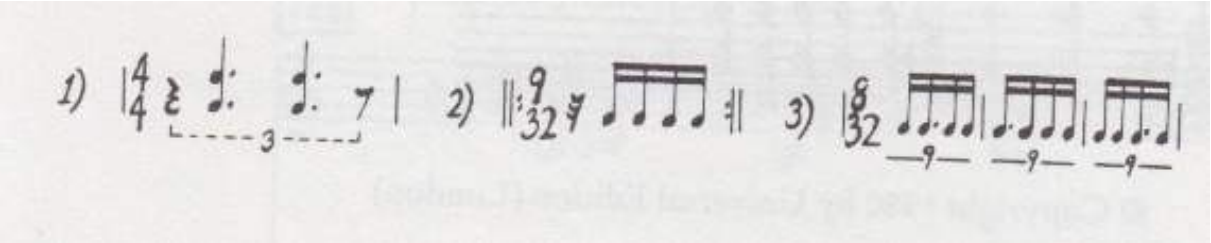

Figure 4.2

Example 1 is characteristic of a vertical pattern framed by silent beats; in this instance the rests on either end are slightly unequal. Linear patterns are naturally more ongoing, and could have the "short breath" regularity of Example 2 or anticipate a slight staggered rhythmic alteration such as in Example 3 (Feldman, 1983, p.129).

Feldman's repetitions also differ from most in his creation of a symmetry 'crippled' by asymmetry, whether from 'slight gradations of tempo', from changes of orchestral color (in The Turfan Fragments) or from rhythmic notations that look exact but will inevitably be performed a touch inexactly (Griffiths, 2010, p.281).

The patterns in his music can be very simple consist of a single note such as the example in figure 4.3. Here we have a repeating single note on the piano. The register of the note already creates a distinctive quality. Even in using a simple motive, or better to say the simplest possible, we can recognize a variation in reiterating. It is not about the motive itself but rather the intervals (silences) between them. It is created by constantly changing the meter.

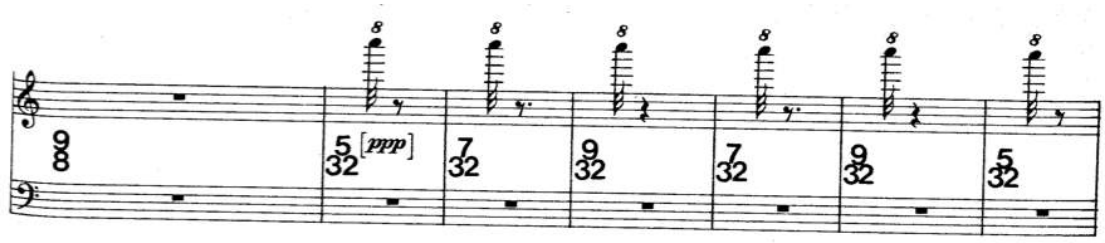

Figure 4.3 *Spring of Chosroes, 1977,* Universal Edition

The patterns can also be a combination of notes together as a chord. Here again this motive in its repetitions goes through the same variation strategy of changing meter and hence, different distances between them. Moreover, he sometimes uses symmetrical arrangements in organizing the interval structure of these chords. (Figure 4.4)

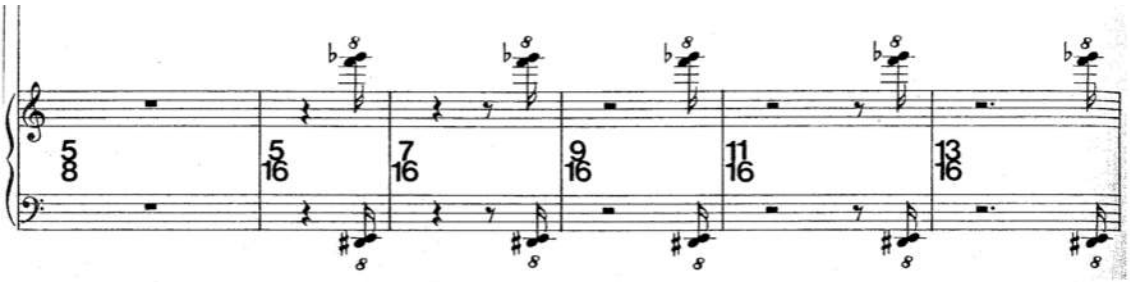

Figure 4.4 *Spring of Chosroes, 1977,* Universal Edition

The other type of these patterns is a combination of different timbres. In this case, two or more instruments combine together to create a single pattern with a new timbre. (Figure 4.5)

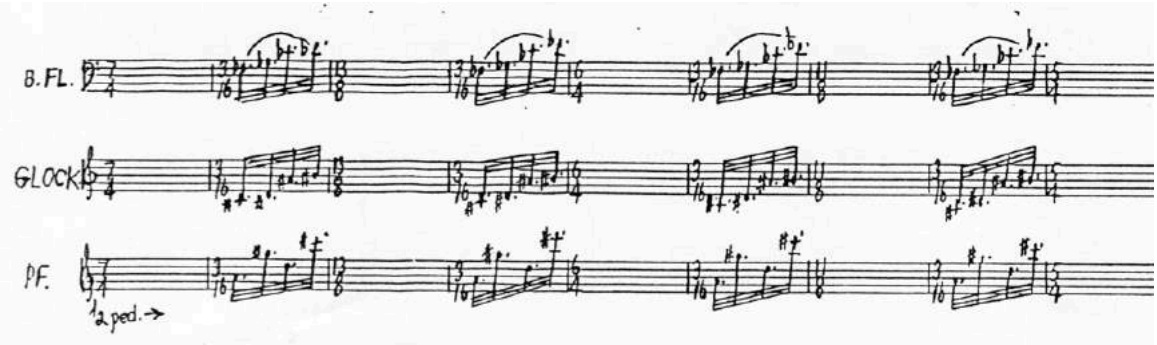

Figure 4.5 *Crippled symmetry,* 1983

Furthermore, we can observe polyphony of different patterns. In this situation any type of patterns mentioned before can be combined together. Sometimes they are happening all together in a certain meter (Figure 4.6) and sometimes they are completely disassociated from each other having their own pace and meter. (Figure 4.7)

