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VISUALIZING MUSIC COMPOSITIONS IN ARCHITECTURAL CONCEPTUAL DESIGN

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Abstract

The relationship between music and architecture goes back to the early history when Vitruvius conceived Architecture as “one of the most inclusive and universal human activities” where the architect should be educated in all the arts, having a vast knowledge in history, music and philosophy. Architecture and music are based on creativity and design principles such as rhythm, proportion, harmony, unity, repetition and others. They share art relationship through performance and visual techniques to create alternative innovative design proposals. The study aims to achieve a new conceptual design-thinking module in architectural education by focusing on the principles and factors of music and the ability of applying it in the architectural design process through an exercise or workshops.

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VISUALIZING MUSIC COMPOSITIONS IN ARCHITECTURAL CONCEPTUAL DESIGN

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ABSTRACT

The relationship between music and architecture goes back to the early history when Vitruvius conceived Architecture as “one of the most inclusive and universal human activities” where the architect should be educated in all the arts, having a vast knowledge in history, music and philosophy.

Architecture and music are based on creativity and design principles such as rhythm, proportion, harmony, unity, repetition and others. They share art relationship through performance and visual techniques to create alternative innovative design proposals.

The study aims to achieve a new conceptual design-thinking module in architectural education by focusing on the principles and factors of music and the ability of applying it in the architectural design process through an exercise or workshops.

KEYWORDS

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1. INTRODUCTION

“No doubt, that the branches of arts are unified in one connected chain, each branch is affected by the others, thus the branches of music and architecture” (Dewidar, El-Gohary, Aly, & Salama, 2006.). Architecture has been considered the most influential art, which shares the same characteristics with music. As a performance art, music is very similar to architecture as a visual art; the speculations about the relation between music and architecture are probably as old as both arts. They occur on two levels: the intellectual and the phenomenological. The first interpretation dates back to ancient Greek, they are linked with the problems of form and structure. In the 18th century. The German thinker Johann Wolfgang von Goethe said that “architecture was music become stone” (Sterken, 2007) and “Music is liquid architecture, architecture is frozen music “. More recently, in the 20th century, Iannis Xenakis studied the similar structural principles between music and architecture creating his own “models” of musical composition based on mathematical principles and geometrical constructions. (Variego, 2011)

With music and architecture intermeshed relationship, the tendency has been perceived music as a metaphorical structure which required translation to visual terms before becoming available to architecture.

The problem of all designer is finding a new innovative ideas or concepts, therefore this relationship between music and architecture could be a new approach to find a learning process to create new musical thoughts in architecture based on the similar principles of music such as rhythm, harmony, repetition and others.

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The research defines the different terminologies used in musical structure to compare it with the field of architecture, in order to find the intersected areas that could be use in architectural design education.

2. THE ELEMENTS OF MUSIC AND ARCHITECTURE

Music is something that people interact with; music is comprehended from its sound produce and the cultural background of the producer.

The paper suggests the relationship matrix between Music and Architecture by studying the four main components of musical structure: Rhythm, Melody, Harmony and Form and their impact on the architecture design levels: plans, elevations, and structure, form and interior elements as shown as Fig.1.

	1	2	3	4	5
Rhythm	Plans	Elevations	Structure	Form	Interior
Melody					
Harmony					
Form					

Fig. 1 Matrix Relationship between Music & Architecture, Reference: Authors

2.1 Rhythm And Meter

Rhythm is the pattern of regular or irregular pulses caused in music by the occurrence of strong and weak melodic and harmonic beats, the unit which measure the rhythm is Meter which measures music in regular pulse groupings, called measures or bars. The signature or meter signature specifies how many beats are in a measure, and which value of written note is counted or felt as a single beat (Titon, Cooley, Locke, McAllester, & Rasmussen, 2009), (wikipedia, Music_theory, 2016). In architecture, a beat or pulse appears as an element that is repeated strictly at identical intervals (Janson & Tigges, 2014).

There are many types of musical rhythm such as:

- **Metrical rhythm:**

It is by measuring the time-relations between the sounds and find a pattern of regular recurrence.

