ABSTRACT

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Many scholars have discussed the relationship between architecture and music. Design methodologies have been created to highlight this intersection, attempting to attain the sublime. While architecture theorists have used western music as a foundation, this thesis aims to investigate this relationship in a non-western setting. Music would be used as a cultural identifier, to unlock "hidden dimensions" shared in language, music, and architecture.

The case study site is historic Cairo, between the Fatamid Walls. For the past two centuries, Cairo has abandoned its cultural heritage and embarked on a process of westernization. Those who seek to hold onto the city's identity are abusing traditional motifs in a manner that seems cliché and somewhat absurd. The thesis calls for a deeper understanding and evolution of Cairo's heritage, using concepts of the Arabic Melodic modes, *Maqams*, to create a place for listening, *al Masmaa'*.

ARCHITECTURE: MUSIC, CITY, AND CULTURE

By

Mahmoud Riad

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Advisory Committee:
Professor of the Practice, Peter Noonan, AIA
Professor Robert L. Vann, PhD
Associate Professor Brian Kelly, AIA
Visiting Assistant Professor Elliot Bates, PhD
Professor Emeritus William Bechhoefer, FAIA

Preface

If needed.

Foreword

If needed.

Dedication

I would love to dedicate this to my family; Mohamed, Rajaa, and Khaled. Without your support over the years, none of this could have happened.

It was all worth it

Acknowledgements

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Chapter 1: Introduction

Throughout history, music has been looked upon as either an intellectual body or an expression of emotion. These two different approaches can be traced back to Greek mythology[1]. In a Homeric hymn to Hermes, the "lyre" is said to have been invented when Hermes proclaimed that a shell of the body could produce sound if its body was used as a resonator. This myth embarks on a discovery of sonic properties in the materials of the universe. The lyre becomes the instrument of Apollo, and music is conceived as external sound that God sent us to remind us of the harmony of the universe. Such music is serene, mathematically derived, associated with transcendental views of Utopia and the Harmony of the Spheres. This train of thought is evident in Pythagoras's teachings and their rebirth during the Renaissance, where music is a subject of the intellect belonging to the seven liberal arts[2] (it belongs in the *Quadrivium* section, along with arithmetic, geometry, and astronomy, while the expression, *Trivium*, includes the arts of grammar, rhetoric, and logic). Arnold Schoenberg's music in the early twentieth century (twelve-tone method of composition)[3] is a good example of such thought in music. The methods of

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[1] The reference to Greek mythology is taken from R. Murray Schafer's *The Soundscape* (Destiny Books, Rochester, Vermont) 1977

[2] The term *liberal arts* refers to a particular type of educational curriculum broadly defined as classical education. Martianus Capella (5th century AD) defines the seven Liberal Arts as grammar, dialectic, rhetoric, geometry, arithmetic, astronomy, and music. The Medieval Western University, established during the Gothic period in Europe, distinguishes the *Trivuim* from the *Quadrivium* as mentioned in the introduction.

[3] Arnold Schoenberg (1874 - 1951) was an Austrian composer associated with the expressionist movement in German poetry and art. He developed the twelve-tone technique of composition, which ensures that all twelve notes of the chromatic scale (musical scale with all the twelve pitches of

expression are number theories, seeking to harmonize with the world through acoustic design.

On the other hand, Pindar's twelfth Pythian Ode tells the story of the beheading of Medusa, leading to the creation of the *aulos*[4]. Athena, Goddess of strategic warfare and heroic endeavor, was touched by the cries of Medusa's sisters over her slaying, so she created a special *nomos* in their honor. In this myth, music arose as subjective emotion. The *aulos* is an instrument of exaltation and tragedy, and the instrument of Dionysian festivals. Such music is conceived as internal sound breaking through the human heart. The music produced is subjective and somewhat irrational (compared to the Apollonian view). It employs expressive devices such as tempo changes, dynamic progressions, and tonal colorings. It is the music of opera, of Bach's passions, of Beethoven's symphonies, of Tchaikovsky's ballets. It is the music of the romantic artist, the kind of music that we associated 18th and 19th century classicism, and the kind of music that we would be trained in today[5].

Music, in general, is found to incorporate both views. The Apollonian thought can be

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western music) are used within composition, with all the notes being more or less equally important, avoiding the music to belong to any key.

[4] An *aulos* (Greek αυλός, plural αυλοί, auloi) or tibia (Latin) was an ancient Greek musical instrument. Different kinds of instruments bore the name, including a single pipe without a reed called the *monaulos* (μόναυλος, from μόνος "single"),[1] and a single pipe held horizontally, as the modern flute, called the *plagiaulos* (πλαγίαυλος, from πλ γιος "sideways"),[1] but the most common variety must have been a reed instrument.[1] Archeological finds and other evidence indicate that it was usually double-reeded, like an oboe,[2] although simple variants with a single clarinet reed cannot be ruled out. Although sometimes embraced, not unlike the lyre, by aristocrats with sufficient leisure to practice it, from the later fifth century on the aulos became chiefly associated with professional musicians, often slaves.

[5] Schafer, R. Murray, *Our Sonic Environment and the Soundscape, the Tuning of the World* (Destiny Books, Vermont, 1977) pp. 6

viewed as a left-brained mode of thinking, a rational view of the universe, as it deals

with issues in music theory like scales, rhythmic value, and acoustical design, or in

other words, the objective scientific aspects of music theory. The Dionysian thought

can be viewed as a right-brained mode of thinking, a subjective emotive view, dealing

with how these scales, rhythms and acoustics properties can be used, altered, and

manipulated to create expressions of emotions.

Architecture theoreticians have talked about the intersection between music and

architecture in both views. This thesis identifies five ways that discuss such

intersections:

Architecture as a Sequence of Harmonic Spaces[6]:

Pythagoras was the first to establish the musical ratios, believing that music could be

represented as pure mathematical ratios, which are the ratios of the cosmos.

Renaissance architects used these musical ratios in their architecture because they

believed that "as man is the image of God and the proportions of his body are

produced by divine will, so the proportions in architecture have to embrace and

express the cosmic order.[7]" This method belongs to the Apollonian view, as it is seen

as an intellect rather than expression. The important factor in this method is

proportion.

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[6] For more, please see Wittkower, Rudolph, *Architecture Principles in the Age of Humanism*, 1971, New York: W.W. Norton & Company

[7] Wittkower, Rudolph, *Architecture Principles in the Age of Humanism*, pp. 101, 1971, New York: W.W. Norton & Company

Architecture as a Stimulus for Movement[8]:

Elizabeth Martin notes that while "architecture represents the art of design in space; music is the art of design in time." Movement through architecture is what links both the units of time and space, so the question becomes, how can architectural elements be placed in space, to influence one's movement patterns. This method belongs to the Apollonian view, as it is seen as an intellect rather than expression. The important factor in this method is *rhythm.*

Architecture as a Musical Instrument[9]:

The architecture of musical instrument relies on both materiality and enclosure of a defined space for sound to be able to resonate throughout the body of the instrument. If architecture is seen as a musical instrument, then the sounds that are generated and manipulated within the space becomes a participant in the whole architectural experience. This method could be seen to belong to both the Apollonian or Dionysian view, depending on its use[10]. The important factor in this method is *acoustics.*

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[8] For more, please see both Yudell, Robert J., *Body Movement*, chapter 7 from *Body, Memory, and Architecture* (Yale University , 1977) and
Xenakis, Iannis, *Musique Architecture* (Tournai: Casterman, 1971)
[9] Blesser, Barry / Salter, Linda-Ruth, *Spaces Speak, Are You Listening? Experiencing Aural Architecture* (MIT Press, 2007) and Rasmussen, Steen Eiler, *Experiencing Architecture*, (MIT Press, 1964)
[10] While acousticians would argue that the manipulation of sound and acoustics is an intellectual art, Sound artists and architecture have used this manipulation to create expressionist spaces that aim to speak to the visitor's emotions, rather than the normal noise control use of most acousticians.

Music as an Inspiration for Architecture (irrational expression)[11]:

Many artists, musicians, and writers have experienced sensations where sound triggers visual stimuli, like color or shapes. This phenomenon is called *Synesthesia.* It is irrational in a sense that the triggers are usually a reflex action that cannot be pre-rationalized. This method belongs to the Dionysian view, as it is an expression rather than intellect. The important factor in this method is *Synesthesia*.

Music as an Inspiration for Architecture (rational expression)[12]:

To be able to translate one art form into another, a level of deconstruction is needed in order to understand the otherwise hidden abstract qualities that the original art form possesses in order to apply it to the other. An analysis is thus performed and rationalized. This method could be seen to belong to both the Apollonian or Dionysian view, depending on its use[13]. The important factor in this method is *deconstruction.*

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[11] For more, please see Cytowic, Richard E., *The Man who Tasted Shapes* (G.P. Putnam's Sons, New York, 1993)

[12] Fore more, please see Xenakis, Iannis, *Musique Architecture* (Tournai: Casterman, 1971)

[13] While acousticians would argue that the manipulation of sound and acoustics is an intellectual art, Sound artists and architecture have used this manipulation to create expressionist spaces that aim to speak to the visitor's emotions, rather than the normal noise control use of most acousticians.

Chapter 2: Architecture as a Sequence of Harmonic Spaces

Section 1: Introduction

The famous quote "Architecture is Frozen Music"[14] seems to be an oxymoron. Music relies on the notion of time, so if music is frozen in time, it is non-audible; where architecture is the art of design in space, music is the art of design in time**.** The key to unravel the connection between both arts, that the above quote suggests, lays in the phrase *Frozen Music*[15]*;* if one understands the musical notes not as vibrations that resonate through time, but as a series of proportional ratios between two notes playing together in harmony. The first half of the chapter explores *musical* proportions and how they may relate to architecture, through the ideas set forth by Rudolph Wittkower in *Architecture Principles in the Age of Humanism*, looking at works of Andrea Palladio and Leon Battista Alberti. While Wittkower and his successors have argued that the use of musical proportions in architecture was never meant to be translated back into musical pieces, one starts to question how would the spaces be affected had it actually been based on a musical piece or standard, one that could be directly translated from the work of architecture, or vice versa. The second half of the paper starts to explore this idea based on Johan Pachelbel's "Canon in Dmaj", detached from any site, program, or economic constraints, to investigate whether

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[14] Quote by German poet Johan Wolfgang Goethe (1749-1832)

[15] The quote "architecture is frozen music" also seems to imply that architecture is a static design of space, a concept that has very much abandoned in 20th century architectural literature. For more, please see both Le Corbusier, *Towards a New Architecture* (Getty Research Institute, 1923) and Lynn, Greg, *Animate Form* (Princeton Architectural Press, 1999)

similar sensations that are felt by listening to the canon could be felt by moving

through the sequence of spaces that correspond to it.

Section 2: Frozen Music (a General Guide to Music Theory)

There are twelve notes found in the traditional Western music vocabulary. Each of

these notes is a *semitone* apart from one another, creating what is known as the

Chromatic scale[16]. The notes in this scale are commonly[17] known as:

A - A# / Bb - B - C - C# / Db - D - D# / Db - E - F - F# / Gb - G - G# / Ab[18]

A s*emitone* (also known as a *half*-step) is the interval between each note and its

successor in the chromatic scale, for an example; a semitone after the A note would

be the A# / Bb note, or a semitone after the B note would be a C note. A *wholetone* is

equal to two semitones, for example; a whole step from an A note would be a B note,

or a *wholetone* from an E note would be an F# / Gb note. The Common ear is able to

distinguish *wholetones* easier than semitones, thus, the musical scales used in most

common Western music are not based on the Chromatic scale, but uses a variety of

Diatonic scales. The difference between them is that while the Chromatic scale relies

on the 12 notes being played successfully at semitone intervals, the Diatonic scale

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[16] Virginia Tech Multimedia Music Dictionary: A scale that the divides the octave into its semitones. There are 12 semitones, or half steps, to an octave in the chromatic scale.

[17] The French system of note naming is different and is not letter based. Known as the *Solfege* (sometimes called *Solmization*), the notes are Do – Re – Mi – Fa – Sol – La – Ti – Do. The Do note is the equivalent of the C note.

[18] The # symbol (sharp) means the tone after, therefore A# means the Semi-tone after A, while the b symbol (flat) means before, so Bb means the Semi-tone before B.In naming the notes of a scale, it is customary that each scale degree be assigned its own letter name: for example, the A diatonic scale is written A - B - C   - D - E - F   - G   rather than A - B - D   - D - F   - E - G . This is the reason for having multiple names for each note (e.g. A# / Gb). Therefore a note like C could be named B# in a scale that contains a C# note…etc.

incorporates a mixture of both semitone and *wholetone* intervals. This creates musical

scales with notes that harmonize with one another, while the Chromatic scale may

include notes that are cacophonic when played together.

A Diatonic scale generally consists of seven notes and repeats at the octave. Western

music in the Medieval and Renaissance periods (1100-1600)[19] tends to use the white-

note (natural major) diatonic scale C-D-E-F-G-A-B and its transpositions[20]. Notice

that this scale is made of Whole-tone and Semi-tone intervals, more specifically, two

Whole-tones / one Semi-tone / three Whole-tones / one Semi-tone.

Musicians tend to find that these tonal intervals are the most acceptable and do not

offend the ear. Other tonal intervals are used to create more exotic scales, yet they

require more caution when being used. Rameau[21] discusses that the reason for that is

that these are the intervals that are easily proportionally extracted from a length of

string. As documented in his Treatise on Harmony, a length of string that produces a

certain pitch could be easily divided up to create different intervals of that pitch.

Let's assume that we have a piece of string held at two points that produces that pitch

C. If the length is divided into two equal parts, the pitch of each side of the string also

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[19] This period witnessed the evolution of western music theory, specifically the use of rhythmic notation and musical scales, and was therefore the basis of baroque and classical music. For more, please see Reese, Gustave. *Music in the Middle Ages*. New York: W. W. Norton, 1940, and Reese, Gustave. *Music in the Renaissance*. New York: W.W. Norton, 1954.

[20] Transposition means moving a note or collection of notes up or down in pitch by a constant interval. Transposing scales means moving that scale up or down in pitch by a constant interval, i.e a Cmaj scale transposed five steps become the Gmaj scale (the difference between both scale is that the F note in the Cmaj scale becomes an F# note).

[21] Jean-Philippe Rameau *Treatise on Harmony,* book I: the Relationship between Harmonic Ratios and Proportions.

produces a C pitch, except an octave higher. This pitch is the *tonic* degree of the scale, meaning the first note of the musical scale.
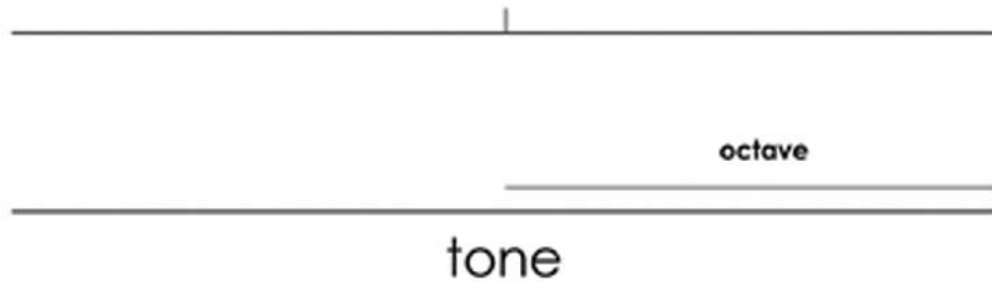
Figure 1: Division of a string (ratio 1:2) to produce an octave.

If one were to divide the string into three equal parts and pluck the string at the point where the resultant length is 2/3 times the original length. The pitch produced would be the 5th note in the scale, in this case the G note. This pitch is the *dominant* degree of the scale.

Figure 2: Division of a string (ratio 2:3) to produce the fifth of the scale.

If the string is divided into four equal parts, and the string is plucked at the point where the resultant length is 3/4 times the original length, the pitch produced would

be the 4th note in the scale, the F note. This pitch is the s*ub-dominant* degree of the scale.
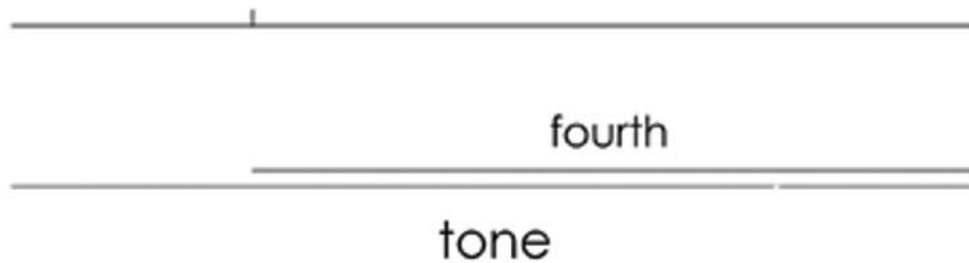
fourth

tone

Figure 3: Division of a string (3:4) to produce the fourth tone of the scale.

Note that while F is the 4th degree after C, C is the 5th degree after F. If one plays the sequence of pitches C - F – C (octave higher), one will be moving 4 degrees to the sub-dominant and then 5 degrees to reach the octave. The same is reversed with the G; while the G is a 5th degree to the C, the C is a 4th degree to the G. This also makes sense mathematically, if one multiplies 2/3 to 3/4 the answer would be 1/2. The tonic - dominant - subdominant degrees are the most vital in any musical scale; they are sometimes called *perfect* tones[22] and the most commonly used chord, the 5th chord (or power chord) is derived from these notes; either using the tonic and the dominant with the tonic in the bass note, or using the subdominant and the tonic with the subdominant in the bass (both examples are 5 degrees apart from one another). Such chords are vital because the note that completes the chordal triad, distinguishing the major and minor chords (the 3rd degree) is absent, so the chord could be applied to

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[22] They are called *perfect* because of their extremely simple pitch relationships resulting in a high degree of consonance and also because when they are inverted they remain perfect (a perfect fourth inverts to a perfect fifth and vice versa).

both major and minor scales[23].