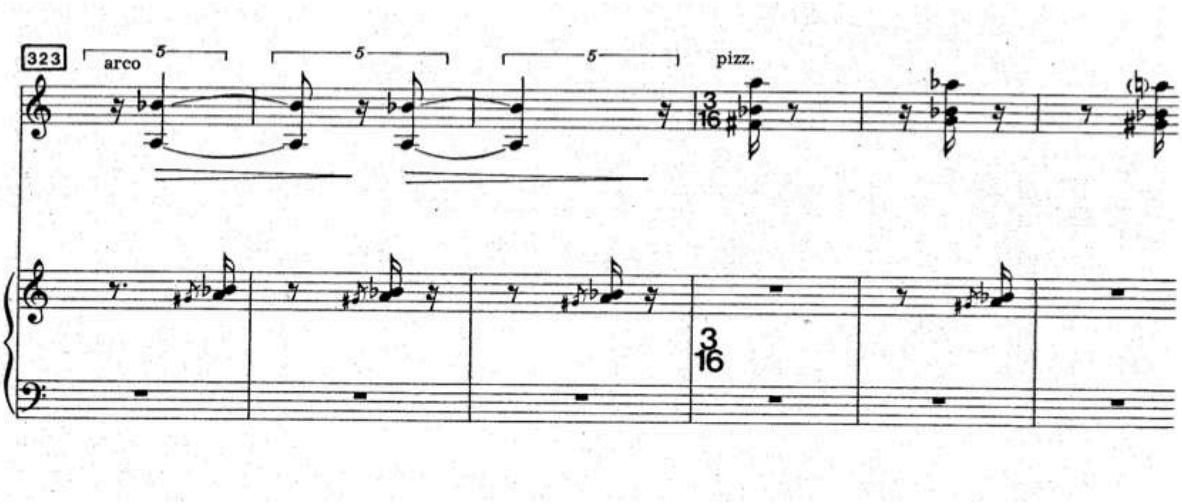

Figure 4.6 *Spring of Chosroes, 1977,* Universal Edition

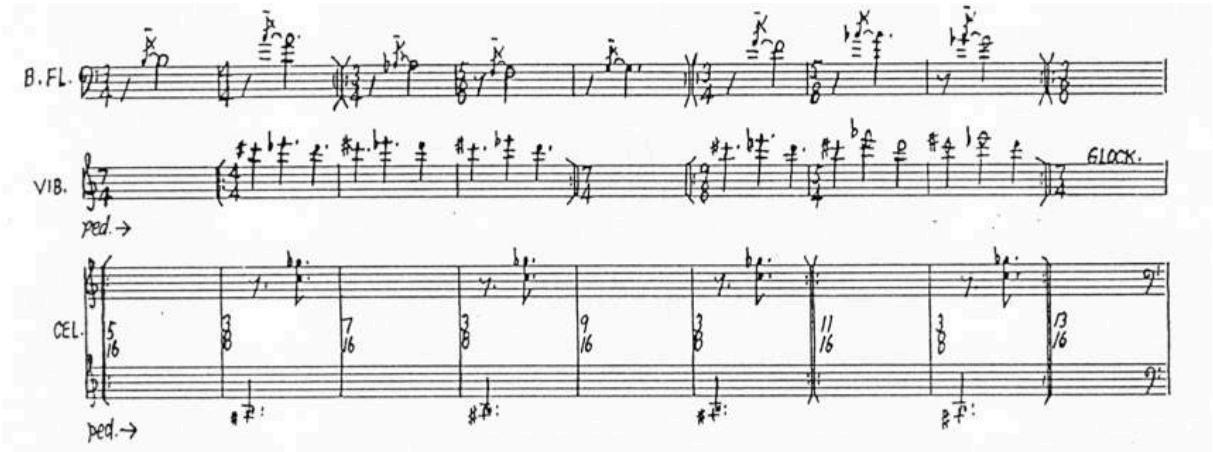

Figure 4.7 *Crippled symmetry, 1983*

We can see an analogy between the way he combines different musical patterns and the combination of patterns in a carpet. In the example in Figure 4.8, three different patterns are used together. Here, the vibraphone is relatively active and consists of sixteenth notes. The flute is less active comparing to the vibraphone with eighth notes and at the end quarter notes on piano are the slowest ones. In fact, we have different patterns with different rates of repetition. We can compare this to an example of a border of a carpet in Figure 4.9; we have smaller elements with higher and bigger elements with slower rate of repetition.

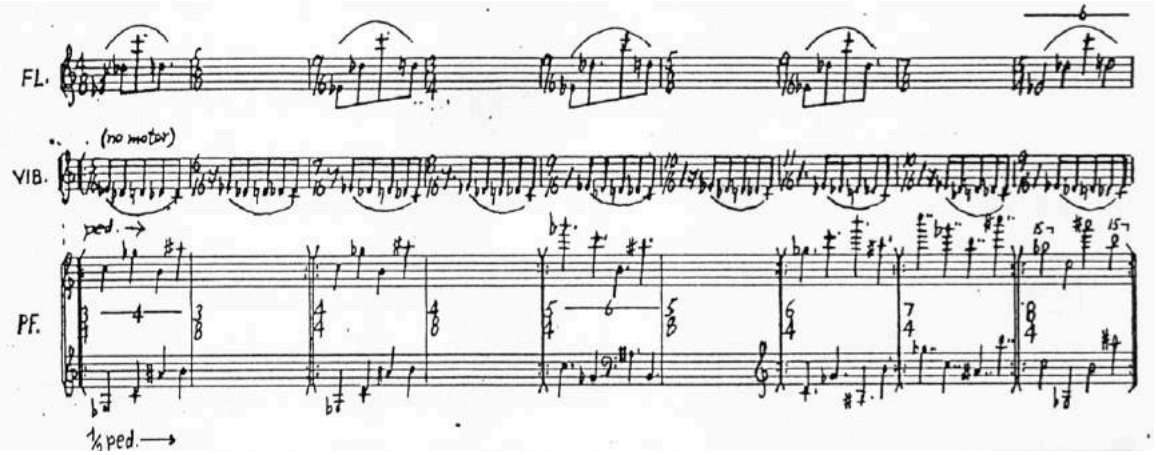

Figure 4.8 *Crippled symmetry,* 1983

Figure 4.9 patterns on the border of a carpet

Repetition and variation are the main strategies in Feldman's music. These are the features he extracted from observation of a carpet design. This variations occur in different areas. As we saw before, in figure 4.3 it is about various intervals between recurring a single note. In Figure 4.10 we can see how the rhythm is changing within a pattern. However, the fixed pitch set retains the identity of the pattern while the rhythm is varying constantly.