- **Polyrhythm:**

It is by playing simultaneous rhythms in more than one time signature, the popular music they listen to usually has more than one rhythm. The singer's melody falls into one pattern, the guitarist's into another; the drummer usually plays more than one pattern at once. Even though these rhythms usually relate to the same overall accent pattern, the way they interact with each other sets our bodies in motion as we move to the beat.

- **Free rhythm:**

It is used in Arab music non-metrical music that is singing and instrumental improvisation in free rhythm (Titon, Cooley, Locke, McAllester, & Rasmussen, 2009).

Rhythm in architecture is characterized by repeated patterns or alternation of formal elements or motifs in the same or a modified form (Ching, 2014). These repeated patterns could be regular or irregular pattern which, is defined in music as a metrical rhythm,

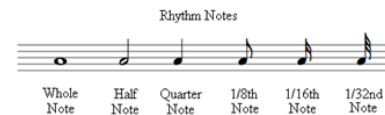


Fig. 2 the rhythm notes

Reference:

<http://www.pianotricks.com/lesson.php?input=177>

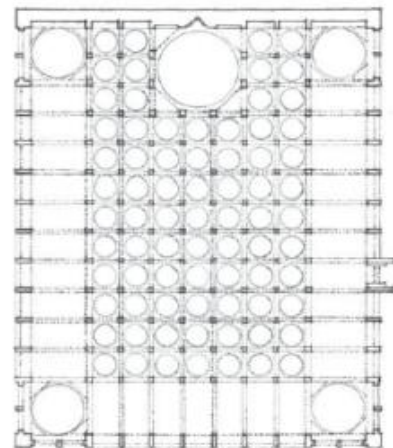


Fig. 3 shows the Rhythm in structure elements in architectural plan.

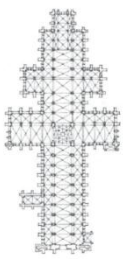

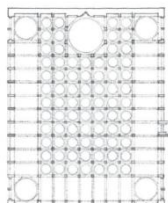

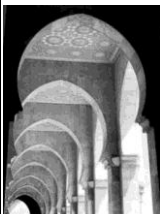

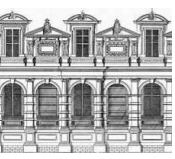


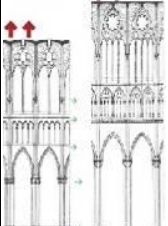
Reference: Ching, 2014

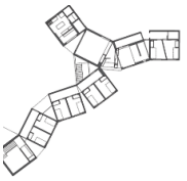




polyrhythm or free rhythm. The rhythm could be presented in plans, structure, elevation, form of masses and in interior spaces.

- Rhythm in plans:
Rhythm appears as a repetition of elements such as design module, units of design and others. Also in interior space elements and decoration.
- Rhythm with structure elements:
The repetition of frames, beams and columns create structural bays and modules rhythm.
- Rhythm in elevation:
The repetition of openings, structural elements and decoration is forming a sort of polyrhythm in elevation designs.
- Rhythm in form or composition of masses:
The repetition and organization of masses together creates a sort of repetition pattern.

Table 1 shows the musical rhythm and meter and their application in all levels of architectural design such as plan, elevation, structural elements, form of masses and interior design elements.

Table 1. Applies Musical Rhythm and Meter in Architecture
Reference: The Authors

Music element		Application in Architecture				
		Plan design	Elevation design	Structural elements	Form of masses	Indoor elements
RHYTHM	Metrical-rhythm	 <p>Rhythm in plan module</p>	 <p>Columns and decoration repetition in equal spaces</p>	 <p>Rhythm in module and structure elements</p>	 <p>Building form has a metrical rhythm</p>	 <p>Interior arcades create a metrical rhythm in equal spacing</p>
	Poly-rhythm	 <p>Two types of rhythm in plan</p>	 <p>The repetition of arches , windows , columns and decorative elements create a polyrhythm in elevation</p>	 <p>The structure elements between columns and walls create a poly-rhythm</p>	 <p>Floor repetition and side masses creates a polyrhythm in masses</p>	 <p>The repetition of arches , windows , and decorative elements create a polyrhythm in these interior walls</p>