If the string is divided further, into 5 or 6 parts, the 6th (Submediant) and 3rd (Mediant) degrees would be produced. Chapter Three of Rammeau's Treatise on Harmony, *on the origin of Consonances and on their relationships*, he notes that the string can only be divided into 6 parts; "since the capacity of the ear extends no further." This doesn't seem to be entirely true, since you still can produce more pitches by dividing into more parts. The answer may lie in his definition of Consonance: "An interval the union of whose sounds is very pleasing to the ear. The intervals of the third, the fourth, the fifth, and the sixth are the only consonances." This leaves the 2nd (Supertonic) and 7th (Leading note) degrees of the scale, which he labels Dissonance: "The name for intervals which, so to speak, offend the ear."[24] This is not to say that the 2nd degree notes are cacophonic to the ear, but when they are played with the tonic note to form a chord, another note should be applied to resolve the enharmonic problem that it brings forth[25].

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[23] Chords are generally composed from the tonic, mediant and dominant degrees (the 1st, 3rd, and 5th notes). The different between a minor and major chord lies in the 3rd note, where the minor chord requires a flatted 3rd i.e. C-Eb-G is a Cmin chord while C-E-G is a Cmaj chord.

[24] Descartes, *Abrege de la Musique,* p.60 (R.) One of Rene Descartes' (1596-1650) earliest efforts was his *Compendium Musicae* (1618). Though circulated only in manuscript during his lifetime, the *Compendium* was published in Utrecht (1650) shortly after his death. It went through several editions, and was translated into English as early as 1653. Rammeau was familiar with the French version, translated from the Latin by Father Nicholas Poisson and published in Paris in 1668 as *Traite de la mechanique, compose par Monsieur Decartes. De plus l'Abrege de musique du mesme autheur mis en francois.* Rammeau's citations of Descartes are from this translation.

[25] For example, if the 7th degree is applied to the 1st, the resultant sound is quiet obscene to the ear, except if other notes like the 5th and 3rd, the 7th chord is produced, which is a common chord used in jazz music, and is known for its beautiful soothing voice.

In Rudolf Wittkower's *Architecture Principles in the Age of Humanism, part four: The Problem of Harmonic Proportion in Architecture,* Wittkower discusses the importance of harmonic ratios in architecture, where in the Renaissance period; the proportions used should correspond to a higher order and seek connection with the powers of the universe, citing ideas of Pythagoras and Plato's mathematical cosmos. Francesco Giorgio, Leon Battista Alberti, Serlio and Palladio are among the architecture theoreticians whom Wittkower notes that have used such proportions in their work and writings.

When the degrees of the scale, as discussed earlier, are rendered in ratio form, one can start to associate shapes that have similar proportional qualities. The tonic degree, ratio 1:1 could be represented as a square, and the Dominant degree, ratio 2:3 could be represented as a rectangle with the same width: length ratio. These ratios are not limited to the notes of the diatonic scales; they could be applied to the whole chromatic scale. The figure below shows the relationship between the Tonic note (shown as C in the figure) and its proportional relationship to the rest of the chromatic scale[26].

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[26] The name of any interval is further qualified using the terms perfect, major, minor, augmented, and diminished. This is called its *interval quality*.

Fundamental tone 1:1

Minor 2nd 15:16

Major 2nd 8:9

Minor 3rd 6:7

Major 3rd 4:5

Perfect 4th 3:4

Augmented 4th 5:7

Perfect 5th 2:3

Minor 6th 5:8

Major 6th 3:5

Minor 7th 5:9

Major 7th 8:15
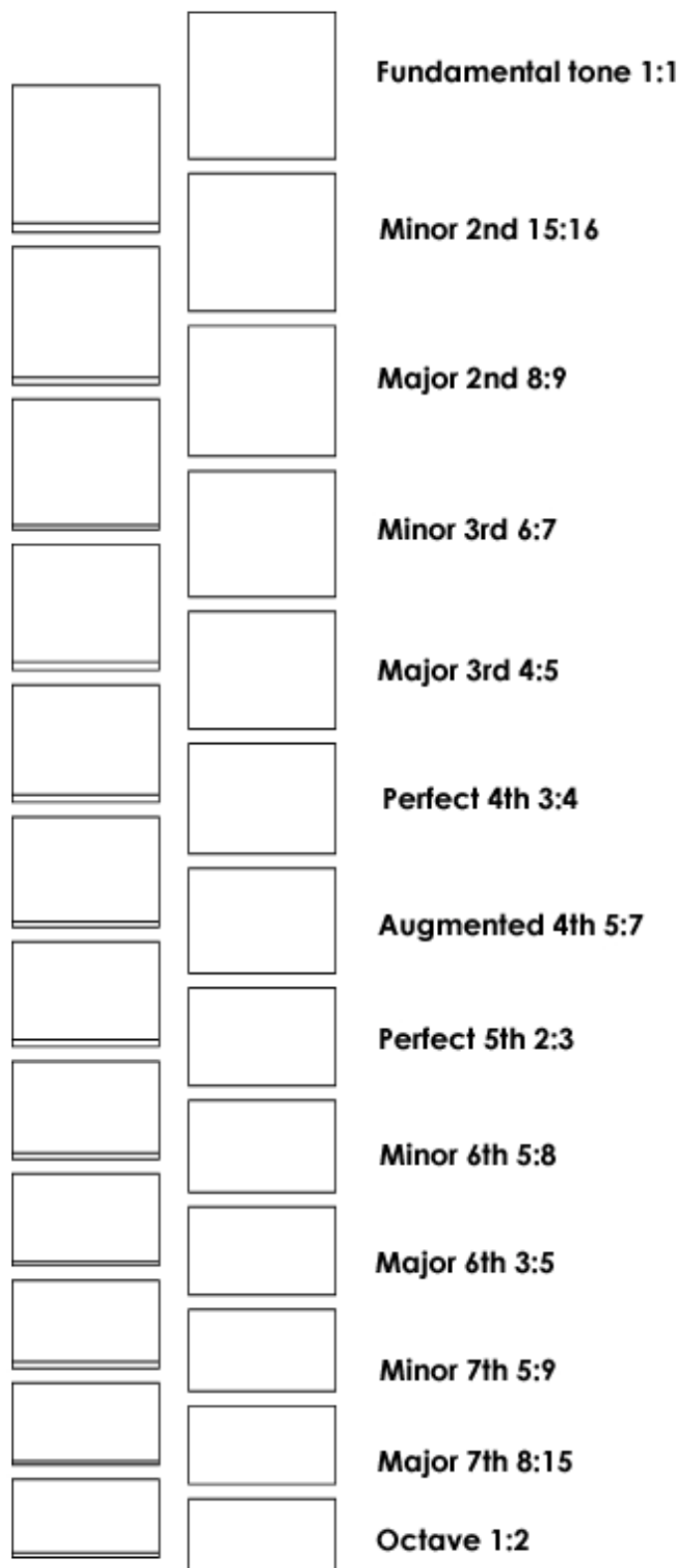
Octave 1:2

Figure 4: Proportions of the Twelve Tone System

The next diagram explores the sequence of proportions in the Cmaj scale, starting

from the tonic degree to the tonic octave[27]. It is important to note that each shape does

not signify a specific note, but a degree within the scale. For example, the 8/9

rectangle does not necessarily signify the D note, but the 2nd degree of the Cmaj

scale (the Supertonic degree). The D note could very well be the square shape if the

scale would be in the Dmaj scale, or be the 2/3 rectangle in the Gmaj scale, but the

2nd degree is always the 8/9 rectangle.

Fundamental Tone (C) 1:1	Major 2nd (D) 8:9	Major 3rd (E) 4:5	Perfect 4th (F) 3:4	Perfect 5th (G) 2:3	Minor 6th (A) 3:5	Minor 7th (B) 8:15	Octave (C) 2:1
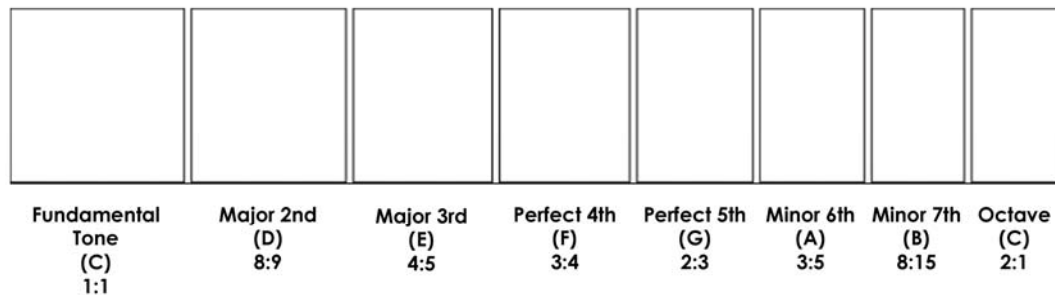
Figure 5: Sequence of Proportions in the Cmaj Scale.

It is important to note that the diagram above was purely based on the Ionian mode. A

mode is an ordered series of musical intervals, just like a scale, but the difference is

that its starting and ending note determine each mode. Within a scale, there are 7

modes, each using a different degree in the scale as a starting or reference point. The

common major scale, starting with the tonic degree and ending at the tonic octave

(CDEFGABC in the Cmaj scale) is called the Ionian mode. The 2nd mode is the

Dorian mode, starting with the Supertonic degree and ending the at Supertonic octave

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[27] Note that in these diagrams, the ratios are expressed from larger number to smaller number, as in 3:2, as opposed to that in the rest of the paper. The reason for that is the larger number corresponds to the Tonic degree and the smaller number represents the proportion of the following degree.

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(DEFGABCD in the Cmaj scale). They both have different tonal qualities: the Ionian mode intervals is 2 Whole-tones / 1 Semi-tone / 3 Whole-tones / 1 Semi-tone/ Octave and repeat, while the Dorian mode intervals is 1 Whole-tone/ 1 Semi-tone / 3 Whole-tones / 1 Semi-tone /1 Whole-tone /Octave and repeat.

The list of the other modes is as follows:

The 3rd degree (Mediant) is the Phrygian mode (EFGABCDE in the Cmaj scale).

The 4th degree (Subdominant) is the Lydian mode (FGABCDEF in the Cmaj scale).

The 5th degree (Dominant) is the Mixolydian mode (GABCDEFG in the Cmaj scale).

The 6th degree (Submediant) is the Aeolian mode (ABCDEFGA in the Cmaj scale).

The 7th degree (Leading tone) is the Locrian mode (BCDEFGAB in the Cmaj scale).

The relevance of modes in the translation of music into architecture is important, because while a musical phrase depends on the starting note and the ending note, an architectural space can be entered, exited, and experienced from a multitude of ways. From the diagrams above, it could be seen that a main room has a square shaped plan, which corresponds to the tonic degree of a musical scale. While the square room is the reference point in this case, one can start the architectural promenade/experience from an adjacent room that has a 2/3 shaped plan. In this case, the observer is experiencing the promenade with a Mixolydian mode analogy.

Section 4: Musical Proportions in the Palladian Villa

This information begs to question if one can decipher musical melodies from the Palladian villas that use harmonic proportions in their rooms. Book I of the Quattro Libri contains important insights in Palladio favored room proportions. In chapter 21, Palladio recommended seven shapes of rooms in the following sequence: 1) circular, 2) square, 3) the diagonal of the square for the length of the room, 4) a square and a third, i.e. 3:4, 5) a square and a half, i.e. 2:3, 6) a square and two-thirds, i.e. 3:5[28], 7) two squares, i.e. 1:2. Wittkower had previously mentioned that the diagonal of the square for the length of the room (i.e. root 2:1) is the only one of these is not part of the harmonic ratios, however, Branko Mitrovic[29] argues that the root 2:1 ratio could be explained if one considers the differences between the tempered and the untempered scales, which will lead the root 2:1 ratio to correspond to C: F#[30].

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[28] Wittkower mentions that this is said to be Palladio's favorite ratio. This proportion represents the 6th degree, which in music theory is known as the relative minor. Every major scale has its equivalent minor scale, and the minor scale is equivalent to the Aeolian mode, i.e. starting from the 6th degree and ending at the 6th degree. This is also the closest musical consonance ratio that is equal to the golden ratio, where $5/3 = 1.67$, where the fifth. $3/2 = 1.5$, and the seventh, $15/8 = 1.875$. On that note, it should be noted that the harmonic minor note, which is a sharped 5th, or an augmented 5th(G# in the Cmaj scale) is closer to the golden ratio, $8/5 = 1.6$. The harmonic minor is a deviation from the regular minor scale, and gives the scale a more oriental sound. Yet it is not considered part of the natural major or minor scale because it is a deformation of it. As Angela Pinatore points out, this is the ratio used in the Arc in the Covenant (see note 16 in ibid): "The biblical predilection for harmonic ratios harmonic ratios is made evident, among other things, by the choice of the dimensions of the Ark of the Covenant described in Exodus 25:10: God ordered Moses to build a chest of precious cedar that was 1.5 cubits high, 1.5 cubits wide, and 2.5 cubits long. The governing 5:3 ratio constitutes a rough approximation of the golden rectangle ($5:3 = 0.6$, while the golden ratio is an irrational number m 0.618…).

[29] Mitrovic, Branco *Palladio's Theory of Proportion and the Second Book of the Quattro Libri dell' Architettura.* JSAH, XLIX:3 september 1990

[30] Mitrovic: Musical ratios between neighboring tones in an untempered major scale:
C-D (9/8)   D-E (10/9)   E-F (16/15)   F-G (9/8)   G-A (10/9)   A-B (9/8)   B-C (16/15)
This means the intervals between notes are not equal (C-D $\neq$ D-E   C-C# $\neq$ D-D#).
The person who is credited of suggesting equal temperament is Gioseffe Zarlino (*Muzicka enciklopedja leksikografskog zavoda Jugoslavige,* III, Zagreb, Jugoslovenski Leksikografski Zavod, 1971-1977. English-speaking readers may consult M. Kennedy, *The Oxford Dictionary of Music,* Oxford, 1985, 805). Zarlino was a contemporary of Palladio, born in Chioggia in 1517. The interval of the octave has a ratio of 2/1 and contains 12 semitones. In view of the rule that the addition of intervals is, mathematically speaking, equal to the multiplication of their ratios, we conclude that a tempered semitone corresponds to the ratio x/1, where x stands for a ratio that, multiplied by 12 times by itself,

Based on that, one can attempt to translate Palladian rooms into their musical proportions. In Villa Malcontenta at Foscari, the shapes found are the square, the 3:4 rectangle, the 3:2 rectangle, and the 1:2 rectangle. The two anomalies in the villa are the porch, which has an 8:3 ratio, and the main room, which the square, the 3:4 rectangle, the 1:2 rectangle, and the 4:11 rectangle could be derived. The 4:11 rectangle should be neglected at this point, as number 11 is not a harmonic number, but the shape, which is the longitudinal axis of the room, minus the two flanking apses, could be divided into a 3:4 rectangle and two squares. In that case, one could derive many versions of the tonic note and the tonic octaves (the 1:1, 1:2, 2:4 ratios) and the subdominant degree (the 3:4 rectangle that leads it the garden at the back). The other rooms in the villa correspond to the Dominant degree (the two bottom rooms overlooking the Malcontenta River) and the Subdominant degree (the upper rooms overlooking the garden).

Another example would be Villa Godi at Lonedo. This villa has a 2:3 main room, which means that the reference point is of the *Mixolydian* scale. What is interesting about this villa is that all of the rooms correspond to a 2:3 ratio, yet the main room is considerably larger than the other rooms in the villa, therefore they cannot share the same note (The main room is 36 by 24 paces, while the others are 16 by 24). If we imagine that the main room corresponds to a G note (the Dominant degree), the transition between it and the other room is also a 2:3 transitions, so its another 5th

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gives 2. It is also important to note that the F# note along with the G# note substitute their F and G counterparts to give the Melodic Minor scale, a scale that Mozart was known to be quite fond of.

degree from the G note, which brings us to the D note (which is the mediant degree of the Cmaj scale, but is a perfect 5th from the G note). Unfortunately, sections of the villa were unavailable to height exploration, so it was not apparent if all the rooms with the D note share the same height or not. If we imagine that the dimensions in plan correspond to one note, while the dimensions in height correspond to another, and both notes play together in harmony, one can then start to build chords with these rooms, and instead of a note to note transition, it would be a chord to chord.

The Porches in both the Villa Godi and the Villa Foscari along with one of the side rooms of the Villa Emo present an interesting dilemma. The Porch at Villa Godi is 16 x 36 paces (ratio of 4:9), while the porch at Villa Foscari is 12 x 32 paces (ratio of 3:8), and the rooms flanking each side of the main room is 16 x 27 paces (ratio of 16:27). All of these ratios do not correspond to any of the musical notes as explained above. They do however, relate to what Alberti's composite ratios[31]. As Wittkower explains, Francesco Giorgi expressed the relation of width to length of the nave of S. Francesco Della Vigna as the ratio 1:3, or in terms of the compound ratio 1:2, 2:3 (the nave is 9 paces wide to 27 paces long, so the compound ratio is 9:18 and 18:27). Mathematically, if you multiply ½ by 2/3 you would get a 1/3. Musically, the 1:3 ratio is made of an octave (1:2) and a fifth (2:3), which starts to hint at creating chords, as the octave and the fifth create the power chord.