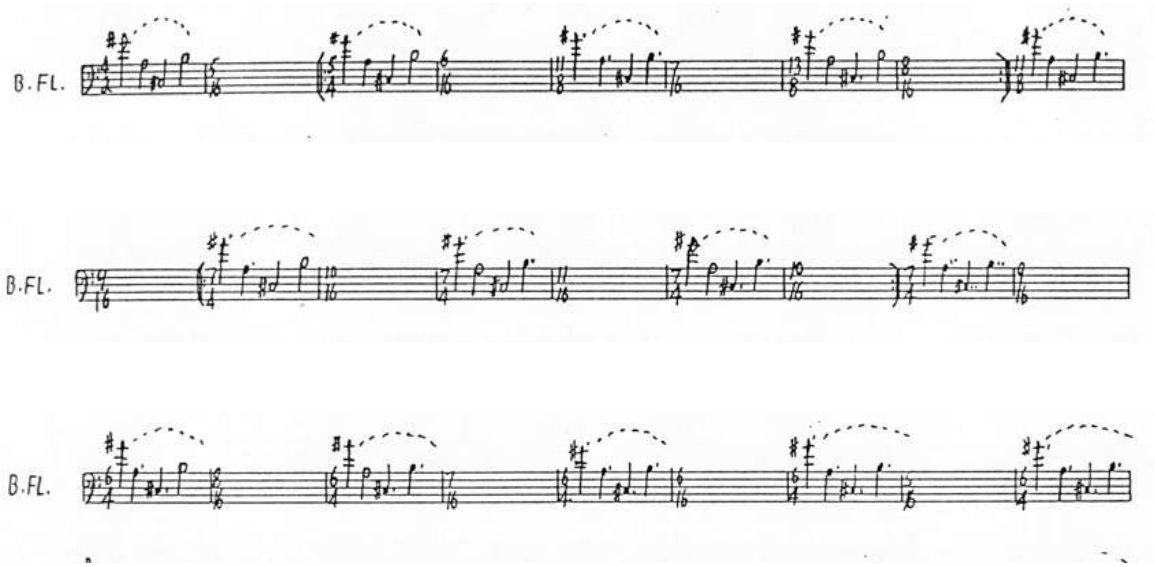

Figure 4.10 *Crippled symmetry, 1983*

In Figure 4.11 these variations occur in the order of a pitch set. You can see the permutation of four pitches (C, G♭, B, A♯) on the piano part. Moreover the rhythmical variation is also added later on the same line. In fact, the variations could appear in all different aspects of the music in different combinations.

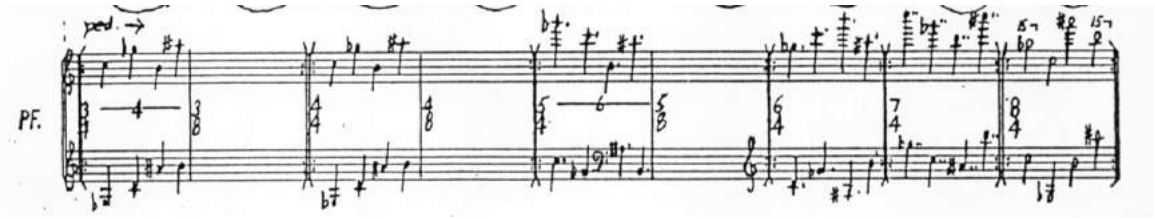

Figure 4.11 *Crippled symmetry,* 1983

Chapter 5

Composition Projects

Figure 5.1 Malayer, Iran, circa 1900, a unique *wagireh* or sampler rug features a combination of large and small-scale patterns.

5.1 My general approaches

In this chapter I would like to talk about the general approaches in my compositions; individual pieces that I have composed during my research will be discussed later.
I have already discussed possible ways and connections in doing this research - including what I did not aim to do – as in my opinion, lacked the potential for basing the composition of innovative music.
During this research, I tried to delve deeper than the visual aspects of a carpet and sought to understand it more integrally. Indeed, I grew up surrounded by carpets from my early childhood on and like other people from my culture, have internalized them in my being.
I've tried to locate and understand the governing laws of a carpet, which makes it unique and special. I ventured to discover the essence and aesthetics behind them and examine the intriguing ways of applying the findings in my music. During this time, the chief question for me has always been: "is it also musically interesting?"

If the answer was *yes,* then I started to experiment to see how far I could take the idea and how I could connect it to my other ideas in developing a piece of music. Nevertheless, I also experimented with concepts that I did not find interesting in order to have a clear understanding of things that I would not apply in my music. On another level, during the time working on this project I was also thinking about the relationship between these features of carpets and traditional Iranian music (the base for a completely different research project). In this regard, I would like to mention that I believe that as long as I am honest with myself in my work, this cultural connection emerges naturally.

Below is a list of some important considerations that I applied in my music based on key features of carpets. Although each one can be explored much more deeply, I limited myself to these attributes in relation to carpets and meaningful ways of applying them in my music.

1. Spatial concerns
2. Symmetry / Asymmetry
3. Garden
4. Complexity
5. Proportions
6. Repetition / Variation

7. Wholeness
8. Impressionistic aspect

These subjects are related to different areas of music. In fact, most of the time I tried to include them all in different levels in my music as I believe this approach gives a polyvalent quality to the music. However, it should be noted that some issues are more dominant in some pieces than others.

Before talking about my pieces in more depth, I would like to explain these attributes and the way I applied them in my music.

Apart from my personal interest in spatial aspects of music, I immediately realized the importance of space in my research subject. As I am working on a spatial phenomenon, paying attention to this aspect brings me closer to the subject.
Using multi-channel audio setups gave me an excellent tool to get closer to the spatial nature of a visual world like carpet. Geometry is the leading rule in the world of carpets, so I tried to explore that in realizing the spatialization of my pieces as one of the important aspects of the compositions.
In this regard it needs mentioning that for me, spatialization is not something that comes at the end after finishing the piece, but on the contrary, is part of the initial ideas of the piece or even sometimes the main idea itself. Knowing this from the outset, I often produce my materials in multi-channel.
Considering one of the prominent features of a carpet, symmetry, I tried to use that in my spatialization by creating a sonic symmetric space through sound materials occurring in a symmetric manner in different ways. In the carpet world, symmetry comes with its twin: asymmetry (as explained in chapter one). This means I am not copying or repeating the same material, rather using a slightly varied version in order to produce a much more interesting result. In the same manner, you can find endless tiny differences in symmetrical arrangements of a design of a carpet, specifically in organizing details which are less conspicuous.
I also found this approach very close to the idea of a garden as a contained place. In this way, the listener is immersed into the sound world and he/she can explore the similarities and differences of this sonic symmetric space, as you do in observing a carpet, exploring different parts and their relationships. What you see becomes less important than how you see (Sciarrino, 1998, p.89).

This is related to various ways of interpreting the same work; in fact, in this world it can be said that everything is everywhere.

Focusing on the microtemporal aspects of music has also been my strategy to approaching the visual world. Intensity, timbre and space are three basic listening dimensions, experienced instantly and simultaneously, and within a fraction of a second provide information about the relation between the listening body and mind and the surrounding world (Christensen, 2012, p.297).