Free-rhythm					
	The same unit repeated in a free rhythm in plan	The elevation skyline have a free rhythm by repeating the same shape but in different proportions	The structure has a free rhythm creation	Free rhythm in masses	Repeating same element in different orientation

2.2 Melody

Melody is the main bond of music. it consists of several terminologies some of them have direct relation with architecture terminologies like color, emphasis, scale and style but others could be need more effort to find relation between melody terminologies in music and in architecture such as pitch, intervals, octave and articulation (Titon, Cooley, Locke, McAllester , & Rasmussen, 2009).

Commonly melody refers to the tone which is the part of music that goes up and down, the part that most people hear and sing along with by another wording. The main element of the music melody is the tone by organizing several tones together with different pitches and intervals.

Architecture tone refers to the architecture elements such as columns, doors, windows, furniture and others.

There are essential terminologies that should be defined such as:

- Pitch:

It is a musical tone quality which refers to how high or low a note is. The pitch of a note can be measured in a unit called Hertz. (Rath, 2016) Pitch in architecture could be referred to the quality of this element in volume. The biggest element is higher pitch than the smallest one comparing to the measurement unit scale of architectural part either surface such as area or volume such as room (Titon, Cooley, Locke, McAllester , & Rasmussen, 2009).

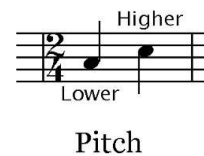


Fig. 4 shows pitch types between higher and lower

Reference: <http://donrathjr.com/wp-content/uploads/2010/01/Blog-Aticle-Graphic-Pitch.jpg>

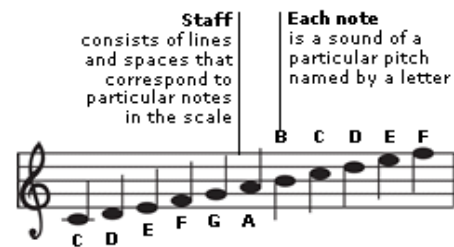


Fig. 5 high lights different pitch notes

Reference:

<http://www.infoplease.com/images/ESCI104MUSSOU007.gif>



Fig. 6 shows Melodic and harmonic intervals.

Reference:

<https://en.wikipedia.org/wiki/Interval>

- Interval:

It is the distance between pitches in another word interval is the difference in frequency between two pitches. There are two ways to describe an interval the first is Vertical or harmonic if the two notes sound simultaneously. The second is Horizontal, linear, or melodic if they sound successively (wikipedia, Music_theory, 2016) (Titon, Cooley, Locke, McAllester, & Rasmussen, 2009). Also in architecture the intervals are the distance between elements in vertical direction like elevations or horizontal direction such as the spaces between masses in plan.

- Timber (or Color):

It is a kind of tone quality in music. Timbre is caused by the characteristic ways different voices and musical instruments vibrate. Timbre tells us why a violin sounds different from a trumpet when they are playing a tone of the same pitch (Titon, Cooley, Locke, McAllester, & Rasmussen, 2009). the instrument voice often described in terms like bright, dull, shrill, etc. In architecture Timber or color from its name and definition in music it reflects the material of each element and its appearance characteristics such as coloring, brightness, darkness and others.

- Emphasis:

It is a critical aspect of melody to pay attention to in world music, could be by contrasts notes or melodies or by add decorative tones which called ornaments (Titon, Cooley, Locke, McAllester, & Rasmussen, 2009). Emphasis in architectural design it refers to focal point or special element or feature which attract the observer. It could be by contrast in shape, size, color, texture and others.