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[31] Wittkower p.113 *Alberti's ' Generation' of Ratios*
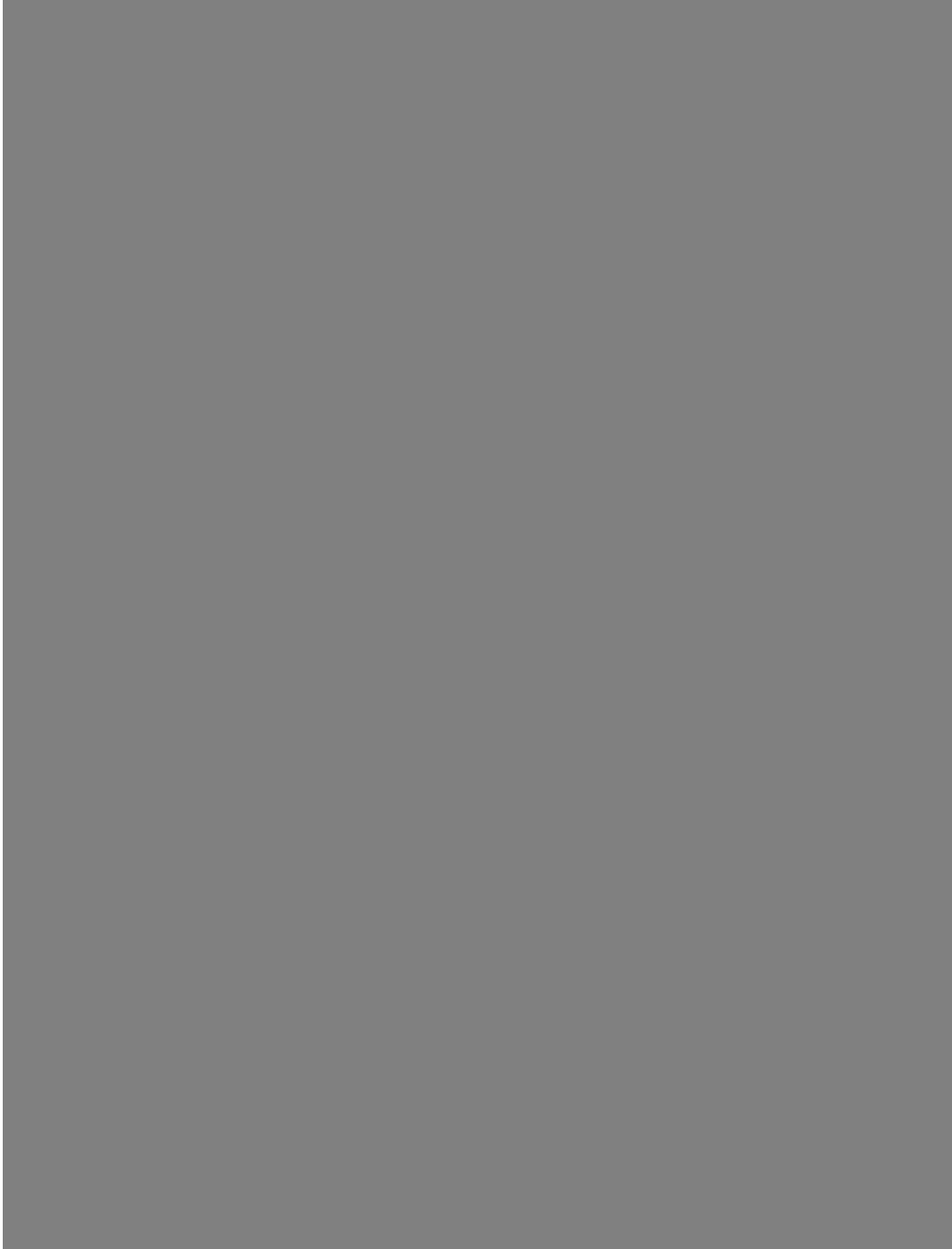
Figure 6: Table of the construction of the areas according to Alberti's indications. At right are the relative **citations from De re aedificatoria, book XI, ch. vi**

Alberti later explored this idea, differentiating between three types of rooms: small, medium, and large. The small rooms would have the shapes that comply with the musical consonances; the square shapes, along with the 2:3 and 3:4 rectangles. The

medium rooms 'duplicate' the ratios of the small rooms; 1: (1x2), 1: (2/3 x 2), 1: (3/4 x2), which can be expressed as 1:2, 4:9[32], 9:16[33]. These ratios can be expressed musically as an octave, a fifth and a ninth[34], and an octave and a fifth with another octave and a fifth[35], respectively.

Figure 7: Table of the construction of the areas according to Alberti's indications. At right are the relative **citations from De re aedificatoria, book XI, ch. vi**

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[32] *4:9 is the compound ratio of 4:6:9. 4:6 = 1: 1 ½, 6:9 = 1:1 1/2*
[33] 9:16 is the compound ratio of 9:12:16. 9:12 = 1:1 1/3, 12:16 = 1:1 1/3
[34] The ninth is the same as the 2nd except at an octave higher. The ratio represents two fifths, so it's a fifth and then a fifth of the fifth, which equals the ninth.
[35] This is where it starts to get complicated; an octave and a fifth and then an octave of the fifth, which is the twelfth and a fifth of the twelfth, which is a 17th (two octaves above the 2nd). In musical terms, this corresponds to a Sus2 chord, of a suspended 2nd chord, which is like the power chord because the 3rd degree is absent, but it differs from a power chord because it adds the 2nd degree to the equation, giving it a more exotic sound. An example of this ratio would be the Csus2 chord, which notes would be, from lower to higher, a CGCGGD.

20

For the larger rooms, first another square is added to the double square ratio of 1:2 to get 1:3. The second would add a third to the double square, to get the ratio of 3:8[36]. And the third room would be doubling the double square to get the 1:4 ratio. Musically, the 1:3 ratio would correspond to an octave and a fifth (the power chord), the 3:8 would correspond to an octave and a fourth (a power chord with the 5th in the bass)[37], the 1:4 ratio would correspond to a double octave.

It should be noted at this point that according to Plato, harmonic numbers follow one of the two numeric progressions: 1-2-4-8 or 1-3-9-27. In his *Timaeus,* he explains that harmony is found in the squares and cubes of the double and triple proportion starting from unity; the harmony of the cosmic order is expressed in the seven numbers 1-2-3-4-8-9-27; these numbers contain "the inaudible music of the heavens[38]." Deborah Howard and Malcolm Longair argued that there exists a set of "harmonic whole numbers", such that "any two of them, when reduced by division by the appropriate power of 2, will correspond to the harmonic ratios[39]…" The *harmonic whole numbers* up to 100 are:

1 2 3 4 5 6 8 9 10 12 15 16 18 20 24 25 27 30 32 36 40 45 48 50 54 60 64 72 75 80 81 90 96 100

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[36] Wittkower p.115: by adding the double square, 3:6, one third so that the proportion 3:8 is generated from 3:6:8

[37] 3:6 is an octave and 6:8 (3:4) is a fourth. Since the degree difference between the fourth and the octave is equal to a perfect 5th, the chord could be also understood as a power chord but having the fourth played in the bass with the octave following.

[38] CF. *Timaeus,* 35B-36B (F. M. Cornford, *ibid*, p.66 ff., and A. E. Taylor, A *Commentary on Plato's Timaeus,* Oxford, 1928, p.116 ff.).

[39] Howard-Longair: Harmonic Proportion and Palladio's "Quattro Libri", *The Journal of the Society of Architectural Historians,* Vol.41, No.2. (May 1982) pp.116-143)

Going back to the Palladian villa examples, the porch at Villa Godi (ratio 4:9) would

correspond to a fifth and a ninth, and the porch at Villa Foscari would correspond to a

octave and a fourth. It is now evident that both these Villas are only using the Tonic-

Subdominant-Dominant degrees in their musical consonances, the 3rd and 6th degrees

are not evident so one could not say that the villas would correspond to either a major

or minor chord. The same is true for Villa Emo, for the most part. The rooms flanking

each side of the square main room are 16: 27 paces[40], which can be represented as

either compound ratio 16:18:27, or 16:24:27. Both ratios yield out a fifth and a

second. If we consider the first compound ratio, 16: 18 (8: 9) is a whole step, or a

major second, and 18:27 (2:3) is a perfect fifth. If our Tonic is a C, the major second

is a D and the perfect fifth is a G, resulting in a G5 chord (the D is a perfect fifth from

the G). If we consider the second ratio, 16:24 (2:3) is the perfect fifth, and 24:27 (8:9)

is the major second, also resulting in the G5 chord. The appearance of the major

second is interesting because it is not a consonance but a dissonance. If we consider

the transition between the C to the D alone, we will note that the shape produced is a

8:9 rectangle. This ratio hardly appears in any architectural precedents[41], as it is easily

mistaken for a square. But the degree appears more often in these compound ratios,

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[40] The dimensions are taken out of the *Quattro Libri* and are acknowledged by Wittkower. However, Rachel Fletcher documented the room dimensions to have a 3:5 ratio in her article *Proportional systems and the Timber Frame.* Fletcher credits her drawings to be taken out of Scamozzi's measured drawings (Scamozzi, O.B. 1776. *The buildings and the designs of Andrea Palladio.*Trans. H.Burns. Trent: La Roccia, 1976. In this case, the room would correspond to a 6th degree, or the relative minor note (an A in the case of a Cmaj scale).
[41] Most agree that discrepancies between the plans drawn in the *Quattro Libri* and what is carried out in the field may have been due to inaccuracies of the builder, but nevertheless the initial intent to keep the dimensions in harmonic proportion to one another is still credible. In this case, some square plans maybe closer to an 8:9 ratio than a 1:1 ratio, but they are still conceived of as squares. As Wittkower notes "Most of the actual proportions do not correspond exactly to his (Giorgi) ratios, but the divergences are small and due to the kind of irregularities which occur in practice." Pp.105

resolving any proportionally uneasiness as Rammeau explains when he talks about Dissonance. Villa Emo would then have a square main room, a Tonic degree (lets assume we are in the Cmaj scale, so the note would be a C). The transition would then be to a G5/D chord (the 16:27 rooms), and then to a smaller 12:16 room (3:4)[42], which brings us to the C octave (a perfect 4th from the G). The Next room is a square (16x16), so the C note is still maintained, and then back to a 16:27 porch (G5/D chord).

To take this a step further, the heights of each of these rooms should be added to see if the harmonies produced would add to a coherent chord progression or not. Unfortunately, not enough adequate sections were found to conduct a thorough investigation, and as Mitrovic points out "neither Wittkower nor Howard-Longair took into consideration the heights of the rooms; they were concerned only with their ground plan (length/width) ratio[43]." In chapter 23 of Book I of the *Quattro Libri,* Palladio defines his means of height generation[44]:

1) For the arithmetic mean : $h = (w + 1)/2$

2) For the geometric mean : $h = \sqrt{wl}$

3) For the harmonic mean : $h = 2wl/(w + 1)$

4) For vaulted rooms: $h = (4/3)w = (4/3)l$

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[42] In Fletchers article, the room is not of a 3:4 ratio; she notes it down as 2:3. In this case, the musical correspondence would make this room an E note, since the E is a perfect fifth from the A of the 3:5 room. The E note continues into the 3x3 Square and then back to the A of the 3:5 porch. This makes this villa unique as it includes all the notes that makes up an A minor chord.

[43] Wittkower does briefly talk about Palladio's generation with heights (p.109) also citing Scamozzi's simplification of the height issue by always using the arithmetic mean between the width and length.

[44] h = height, l = length, w = width. Mitrovic notes that it is only after Descartes that the notation we are accustomed to come into use.

5) For flat ceilings: h = w

Further exploration of this would be unnecessary at this point, as it have become

evident that the spaces were never meant to be translated into music[45].

Section 5: Proportions in Music

It could be argued that translation of music into architectural spaces, using the same

proportional elements discussed, is possible. Let's take Johan Pachelbel's[46] Canon in

Dmaj[47] as an example. The musical piece is based on a 4 bar chord progression

starting with the Dmaj chord, the progression goes as follows:

Dmaj (1st) - Amaj (5th) - Bm (6th) - F#m (3rd) - Gmaj (4th) - Dmaj (1st) - Gmaj

(4th) - Amaj (5th)

Lets only use the Bass notes of each of the chords for the next series of explorations

(D - A -B -F# - G - D - G - A). If we use the D (tonic) note as our reference point, the

procession from shape to shape is as follows:

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[45] Wittkower pp. 111 "The architect who relies on these harmonies is not translating musical ratios into architecture, but is making use of a universal harmony apparent in music: "Certissimum est naturam in omnibus sui esse persimilem / It is indisuputable that Nature always manifests herself consistently." See also Luca Pacioli, *Summa de Arithmetica,* Venice, 1494, dist. VI, tract. 1, artic. 2: "…impossibilie e alcuna cosa in natura persistere: se la non debitmente proportionate a sua necessita."

[46] Johan Pachelbel (1653-1706), German Baroque composer.

[47] The following piece was chosen because its main musical structure is based on a progression of 4 bars with 8 chords in a slow tempo that gets repeated throughout the piece. Every time it is repeated, something else is added into the loop, whether it is the main theme, or its harmony accompaniment or variations on the theme. This makes it a good example to use and explore.
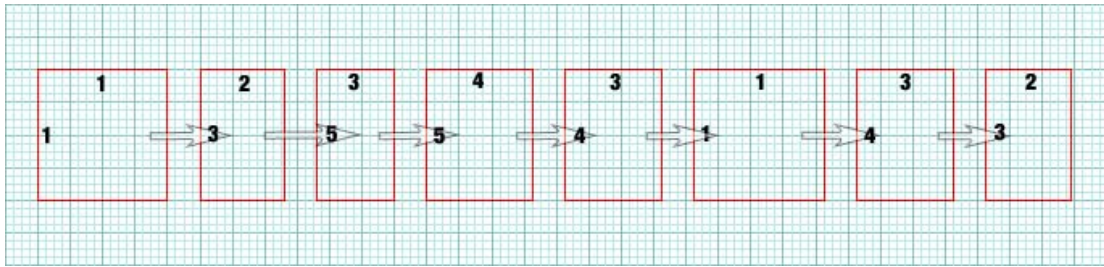
Figure 8: Procession of Pachelbel's canon in Dmaj using the Tonic note as a reference point

The diagram above does not take into consideration the transition between note to note; the transition between A to B is a whole tone transition (8:9) and not a 3:5 transition as shown in the diagram. Every transition in the above diagram is referencing the D (tonic) note. From D to A is a perfect 5th (2:3). From D to B is a Major 6th (3:5). From D to F# is a Major 3rd (4:5). From D to G is a perfect 4th (3:4). From D to D is unison[48] (1:1). From D to G is a perfect 4th (3:4). From D to A is a perfect 5th (2:3).
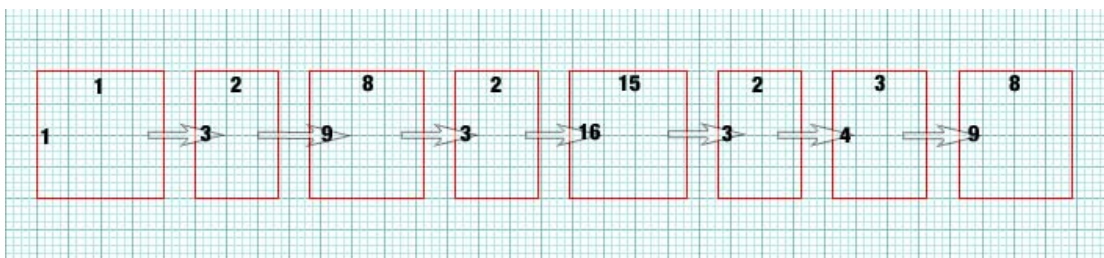
Figure 9: Procession of Pachelbel's canon in Dmaj using the previous note as a reference point

This next diagram uses the previous note as the reference point, depicting a more accurate transition between the notes. From D to A is a perfect 5th (2:3). From A to B is a whole tone (8:9). From B to F# is a perfect 5th (2:3). From F# to G is a half tone

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[48] Unison means a singular sound. When different instruments all play the same note with its same frequency (i.e. not an octave lower or higher, but within the same octave register), it is said that they are playing in unison.

(15:16). From G to D is a perfect 5th (2:3). From D to G is a perfect 4th (3:4). From G to A is a whole tone (8:9).

It was suggested that a correct representation of the piece should incorporate both the above diagrams to represent an accurate progression. The next set of diagrams uses composite ratios, where both transitions are multiplied to each other (the transition using the tonic note as a reference point, by the transition of using the previous note as a reference point). The results were as follows:

First transition : From D to A = a perfect fifth = 2/3

Second transition : From D to B = a major 6th = 3/5

From A to B = a whole tone = 8/9

Composite ratio = 9/15 x 8/9 = 8/15

Third transition : From D to F# = a major third = 4/5

From B to F# = a perfect 5th = 2/3

Composite ratio = 12/15 x 8/12 = 8/15

Fourth transition : From D to G = a perfect 4th = 3/4

From F# to G = a half tone = 15/16

Composite ratio = 48/64 x 45/48 = 45/68

Fifth transition : From D to D = a unison = 1/1

From G to D = a perfect 5th = 2/3

Composite ratio = 2/3

Sixth transition : From D to G = a perfect 4th = 3/4

From D to G = a perfect 4th = 3/4

Ratio[49] : 3/4

Seventh transition : From D to A = a perfect 5th = 2/3

From G to A = a whole tone = 8/9

Composite Ratio = 16/27
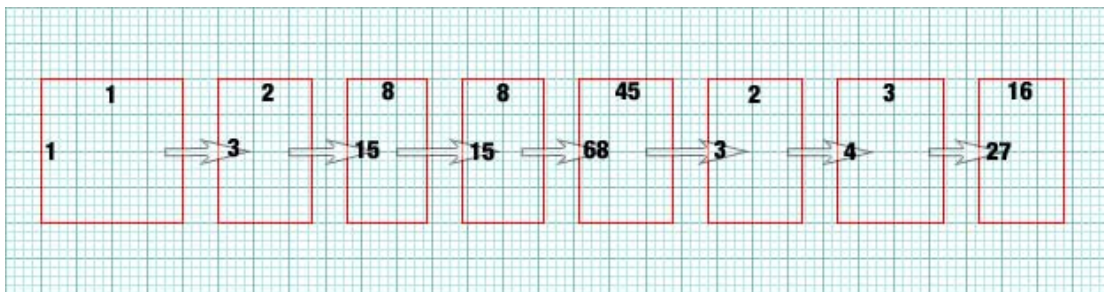
Figure 10: Procession of Pachelbel's canon in Dmaj using composite ratios

This set of diagrams seems highly unlikely and illogical; the second and third

transitions both have the 8:15 ratio[50], which makes this particular sequence not a good

representation for the cannon.