The sonic materials that I use in my compositions are processed based on sounds I recorded myself. I search for specific characteristics of sound by using unusual ways of recording, such as putting the microphone very close to the sounding object or using different and unusual types of microphones for the situation.

In these series of compositions, most times I use a quality of complexity which is the result of simultaneous diverse elements, which are in concord and contrast to each other. These different materials occupy the whole frequency range, from very low to very high. In a way, each element occupies its own frequency domain.
This complexity is also closely related to other factors like proportion and scale - the way that these materials are grouped together in forming bigger sections.
To generalize these groups we can define them as micro and macro arrangements. Micro scale is about numerous detailed elements, which all together create a perception of a bigger entity. The interesting detail about them is that while separately each has a totally different character, when these small elements gather together they create a new and different quality, which is not the same as they would be sound individually.
This fact is closely related to the organization of microscale of a design in carpets.

> Here we are in front of the filling figures, a microcosm inserted in the macrocosm of the major figures and groups. A double order of proportions to which correspond two degrees of perception (of the details and of the whole), two levels found practically in all the Oriental carpets (Sciarrino, 1998, p.91).

Generally in my music, during the whole piece you won't hear the exact repetition of musical materials though many similar elements are reiterated. This approach is related to the idea of imperfect symmetry in carpets or in Feldman's words, "crippled symmetry".

Indeed, all these aspects are closely interconnected and this results (or is hoped to result) in a quality called wholeness - the consequence of all the relationships between elements, which lends the final result a sense of unity.

Lastly, I would like to mention another aspect which exists rather unconsciously in my series of compositions. There is an impressionistic quality underlying the music which is the natural and direct aspect of the result of constant connection with this subject and personal feelings of the composer in relation to the carpet. The very impression of appreciating these masterpieces plays an important role in shaping the soul of the music. This is a rather hidden and intuitive aspect, which is not easy to discuss. Nevertheless, this aspect is at the core of the composition as the final product always passes through this filter.

Before talking about my pieces I would like to point out that I am not going to explain them in a great detail. I believe that is a very personal choice. Some composers explain every single detail of their piece and all the steps they have gone through. On the other hand, some composers say almost nothing.

In the following section I will discuss each of my pieces individually and describe general ideas and approaches behind them. Obviously, music must be heard not explained, so I believe going into greater detail would be redundant.

5.2 *Toranj*

Fixed media, 8 channels

Figure 5.2 Ardabil Carpet, 1540, Victoria and Albert Museum, London

'I have no refuge in the world other than thy threshold
My head has no resting-place other than this gate'

This couplet by Hafez, the famous 14th century Iranian poet, is inscribed in a small box on top of the Ardabil carpet followed by the signature of the court servant, Maqsud of Kashan, and the date "1539-40."

The Ardebil carpet, (Figure 5.2) now in the Victoria & Albert Museum in London, is probably the best known of all ancient Persian carpets. During the period I was working on my composition I was very impressed by this masterpiece. I wouldn't go so far as to say that my composition is based on this carpet, but rather that it inspired me to a great extent.

Toranj is the geometrical figure in the center of a carpet, which is like the sun with everything else is orbiting around it. In this piece I tried to apply some of the ideas and concepts that I developed during my research so far, in particular the aspects that I found also musically interesting and relevant.

One of the main ideas for this piece is symmetry. Here, in a different application of temporal symmetry in music (like the Feldman's examples), I use symmetry in spatialization. In fact I tried to create a symmetrical space. I think this approach works very similar to immediate perception of symmetry in visual territory. This symmetric spatialization operates on a geometric level and is linked to our instant understanding of sound sources positioned at any given moment. Consequently, the passage of time is not a fundamental element in the perception of this symmetric aspect, but rather works to sculpt the space. In this regard, I was inspired by how a carpet implies an immediate impression of symmetry when observed, specifically, the possibility of perception of the whole at once, rather than perception of symmetry on a temporal level, such as symmetrical arrangement of the form in music.

In this piece, the spatialization layout employs eight channels, and in a way also represents four corners and four sides of a carpet, making it an important number here. Moreover, this arrangement is also akin to the shape of Toranj (the central figure) in a carpet. The eight channels are a combination of two interlocked quadruple shapes. Each one has its own group of sounds materials and character in order to create a state of equilibrium. (Figure 5.3)

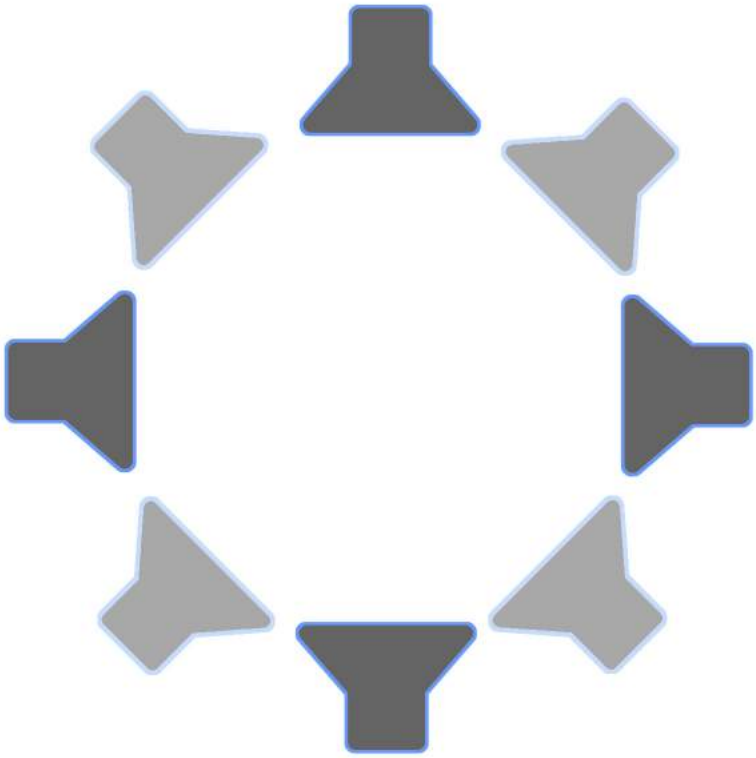

Figure 5.3 the eight-channel layout of *Toranj*

With this type of spationalization, I was also concerned with the idea of simultaneous symmetry and asymmetry, which is one of the interesting features of a carpet as discussed earlier. Therefore, the symmetrical space in this piece is not created by doubling the same sound in corresponding speakers, but rather, by using subtle variations to make it more unique. Again, one of the important differences between symmetry in the visual and sonic realm is that in visual objects the symmetric aspect reveals itself instantly and the perception of symmetry is conveyed at once when you observe it, whereas in music, generally you need time to perceive symmetry. For instance, you need to listen from the beginning to the end of a piece of music in order to understand a symmetric form. Again this is time passage that unfolds a symmetric relationship in a pitch set around a vertical axes. Generally, time is a very critical aspect to perceive symmetry in music.