Fig. 7 shows major scale

Reference : Wikipedia, Music_theory, 2016

- Scale (or solfe`ge major scale):

This is the familiar do-re-mi (solfe`ge) scale which present in the White Keys of the piano which have different intervals (distance between pitches) between them. There are many types of scales like harmonic minor, melodic minor, natural minor, octatonic scale, five-tone scale and others (wikipedia, Music_theory, 2016), Octave : (the solfe`ge interval between one "do" and another). The major scale and minor scale in music could be refers to monumental scale and human scale in architecture. (Janson & Tigges, 2014)


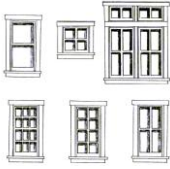
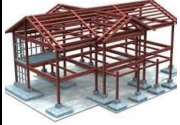


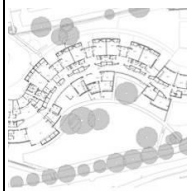




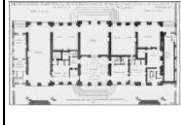
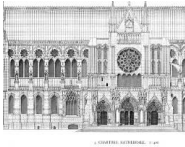








- Style:



















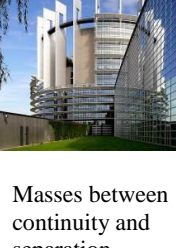
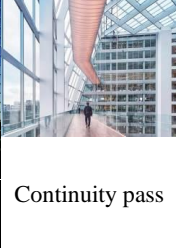
Musical style use melody in different ways such as jazz, rock, popular, folk, Indian classic, classical music and others. (wikipedia, Melody, 2016) Also we have different styles in architecture some of them have same common names with music styles

- Articulation:

It is the way of the sound performance such as legato (smooth, connected); tenuto (pressed or played to full notated duration); marcato (accented and detached); staccato ("separated", "detached"); martelé (heavily accented or "hammered") ...etc. the different between type or articulation and another is the duration for example staccato is the shortening of duration compared to the written note value, legato performs the notes in a smoothly joined sequence with no separation. (wikipedia, 2016) In architecture Articulation also appears in organizing the architecture elements could find different type of articulation which represents in the visual continuity of these elements in its located area or space, table 2 shows the musical melody and its application in all levels of architecture design.

Table 2. Applies Musical Rhythm and Meter in Architecture
Reference: The Authors

Music element		Application in Architecture				
		Plan design	Elevation design	Structural elements	Form of masses	Indoor elements
MELODY	Pitch	 Pitch in plan is the space the bigger the space the higher the pitch	 Pitch in elevation is the openings or decoration features	 Every structural elements is a pitch	 Every mass is a pitch	 Every piece of furniture is a pitch
	Timber or Color	 the type of plan module describe the plan color	 related to material and colour of elevation	 types of materials of structure elements (timber , steel , concrete)	 using different materials and colors in masses	 color is a main feature in interior design
	Intervals	 The spacing in design modules refers to intervals	 Spacing between features and compositions	 The spaces between structure elements	 The spaces between masses	 The spaces between indoor elements
	Emphasis	 Center of the plan	 The highest and unique part in the elevation	 The unique structure	 The contrast mass	 The contrast color wall

MELODY	Major Scale					
		Plan of biggest projects	The higher elevation	High rise buildings	Mega structure systems	Huge inner spaces
	Minor Scale					
		Plan of smallest projects	The 2 or 3 floors buildings	The small structure	The small mass	The intimate scale
Style						
	The style could appear in plan	Every elevation has its style	Style in structure	Style in masses	Style in interior spaces	
Articulation						
	The continuity in plan	The level of continuity in elevation	The continuity in structure	Masses between continuity and separation	Continuity pass	

2.3 Harmony

Harmony is often said to refer to the "vertical" aspect of music, as distinguished from melodic line, or the "horizontal" aspect (Jamini, 2005), it is also a part different from the melody, at the same time You hear the intervals between the tones not only in a sequence, as in a melody, but also simultaneously. (Titon, Cooley, Locke, McAllester , & Rasmussen, 2009). In architecture, it refers to two categories; the first is the horizontal harmony which appears in areas between elements of architecture such as plans or elevations. The second is the vertical harmony which combines and integrates several layers of architecture together such as structure, function, zoning, landscape, furnishing and others, for example, the relation between the built area and the landscape that could complete the main concept of the design or the continuity of architectural masses.