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[49] The ¾ ratio was left as is, as it seemed illogical to take a composite of the same ratio.
[50] The 8:15 ratio belongs to the 7th degree (leading note or major 7th) proportion (which is the note B in the Cmaj scale, or in this case a C# in the Dmaj scale). What is interesting is that if one played a major 6th and then a whole tone the major 7th is produced. Also, if one plays the major third and then a perfect 5th, the major 7th is also produced. This gives further reason why composite ratios are not a good representation of the sequence of spaces.

27

It was previously stated that heights of rooms might relate to the harmonies that produce the chords. Up to this point, we have been dealing primarily with planes, and not with volumetric spaces. The proportions of the height: length, or height: width, provides another note that is added into the equations, which makes more sense since music is all about harmony and not about single notes. Another way to make volumetric spaces could be to take both sequences discussed above and put them together. We know that the second transition could be read as two rations, either from the reference point or from the previous note (from D to B or from A to B), what if both were include in the space; using the D to B ratio for the floor and the A to B ratio for the height, or vice versa. The following set of diagrams explore these ideas in the following sequence:
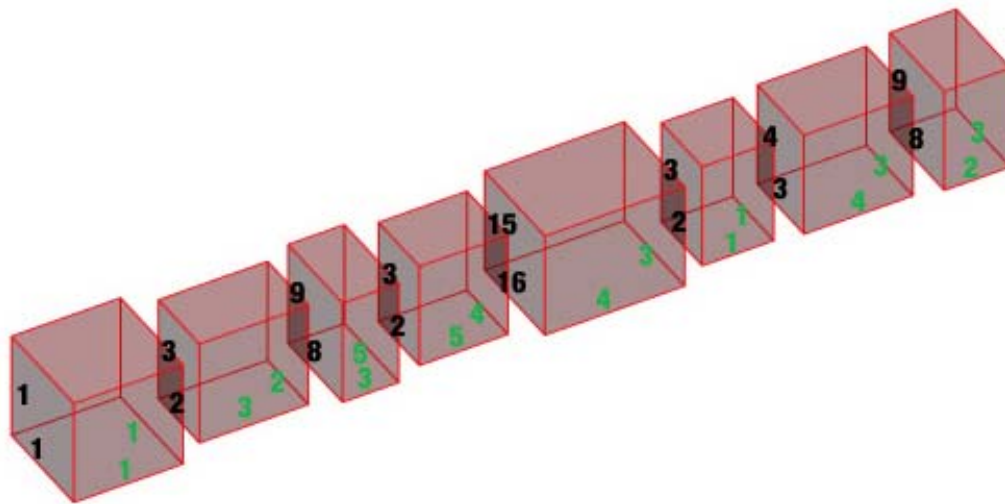
Figure 11: Using the transition from the reference point as the floor ratio and the transition from the previous note as the height ratio (with a set height).
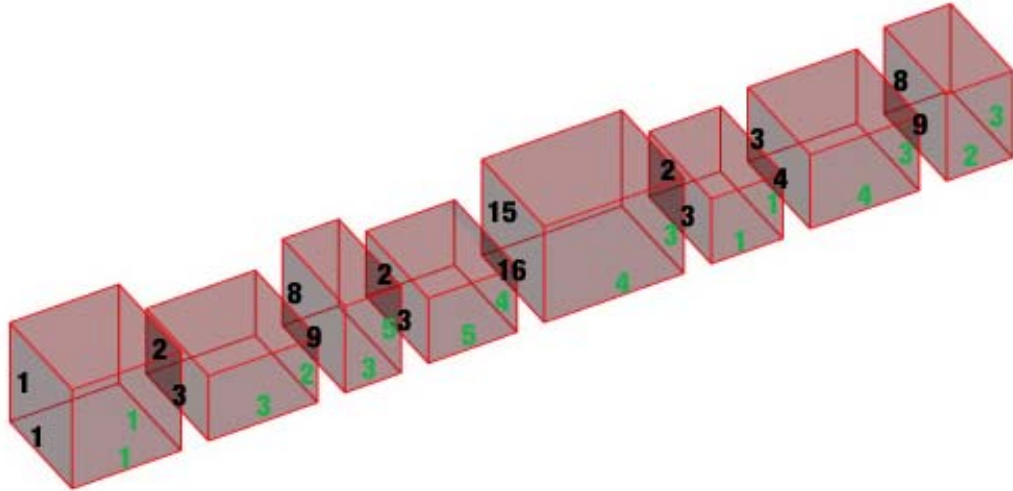
Figure 12: Using the transition from the reference point as the floor ratio and the transition from the previous note as the height ratio (with a set width)
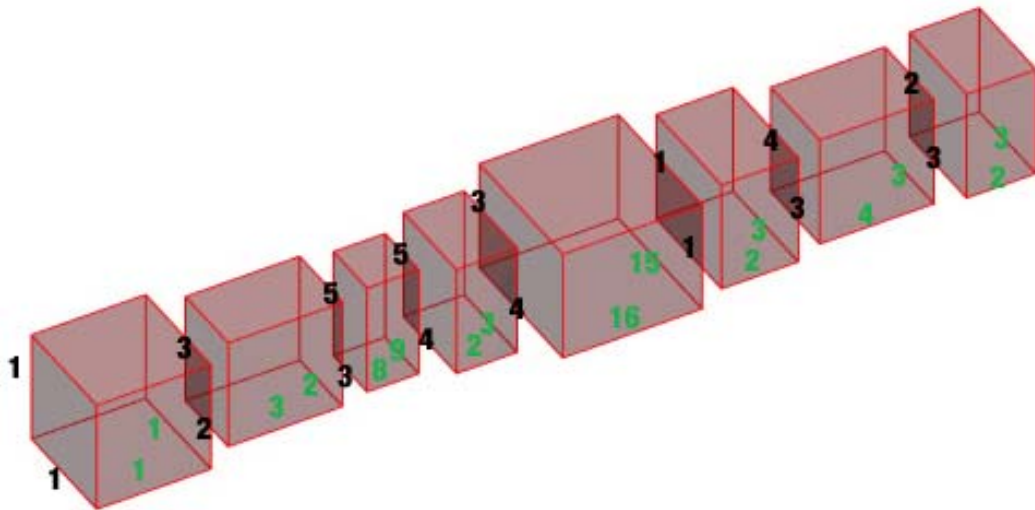
Figure 13: Using the transition from the reference point as the height ratio and the transition from the previous note as the floor ratio (wit a set height).

Section 6: Harmony in Architecture

Harmony is base of all chords, as it is the study of different pitches occurring simultaneously. Any note is harmonious with any of its consonances (the 3rd, 4th, 5th or 6th degree intervals). Dissonances could be just as harmonious if they are employed with its common consonances to resolve any cacophonic sounds (as in the previously discussed Sus2 chord; with the Csus2, both the C and the D notes, which are not harmonious with one another, are harmonizing with a common consonance, the G note). Chords are based on triads, and triads mean that three notes are occurring simultaneously in harmony.

Angela Pintore discusses Alberti's Rucellai sculpture in her article Musical

Symbolism in the Works of Leon Battista Alberti[51]. The sculpture, which is located in a chapel in the church of S. Pancrazio in Florence, adheres to the same musical harmonic proportions that we are discussing, and Pintore references Alberti's *De re aedificatoria* which documents his writings about harmonic proportion. Alberti did not design the chapel; however he designed the mass of the sculpture to be one third of the chapel. As mentioned earlier, the ratio 1:3 is one of the ratios that Alberti uses for large size rooms and corresponds to the musical proportion of an octave and a fifth.

This suggests that objects in a space could be designed to correspond to the musical harmonies of the space that contains it. Going back to Pachelbel's Cannon, the next bar after the opening chords is the main theme, which harmonizes with the bass line (D-A-B-F#-G-D-G-A). The main theme goes as follows:

F# - E – D – C# - B – A- B- C#

Notice that the progression of notes is always a whole tone progression going backwards (with the exception of the transition between D and C# which is a half step transition), which means that each of these notes would have an 8:9 ratio transition from one another (with the exception between D and C#, which would be a 15:16 ratio transition). In this case it is not relevant; the ratios would be between each note and its bass harmony and not of the transition of the notes in the main theme, which would make the ratio more of a scaling factor and not a sequence as the bass notes produced.

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[51] Pinatore, Angela *Musical Symbolism in the Works of Leon Battista Alberti (from De re aedificatoria to the Rucellai Sepulchre)* Nexus Network Journal – Vol 6, No.2, 2004

Figure 15: Geometric-compositional analyis of the plan and cross sections

The harmonies of each of these notes and their corresponding bass notes are as follows:

1) The F# is a major third from its corresponding D note (ratio 4:5).

2) The E is a perfect fifth from its corresponding A note (ratio 2:3).

3) The D is a minor third from its corresponding B note (ratio 5:6).

4) The C# is a perfect fifth from its corresponding F# note (ratio 2:3)

5) The B is a major third from its corresponding G note (ratio 4:5).

6) The A is a perfect fifth from its corresponding D note (ratio 2:3)

7) The B is a major third from its corresponding G note (ratio 4:5)

8) The C# is an augmented fifth from its corresponding A note (ratio 5:8)

However, since our reference notes are actually the bass notes, the harmonies produced are actually an octave higher then the ones we had just recorded, meaning that the F# note is not a major third, but a major tenth from its corresponding D note, which would make its ratio a 2:5 ratio (and octave from 4:5 = 4:10). The ratios would then turn as follows:

1) The F# (octave higher) is a major tenth from its corresponding D note (ratio 2:5).

2) The E (octave higher) is a perfect twelfth from its corresponding A note (ratio 1:3).

3) The D (octave higher) is a minor tenth from its corresponding B note (ratio 5:12).

4) The C# (octave higher) is a perfect eleventh from its corresponding F# note

(ratio 1:3).

5) The B (octave higher) is a major tenth from its corresponding G note (ratio 2:5).

6) The A (octave higher) is a perfect twelfth from its corresponding D note (ratio 1:3).

7) The B (octave higher) is a major third from its corresponding G note (ratio 2:5)

8) The C# (octave higher) is an augmented twelfth from its corresponding A note (ratio 5:16).

One could start imagining that the sequences of spaces that were shown in the animations before are spaces that belong to an exhibition or gallery, with the object being displayed in the center of the room, corresponding to a harmony. In the next sequence of animations, the object in each room is scaled so that it fits exact the ratio of the harmony as discussed above (e.g. for the first room, the object which corresponds to an F# note is exactly 2/5 times the volume of the room that corresponds to a D note)[52].

In the next progression repetition, another harmony line is introduced, this one harmonizing with the main theme line. The harmony line is:

D – C# - B – A – G – F # - G – A

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[52] The object is seen floating in space in the animations so it can fit exactly as the ratio requires. In reality, the object may not be seen floating in space and maybe situated on the ground plane, just like Albert's Ruccelai sculpture, the intent however is to illustrate the point in abstract form, and not create a realistic exhibition space.

This harmony line is a reverted 3rd of the main theme[53], which means as a space, the spaces would be larger than that of the main theme. This harmony line not only harmonizes with the main theme, but should also harmonize with the bass line as well, creating a chord situation with some of them. The ratios should also be proportional equal in mathematical terms with both the main theme and the bass line.

Each space / room now represents a chord; the question is how one would experience these other two notes in the room. If the main volume of the room is the bass note, should the other two notes be experience as two separate objects in the room? Should they each be separated from one another? Or should they interlock? In all scenarios, the proportions remain the same, it is now a question of architecture to place them where needed. Perhaps they are not objects at all; perhaps they are openings in the walls to provide light, each note on the opposite wall. Maybe the area within the room that the light is emitted in could represent one of the harmonies.

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[53] I say it is reverted because it is not the 3rd of the main theme, but the main theme is a third of it, meaning that the F# is a 3rd harmony of the D and note the vice versa.

Section 7: Proportions in Egyptian Music and Architecture

Subsection 1: Egyptian Music
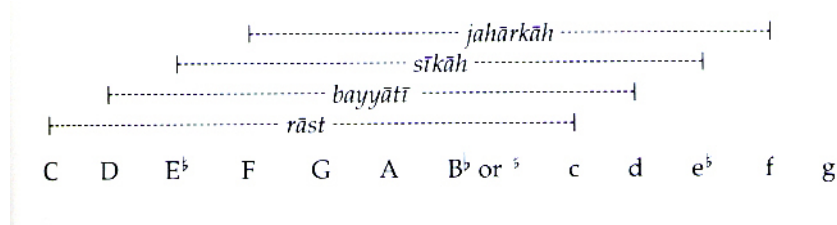
Figure 16: The *Maqam* in Arabic music

Arabic Music is different than the twelve-tone system of Western Classical Music. Europe adopted equal temperament, meaning dividing the octave in equal intervals (12 in the case of Western music) sometime during the 16th century, when Galileo Galilei's father, Vincezo Galilei, first suggested a twelve-tone system in his 1581 treatise[54]. Equal temperament made it easier to develop instruments like keyboards and pianos, and later guitars, as they are instruments that depend on incremental tones (each key on a keyboard represents a tone, while each fret on a guitar represents a tone), with no in-between tones.

Arabic musical instruments on the other hand are fretless and non-incremental, and thus equal temperament would make no sense. They are tuned on the Just Intonation scale, where the tones are divided upon Pythagorean theory and thus not all tonal intervals are of equal value. This means that any tones played on an Arabic music scale are a rough estimate of what the tone value is (e.g. the note C maybe played a

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[54] Cho, Gene Jinsiong. (2003). *The Discovery of Musical Equal Temperament in China and Europe in the Sixteenth Century*. Lewiston, NY: Edwin Mellen Press.

few cents above or below its true value), and if that tone is played twice in the piece then the value can slightly change each time. This creates a favored nuance in Arabic music, one that will be discussed in more detail later in chapter 11, called heterophony.

Arabic music is famous for using quartertone increments, as opposed to half tone in Western Music. It should be noted that an actual quartertone increment is seldom used, but a ¾ tone increment is commonly used. Such an increment is impossible to play on an equal temperament instrument like the keyboard, but very easy to play on an unfretted instrument like the oud.

Such a tuning remained the standard in Arabic music until the Cairo Congress of Arabic Music in 1932, where musical scholars around the world (mostly Arab, but included western composers like Bela Bartok and Paul Hindermith), advocated the use of the 24 tone system, an equal temperament tuning that divides the octave into 24 equal increments. This sort of tuning made it easier to incorporate instruments like the keyboard in the Arabic music repertoire, introduced the concept of harmony in Arabic music, and made documenting Arabic music an easy process. Many musicians in the Arab world saw such a modification as an unwelcome western influence, as it denies the merits and kills the nuances that made Arabic music unique.

Subsection 2: Proportions of Islamic Monuments in Cairo

A study of proportion on Islamic monuments in Cairo was conducted, testing if their proportions also adhere to harmonic proportions, and if such proportions differ from that of the European models due to the difference in musical scales.

Starting with the mosque of Sultan Hassan, whose construction was complete in 1361, it was a surprise that the 4/5 proportion was evident in a very prominent space of the mosque. The mosque is the first to incorporated the four iwan mosque type in Cairo, which is the courtyard cross shape plan demarcating four zones for each of the teachings of the Islamic *sharia*[55] (law). The larger space of the cross, the one right before the *quibla* wall and where all the praying commences, contains a 4/5 proportion. This was first seen as an anomaly, since the 4/5 ratio belongs to the major third, a tone seldom found in Arabic music.

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[55] The term means "way" or "path to the water source"; it is the legal framework within which the public and private aspects of life are regulated for those living in a legal system based on *fiqh* (Islamic principles of jurisprudence) and for Muslims living outside the domain. *Sharia* deals with many aspects of day-to-day life, including politics, economics, banking, business, contracts, family, sexuality, hygiene, and social issues. Most Sunni Muslims follow four schools: *Hanafi, Hanbali, Maliki or Shafi`i.*
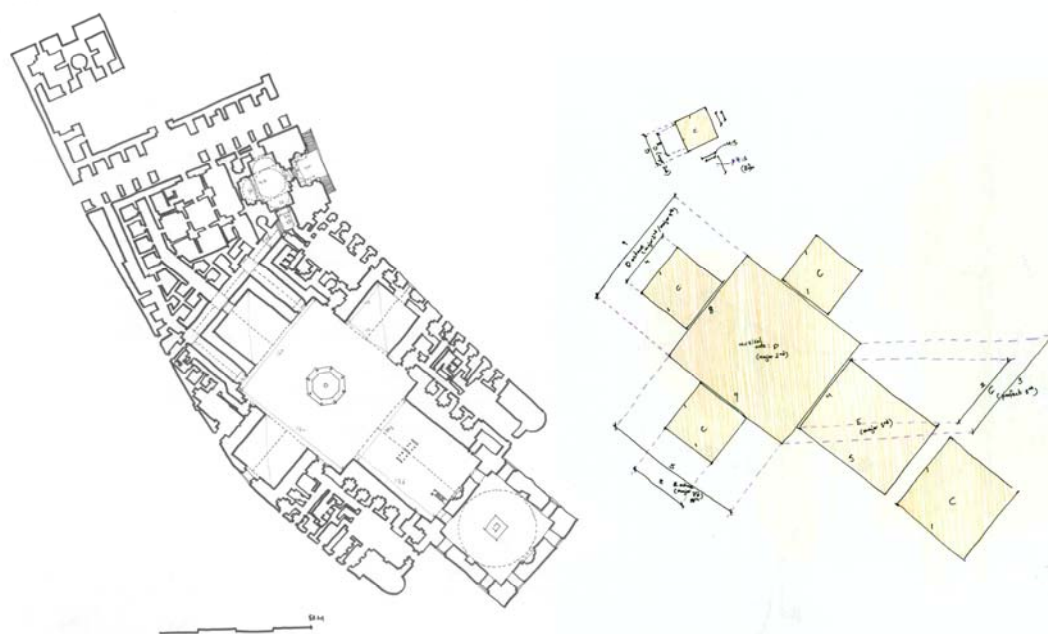
The Arabic musical equivalent to the 4/5 ratio would be more like 41/50. Although this is a very slight difference, and any proportion slightly larger than 4/5 would be considered a perfect match with the error being attributed in either measurement from the plan or error in drawing the plan, but the proportion measured was actually slightly less than 4/5, making it adhere more to the western scale as opposed to the Arabic scale.