The other aspect in this composition is passing time. In the process of making a carpet, time is a key element. Knots are put together one by one, layer on layer in order to realize the whole carpet as a finished product. There is a gradual progression from almost nothing to the final result of the whole image. While it precedes you start to perceive it slowly. Therefore the concept of time passage, patience and growth are fundamental ideas in the piece.

Toranj starts on the edge of silence and over twenty minutes, many subtle events happen at different paces in an exponential manner. At the end all these events create a dense and complicated texture filling the whole frequency range. Exactly in the same manner that in a carpet, the patterns of a design fill almost the whole space on different levels. In fact, the piece has a monolithic structure, consisting of a single large section.

The low frequency sounds, which have an ostinato character, consist of multiple phrases, which are sometimes overlapped and sometimes separated. These phrases work like ebb and flow. After each one, something small is added to the music. For me, this idea associates again with the process of making a carpet. During which each row of knots adds a fraction of the image to the whole. These rows come one after the other until forming the final result.

The other aspect of using a very long crescendo gesture was the idea of perception of musical material on different dynamic levels. As my materials consist of different frequency components from very low to very high, on an extremely soft level, some parts remain inaudible. With a gradual increase in volume they start to reveal themselves. In the same manner as observing a carpet, at first you have a distant overall image of a very detailed and elaborated whole And when you spend time to approach it and focus on different details, you have a different level of perception of each element and their interconnections. Similarly for me, this crescendo gesture works as a gradual change in development of understanding the music. The louder it is the more details become audible and their interconnections are exposed. Consequently, the result is a subtle continues change in the texture.

In another aspect, at the beginning of the piece, the simultaneous presence of very high and very low sounds implies a big space in the frequency domain. It represents the idea of multiple spaces for me, where I am creating a big intervallic space at the beginning, which is gradually filled with the rest of the sounds in between. I associate this with the notion of borders as a prominent feature of a carpet. These two layers on the extreme sides of the frequency range, in fact, imply a sense of border in the frequency range.

The very quiet beginning of the piece is like an emergence from silence. It is not total silence, but rather is implied by using an extremely soft level in a way that the noise from the audience and the hall dominates it. In my opinion, apart from the poetic function, this silence lowers the hearing threshold and creates an opportunity for the listener to perceive and appreciate the subtleties that happen in the music.

5.3 *Gereh*

Fixed media, 8 channels

Figure 5.4 Serapi (northwest of Iran), late 19th century, Claremont rug collection

Gereh in Persian means knot, the smallest constituent of a carpet. *Gereh* premiered at the *next_generation Akusmatik* festival at ZKM (Center for Art and Media), Karlsruhe, Germany. It was played on the Acousmonium system (Figure 5.5), a sound diffusion system designed in 1974 by Francois Bayle and originally used by the *Groupe de Recherches Musicales* at the *Maison de Radio France*. It consists of almost 80 loudspeakers of differing size and shape, and was designed for tape playback. ("L'ACOUSMONIUM", n.d.)

Initially this loudspeaker orchestra developed as performance systems for stereo works, but now days in theory any arrangement is possible. The term orchestra is appropriate not only because of the deployment of individual 'loudspeaker-instruments' in space, but also because of the different registers and timbral qualities of each loudspeaker. The setup of the Acousmonium is not fixed. It can vary on each occasion enabling experimentation with each new speaker configuration.

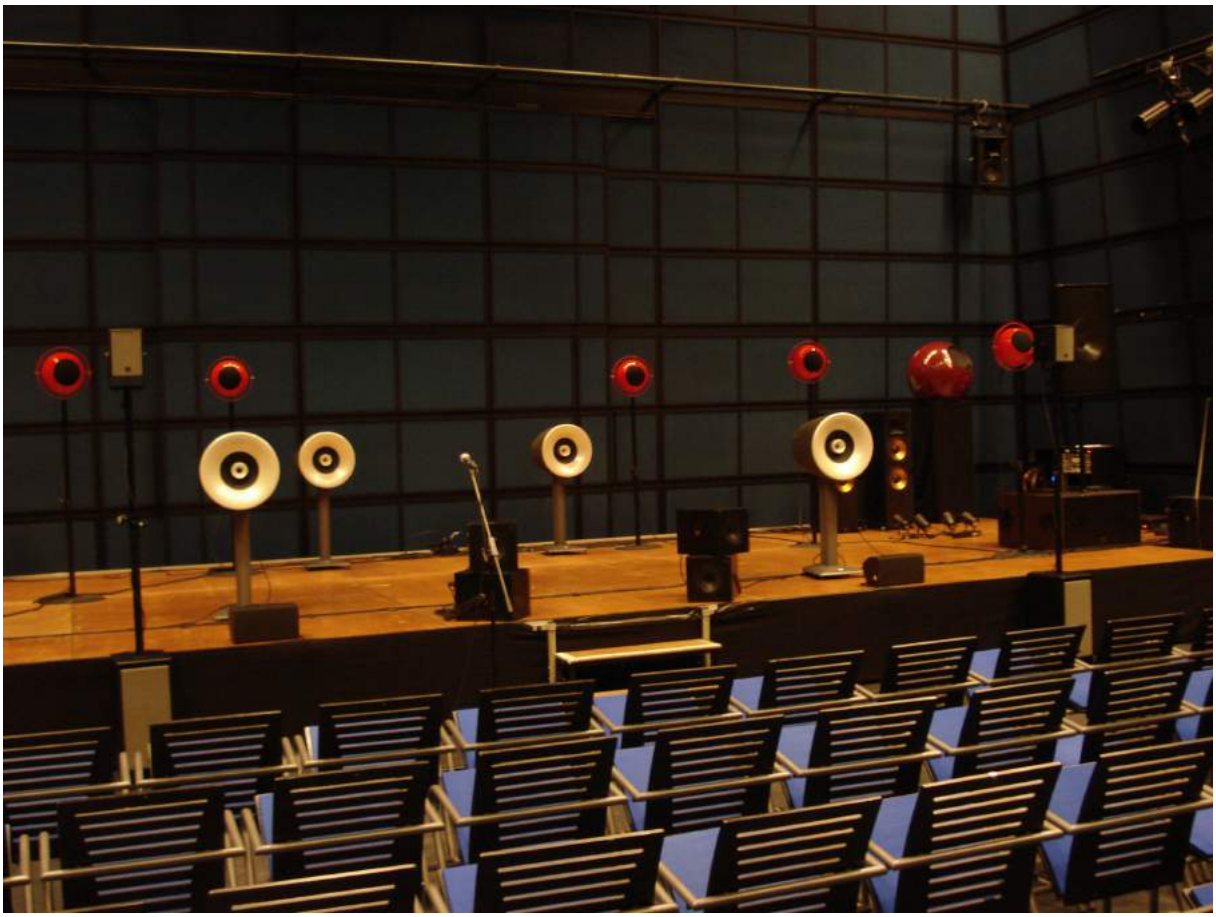

Figure 5.5 *Acousmonium* at ZKM, Karlsruhe, Germany, 2013

The first part of *Gereh* consists of blocks of different tiny percussive-like sound particles, which are grouped together by conspicuous silences in between. These groups are repeated and in each repetition the sound particles are subjected to small changes and also new materials are introduced within the groups.