- Chords:

These simultaneously sounding tones consists of harmonic set of three or more notes (Bruce & Saker , 2003), (Karolyi , 1965), (wikipedia, Music_theory, 2016), chords could be seen also architecture vertically in a architectural building, such as using a combination of elements to create a harmonious composition.

- Texture:

It describes how melody and harmony interact in music. But in architecture, the texture is the softness and hardness of the surface that could be understudied physically or visually while music applies texture as integration between elements as a melody and surfaces as a harmony.

On another hand, there are different types of harmony in music such as:

- Monophonic:

When the musical texture consists of a single melody only.

- Heterophonic:

When two or more voices elaborate the same melody in different ways at roughly the same time.

- Polyphonic:

When two or more distinct melodies are combined, the texture is polyphonic.

- Homophonic:

When two or more voices are combined in a way that one dominates and any others seem to be accompanying the dominant voice—or what most people mean when they say they hear a harmony. (Titon, Cooley, Locke, McAllester , & Rasmussen, 2009) , In architecture also could find the harmony in one element or a combination of elements or in a layer of thinking such as plan, elevation, landscape...etc. or the combination in all of the design layers. Table 3 shows the musical harmony and its application in all levels of architecture design such as plan design, elevation design, structure elements, form of masses and interior design elements.





Fig. 8 harmony in music

Reference:

<http://www.bluesjazzpiano.com/piano-harmony.html>

Table 3. Applies musical harmony in architecture
Reference: The Authors

Music element		Application in Architecture					
		Plan design	Elevation design	Structural elements	Form of masses	Indoor elements	
RHYTHM	Texture	Monophonic					
			The building without context has a single melody	Monophonic elevation harmony	One structure system for all the building is monophonic	All masses have one main material and texture	The melody of elements use one color tone
		Heterophonic					
			Different layers (building and landscape) elaborate the same module in different way	Same elevation element in different direction	Same structure material by opposite direction	The same curvilinear masses by different orientation	Same interior square feature in the different layers (floor and ceiling)
	Polyphonic						
		Two modules are combined one for building other for open spaces	Two different materials	Two structure systems, one for the outer shell of the building other for indoor floors	Two different orientation between masses and landscape	Two different patterns in floor and ceiling in the same orientation	
	Homophonic						
		The building dominates and the landscape is accompanying the building plan	The solid material dominates and all other features in elevation are accompanying it	The two main structures dominate and other buildings are accompanying them	The mass dominates and the landscape is accompanying the mass	The staircase dominates and other interior elements are accompanying it	








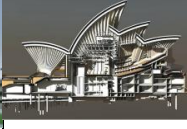


2.4 Form

The term musical form or musical architecture refers to the overall structure or plan of a piece of music .its structure consists of compositions, which are divided into patterns. To understand form in music, we look for patterns of organization in rhythm, melody, and harmony. Patterns of musical organization involve, among other things, the arrangement of small- to medium-sized musical units of rhythm, melody, and/or harmony that show repetition or variation these patterns could be organized in a sort of repetition (Titon, Cooley, Locke, McAllester , & Rasmussen, 2009).

In architecture also form consists of elements such as plans, elevation, structure elements, masses, landscape, interior spaces, context relation, environments features...etc., these elements creates a compositions. Each composition has different patterns of repetitive units.

Table 4 shows the musical form and its application in all levels of architecture design such as plan design, elevation design, structure elements, form of masses and interior design elements.