This revelation seemed very troublesome at first. However, after conducted more research on the subject, it was revealed that the philosopher al Farabi (872 – 951), was among the first to revive the concept of harmonic proportion in his book *kitab al musikie el kabeer* (the big book of music)[56]. Music, along with arithmetic, geometry,

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[56] get safi el din footnote

astrology, logic…etc, was considered one of the more important subjects in his *Ihsa al Ulum* (survey of important subjects and topics) setup, much like that of the western liberal arts of the Renaissance period. It clearly documents each note of the major, Just Intonated, scale and its proportions; all derived from the Pythagorean teachings.

Figure 18: Mosque of Sultan Hassan

It could be argued that the information found in *Ihsa al Ulum* was studied and utilized by the thinkers of the Islamic World at the time, the philosophers, the mathematicians, the scientists, and the master builders. The same harmonic proportions that exist in the Paladian villa[57] are also found in all the mosques that were analyzed in this study. This finding suggests that the earlier assumption of proportion being a cognitive element, where each region would differ from one another due to elements either found in nature or in linguistic structure, and such proportions are even found in the region's music is improbable. The difference

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[57] It is now obvious that the harmonic proportions in the Paladian villa are based on the Just Intonation scale and not the equal temperament scale, and that is why it shares common proportions with Arabic music.

between the 4/5 ratio and the 41/50 ratio, in any case, is rather miniscule that it is impossible to discern by the naked eye.
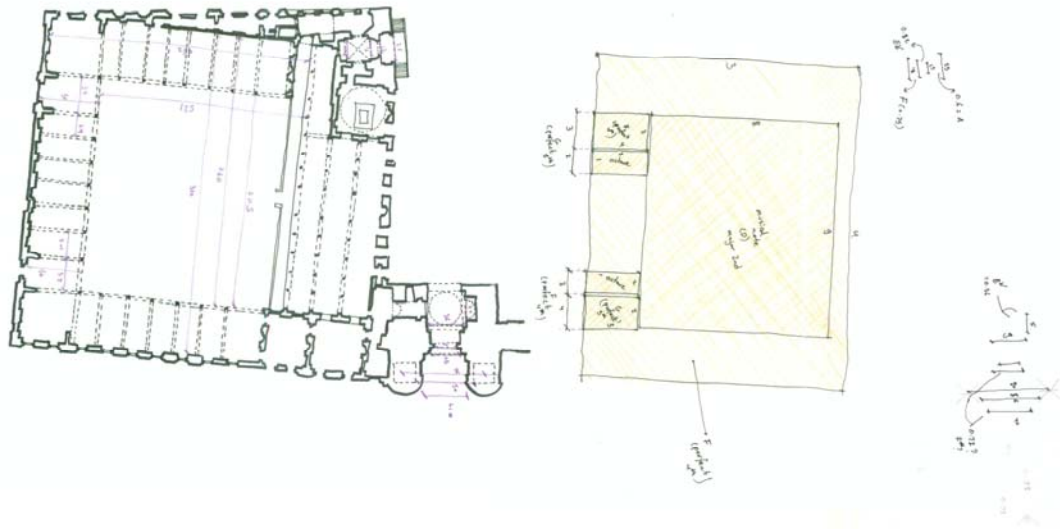
Figure 19: Plan and diagrams of the mosque of Sultan al-Mu'ayyad Sheikh (1415)

Figure 20: Mosque of Sultan al Mu'ayyad Sheikh

The interesting find while diagrams these mosques is the often use of the 8:9 proportion in the courtyards. The 8:9 proportion is that of the major 2nd, and in Arabic

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Maqams, is the starting note of the *Bayati, Bayati Shuri, Husseini, Zanjaran, Ushaq Masri, Shahanaz, Saba, Saba Zamzam, Kurd,* and *Hijaz Maqams.* More research is needed to understand the significance of this, if there is infact any at all.
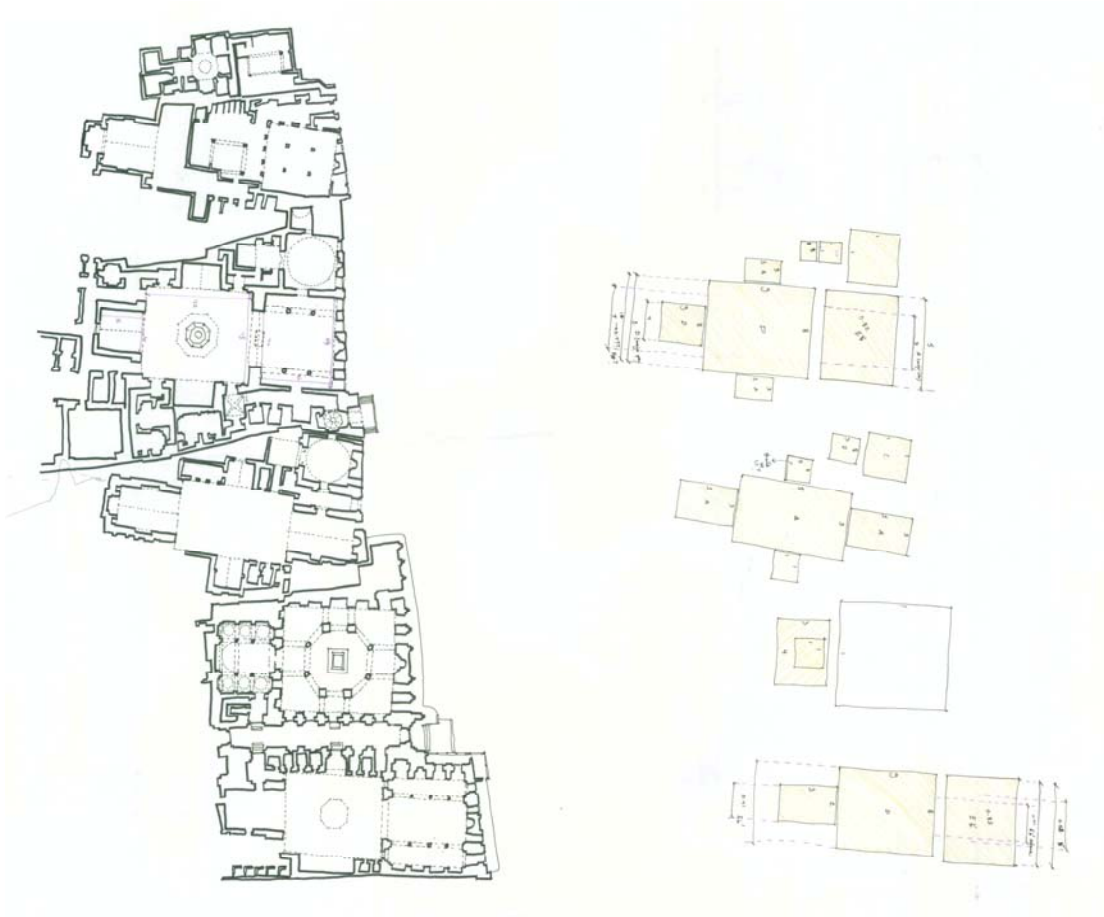
Figure 21: Barquq / Qalawun complex (13th & 14th century)

Figure 22: Barquq / Qalawun complex (between the two palaces) along the Qasaba (Palace Walk)

Chapter 3: Architecture as a Stimulus for Movement

Section 1: Introduction

The title "Building as a Stimulus for Movement"[58] comes from Kent Bloomer and

Charles Moore's "Body, Memory, and Architecture"[59] in the chapter "Body

Movement", which is actually a contribution by Robert J. Yudell. The chapter asserts

that the movement of our bodies is affected by the animation of space, and thus the

spaces we create tend to embody our own natural rhythms of movement.

"The ebbs and flows, weights, rhythms, and surges that emanate from us are inherent
in the body and its movements. Try to walk in precise and even measures. Even if you
succeed in doing so horizontally, as in a march, there will still be complex rhythmic
events in the vertical dimension (the raising and lowering of the chest with breathing
and the changes in the relative alignment of body weight), not to mention the internal
rhythms of heart and pulse.

Given this rhythmic richness which we all possess, and the fact that patterns as
mundane as pavement cracks and picket fences can elicit complex haptic responses,
we might well wonder why any building cannot be as good as the next in generating a
body response."[60]

<div align="right">- Robert J. Yudell</div>

Yudell goes on to criticize today's repertoire of movement, saying that our bodies are

increasingly becoming immobilized[61]. While automobile and transit technology have

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[58] *Body, Memory, and Architecture*, pp.59 - 65
[59] Bloomer, Kent C. / Moore, Charles W., *Body, Memory, and Architecture* (Yale University, 1977)
[60] *Body, Memory, and Architecture*, pp.60 - 61
[61] Subsections *Our Repertoire of Movement* and T*he Frozen Body and The Floating body*, (*Body, Memory, and Architecture*, pp.72 – 74)

been able to connect places and open up vast landscapes of space we would have

never thought of treading before, it is slowly turning us into what Yudell calls "frozen

bodies". The idea of the procession and promenade of pilgrimage is diminishing, so in

a sense, it could be argued that we don't appreciate our spaces as much as we used to.

The end location is becoming much more important that the journey that we go

through to reach such a location. In *Space and Place*, Yi-Fu Tuan talks about this

end-location mindset:

"Walking purposefully from A to B is felt as leaving so many steps behind and as
having much more ground ahead to cover. Change the environment by introducing
band music and, objectively, one still marches from A to B with seeming deliberation.
Subjectively, however, space and time have lost their directional thrust under the
influence of rhythmic sound. Each step is no longer just another move along the
narrow path to a destination; rather it is striding into open an undifferentiated space.
The idea of a precisely located goal loses relevance.[62]"
                                        - Yi-Fu Tuan

Pamplet Architecture's "Architecture as a Translation of Music"[63] cites numerous

examples of how musical rhythm can affect one's movement and awareness of space.

Elizabeth Martin introduces the subject-matter, saying that while "architecture

represents the art of design in space; music is the art of design in time." If one flattens

the dimension of time, into a 2D surface (in the same way sheet music does), one

could really play around with different rhythmic patterns onto the surface.

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[62] Tuan, Yi-Fu, *Space and Place: The perspective of Experience* (University of Minnesota Press, Minneapolis, 1977)
[63] Martin, Elizabeth, *Pamphlet Architecture: Architecture as a Translation of Music* (Princeton Architectural Press, 1994)

Section 2: Introduction to Rhythm: Meter and Time in Music

The time signature (also known as "meter signature") is a notational convention used in Western musical notation to specify how many beats are in each measure and what note value constitutes one beat. Simple time signatures consist of two numbers, one above the other, the lower number indicates the note value, which represents one beat (the "beat unit"), and the upper number indicates how many such beats there are in a bar. For instance, 2/4 means two quarter-note (crotchet) beats; 3/8 means three eighth-note (quaver) beats. The most common simple time signatures are 2/4, 3/4, and 4/4.

Figure 23: Common Time Signatures

Simple time signatures	
4/4 (quadruple)	*common time*: widely used in most forms of Western classical and popular music. Most common time signature in rock, blues, country, funk, and pop[2]
2/2 (duple)	*alla breve, cut time*: used for marches and fast orchestral music. Frequently occurs in musical theater. Sometimes called "in 2".
4/2 (quadruple)	common in early music; rarer since 1600, although Brahms and other composers used it occasionally.
2/4 (duple)	used for polkas or marches
3/4 (triple)	used for waltzes, minuets, scherzi, and country & western ballads.
3/8 (triple)	also used for the above, but usually suggests higher tempo or shorter hypermeter.
Compound time signatures	
6/8 (duple)	double jigs, polkas, fast obscure waltzes, marches and some rock music.
9/8 (triple)	"compound triple time", used in triple ("slip") jigs, otherwise occurring rarely (The Ride of the Valkyries and Tchaikovsky's Fourth Symphony are familiar examples.)
12/8 (quadruple)	classical music; also common in slower blues (where it is known as *shuffle*) and doo-wop; also used more recently in rock music.

Figure 24: Common Time Signatures

Mannerist Facades often compose their surfaces that way, using some kid of parts to serve as the metronome (datum) and other parts to play up these rhythmic changes. The Renaissance ideal of harmony gave way to freer and more imaginative rhythms. Giulio Romano (1499-1546), one of the first promoters of Mannerism, used the triglyphs on the facade of Palazzo Te in Mantua as the metronome element, where all the spacings are equal, while the intervals of the intercolumniation differed creating a rhythmic pattern on the facade. Looking closely to the image below, one could read the facade giving an ABABAC rhythm, and more specifically, if one imagines each triglyph forms a 1/16th note, one could read the columns forming a musical rhythm of 1/8th - 1/4th - 1/8th - 1/4th - 1/8th - 5/16th.

Le Corbusier's La Tourette covenant also uses this same play of rhythm in the architecture. Iannis Xenakis, Le Corbusier's right hand man and internationally well-known 20th century composer, designed parts of the facade to correspond to some of his musical compositions. The seemingly irregular window mullion intervals of the lower levels, juxtaposed with the pompous window openings of the upper levels (which serves as a datum, or metronome, for the irregular mullions below), create a phenomenological play of light and shadow in the interior[64]. The rhythmic intervals of the La Tourette facade are a lot more complex than that of Romano's Palazzo Te.

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[64] Sterken, Sven, *Music as an Art of Space: Interactions Between Music and Architecture in the Work of Iannis Xenakis,* from *Resonance: Essays on the Intersection of Music and Architeccture,* pp. 27 (Culicidae Architectural Press, 2007)

This is mostly due to the fact that Xenakis bases his musical intervals on mathematical ideas like the golden section and Fibonacci series.

Figure 26: Covenant de La Tourette Rhythmic Mullions

Figure 27: Covenant de La Tourette

In Professor Noonan's seminar "Sensing Architecture: Body & Place", a collaboration with Ritsaart Marcelis on a project draft starts to discuss this issue of musical rhythms that affect the architectural promenade. The following stills from an animation investigate how a procession through a colonnade could be altered using different musical rhythm patterns to dictate the intercolumniation.
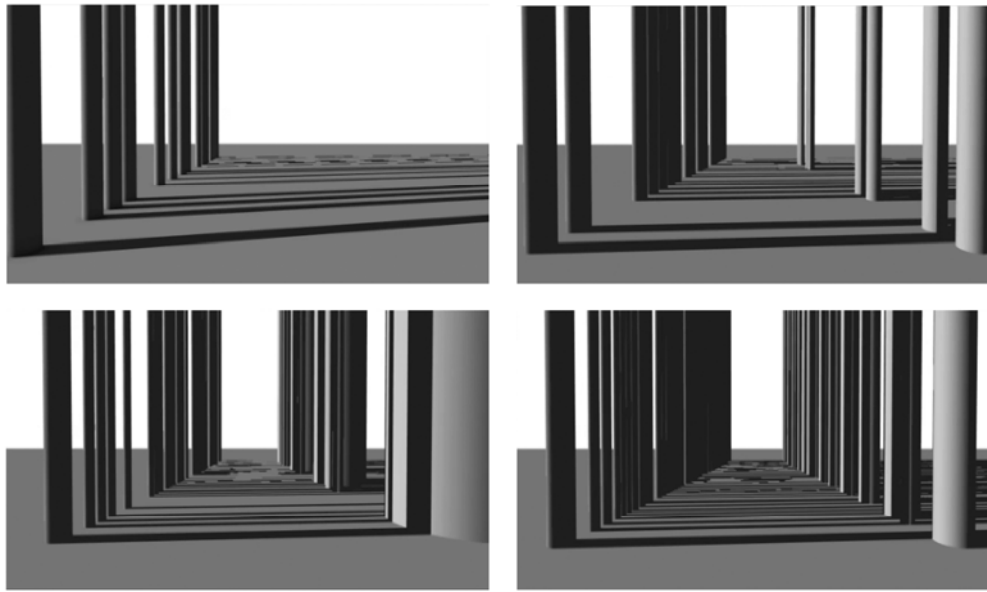
Figure 28: Early animations depicting the concept of Rhythm

The criticism presented in class was that the animation seemed too rigid, and unmusical. This animation lacks two very important aspects of music: layering and attitude. While the animation is a direct translation of rhythm written down on sheet music, audible music is seldom played with one layer of rhythm. Even the most mono-rhythmic music, there exists multiple layers within the rhythm to give it a more powerful output. The animation stills above is the equivalent of a guitar student, playing a rock riff acapella; the rest of the band (datum) is absent to fully grasp the idea of the music.

Attitude (dynamics and crescendo) is also a very important aspect in music. This is why a classical musical piece would sound different when it is being led by one conductor than another, as each conductor would understand the whole mood of the piece subjectively. This is also why many blues guitarists are considered to have

"soul", as the selection of what notes are important to be emphasized and attacked, while what notes are known as leading notes. The same solo, if played without the emphasis on these select notes, would also feel unmusical.

