An Investigation of the Relationship between Images and the Impression Created by the Music: A Case Study of Traditional Music for the Elderly

Alireza Rezvani [1]

Davod Baradaran Tavakoli [2]

Abstract

Architecture and music share many similarities from conceptual and perceptual viewpoints. They are also similar in the fundamental principles governing them, such as rhythm, proportionalities, harmony, repetition, etc. Therefore, the strong link between music and architecture is manifested in the atmosphere they create, a mental or visual atmosphere which is barely investigated in relevant studies. The goal of the current study is to investigate and perceive the formal relationship between music and architecture, beyond the fundamentals linking them. The main research questions are: How can we relate the image created by a musical work and the impression created by that? Is there any relationship between the impression created by the music and an appropriate architectural atmosphere favorable to individuals? The focus of the current study is to consider the image created as a result of some complete piece of Iranian music, which is evaluated by the elderly (sample). Employing logical reasoning research method and simulation model, the study aims to find an answer for the first research question, and by seeking a yes/no answer to the second research question, create an opportunity for the future research. Accordingly, first, the literature regarding the relationship between music and architecture is reviewed. Next, the concept of atmosphere in architecture and music is described. Then the relationship between the feeling of interest towards the music type and the features of images created as the result of music is explained. The results indicated that pieces of music in which the rhythm is happier and faster result in more complex geometric shapes and more extrovert structure. Finally, the study suggests that there is a close relationship between the impression created by the music and the perception gained as a result of simulated image, which can be used in producing architectural works.

Key words: Iranian music, image, atmosphere, architecture, relationship

[1] Assistant Professor, Department of Architecture, Mashhad Branch, Islamic Azad University, Mashhad, Iran, Email: Rezvani0112@mshdiau.ac.ir

[2] PhD Student of Architecture, Art and Architecture Faculty branch, Islamic Azad University, Mashhad, Iran, Email: davoodbaradaran@mshdiau.ac.ir

1. Introduction

As the experience indicates and the history emphasizes, architecture is a knowledge and profession dependent on and intertwined with art. The link is so strong and fundamental according to some theories that sometimes leads to general ideas and ineffectual interpretations. This is also true for the relationship between architecture and music (as a pure art). So much has been written on the link between them, such as Goethe who says, "Architecture is frozen music" or Stravinski who analogizes the elements of music to building materials. But sometimes, by emphasizing the usefulness and applicability of architecture, there are hesitations on its similarity with music. As the authors assume, such fundamentals and principles as rhythm, hierarchy, regulation, balance, harmony, etc. are not only common between architecture and music, but also between architecture and many other arts. What has made the authors to study these two types of art comparatively, which is barely mentioned in other studies, is that like architecture, music surrounds individuals and shapes a governing and relatively perfect atmosphere. In architecture, such atmosphere is visualized by emphasizing on the visual sense (although other senses are also involved), and music visualizes the atmosphere through hearing sense.

Knowledge produced and the comparative and descriptive studies on the commonalities between architecture and music are only at the level of general principles of art and general descriptions. However, experiences gained through case studies, also, have provided opportunities in order for developing such attitudes; experiences that in philosophy can be traced back to such people as Pythagoras and Heinrich Schnerr, and in morphology it is first traced back to Ernst Chladni and then Michael Faraday, and in the latest period they are known by the experiments of such people as Martin Wattenberg and Christensen.

Undoubtedly, the start of considering such relationship is not possible in the scope of delivering a comprehensive definition of architecture (including performance, form and meaning), but it is possible by a comparative study between form and music, and it might be a starting point which can link the music with such visual arts as painting and sculpturing. In this regard, two main approaches could be employed for transforming the music into a picture: formal and conceptual. In the first approach, sounds and the vibrations of air cause to produce a shape, and in the second approach, the impression, perception and the aforementioned principles as rhythm, harmony, symmetry, etc., cause to produce a shape. However, in some experiments, transforming and translating one note or a part of a piece of music is the criterion for the shape production. And in some cases, a complete piece of music is transformed into a shape; in this process some kind of simulation is carried out.