Table 4. Applies musical form in architecture
Reference: The Authors

Music element		Application in Architecture				
		Plan design	Elevation design	Structural elements	Form of masses	Indoor elements
FORM	Compositions	 The composition of design consists of patterns	 Composition of elevation patterns	 Structure composition consists of small patterns	 Form of masses composition consists of multi patterns	 Indoor space composition consists of multi patterns of furniture, cladding...etc.
	Patterns	 Every pattern consists of repetitive unit	 The repetitive unit of elevation pattern	 Each structural pattern consists of small units	 The repetitive units of mass patterns	 Each indoor pattern consists of repetitive units

3. THE CONCEPT OF CREATION IN MUSIC AND ARCHITECTURE

The word Music derived from Greek word “Moesia”, which is the name of the god of poetry, literature and music in ancient Greek. Music described as the art of expressing emotions by voices. Sound and rhythm are the most important factors of it. It is also the knowledge of sound combination in a way that is pleasant and leads to pleasure and mental revolution (Falakian & Falakian, 2013).

There were a few attempts in using the music approach to create new architectural concepts, one of this attempts was the analysis of music layers and its impact on the architectural form , it could be through three approaches , as following : (music-and-architecture, 2016)

1. Visualizing music compositions to its basic components: - by listening to music and transfer it to graphically diagrams. (As shown as Fig. 9)

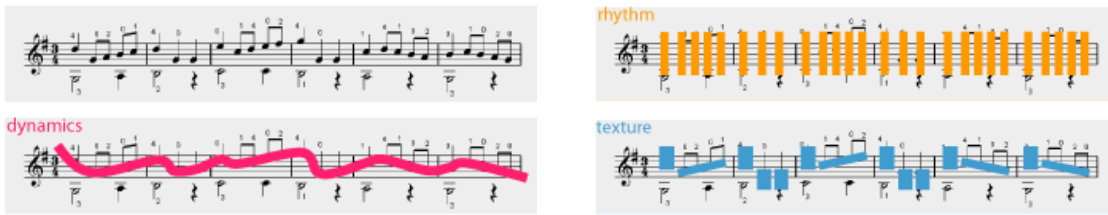


Fig. 9 Visualizing music compositions
Reference: music-and-architecture, 2016

2. Form musical mapping: - by analysis, an architectural design building through the principles and factors of music. (As shown as Fig. 10)

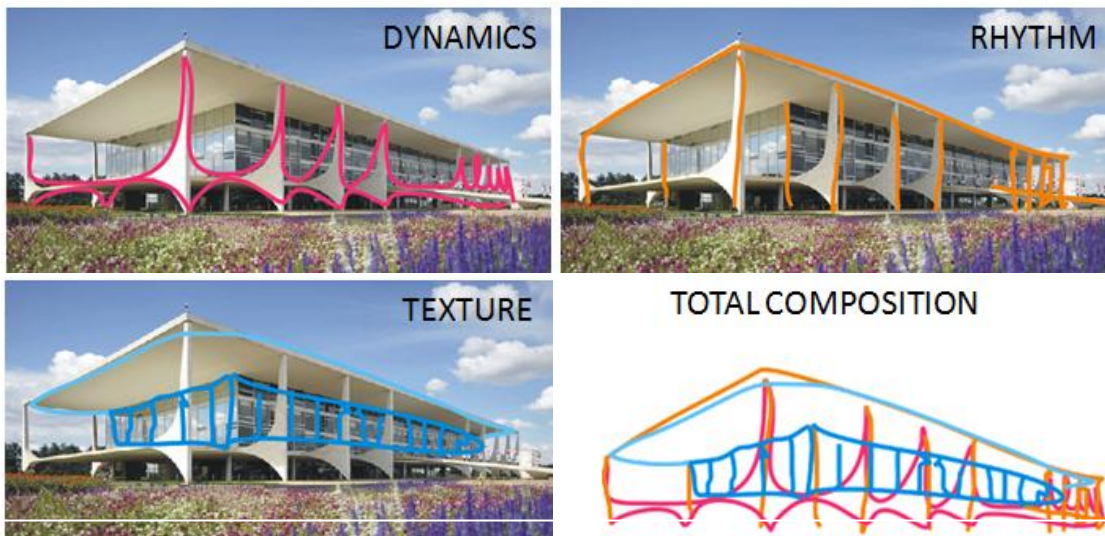


Fig. 10 Form musical mapping
Reference: music-and-architecture, 2016

3. Making architecture dance:-by transfer the music layers into an architectural form or Turn your diagram into a façade of a building. (As shown as Fig. 11)