The notion of attitude and poly-rhythmic layers is also found in architecture. The use and hierarchy of Michelangelo's "Super-order" on his facades could be read as the visual correspondence of multi-rhythmic compositions. Looking at Palazzo dei Conservatori, at the Campidoglio[65], the balustrades on the roof serve as the metronome (it could be argue that the dentils of the cornice has the same effect), with the Giant Corinthian pilasters serving as the hierarchical rhythmic stomps. The intervals between each Corinthian pilaster and the other is equidistant, as opposed to that of Palazzo Te, which means in auditory terms, the musical rhythm would be that of a pounding heartbeat (imagine a POMP - POMP - POMP musical piece). The intercolumniation of the ionic columns on the lower floor, and the smaller Corinthian columns on the floor above to support the window openings, are what provides the variations in the rhythmic patterns of the facade. So in drumming terms, if the giant Corinthian pilaster is seen as the booming bass drum, the ionic columns on the lower floor as the lesser impact Ionic column as the loud yet lesser impacted snare drum, and the variation of window openings and division of balustrades as subtle playing on the hi-hat, then Palazzo dei Conservatori has been transformed into a simple drum rhythm.

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[65] The following observation is mere speculation of the author; no specific evidence exists to support the argument. These observations however, are a result of visual analysis conducted by the author during a recent visit to Rome.

This idea that Palazzo dei Conservatori is analogous to a modern drum rhythm is an interesting one. As classical music of that time is much more melodic based as opposed to rhythm based, it is worthwhile to find out if that analogy has any correspondence to the evolution of music in Europe around that time.

<u>*Section 3: Rhythmic Music, Rhythmic Architecture*</u>

Subsection 1: Pachelbel's Canon in Dmaj

The following diagrams use the musical edifice "Canon in Dmaj" as a generator for form. The series is primarily interested in the rhythmic notation of the piece. This particular edifice was chosen because of its simple, looping eight-chord progression, and a simple theme, that goes through numerous variations with each loop of the chord progression. The series of images are taken out of an animation the author composed, which imagines the music being transformed in a sea of vertical elements that one navigates through, with each row on the X-axis representing a different musical instrument, and the Y-axis representing time. It can also be understood as injecting form into sheet music. The heights correspond to the pitches that the instruments play, assigning the lowest pitch (the lowest pitch played by the double bass) to the lowest unit measurement. The sizes of each vertical element correspond to its rhythmical value, assigning the widest size to the whole note values (one note for every four beats) of the bass and the narrowest size to the thirty-second note values (eight notes for every beat) of the trills (found in the sixth window of

53

Figure 28). This particular animation can be found on YouTube

(http://www.youtube.com/watch?v=g1oSbOy0V9E) or on the author's website

(http://riadmusicarchitecture.blogspot.com/)
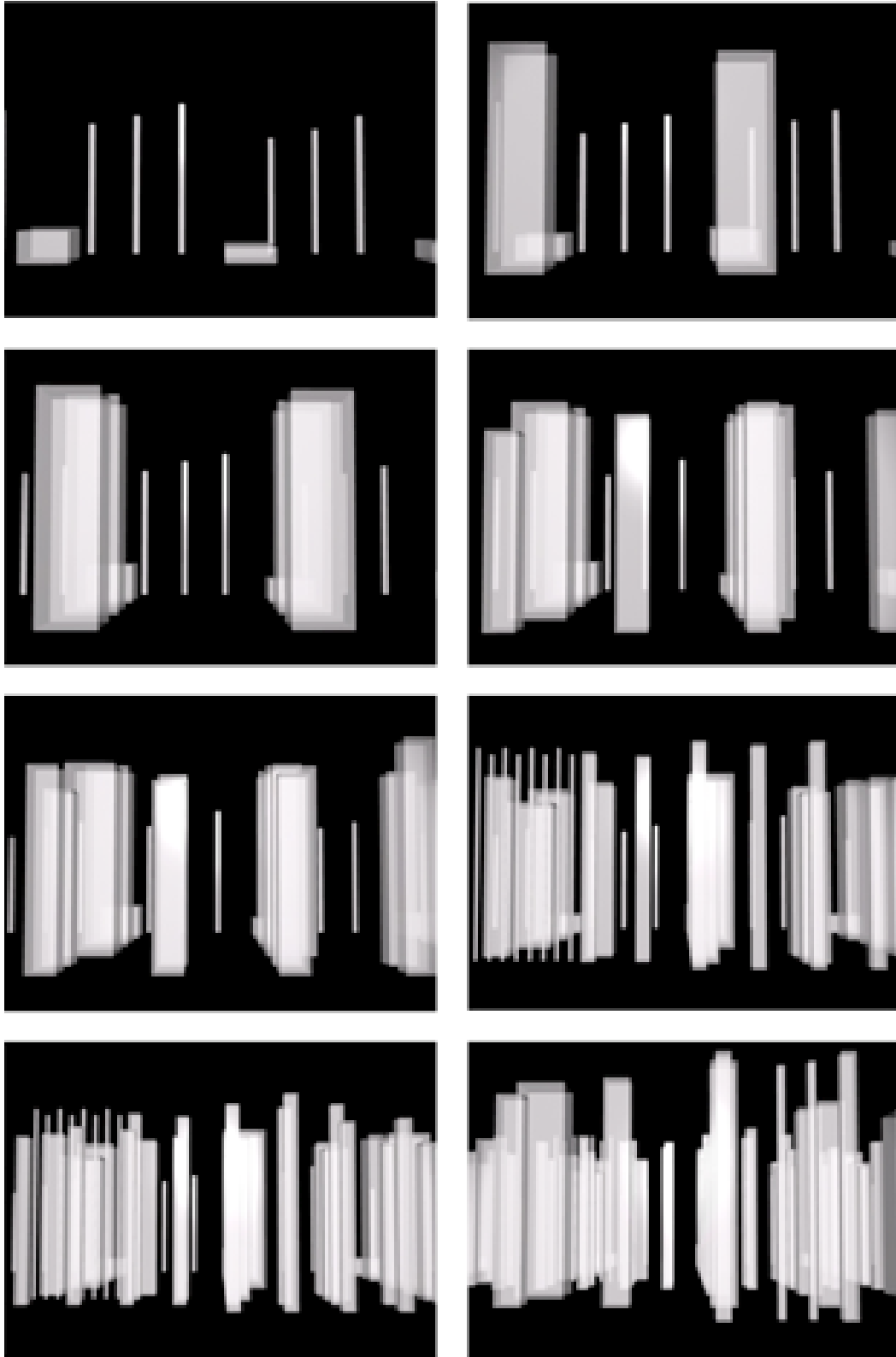
Figure 29: Visualization of Pachelbell's Canon in Dmaj. Each frame represents the beginning of a new theme added to the chord progression, starting from the intial base line and main theme to the cresendo

Subsection 2: Um Kalthoum's "Alf Leila wa Leila"

Figure 29 diagrams the musical edifice "Alf Leila we Leila", by Egyptian composer

Baligh Hamdi, written for Egyptian crooner Um Kalthoum. The same algorithm in

respect to form making used for the "Canon in Dmaj" example is also applied on this

piece. This particular animation can be found on YouTube

(http://www.youtube.com/watch?v=HASPZtftS68).

A number of animations were composed for these two musical pieces, each one with

a different navigation path through the vertical elements. One of the main differences

between music and architecture when it comes to linear composition is where in

architecture one walks forward from point A to B, in music one would walk

backwards from point A to B, as there is no distinguishing what lies ahead in music,

only what has been passed is being recollected in memory, while in architecture, one

can distinguish what lies ahead through a strong visual axis. This notion leads the

author to compose the backward navigating animations. Although the animations are

true to the music, they seemed awkward in an architectural setting. The animations

chosen to be presented in this document (figures 28 and 29) have the camera navigate

through the model so that the forms are seen in elevation. This allows for the element

of surprise, akin to musical experience, without the need for backward navigation.

This also allows the viewer to experience the Y-axis (time) in whole, as one walks

outside the form as opposed to navigating through it. All said animations are available

for viewing at http://riadmusicarchitecture.blogspot.com.
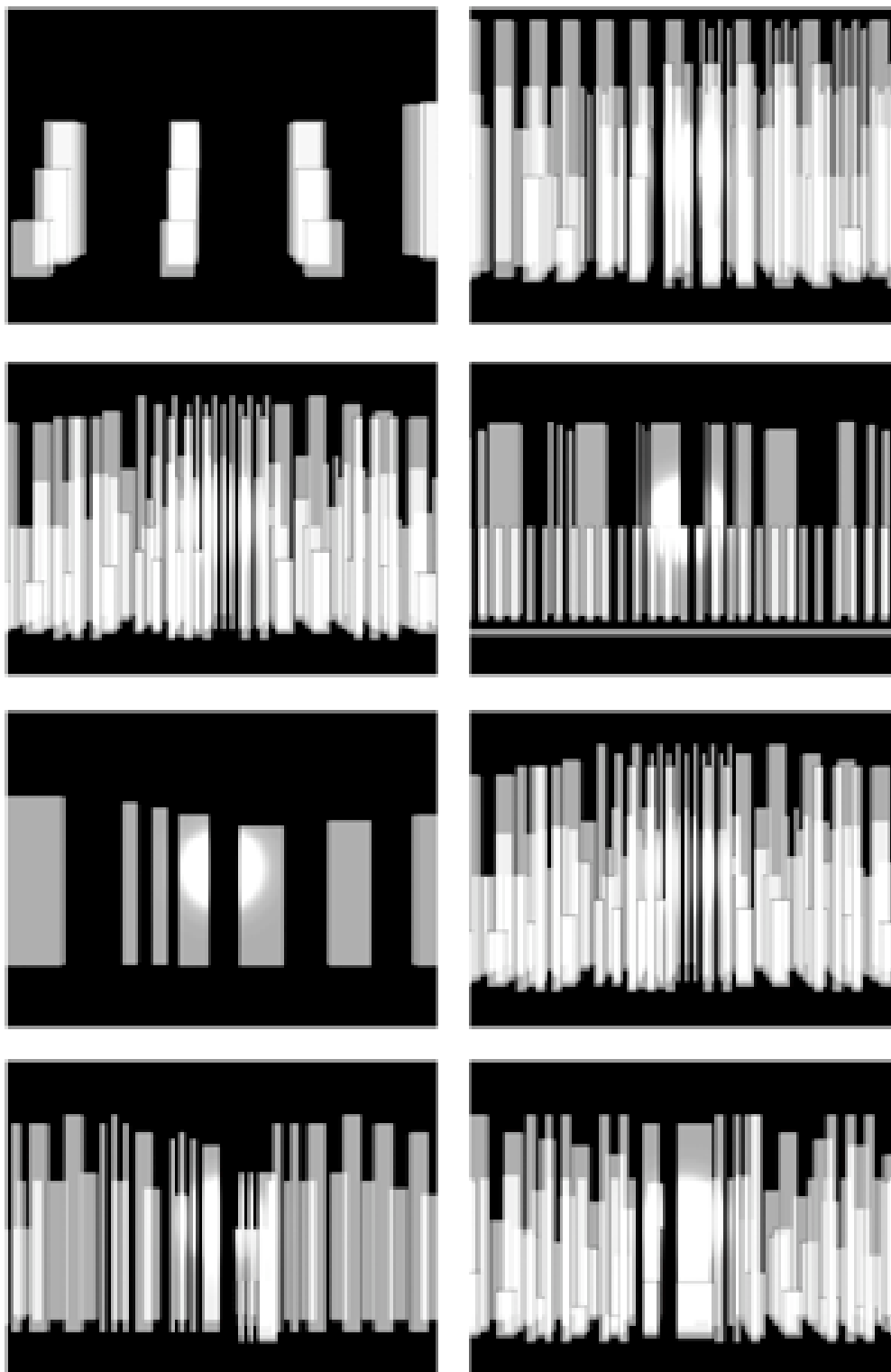
Figure 30: Visualization of "Alf Leila wa Leila". Each frame represents a different episode that occurs within the musical edifice.

Chapter 4: Architecture as a Musical Instrument

The quality and character of sound depends on two factors: resonating volumes and choice of materials. Musical instrument tectonics is based on the size, shape, and volume of the resonating chamber and the qualities of the materials used. This is the reason why steel stringed folk acoustic guitars sound different than nylon string classic guitars, and why both sound incredibly different than the nylon string middle eastern 'ud (the lute's precedent). The decisions made in both factors affect the reverberation time and the tonal quality of the sound produced.

The same could be argued with architecture. An instrument is merely a device that amplifies the sound, so architectural spaces could be seen as large-scale instruments. In concert halls, the acoustics of the space is considered to be the last piece of the puzzle that synergizes the orchestra and blends all the musical instrument so it is perceived as one artifact, as opposed to fragmentary musical lines played collectively. This means that any concert performance would sound slightly different according to the space that it is being played it, as each concert hall as a unique acoustical identity. Aside from concert halls, every architectural space carry sound different than its neighbor. Granted that with small-scale rooms these changes in aural quality are not noticed as much, but sound is definitely an influencing factor that affects our

perception of space. A CD titled "music and architecture: the sound inside"[66] provides

a number of musical performances, recorded live in iconic architectural spaces, each

space chosen to highlight its associated musical piece's unique aural qualities.

Section 2: Architecture as a Musical Instrument

Architecture, at times, has even contributed to the creation of music. The birth of the

Gregorian chant is credited to the proliferation of space in the gothic cathedral.

Cathedrals were the acoustic twins of large natural caverns. Blesser and Salter

(authors of "spaces speak, are you listening?") have noted that the volumes of some

caverns in the Czech Republic approach 50,000 cubic meters, which are comparable

to the volume of a cathedral[67]. Both are large enclosed spaces with irregular

geometries, randomly shaped surfaces, minimal acoustic absorption, and uniform

diffusion of sound arriving from all directions.

It may seems obvious that the creation of such vast acoustical resonance chamber for

cathedrals would be intentional to convey a religious / spiritual message or

connection. The history of the evolution of sacred spaces in Christianity would prove

otherwise[68]. Before Emperor Constantine declared Christianity as the official religion

of the Roman Empire in BC 313, Christians would congregate, secretly, in abandoned

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[66] CD release by Celestial Harmonies, 1998
[67] Blesser, Barry / Salter, Linda-Ruth, *Spaces Speak, Are You Listening? Experiencing Aural Architecture* (MIT Press, 2007) p. 89
[68] Blesser, Barry / Salter, Linda-Ruth, *Spaces Speak, Are You Listening? Experiencing Aural Architecture* (MIT Press, 2007) p. 90

large spaces within their region. These spaces were typically Greek basilicas that had once served as courthouses and commercial meeting places. These spaces were usually rectangular in shape and were defined by two rows of columns. After the Imperial adoption of Christianity, walls were added for protection from the weather and to display political power. This was a major change in the quality of the aural space.

Within the next few centuries, the growth of Christianity prompted the need for larger congregation spaces. These spaces had increasing floor areas and dramatically high ceilings (some would argue that these figural spaces were a symbolic connection to a higher power). The surface materials were usually made of stone, which replaced the use of wood, as a result from advances in building technology, and because stone was resistant to fire. The resulting acoustics was thus unintended. The acoustics were terrible for speech; as the priest spoke to his large congregation, his words, if heard, would blend into one another due to the vast reverberation time (Blesser and Salter note it to approach 10 seconds for middle frequencies). However, such spaces can be used to create sounds that please the ear. If one was to speak in long tones (sing slowly), the blending between one tone and the other would sound harmonious, and thus the communication here becomes a musically tonated one, and not the spoken word. This segues into the birth to the Gregorian chant.

The interesting thing about reverb is that the ears detect a slight harmonizing tone alongside the original one that's being voiced. The tonal difference between the original tone and the harmonic one is a perfect fifth[69] (more on that when musical scales musical scales and harmony would be discussed); creating a common chord that is used throughout western music, and which pop/rock music refers to as the "power chord". This slight harmony was picked up by the chanting monks, and exploited even further in their chanting. The choir could be divided, each group singing a different harmony line, and these tones would just blend into one another, creating beautiful musical chords. Of course, each space has its own reverberation time, so the choirs belonging to each church would compose their music accordingly.

In *Experiencing Architecture*, Steen Eiler Rasmussen talks about two other composers who have used spaces as a generator of their musical compositions. The Byzantine church of S. Mark's in Venice was Giovanni Gabrielli's[70] instrument. The church is built over a Greek cross plan and has five domes, one in the center, and each of the four arms of the cross. S.Mark's had two music galleries, one to the right and the other to the left, as far away as possible with their domes acting as mighty resonators. Gabrielli made use of this, by letting the music come from both sides, one answering the other, in his *Sonata Pian e Forte*[71]. The congregation did not hear two

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[69] Blesser, Barry / Salter, Linda-Ruth, *Spaces Speak, Are You Listening? Experiencing Aural Architecture* (MIT Press, 2007) p. 92
[70] Giovanni Gabrieli (c. 1554/1557 – August 12, 1612) was an Italian composer and organist. He was one of the most influential musicians of his time, and represents the culmination of the style of the Venetian School, at the time of the shift from Renaissance to Baroque idioms.
[71] *Sonata Pian e Forte* also plays another important role in the creation of perspective thinking in music (Schafer, R. Murray, *Our Sonic Environment and the Soundscape, the Tuning of the World* pp. 155, Destiny Books, Vermont, 1977). While perspective was introduced into European painting during the fifteenth century, Gabrieli's piece introduces the use of dynamics into the music (*Sonata*

different orchestras, but heard two musical rooms, each responding to one another in counterpoint, or as Rasmussen puts it "one speaking with silver tones, the other responding in resounding brass[72]." The congregation was placed underneath the central dome, which served as another instrument, or blending spaces that connects the music coming from the left and right.