The vague principles in the link between architecture and music, make it necessary to conduct this research, and the goal is to redefine the relationship between music and architecture and to explain impression and the shape created as a result of music. After reviewing printed literature on theoretical fundamentals about the relationship between music and architecture and the lab experiments based on the first approach, the first and second approach are merged in a unique manner in order for discovering the relationship between architecture and music. By considering the musical impressions of a group of individuals (the elderly in this study) and transforming tempo sound of the intended music into shapes (traditional Iranian music selected by the elderly), the main questions of the research regarding the relationship between music rhythm, the produced shape and the feeling transferred to the audience are answered. In other words, after the sample selection and determining the favorite music, simulation is carried out based on the

intended model, and then evaluation is done. Finally, a new hypothesis regarding the relationship between the favorite architecture and the favorite music of the participants is presented for future research.

2. Literature Review

Regulation and mathematic fundamentals create a set of aesthetic major principles. Although music is assumed to be one of the purest arts, it is supposed to have less relationship with such regulatory criteria. Therefore, according to the studies of many scientists, musical works seem pleasant and beautiful when they follow some special principles that are recognized by math and even geometry and physics knowledge based on senses and mind. Editing the principles relevant to music has a history of 2000 years.

Pythagoras and Plato might be the first who proposed and developed some hypotheses regarding the interplay between mathematics, geometry, music and finally architecture [1]. Pythagoras was inspired by the vibrations of lute strings (a musical instrument similar to Tar), as he observed their successive modes of vibration produce notes whose frequencies have a simple mathematical relationship to one another. Each mode, or pattern of vibration, is composed of nodes (points on the string which remain stationary) and antinodes (points of maximum vibrational amplitude). Thus, sound is joined to a spatial pattern [2]. By reviewing subsequent experiments on discovering the nature of music and its relation with form, one might understand that these early experiences were considerable and served as pioneers. One of the approaches employed in contemporary era for translating sound into form is shown below. One of the methods of this translation was introduced by a German physicist, Ernst Chladni, in 1787. Following the observations of Robert Hooke in the 17th century, he presented a simple way to observe sounds. He first spread some sand on a piece of glass. Then he made them fluctuate by the vibrations of a violin (Figure 1). These fluctuations caused the sand to gather on special points and lines and shape various and completely symmetric patterns, which resulted in shaping vibration patterns [2].

Figure 1. One of the main discoveries of Chladni was finding a technique for making sound observable. He took use of a violin and a flat screen covered by sands. These shapes were named after Chladni (source: URL1)
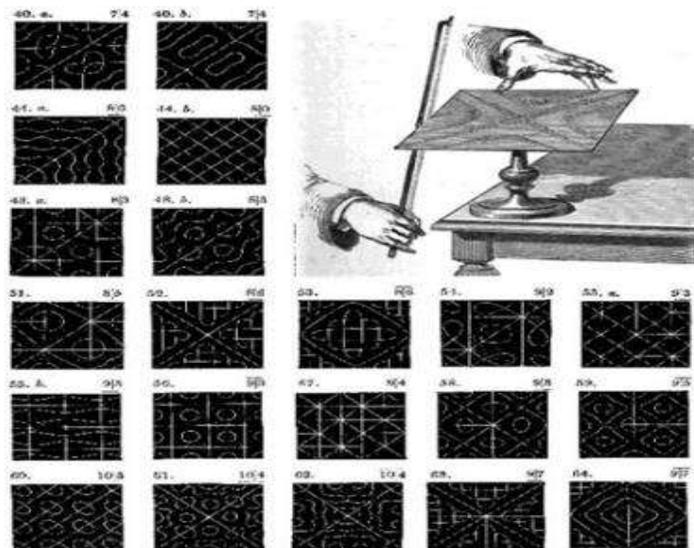
The German physicist, Gustav Kirchhoff, in 1850 presented an accurate definition for Sophie Germain's bending energy. In an article in which the linear theory of sound proposed by John William Strutt included the complete action procedure of Chladni's patterns, Kirchhoff's theory about sound which resulted in producing linear patterns by the use of advanced calculation methods, could transfer determined patterns and frequencies to simple patterns shaped on square screens.