The idea for this comes from the feature of the Acousmonium, which is a collection of many different speakers scattered around the space. In *Gereh*, each time these groups of sounds appear on different groups of speakers situated in different places. Apart from the variations that happen to these groups within the music in each cycle, using different groups of speakers with different characteristics and different positions and arrangements gives a deeper layer of repetition and variation to the music.

The idea of symmetric space is less emphasized here; instead, there is more interaction and activity in the spatialization of the piece.

In this piece I also incorporated the temporal aspects of symmetry in the music by splitting the formal structure into roughly three sections. The last section reminds of the first one and implies a sense of symmetrical organization in form. This symmetry has the same quality of the symmetry in a handmade carpet, which is imperfection. The middle section is relatively plain but slowly and continuously varying in texture. For me, it is reminiscent of the plain mono-colored field in carpets with subtle variations in color. In fact the whole piece is a journey across a carpet. Starting from the multiple layers of borders (the groups in the beginning) from one side through the field and ending at the other side of the borders.

The source material of the piece is very limited and instead very different approaches in sound processing are used, which gives a wide range of diversity and at the same time a coherent quality to the whole piece. The piece revolves around the tremolo gesture, which comes from the source material of a tremolo played on a traditional Iranian instrument called *Setar*.
Two main approaches are applied in using this martial, related to the two scales in a carpet design. In fact, the material appears on two different levels, close and distant. In the first one we are dealing with a single object in which the iterative quality of a tremolo is dominant as we are very close to the material. On the other level, we are dealing with numerous elements of the same material but from distant. In other words, a combination of many of those single material that results into a dense texture in which we cannot distinguish a single tremolo element and instead we hear a new collective identity.

5.4 *Dohasht*

Fixed media, 16 channels

Figure 5.6 Anhalt Carpet, Iran, mid-16th century, The Metropolitan Museum of Art, New York

Dohasht means “two eights”, or eight plus eight. In Old Persian it was used for the number sixteen. It is a very rare word that I found in a poem by Ferdowsi, the famous Iranian poet from the 10th century. The reason for choosing this title will become apparent in the coming explanations.

In this piece I tried to explore my symmetric space idea further. Basically, I extended the symmetric layout into sixteen channels. (Figure 5.7) Having the same approach in my symmetric spatialization, I took apart my music and split it into two rings of eight speakers, one inside the other. The diagram of the channels diffusion implies the center of a big royal carpet. (Figure 5.8)

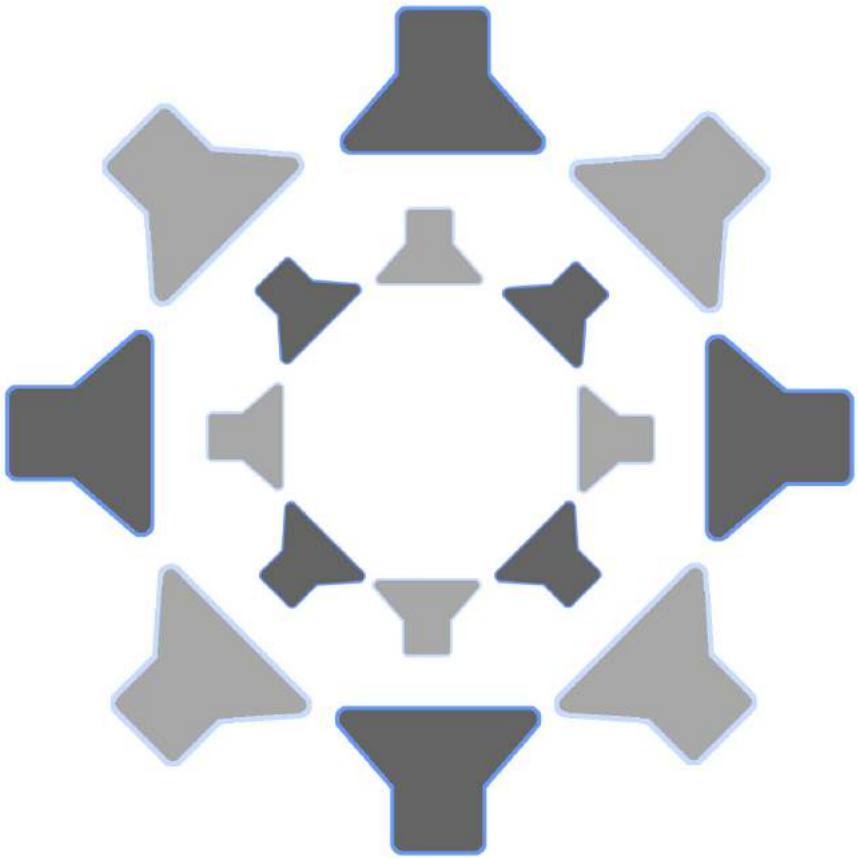

Figure 5.7 the sixteen-channel layout of *Dohasht*

Figure 5.8 the center of Ardabil Carpet

In this setup, the audience feels the exact physical proximity and distance of sounds, which I consider a step further than the conventional layout. In the same way as a carpet has different networks of designs that superimpose and juxtapose together while at the same time all working in concord, here in this piece each ring presents different materials independent or connected to one another. They have different relationships, sometimes as background and foreground or complementary, other times all merge to create a unity and other times still they appear on their own. This idea is also closely related to the concept of complementary opposites - coupled elements with different and opposite characters are locked together to create equilibrium.

> A detailed element should contrast with a plainer element, often seen as merely an empty space; yet the best weavers shape that space so that it has its own coherence, and reinforces the adjoining elements (Alexander, 1993).

This layout places more emphasis on the idea of garden. As there is much more diffusion of sounds in the space, it breaks the barrier between audience and speakers and allows the audience to immerse themselves in a garden of sounds. This big space of diverse sounds creates a situation to explore the corners and to find different connections exactly in a same manner as walking in a garden.