Figure 31: St Marks Cathedral in Venice

Pian' e Forte literally means to be sounded soft and loud). Schafer notes that before this date, there has been no record of dynamic contrast in music.
[72] Rasmussen, Steen Eiler, *Experiencing Architecture*, (MIT Press, 1964)

The St. Thomas church at Leipzig was Bach's[73] instrument. This church was not known for its vast reverberation time. After the Reformation, large areas of resonant wood were added to the naked stone, the sidewalls were lined with tiers of wooden galleries, and curtains were added at openings of the new added private boxes. All elements that absorb sound and not reflect it. Playing the soft slow blending tones of the Gregorian chant would seem boring and less enchanting, as such tones would not sustain or resonate in space for very long. Hope Bagnel, the famed acoustician and author of "*Planning for Good Acoustics"*, figures the reverberation time of the church to be 2.5 seconds, as opposed to 6-8 seconds in standard medieval churches. Bach had to find different ways to how his composition would be as enchanting and awe inspiring. The resultant musical compositions gave birth to the Cantata and Passion[74]. Bach's famed inventions were thus much more musically complex, with a lot of use of counterpoint, where two very distinct musical lines, played in relatively fast speed, could be listened to simultaneously, without the notes blending into one another to form a cacophonic mess.

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[73] Johann Sebastian Bach (31 March 1685 [O.S. 21 March] – 28 July 1750) was a German composer and organist whose sacred and secular works for choir, orchestra, and solo instruments drew together the strands of the Baroque period and brought it to its ultimate maturity. Although he introduced no new forms, he enriched the prevailing German style with a robust contrapuntal technique, an unrivalled control of harmonic and motivic organization in composition for diverse musical forces, and the adaptation of rhythms and textures from abroad, particularly Italy and France.

[74] Rasmussen, Steen Eiler, *Experiencing Architecture*, (MIT Press, 1964)

Section 3: The Soundscape

"It would seem that the world soundscape has reached an apex of vulgarity in our time, and many experts have predicted universal deafness as the ultimate consequence unless the problem can be brought quickly under control."

– R. Murray Schafer

R. Murray Schafer first defined the term Soundscape in 1976 as the surrounding context of our aural space. It is the Aural equivalent to the visual landscape. Scholars like Schafer and Juhanni Palasma have been criticizing the global culture of today's world in their hegemony of vision, saying that we have been an ocular centric society. In his 1976 publication, *The Soundscape: Our Sonic Environment and the Tuning of*

the World[75], Schafer advocates architects and designers to use sound as an integral component in both the site analysis and design process.

Schafer identifies three components in any soundscape that would make up the "figure / ground" of aural space:

The Keynote: The anchor of fundamental tone acting as a reference point that everything else takes on its importance. It is the Sound that is barely noticeable (although usually noticed when they abruptly stop), but sets up the datum to which all the other sounds are measured against. The sound produced from the leaves ruffling from the wind is an example of a natural keynote, while manmade keynotes could be anything from the electric hum of the ventilator or air-conditioning unit, to the sound of continuous traffic sounds of a busy street. The term keynote is borrowed from music, as any musical piece needs a keynote that all other notes are measured upon to make up the scale that the musicians are playing in. All sounds produce frequency, making the pitches produced in any Soundscape measurable like musical notes. The Keynote is also defined as the surrounding ambient noise.

The Signal: Foreground sounds that are listened to consciously, and are usually associated with communication. While the keynote maybe considered the aural ground, signals become the figure of aural space, the sound that penetrates the ambient noise to become the most prominent feature in the Soundscape. Signals are usually noted for being louder than the surrounding ambient noise levels, but sounds

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[75] Schafer, R. Murray, *Our Sonic Environment and the Soundscape, the Tuning of the World* (Destiny Books, Vermont, 1977)

can also be signals by being a higher pitch than its surroundings, yet shares the same decibel level[76].

It is important to note here that there are no sound vacuums. There always is a keynote and always is a signal. Even in a remote setting, like a sealed room, filled with acoustically absorbing materials, the keynote becomes the individual's breathing and heartbeat, while the signal becomes anything else he does that produces sound. It is also important to note that what produces a signal differs from one Soundscape to another. A human voice can be a signal in the countryside, where there are few sounds that can battle with it, while in a crowded restaurant, one's voice is used to serve the overall keynote of a multitude of conversations in a sound blur.

The Soundmark: These are community sounds that are unique or posse's qualities, which make it specially regarded, or notice by the people in that community. Whether it's a church bell, or call to prayer, or even a hum resulting from the passage of wind on a unique terrain or forest of trees. It is the aural equivalent to the landmark, yet it can work either as a signal figural element (call to prayer) or as a keynote ground element (unique landscape setting or sounds produced by local animals).

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[76] While higher pitches can become signals while at the same decibel level as the surroundings, lower pitches cannot. If two instruments are being played at the same time with the same intensity and decibel level, the higher pitch becomes the signal while the lower serves as its keynote. Higher pitches are easier to identify by the human ear, because they are different than the natural sounds, which tend to be lower in register. Low pitches are known to surround space more effectively than higher pitches that are better as piercing tones.

Schafer also goes to identify two types of Soundscapes:

The Hi-Fi Soundscape: Where discrete sounds can be heard clearly because of the low ambient noise level. Sounds cross over less frequently creating perspective and depth in the Soundscape, a very clear distinction between the foreground and background noises. Schafer discerns that all Soundscapes before the industrial revolution were of this type.

The Lo-Fi Soundscape: Individual acoustic signals are obscured in an overdense population of sounds. "There is no distance, there is only presence". Schafer warns that our Soundscape in the major cities today all Lo-Fi, a blur of sound.

In the Architecture | Music | Acoustics Conference[77], Kurosh Mavash presented a paper[78] proposing, "a complete sensitizing of the designer to the contextual Soundscape". He categorized sounds into seven different groups[79]:

Cultural and Musical Sounds: Most of the soundmarks would come from this group. These include Religious sounds (bells, call to prayer, chanting, sounds of prayer…etc), street musicians and parades, clock towers…etc.

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[77] Architecture | Music | Acoustics International Cross Disciplinary Conference; Ryerson University, Toronto, Canada; 8 -10 June 2006.

[78] Mavash, Kourosh, *Site + Sound: Space*, from *Resonance: Essays on the Intersection of Music and Architeccture*, pp. 53 - 76 (Culicidae Architectural Press, 2007)
[79] Ibid pp.65-66

Sounds of People: The language spoken within the region creates different ambient Soundscapes. Some languages are more tonal based, while others include more staccato rhythms, all of which produces a different datum in the keynote. Accents, dialects, and use of dynamics all play a role in creating the soundmark keynote of any Soundscape.

Natural Sounds: Sounds of weather, animals, water…etc.

Sounds of Movement: The sounds produced by the modes of transportation within the region.

Sounds of Buildings: The sounds and reverberation produced through human interactions with the materials and surfaces of architecture.

Sounds of Trades or Industries: Whether small scale like blacksmiths or glassblowers, or larger scales like factories and power plants

Sounds of Awareness: Sirens, alarms, doorbells, dog-barking…etc.
It should be noted that many of these groups frequently overlap. While the church bell is a cultural sound, it is also a sound of awareness, calling for people to prayer or announcing noon. While footsteps are considered by Mavash to belong in the sounds of movement group, it could be argued that the rhythms produced by such footsteps is a cultural phenomenon produced by the people. Arabian and Persian women used to

wear ankle bells, announcing their entrance while walking, producing a unique rhythmical sound that was later emulated by Arabian musicians in the riqq instrument[80].

Section 4: The Use of Sound as a Place Making Tool

In response to the international style of the early twentieth century that has swept the world by storm, a lot of architects and theorists are now arguing about the importance of place making. Norberg-Schulz describes place as the art of totality, "its purpose is to create 'images of the world', which through their interaction manifest the meaning of things, which surround us and clarify the interaction itself as a local presentation of global meanings."[81]

What about the use of Sound as a means of place making and place understanding? During the author's trip to a few cities along the east coast of the United States and around Egypt to record sound bytes for this research, it becomes apparent that cities within Egypt use sound more effectively than any of the American cities. While an image of New York is very identifiable, it's sound byte is very close to any other city of the same stature around the world (Lo-Fi Soundscape). Such cities share similar sounds of transportation, similar sounds of trade, similar sounds buildings, and a lack of cultural sounds to help create a soundmark. There of course are a few exceptions,

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[80] The *riqq* (also spelled *riq* or *rik*) is a type of tambourine used as a traditional instrument in Arabic music.

[81] Norberg - Schultz, Christian, *Architecture: Presence, Language, Place,* pp 221, Skira Editore S.p.A., Milan, 2000

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Cairo being one of them; the sounds of the call to prayer (*adhan*) immediately

pinpoint the city as an Islamic city.

Section 5: The Islamic Aural City

An early assumption was made that the Soundscapes in Cairo would be considered as

Lo-Fi. Cairo is well known to be a noisy[82] city, where the streets were filled with the

orchestration of car horns and overblown radio sound systems. This was not the case.

Cairo is a very loud city, but there is a level of hierarchy within the Soundscape. The

louder the sound, the more power and authority it has over the region, which is why

the sounds of the call to prayer (*adhan*) is the loudest and can be heard within a busy

street filled with car horns.

Islamic communities are traditionally characterized by acoustic space within which

the call to prayer can be heard from anywhere within the city[83]. Figure 32 diagrams

the extent of which the sound of the call to prayer can be heard within the historical

Islamic city[84]. The center of the circles is pinned on the minarets that function as call

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[82] There are two different concepts of noise: one is that of the Lo-Fi Soundscape, where one cannot distinguish one sound from the other because everything is just blended in to make a sound blur, and the other where the sounds are considered to be too loud or above the threshold of pain in listening (above 90 dB). The noise in Cairo is of the latter.

[83] "In his insightful study of the call to prayer in Singapore, Tong Soon Lee (1999, 91) presents the idea that the community of Islam has traditionally been defined aurally, that is 'an *acoustic community*, a community characterized by the acoustic space within which the call to prayer could be heard.' Indeed, the sound of the call permeates life in Muslim countries." Marcus, Scott L., *Music in Egypt: Experiencing Music, Experiencing Culture*, Oxford University Press, New York / Oxford, 2007,

[84] The map chosen is taken from Warner, Nicholas, *The Monuments of Historic Cairo: A Map and Descriptive Catalogue (American Research Center in Egypt's Conservation)*, 2005. The map shows the modern day remnants of what used to be Mamluk Cairo (reaching its urban zenith in the 15th century). Map designed and prepared in co-operation with the Supreme Council of Antiquities, for the Egyptian

to prayer platforms. The first circle (diameter 80m) diagrams the area where the call

is the loudest, where the second circle (diameter 160 m) diagrams the area where the

call can be heard and the words be understood clearly, while the third outermost

circle (diameter 320 m) diagrams the limits to where the call is heard[85]. The area

between the second and third circles are areas where the call is heard as a general

hum, words cannot be heard clearly, where the reverberation of the sounds turn the

sound into a blur and it then becomes a loud keynote. It should be noted that the

diagram uses the unamplified human voice (loudest at 80 dB), while today's

amplified calls[86] would span further than what is depicted. The map proves that the

entire city is within audible reach to a mosque, save three areas, one of which houses

a number of synagogues and the Jewish community, while the other two are of

modern reconstruction (19th and 20th century).

Similar recordings have been performed in Islamic Cairo's main thoroughfare, and

have yielded slightly different results than that of the American cities[87]. A totally

different shift in keynote for one, where the keynotes in the American cities featured

little footsteps, Cairo's keynote is filled with footsteps, where the locals wearing

cheap slippers, allow there feet to be dragged on the dusty ground for a second before

the foot is airborne once more, creating a slow sliding sound as opposed to the ticking

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Antiquities Project of the American Research Center in Egypt. Completed in March 2001 under
USAID GRANT no. 263-G-00-93-0089-00. © 2001 American Research Center in Egypt.
[85] The diagram was based on a simple physics equation on the intensity of sound: each time the
distance is doubled the intensity level is divided by four. Knowing that any sound made by a human
being cannot exceed 80dB (without amplification), the outer large circle marks the point where the
sound has reached 20dB (audible whisper).
[86] The use of amplification came about in the 1960s, to combat the loudness of the street noises.
[87] A number of recordings were done on cities along the East coast of the United States in an ongoing
research on Sound Typologies within urban cities.

sound of the western heel. Sounds of local trades are also more prominent in Cairo, whether it's the clanking of the blacksmiths, or the hammering of the carpenter, or even the sounds or their radios cranking up in the background, either cranking out music or Quran recitation.

The major soundmark in the area are all the religious sounds (call to prayer, quran, sermons…etc). As seen in figure 32, one can hear the call to prayer from multiple locations as the mosques are very close to one another, creating dialectic between sound sources, which depending on the muezzins of the area, can be either a harmonic or cacophonic experience. Although the Egyptian government recently declared its intention to connect all the calls to a single sound system, this idea of multiple sound sources reciting the same thing is a common thread in Arabic music and is referred to as Heterophony (different voices)[88].

Furthermore, the melodic modes (*Maqams*) used in the call to prayer chant are also another place identifier. Cairo generally uses an Arabic scale called *Maqam Rast* in their calls, while other mosques in Turkey have a tradition of using 5 different *Maqams,* one for each specific prayer time, throughout the day: *Maqam Saba* for the predawn call, '*Ushshaq* for the noon call, *Rast* for the afternoon call, *Sikah* for the sunset call, and *Hijaz* for the final call[89].

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[88] In Arabic music, each performer may execute the given melody in a matter unique to their specific instrument, resulting in a rich, multifaceted rendition of a single melody.
[89] Marcus, Scott L., *Music in Egypt: Experiencing Music, Experiencing Culture*, pp. 14 -15 , Oxford University Press, New York / Oxford, 2007,

While this research explores the use of sound in the site analysis portion of design, it has yet to explore methods on how sound can be used in the design process. Ideas of designing through musical composition is currently being tested, where instead of the use of graphical representation to describe and explore space, the designer uses simple musical arrangements to describe the aural quality of the sequence of space. The composition maybe a simple rearrangement of existing sound sources to create a pleasing Soundscape, or within the building interior, where the designer then is required to recreate the musical composition through the acoustic carving of spaces and selection of materials. The sounds produced within the architecture would be through human and climate interaction, where footsteps and wind passage could be manipulated to achieve the desired effect.

Moreover, analyzing sound bytes provides patterns within the culture of the site that is invisible throughout image-based analysis. It also provides a different paradigm in creating place, where so called visual eyesore places are considered more pleasing sonic environments than some more aesthetically pleasing places. These studies need to be further developed and added to designer toolset in order to create places that engage all five senses equally.
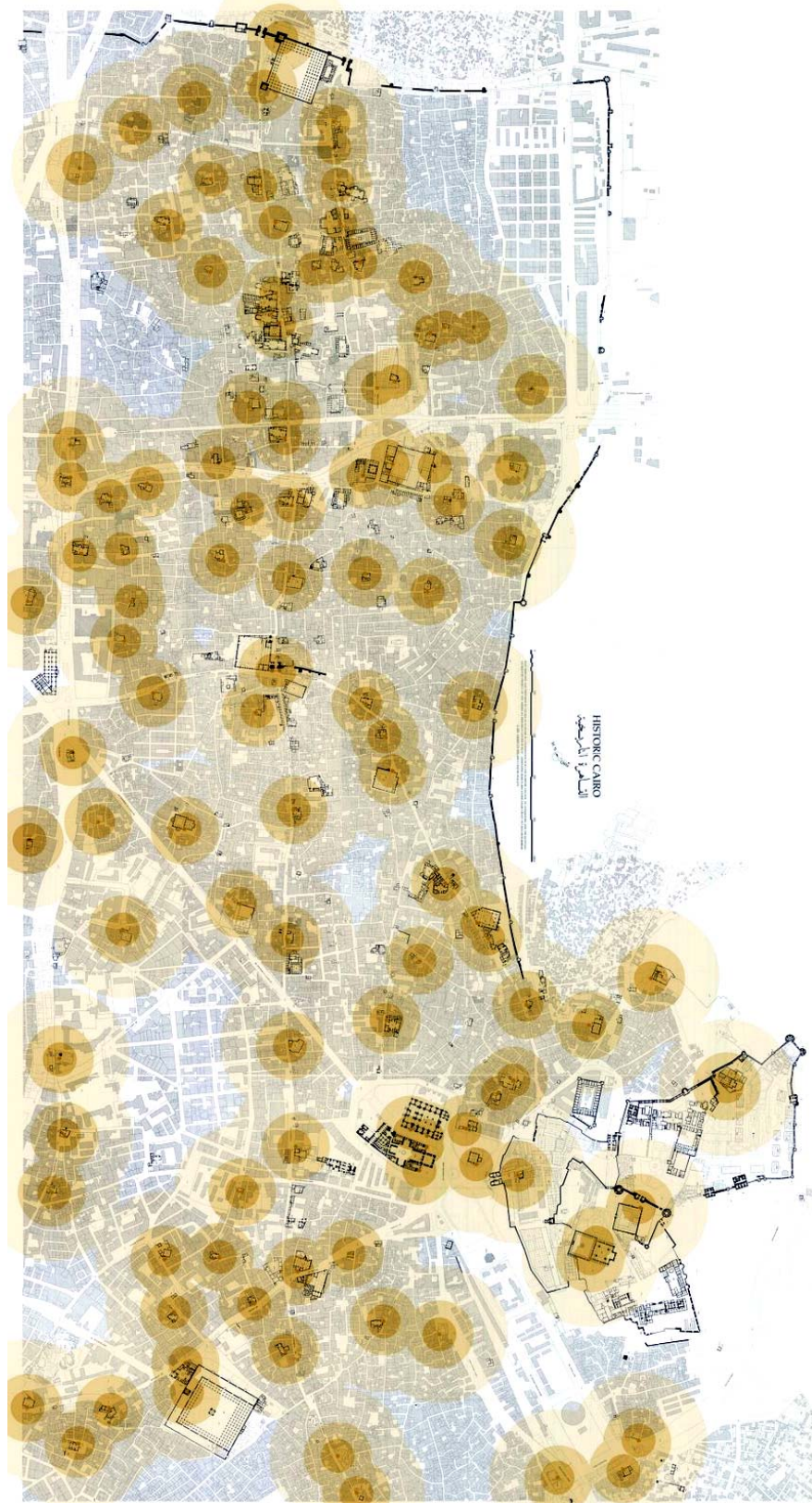
Figure 33: Extent of the call to prayer in Historic Cairo

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Chapter 5: Music as an Inspiration for Architecture (Irrational Expression)

Section 1: Introduction (A Personal Voyage with Synesthesia)

As a guitar instructor, I tried to keep my lessons interesting. I felt that a guitarist (or just a musician in general) should always be proficient in three aspects: his technical dexterity on the instrument, his knowledge of music theory, and his ability to be creative. It's relatively much easier to improve your technical skills, and study your music theory as opposed to expand the horizons of your creativity. As an instructor, I tried to keep the student engaged in all three throughout the lesson. For the creativity part, I would try to get the students to force themselves to think out of the box. For example, the very first of these exercises, would be focused on painting. I would ask the student to describe to me what they see, what they feel the artist is trying to express, what do they think the intent of the artist was, what aspects of the painting makes them feel that way...etc. After I felt the student had deconstructed the painting and started to be at one with the emotions spurring out of the painting, I would ask them the million-dollar question,

"What Music was going on in your head, while you were analyzing the painting?"