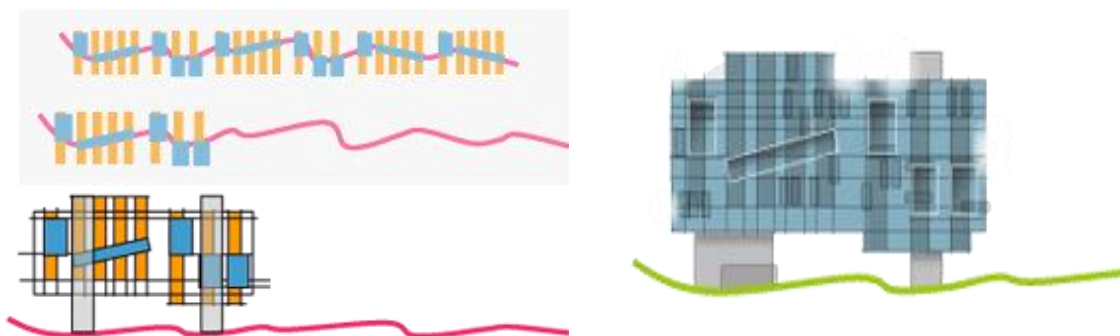


Fig. 11 Making architecture dance
Reference: music-and-architecture, 2016

4. MUSICAL CONCEPTUAL DESIGN THINKING MODULE IN ARCHITECTURAL EDUCATION

Creating new module in design education needs to establish an innovative approach to be considered in the design studio based on the relationship between Music and Architecture through the three main stages of the design process as following (Lawson, 2005): (As shown as Fig. 12).

- **Analysis:**
Studies the theoretical background of the music components through data gathering and advising students to choose a piece of music, analysis it to the main components and studying the impact on the levels of architectural design.
- **Synthesis:**
Creates new architectural design alternatives based on the analysis of the chosen piece of music.
- **Evaluation:**
Evaluates the design alternatives to select the ideal one. Consequently, the design module could be in two ways or approaches (As shown as Fig. 13):

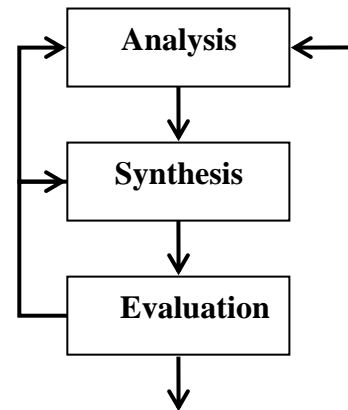


Fig. 12 Design Process
Reference: Lawson, 2005

- A. The vertical approach contains the stages of design process (analysis, synthesis and evaluation)
- B. The horizontal approach is through the level of design (plans, elevations, structure, form and interior spaces) to get a comprehensive study of the design project.

Fig. 13 Matrix Relationship between Music & design process
Reference: Author

		Levels of Design				
		Plans	Elevations	Structure	Form	Interior spaces
Design Process Stages	Analysis	Analyze the piece of music and apply elements of music (rhythm, melody, harmony and form) in different fields of building design				
	Synthesis	Create different compositions and design alternatives by using the concept of applying music elements in architecture				
	Evaluation	.Evaluate design alternatives and its relation with musical elements				

5. CONCLUSIONS

- A. This paper suggests an innovative tool to create new conceptual ideas in architectural design based on direct relationships between musical elements and the different levels of architectural design.

- B. Most previous studies of design through music was not based on the study of aspects of music and the intersected areas which could be used in architectural design education.
- C. There are similarity between music and architecture, where the music can be regarded as a source of innovative architectural ideas.
- D. The paper suggests an architectural module merging music in architectural conceptual design through theoretical and applied approaches by using the four main components of music rhythm, melody, harmony and form and their impact on the architectural design fields through plan, structure, elevation, landscape and others. to find new architectural innovative ideas or concepts from new intellectual approach.

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