One gateway into "nonlinear" pattern formation, a very active research topic today, was opened in the 1830s by the great experimentalist Michael Faraday. Later on, in the 1960s and '70s, Hans Jenny undertook a series of experiments on the visual characteristics of vibrational effects and wave phenomena. Hans Jenny's experiments includes references to Chladni and some of his experiments, such as the square patterns created in fluids spread on a plate, are similar to Faraday's. Jenny also undertook and documented experiments with "writhing and leaping" cornstarch suspensions. He named his area of research Cymatics. The most aesthetically beautiful images in Cymatics (1974), in both color and black-and-white, are those created by animating a fluid drop with a simple audio frequency [2]. After Jenny, John Stuart Reid, a Cymatics specialist, could create other different shapes by replicating Chladni's experiment (Figure 2). Another contemporary research in this area is a digital design research conducted by Christensen. He designed a parametric software including figures and ratios to produce 48 virtual forms from the preludes of Johann Sebastian Bach's first book [3] (Figure 3).
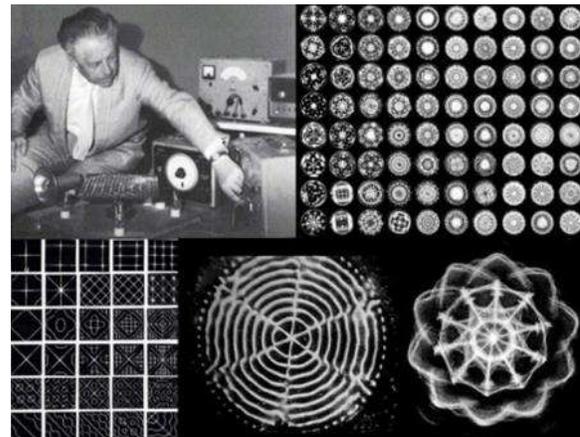
Figure 3: Translating the preludes of Bach's first book to virtual geometric forms by a parametric software using a system of numbers and ratios [3].

Figure 2: Patterns created by John Stuart Reid through the replication of Chladni's experiment. (source: URL1)

In one of the contemporary research conducted by Martin Wattenberg in 2002, he used arched diagrams to transform the most famous musical works in the world into diagrams. In his research he posits that the relations existing between pieces of pre-modern music have much more layers compared to the post-modern music, and he compared them with the diagrams derived from some modern famous pieces of music [4] (Figure 4).

Figure 4: In this figure, we see diagrams presented by Martin Wattenberg in order for showing the musical structure while playing different musical pieces [4].
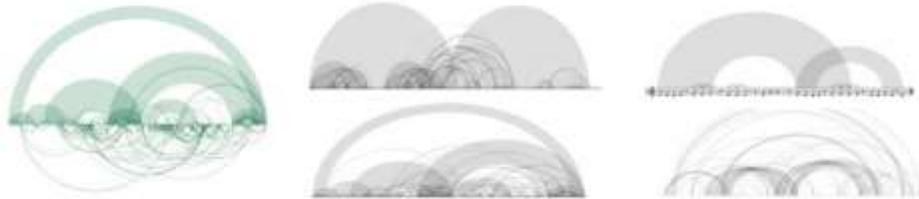

Figure 5: Inspired by the experiments of Hans Jenny and medieval Moroccan mosaics, Lydia Sharman uses small icons in the form of a silver pendant, an intaglio plate or a silk screen image based on these fundamental geometries, and then connects and expands them over the surface in closed or open repeating forms [2].

Discursive and sometimes purposeful studies have been carried out on the direct relationship between architecture and music. Iannis Xenakis who gained experiences in the field of geometry and proportionalities in architecture through Le Corbusier, has emphasized in his book entitled "Music and Architecture", the role of geometry science in synchrony and the connection between these two arts. He has reviewed cases where the music is transformed into an architectural work, in his own experiments and the works of some other architects. In the final section of his book, he emphasizes, "The relationship between music and architecture is of virtual and mental type, and not a real one"[5].

Although many studies were mentioned in the literature of the current research regarding the relevant initial principles, and some studies have examined the visualization of an image derived from a note, the current study has focused on the morphology of a complete piece of music, which distinguishes it from previous works in this field.

3. Research Methodology

Within the first phase of the study, correlational research method and survey questionnaire are used in order for determining the favorite music of the elderly. Among the different methods for data collection, survey questionnaire is mostly used in correlational research. Indeed, two phrases of "survey questionnaire" and "correlational research" have commonly been used interchangeably. The main advantage of survey questionnaire is collecting extensive data about demographic characteristics as well as behavioral habits, beliefs and attitudes on different issues, from a large population within a short time. Survey questionnaire is often used in studies regarding the interaction between social and cultural issues or the environmental perceptual concepts. However, this method is also applicable to the different topics of architecture [6]. In the following, to understand the relationship between the impression derived from music and the perception of the produced

image, simulation has been used. Groat based on Crano and Brewer's statement, sees the simulation research as an experimental tool to examine the theoretical positions, and that the data collected through this kind of research can be used to introduce new theories. She continues that simulation research could add to the strength of confirming or rejecting the hypothesis, since it has the substantiation ability [6].