The distribution of musical materials on two sets of speakers is based on the character of martials in relation to the different quality of speakers and their positioning. For instance, louder sounds mainly appear on bigger ring with bigger speakers and softer sounds on smaller ring with smaller speakers. One reason for that is the proximity of the smaller ring to the audience. The frequency rang is another factor for the distribution of materials on different rings. Since there are two types of speakers with two different frequency respond and character.

Another aspect of the piece is repetition and variation. During the whole piece the exact repetition never happens even though some elements are quite similar. One strategy for creating this variation is having similar materials on different rings. For instance, at the beginning of the piece one material appears on the small ring and near the end a very similar variation of the same material this time appears on the bigger ring. This change in position and volume gives a different quality to a similar material. This idea of repetition and variation as mentioned before, is a prominent feature in carpets.

The sound material of the piece also consists of two contrasting elements. One is an attack and the other is a continuous sound. These two different characters in the sound are also another factor in the diffusion of materials in two different rings. The bigger ring mainly being used for attack sounds and the smaller ring for continuous ones. This fact creates an association between a specific sound material and a specific position in the space, regarding to the distribution of the patterns in a carpet design.

5.5 *Cadrados*

For percussion and electronics
Commissioned by Mario G. Cortizo

Figure 5.9 *pandero cuadrado,* Spanish frame drum

In Spanish, Cadrados means squares. This is a piece in collaboration with the Spanish percussionist, Mario G. Cortizo, for his master's final exam graduating from the Classical Department of the Royal Conservatory of The Hague. Mario had been working with electronics in combination with his percussion set-ups before and in his master's research he decided to work on an interesting subject area entitled: *Proposing Live Electronics as an Alternative to Larger Performance Set-Ups*.

In his Thesis he argues for the possibilities of electronics as an alternative to large performance set-ups in a creative way. Richard Barrett was the connecting point for this piece, supervising both our projects. Consequently, I tried to realize a piece related to both research projects, and for this reason I primarily decided to compose for only one percussion instrument as the extreme case with regards to Mario's project, and then having the other sound materials in electronics. After exploring his large collection of different instruments, I decided on a traditional Spanish frame drum called *pandero cuadrado*. (Figure 5.9)

The instrument is a very primitive frame drum with skin on both sides and some rattling grans and a sleight bell inside. Traditionally, the instrument is used to accompany voice in folk songs and is normally played by hands and sometimes a wooden stick.
Thinking of a way of associating this piece to my own project, the primitive square shape of the instrument immediately triggered the image of nomadic rugs in my mind. These rugs have a very simple structure consists of simple blocks of colors. (Figure 5.10)

The particularly intriguing thing about these types of rugs for me is the procedure of weaving them. In doing so, the weaver is an improviser as there is no specific scheme on paper involved. Of course, the weaver more or less knows what the general structure of the rug is (in this case, simple blocks of colors) but she makes spontaneous decisions about the colors, size of the blocks and many other details. Unavoidably, there will be surprises during the process of weaving the rug and even some mistakes and all these factors together give a unique identity to the rug as a final product, making it one of a kind.

Figure 5.10 Gabbeh Bakhtiari, early 20th century (Tanavoli 2004)

This interesting procedure made me think of it as a way of forming the piece. Having the percussionist as an improviser in a certain areas to create a unique piece in each performance and at the same time similar in some basic features. This requires spontaneous decision-making while at the same time knowing how materials function in electronics and having control over them.

Inspired by the structure of the rug with blocks of colors, I associated these blocks to some short sections of music of around one or two minutes with contrasting characters. In the electronics part, these sections are composed based on the materials from processing the frame drum recordings. Moreover, some voice materials in the electronics are associated with the traditional way of using *pandero cuadrado* in accompanying a voice. On the other hand, the element of the human voice (mainly a lullaby sang by women) is a metaphor for the weaver of nomadic rugs in the piece since the weaver also normally sings while weaving.

Each part suggests a certain type of sounds and gestures on the live instrument to play along with electronics. Basically, the player uses a low attack sound by hitting the center of the frame drum as the junction of these parts. On the other word, each beat from the instrument is the ending of one section and starting a new one. This procedure is based on a Max-patch, which recognizes the attack sound and uses it as a trigger to end one section and start a new one. In fact the player during his improvisation on pre-composed materials in electronics, also decides when to move on to the next stage. Exactly in the same way as a weaver decide to finish a pattern and go to the next one.

This is relates to the idea of the procedure of weaving a rug in the piece which is a combination of predetermined structure and spontaneous decisions. Obviously, the general structure of the piece is also already known. However, in the same manner as in a nomadic rug, the final result would be different in each performance. Also the duration of the piece would be different based on the player's spontaneous decisions ranging from eight to fifteen minutes. In the same way the materials he plays are also different in each performance based on his improvisation in respond to electronics. Nevertheless, we already rehearsed on each section to discover more possible varieties in connection with electronic parts.

The Max-patch also has another part, which deals with live manipulation of the percussion sound. It consists of different filterings and spatialization methods over the eight-channel speaker setup. Each part of this live processing has a different setting and approach according to the section of the music.

Here again I used a layout of two interlocked sets of speakers (Figure 5.11); as the title implies, everything in the piece has a quadruple quality related to the squared shape blocks of the carpet design and the shape of the instrument. In this setup, diffusion of the sounds is related to the idea of garden. In fact the player is sitting in the middle of a garden surrounded by speakers.

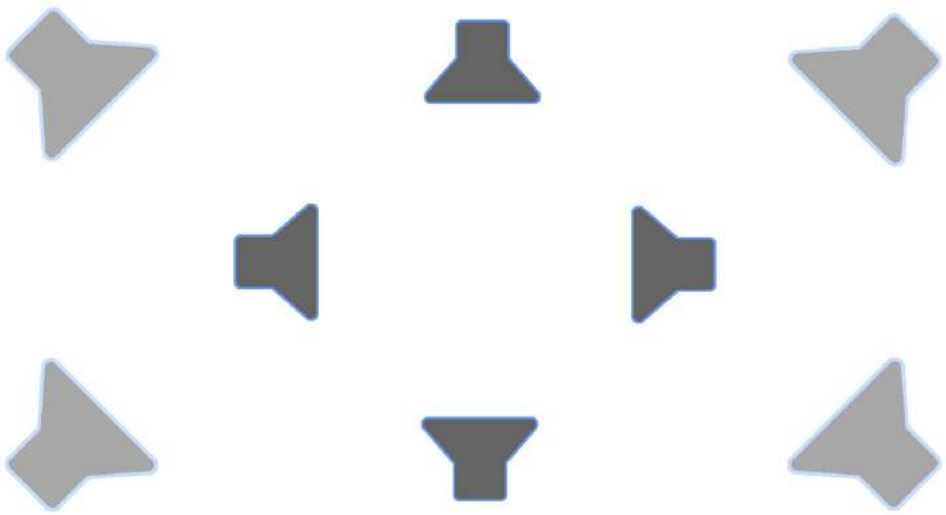

Figure 5.11 the eight-channel layout of *Cadrados*

5.6 *Gabbeh*

Fixed media, one channel

Figure 5.12 Bakhtiari Gabbeh, Nazmiyal Collection

Searching for diverse and radical approaches in my research project, I was fascinated by the simplicity of Gabbeh and the stark contrast between them and a royal carpet such as the Ardabil example. (Figure 5.2)

A Gabbeh a hand-woven pile rug of coarse quality and medium size characterized by an abstract and simple design that relies upon open fields of color and playfulness with geometry.
The word 'Gabbeh' comes from the Persian meaning raw, natural, and uncut. This is a rough and primitive carpet. (“Gabbeh” n.d.)