3.1 Architectural and Musical Atmosphere

Although many have been written on the nature and whatness of atmosphere or space, there is a deep belief that we are in initial stages of explaining and perceiving it. By the multiple and various relationships between objects and elements, atmosphere is visualized, and the complexity of these relationships makes understanding the atmosphere more difficult [7]. The most operational definition of atmosphere is the one that includes both elements of humans and their surrounding atmosphere (i.e., a definition in which atmosphere is created as a result of the interaction between humans and their surrounding environment, or the interaction between mentality and objectivity). The multiplicity of this interaction, reflects the richness of humans' experience in the atmosphere.

In Mallah's opinion (1991), by space one could refer to either a position and place, or an emotional and psychological environment or an atmosphere or ethereal atmosphere. In all kinds of art, one of the purposes of those creating artistic works is developing an emotional-psychological atmosphere. In the art of architecture, atmosphere has a special place. The artist architect, also, like other creators of artistic works, is able to instill the same emotional-psychological atmosphere into the audience by creating different atmospheres likewise a musician creates the same atmosphere by the use of tones and musical instruments [8].

Accordingly, there is always a connection between the observer and the atmosphere, and a regulated relation connects these two to each other [9]. According to the theory of Hans Jantzen, an art historian, the analysis of the formalistic atmosphere in which the artistic work is described as an independent formalistic style, shows that the semantic aspect of the atmosphere, also, should be reflected by the artistic work [10].

Based on Zuckerkandl's theory, the diversity of the relations in musical atmosphere is also an issue worthy of note and "the concept of atmosphere not only means something that faces me, but also a place in which whatever faces me, interactively connect with each other, too". The main assumption of the theory is that music belongs to the external world, and its atmosphere is flowing. According to this theory, as atmosphere is a place for the phenomena to face and connect with each other, music has physical atmosphere [11]. However, Bowman believes that the musical atmosphere is not objective, so one cannot merely feel it by visual senses, physical power and geometry knowledge. The musical atmosphere is of phenomenological type; an atmosphere that changes and flows without going anywhere. But, all of the mentioned features are true for an atmosphere that is perceived by our conscience mind and our all senses, and not only through our auditory sense [12].

The perception of the musical atmosphere plays an important part in Clifton's philosophy. Atmosphere belongs to four constructive elements: music, time, performance and feeling. In Clifton's theory, the musical atmosphere is not only a visual and physical atmosphere, but also it includes lines, flat screens and surfaces which manifest different levels of elegance and softness, or includes masses which reflect different levels of rigidity [13]. According to what was said and Robinson's theory, it can be concluded that there

are two approaches in the definition of musical atmosphere: one group sees music as an absolute auditory design art and do not assume that a sort of atmosphere exists in the music. The other group sees music as a combinational art which represent meaning through words or associations [14]. Although according to the latest research, Davies emphasizes that the second approach is more precise, he explains that the spatiality of music is not something created accidentally, but it is created by the planned design of the composer [15].

It is necessary to be emphasized that although the main context of linking architecture and music is atmosphere, which is construed as three-dimensional or multidimensional, in most of the studies like the current one it is believed that transforming music into two-dimensional forms, creates an opportunity to develop the perception of a three-dimensional atmosphere. This section is ended by a quote from Iannis Xenakis who says, "Whether we want it or not, there is a link between architecture and music. This is an issue based on our mental structures which is the same about these two types of art"[8].

### 3.2 Statistical Population and Determining the Favorite Music

As mentioned in the Introduction section, after surveying the type of music, the purpose of the

study is to investigate the relationship between style and the rhythm of the music with the forms created as a result of it, and then to establish a relationship between the feeling and interest towards the type of music and the features of the forms obtained from it. The sample population is a group of the elderly, who were 65 years old or over and reside at nursing house. They were randomly selected from three nursing houses throughout Mashhad City. Accordingly, the statistical population included 93 participants. To determine their favorite music, survey questionnaire was used.

The questions were related to the selection of their favorite music style among three styles of Pop, Traditional and Rock music. In order to remove potential ambiguities, for each style some pieces of music were played. Then the participants expressed their opinions about their favorite music.

The results indicated that traditional music was the most favorite one (57%) and Rock music the least favorite one. Therefore, for the subsequent survey, Iranian traditional music was selected. In this regard, questions were asked about three types of tempos: 2/4, 3/4 and 6/8. The results showed that tempo 2/4 was the most welcomed tempo (68%), next tempo 6/8 (26%) and then tempo 3/4 (6%).

Figure 6. The favorite music type and the favorite music tempo of statistical population, the elderly (source: authors)
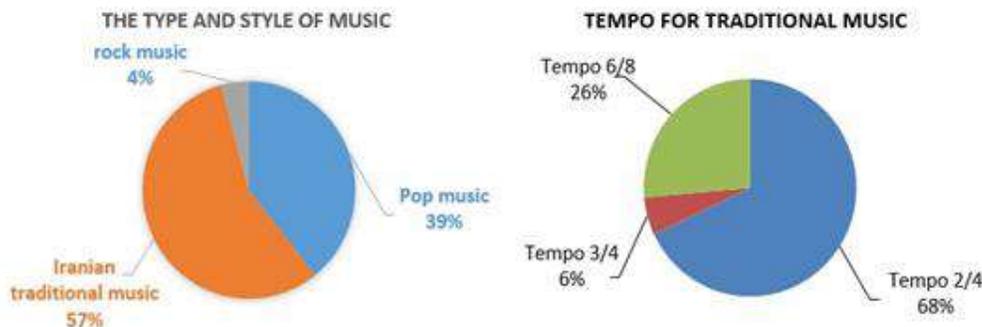
In the second phase, for the simulation and transforming music to patterns, Chladni's technique was employed. First, measures were taken to invent a tool in order for creating vibrations with different frequencies, in such a way that proportionate to the frequencies of vibrations, linear or shape patterns of music are emerged. Therefore, a thin metal screen was used together with a speaker to produce vibrations with different frequencies. The vibrations of the sound gradually resulted in accumulation of salt in special points of the screen and the creation of nodes of waves on the metal screen.

The effects of the music and the derived form were recorded in the beginning part, climax and the final part of the music, and photos were taken from the patterns shaped due to the vibrations produced within the three stages. The data were analyzed comparatively.

3.3 Producing a Form out of music and Data Analysis

The statistical results indicated that traditional music played using tempo 2/4 is favored by most of the elderly. In this phase, two different traditional pieces of music with 2/4 rhythm which were counted as simple tempos, were selected based on the sample's taste. It seems that music produced by tempo 2/4 is a sort of introverted music with simple rhythm, which is used in most of the calm and sad songs. By instilling a feeling of concentration, such music immerses the individual in dreams and thoughts. It is necessary to note that rhythm is the first common factor between the arts of music and architecture [8]. As

the issue of rhythm in music is dependent on the factor of time, it is dependent on the atmosphere in architecture, and there is a special coordination and consistency between the two [16]. The rhythm and the frequency governing each main rhythm create the main arrangements of the musical atmosphere, and they definitely have direct influence on the shape derived from the music. The important difference between this simulation and the previous modeling lies within the difference between the simulation of one note or a complete piece. Clarity derived from one note and one frequency is definitely more. Therefore, a piece of music creates a more comprehensive though general image which is affected by the main arrangement and the whole music, particularly its main rhythm.

By playing the music number 1 for the first time within a determined time interval (from the beginning to the end of the music piece) the pattern of shaping particles changed from the first stage to the third (Figure 1). The second stage shown in the Figure is created at the climax of the music, which trivially and subtly changes to the end of the piece of the music. The final image which consists of concentric circles represents a sort of all-round symmetry, unity, balance and proportionality between the three central, middle and marginal areas.

To achieve relatively definite results and reduce errors, the same experiment was conducted with the same music and maintaining the same conditions for all the environmental variables (Figure 7).
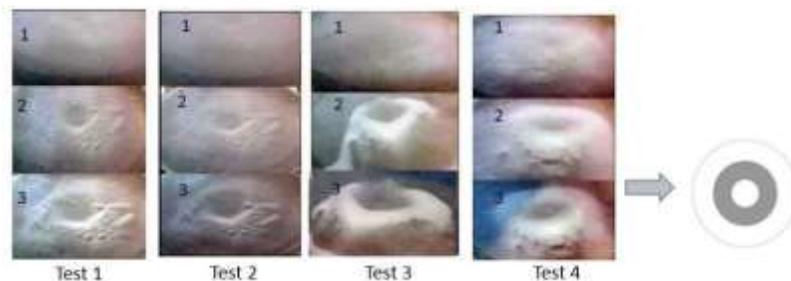

Figure 7. Test 1 to 4 (from left to the right): The experiment is conducted by employing tempo 2/4 in two different songs. To reduce errors maximally in the results of playing the song and photo taking, the stages of producing the shape were repeated twice, which led to the pattern shown above (source: authors).