These simple but beautiful nomadic rugs raised the question as to what my approach towards them in comparison to other carpets would be. In other words, what kind of features I could extract from Gabbeh and how to apply them in a composition.

First of all, the huge contrast made me think about my approach in terms of spatiality.
Consequently, in contrast to the overwhelming multichannel arrangements that I had been using, I came up with the idea of using only one speaker. I found this idea very much in keeping with the oneness quality of Gabbeh. The modest and humble character of Gabbeh can be represented using only one speaker to project the music.

The next question was about the musical content, which preoccupied me for a while. In doing so, I tried to concentrate on the dominant qualities of Gabbeh and found the features of simplicity, unity, monotonic, plurality and subtle continuous variation.
Due to the visual similarity of Gabbeh and spectrogram of a sound, I decided to import a Gabbeh image into an application and use it as spectrum information to synthesize sound. It produced some interesting results but it was not convincing yet. However, this experiment and thinking about contradicting concepts like unity and plurality resulted in using hundreds of sine waves interwoven together, forming a complex unified mass in a state of constant change.

In Figure 5.13 you can see a screen shot of these sine waves and the visual similarity between that and a Gabbeh texture. However this visual similarity is not the most important aspect.
An interesting quality in a Gabbeh is a subtle variation in color, which is called *abrash*.
As Feldman explains:

> One of the most interesting things about a beautiful old rug in natural vegetable dyes is that it has "abrash." "Abrash" is that you dye in small quantities. You cannot dye in big bulks of wool. So it's the same, but yet it's not the same. It has a kind of microtonal hue (Feldman, 1983, p.193).

The idea of using numerous sine waves is related to the fact that Gabbeh consists of numerous similar knots as the basic constituent of the work. At the same time, the plurality of this basic element creates the unity of final result. These sine waves fill the whole frequency range from very low to very high frequencies and at same time they move in a quasi-chaotic way up and down but in a certain range. This feature gives an ever-changing quality, the same impact, which exists in a mono-color Gabbeh. All the intricate relationships between these sine waves create various timbre identities, which emerge slowly from the texture and disappear. However the music has a monolithic formal structure of a single block. This structure is very close to the structure of a *Gabbeh*.

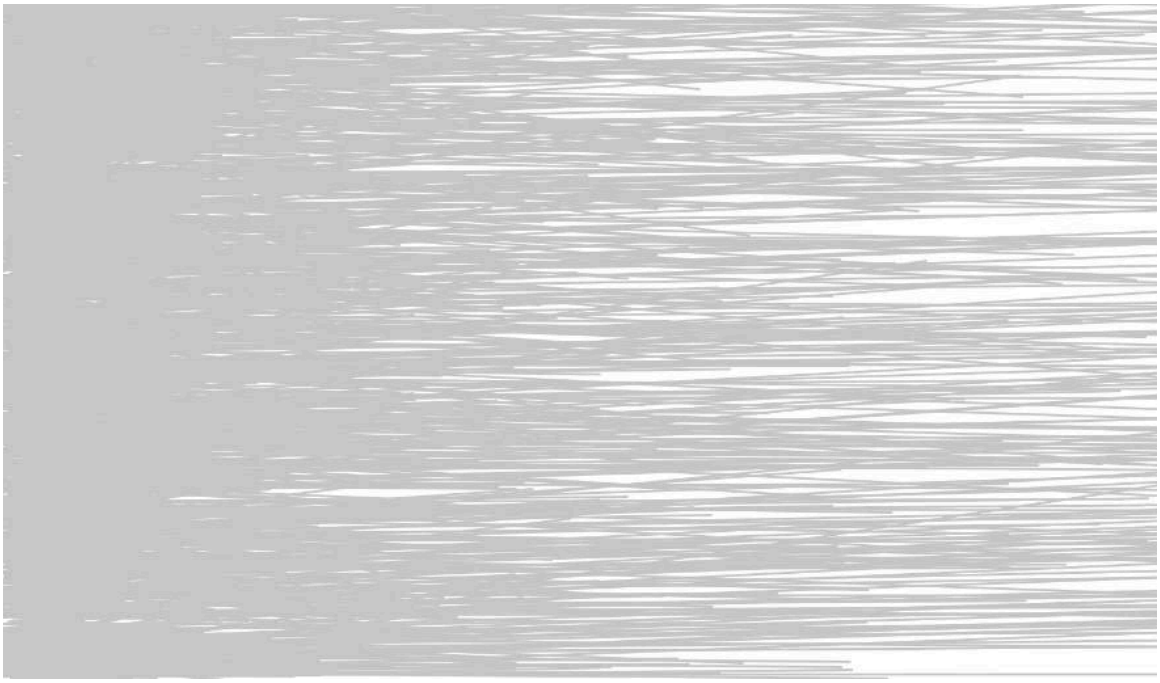

Figure 5.13, sine waves interwoven together

Conclusion

During this research the main objective for me has been feeding my compositional ideas. This time by exploring a non-musical territory I ventured to learn fresh and different concepts. I believe there are interesting things to learn from interdisciplinary areas. This is something that has been around for a long time in the history of art. There has been a flow of influence between different areas such as painting, architecture, cinema, literature and music.

In a research in the creative areas, there is not a single answer. The result is to a great extend depending on the researcher's approach and inclination. However, I think this research is a paradigm of working on a pre-existing visual phenomenon in order to compose music. I do not present a general guideline of doing such a project but rather I arise questions and problems inherent in the issue and discuss the ways and solutions empirically by composing different pieces in this regard.

Dealing with this subject opened new doors for me and helped me to address part of my concerns regarding the identity as an eastern contemporary composer. I believe that the features and concepts that I learned from studying carpets are something that are shared with other forms of arts in my culture, But embedded differently. Therefore, this project gave me a new perspective in dealing with that issue.

Finally, I need to mention that I am not done with this subject yet. I still have some ideas and projects triggered during this research that I would like to accomplish them, specifically my project for wave field synthesis.

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