Then by selecting another piece of music whose only common point with the previous one was using tempo 2/4, the experiment was repeated, the results of which are presented under the above figure. It was revealed that the obtained image is similar to the results of the first experiment, and rhythm 2/4 in traditional music produces similar concentric circles including three central, middle and marginal areas. Such features as calmness, discipline and introversion seen in the image manifest its hidden and considerable relationship with the emotional-psychological effect of such music style.

To confirm our opinions, it was necessary to do the same experiment for other tempos. Therefore, the same experiment was conducted for tempo 3/4 and 6/8 in order for comparing new patterns with previous ones. As shown in Figure 5, by playing the music with tempo 6/8, the general pattern of the image changes from state 1 through 3 and an image like a star with six angles is produced. Accordingly, this tempo of traditional music which has faster rhythm and is happier, results in a shape with less introversion (Figure 8).

With regards to the piece of music playing with tempo 3/4, the results are shown in three consecutive stages in Figure 6, and includes a pattern consisting of four cycles which are on the perimeter of a central circle. It is also shown that the image is more extroverted and establishes more relationships with the environment compared to tempo 2/4. It seems that the faster and happier the tempo, the less introversion in the image (i.e., it becomes extroverted). And the image also manifests more rhythm and internal parts out of itself (Figure 9).

Figure 8 (left): The simulation is conducted by tempo 6/8, and the images were photographed within the three stages, and the geometric form of the last image is displayed, which has a six-part structure around the center. (Source: authors)

Figure 9 (right): The simulation is conducted by tempo 3/4, and the final image consists of four cycles around a square. (Source: authors)
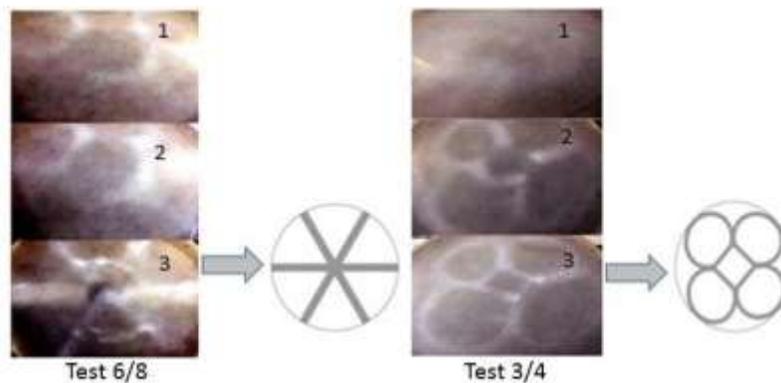
4. Conclusion

In the current study, by assuming that there is a relationship between the image obtained from musical waves and the impression derived from it, and by reviewing the nature of atmosphere as a common and fundamental point between architecture and music and explaining the experiences on transforming sounds into forms, the grounds were provided to deepen the relationship between these two pure and practical types of art. The evaluated group (statistical population) consisted of the elderly, and their favorite music (the traditional music of Iran) was simulated by the use of different tempos of 2/4, 3/4 and 6/8, based on Chladni's method. The

experiment and observations showed that the happier the rhythm of the music, the more extroverted the geometric shape (i.e., the geometric shape changes from introverted state (tempo 2/4) to extroverted state (tempo 3/4 and 6/8)). And it has also more geometric parts. In other words, a music with fast rhythm and extroverted shapes including multiple elements creates an impression of happiness on the audience. In the contrary, a sad music with slow rhythm creates introverted shapes with more limited elements.

At the end, with an emphasis on the Schumann's words who says, "Only if the form is first clear to you, will the spirit then reveal itself" [8], the research directs us to another hypothesis: We could use the relationship between the impression derived from the music and the perception from the simulated shape to produce architectural works. In other words, by considering the favorite music of the individuals and the features of the shape derived from simulation, we could transform the music into an appropriate architectural work. Given the mentioned hypothesis, the authors believe that the interest of the elderly towards traditional music with tempo 2/4 indicates that most of them tend for introverted architectural atmospheres.

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