Usually the first response would be that of shock, "Music? I thought we were talking about colors here!" Some of them had to take a while to be able to let the idea sink in.

What was interesting is the variety of answers that I got from them, and what aspect of the painting that they identified the music with; some students would try to imagine the sounds that may have taken place in the scene painted and just see what music fits best with the scene, others looked at it like a film scoring method and identified the general mood that the painting conveys and adds the score that depicts that mood, others responded more to colors, others to quality and character of the lines and brush strokes, some identified them with actually music pieces, some to genres, and some to instruments, and some students just didn't get it and couldn't make any connections whatsoever. The paintings used were of my favorite painters: Kandinsky, Klee, Picasso, Dali, Giger, Da Vinci...among others.

The idea of the association between music and art came upon me in high school, when a particular painting of an abstraction of a landscape that I have been working on prompted a comment that it "felt" like ballet "Swan Lake". I was very intrigued by the comment, especially because I was listening to a lot of Swan Lake at the time. I felt that some of the expressive elements of Tchaikovsky's masterpiece that resonated within me were manifested in the painting I was focused on. At that point of time, I believe that architecture and music could also be related, and I have since (eight years now) been pondering and wondering about it.

Years later, while taking Professor Peter Noonan's seminar " Sensing Architecture:

Body and Place", the class was introduced to the phenomenon of "Synesthesia". The

way I would personally describe it (I am sure most, if not all, neurologists would

disagree with me) would be a phenomenon when two or more senses linked together,

to create a higher consciousness (or unconsciousness in this case) that transcends the

norm, making you feel things slightly differently than others. Diane Ackerman's

opening sentence in the Synesthesia chapter of A Natural History of The Senses,

possibly describes this better:

"A creamy blur of succulent blue sound smells like week-old strawberries dropped
onto a tin sieve as mother approaches in a halo of color, chatter, and a perfume like
thick golden butterscotch.[90]"

She defines Synesthesia saying that "stimulation of one sense stimulates another",

while the word actually comes from the Greek _syn_ (together) and _aisthanesthai_ (to

perceive). According to Richard E. Cytowie, author of the book The Man Who Tasted

Shapes, Synesthesia occurs in the limbic system, the most primitive part of the

brain[91]. He states that those whose limbic system is not entirely governed by the

much more sophisticated and more recently evolved cortex. His book seems to look at

the phenomenon as more of a neurological disease of some sort, although he, on

many occasions, writes that the phenomenon is fascinating and should not be

considered as a handicap but as an advantage. He also states that those who

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[90] Ackerman, Diane, _A Natural History of the Senses,_ pp. 289 (Vintage books, 1995)
[91] Cytowic, Richard E., _The Man who Tasted Shapes_, pp.151(G.P. Putnam's Sons, New York, 1993)

experience intense Synesthesia are about one in every 500,000, ignoring those cases that seem to be more about association rather than Synesthesia. The difference is, with association, you kind to have to think about it for a little while, to see what fits, but with Synesthesia, the connection between both senses just happens, with no explanation to it.

Section 3: Types of Synesthesia

According to Sean A. Day[92] (moderator of The Synesthesia List), the types of Synesthesia are:

Current count: (at least) 54 types of Synesthesia

Graphemes > Colors	=660/1014	=65.1%
Time units > Colors	=236/1014	=23.3%
Musical sounds > Colors	=191/1014	=18.8%
General sounds > Colors	=86/1014	=8.5%
Musical notes > Colors	=85/1014	=8.4%
Smells > Colors	=68/1014	=6.7%
Tastes > Colors	=65/1014	=6.4%
Personalities > Colors (auras)	=64/1014	=6.3%
Pain > Colors	=53/1014	=5.2%
Touch > Colors	=39/1014	=3.8%
Emotions > Colors	=25/1014	=2.5%

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[92] http://home.comcast.net/~sean.day/Synesthesia.htm

Temperatures > Colors	=23/1014	=2.3%
Orgasm > Colors	=21/1014	=2.1%
Emotion > Smell	=1/1014	=0.1%
Grapheme personification [*]	=37/1014	=3.6%
Non-graphemic ordinal personification [*]	????	???
Number form	=77/1014	=7.6%
Object personification [*]	=16/1014	=1.6%
Ticker-tape [*]	????	???
Emotion > Pain	=1/1014	=0.1%
Emotion > Smell	=1/1014	=0.1%
Emotion > Taste	=2/1014	=0.2%
Emotion > Temperature	=3/1014	=0.3%
Emotion > Touch	=1/1014	=0.1%
Kinetics > Sounds	=3/1014	=0.3%
Lexeme > Taste	=21/1014	=2.1%
Musical notes > Tastes	=2/1014	=0.2%
Personalities > Smells	=5/1014	=0.5%
Personalities > Touch	=2/1014	=0.2%
Smells > Sounds	=5/1014	=0.5%
Smells > Tastes	=2/1014	=0.2%
Smells > Temperatures	=1/1014	=0.1%

[*] Insufficient data

Smells > Touch	=5/1014	=0.5%
Sounds > Kinetics	=5/1014	=0.5%
Sounds > Smells	=16/1014	=1.6%
Sounds > Tastes	=55/1014	=5.4%
Sounds > Temperatures	=6/1014	=0.6%
Sounds > Touch	=41/1014	=4.0%
Tastes > Sounds	=1/1014	=0.1%
Tastes > Temperatures	=1/1014	=0.1%
Tastes > Touch	=6/1014	=0.6%
Temperatures > Sounds	=1/1014	=0.1%
Temperatures > Taste	=1/1014	=0.1%
Touch > Smell	=3/1014	=0.3%
Touch > Sounds	=6/1014	=0.6%
Touch > Tastes	=11/1014	=1.1%
Touch > Temperatures	=1/1014	=0.1%
Vision > Kinetics	=1/1014	=0.1%
Vision > Smells	=13/1014	=1.3%
Vision > Sounds	=25/1014	=2.5%
Vision > Tastes	=28/1014	=2.8%
Vision > Temperatures	=2/1014	=0.2%
Vision > Touch	=16/1014	=1.6%

Figure 34: Types of Synesthesia

Section 4: Levels of Synesthesia

Cytowie goes further and distinguishes three different levels of Synesthesia[93]:

The Direct Level: Sensually concrete, stimulus-response combination should be invariant. The same stimulus should always trigger the same reflex over and over. If one links the color red to the note A, this link will always remain, and not change under any circumstances, yet it is semantically meaningless. Cytowie calls this a Low Link (One to One) level.

The Cognitive Level: Sensually abstract, context may influence the experience. One may start to react to passages of music rather than specific notes. Cytowie says this level is loaded with meaning, and links it to the Aristotle cross-modal associations found in normal people. He calls this a High Link (One to Many) level.

The Intermediate Level: Associations and partly invariant, partly contextual. Intermediate link (One to a Few) level.

For purposes of this thesis, the concentration would be on the Cognitive Level Synesthesia. It seems to me, that the colored music type in the list above is of most fruitful investigation, although Kandinsky, a synesthite, also talks about line width

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[93] Cytowic, Richard E., *The Man who Tasted Shapes*, pp. 93-98 (G.P. Putnam's Sons, New York, 1993)

and character that expresses different musical sounds or instruments (from point and line to plain). I personally experience point and line character synesthesia when listening to music, and particular songs or musical pieces paint an overlay wash on the image in my head. For the final project for Professor Noonan's seminar, the idea of colored music was tested in the below movie clip. Each song would highlight a different hue or tone to the visual image. The movie clip (which was also uploaded in another blog post) is supposed to convey my experience while listening to my ipod and walking through the McKeldin Mall of the University of Maryland.

Section 5: Healing Colors of Sound

One of the major types of Synesthesia is colored music. There have been reports that both Alexander Scriabin and Nikolai Rimski – Korsakov both freely associated colors with music when they composed. To Scriabin, C maj was red, to Rimski – Korsakov it was white. To Scriabin, A maj was green, to Rimski – Korsakov it was rosy 94…etc.

The following diagram lists all the personalities that have written about their personal correspondences of colored music:

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[94] Ackerman, Diane, *A Natural History of the Senses*, pp. 290 - 291(Vintage books, 1995)

Three Centuries of Color Scales

		C	C#	D	D#	E	F	F#	G	G#	A	A#	B
Isaac Newton	1704	red		orange		yellow	green		blue		purple		magenta
Louis Bertrand Castel	1734	blue	teal	green	olive	yellow	yellow	orange	red	dark red	magenta	purple	purple
George Field	1816	blue		purple		red	orange		yellow		olive		green
D. D. Jameson	1844	red	orange	orange	yellow	yellow	green	teal	blue	purple	magenta	magenta	magenta
Theodor Seemann	1881	dark red	red	orange	yellow	yellow	green	teal	blue	purple	magenta	dark red	black
A. Wallace Rimington	1893	red	dark red	orange	orange	yellow	olive	green	teal	teal	blue	blue	magenta
Bainbridge Bishop	1893	red	dark red	orange	yellow	yellow	green	green	teal	purple	magenta	pink	red
H. von Helmholtz	1910	yellow	green	teal	blue	purple	magenta	magenta	red	orange	orange	orange	orange
Alexander Scriabin	1911	red	magenta	yellow	purple	blue	dark red	blue	orange	purple	green	purple	blue
Adrian Bernard Klein	1930	red	red	orange	yellow	yellow	green	teal	teal	blue	purple	magenta	magenta
August Aeppli	1940	red		orange		yellow		green	teal		blue	purple	purple
I. J. Belmont	1944	red	orange	orange	orange	yellow	green	green	blue	purple	magenta	magenta	magenta
Steve Zieverink	2004	green	green	teal	blue	purple	magenta	dark red	red	red	orange	yellow	yellow

© 2004, Fred Collopy—RhythmicLight.com

Section 6: Synesthesia in Arabic Culture

It is difficult to affirm how Arabic music affects Synesthesia, or whether people react to it different than western music, or if Arabs are Synesthetes in the first place, or what kind of Synesthetes are they, as little research has been done on the subject according to region. Arab Musicologist Habib Hassan Touma discusses the emotional content of arabic maqams, stating that results of a survey among Arabian musicians show that maqam rast evokes a feeling of pride, power, soundess of mind, and masculinity; maqam bayati evokes feelings of vitality, joy, and femininity; maqam sikah evokes feelings of love; maqam saba evokes sadness and pain; while maqam hijaz conjures up the distant desert. These have yet to be tested on how they may relate to the built environment.

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Chapter 6: Music as an Inspiration for Architecture (Rational Expression)

Section 1: Introduction

deconstruct |ˌdēkənˈstrəkt|

verb [trans.]
analyze (a text or a linguistic or conceptual system) by deconstruction, typically in order to expose its hidden internal assumptions and contradictions and subvert its apparent significance or unity.

"You employ stone, wood, and concrete, and with these materials you build houses and palaces. That is construction. Ingenuity is at work.
But suddenly, you touch my heart, you do me good. I am happy and I say: "This is beautiful." That is architecture. Art enters in.
My house is practical. I thank you, as I might thank Railway engineers, or the Telephone service. You have not touched my heart.
But suppose that walls rise toward heaven in such a way that I am moved. I perceive your intentions. Your mood has been gentle, brutal, charming, or noble. The stones you have erected tell me so. You fix me to the place and my eyes regard it. They behold something which expresses a thought. A thought which reveals itself without wood or sound, but solely by means of shapes which stand in a certain relationship to one another. These shapes are such that they are clearly revealed in a light. The relationships between them have not necessarily any reference to what is practical or descriptive. They are a mathematical creation of our mind. They are the language of Architecture. By the use of raw materials and starting from conditions more or less utilitarian, you have established certain relationships which have aroused my emotions. This is Architecture."
    – Le Corbusier, *Towards a New Architecture* 1927

The technical aspect of any kind or art, wether its painting, composition, architecture,

or even sport, will only take you so far to create something that others may call art.

There is this hidden quality that differentiates drawing from painting, muzak from

music, building from architecture, or aerobics from sport. A musician once told me

that this hidden quality is *attitude*, two soloist can play the same exact musical phrase, but one possesses a certain "emph" in his playing, maybe using dynamics to accentuate some notes from the rest, allowing the phrase to be much more rhythmic than it actually is, while the other player, but not adding anything to the mix, is just reciting a bland musical phrase. Even if two gifted soloists play the same phrase, each with the right amount of attitude, the outcomes would be entirely different, as each would perform the phrase to reflect their own soul. That's why ever time you hear Tchaikovsky's Swan Lake by a different orchestra and conductor it sounds slightly different.

The question becomes, staring from conditions more or less utilitarian, how do you turn lines, colors, and shapes into art; notes, chords, and rhythm into music; structure, material, and space into architecture; dribbling, kicking, and passing into sport. My thought is that there should always be intent towards a work of art, even if the intent is to capture specific moods or spontaneity of the artist at that specific moment. A narrative or overriding story (or plan of attack in sports) that is not explicitly spelled out within the work of art, but could be understood through cycles of deconstruction. A level of abstraction is needed to break the tangible artifact from its bonds of reality (from the frame off the wall) into a realm of conceptualization. It is then when you can start to translate, or transpose, one work of art into another.

Section 2: Deconstruction vs Synesthesia

Deconstruction is often mistaken for Synesthesia. The main difference is while Synesthesia may be post-rationalized (depending on the level of Synesthesia, the direct levels often could not be post-rationalized) it never is pre-rationalized. Deconstruction entails a preemptive analysis of the subject matter, which means a certain degree of intellectualization is needed at the beginning, as opposed to the sensory reflex action of Synesthesia. That is why many believe that artists like Kandinsky, Paul Klee, and Scriabin are not Synesthetes as had been previously noted, but are Pseudo-Synesthetes, those who rely on association and memory rathen than the sensory reflex action of Synesthesia. In Point and Line to Plane, Kandinsky discusses how musical ideas have influenced his art, specifically mentioning his painting Little Dream In Red. He discusses how dynamics and sounds of musical instruments influence his choice of line weight and color. Although this is very much akin to a synesthete's perspective, Kandinsky states that although some of his correspondences are founded upon his own personal "feelings", others are founded upon cultural biases and mysticism.

Schematization of the correspondences between colors and musical timbres according to Kandinsky:

Yellow   Trumpet; Sound of the fanfare

Azure   Flute

Blue   Deep sounds from the organ

Dark blue	Cello
Very dark blue	Bass
Green	Middle tones of the violin
White	Temporary pause
Black	Conclusive pause
Grey	Lack of sound
Bright red	Fanfare; Tuba / Horn
Crimson red	Drum-roll; Tuba / Horn
Cool red	Medium and deep tones of the cello
Bright cool red	Other tones of the violin
Orange	Middle bells of the church; Strong contralto voice; Viola
Violet	English horn; Bagpipe
Deep purple	Deep tones of the woodwinds; Bassoon

Section 3: Deconstruction as a Tool for Abstraction

There is more to these correspondences than just these Synesthestic reflexes. Some architects took specific events within a musical edifice and used that to as a conceptual bias for their architecture. Steven Holl used Bella Bartok's Music for Strings, Percussion and Celesta as his inspiration for the Stretto House, "(the edifice) has a materiality in instrumentation which the architecture approaches in light and space." Both the piece and the building are formed in four sections, consisting of two

modes: heavy orthogonal masonry representing the percussion, and light curvilinear metal roofing representing the strings.

Daniel Libeskind drew inspiration from Arnold Schoenberg's "Moses und Aron" for the Jewish Museum in Berlin. He was particularly interested in the sudden break of the music in the third act of the operetta, after two acts of fairly complex music, the music abruptly stops in the second act, allowing the silence to act as a figural element just as the music. Libeskind goes on to say that the unwritten third act is actually one of silence, allowing sounds from the audience to come into play. Whether Schoenberg actually intended that is highly questionable, but his contemporary John Cage

"composed" 4'33" based on that idea; not letting the musicians play their instruments for 4 and a half minutes, allowing the sounds from the audience to compose itself into the piece. Libeskind says that his "void" spaces within the museum are placed to achieve the same effect; a disorienting phase to allow the visitor to become a participant in a space allowing contemplation and reflection.

Section 3: Deconstructing Rhythm

How people dance and sway to rhythm is subjective, but they do move to it nonetheless. The following series of exercises, done in Professor Michael Ambrose's ARCH670 class at the University of Maryland, attempts to deconstruct Extreme's "Get the Funk out". The song is an upbeat catchy, funk-rock/funk-metal tune. The objective of the project was to deconstruct the rhythmic sensations of the song. I asked former tap dancing state champion, Martiena Schneller, to improvise a routine for the song, and I analyzed her body movement accordingly.
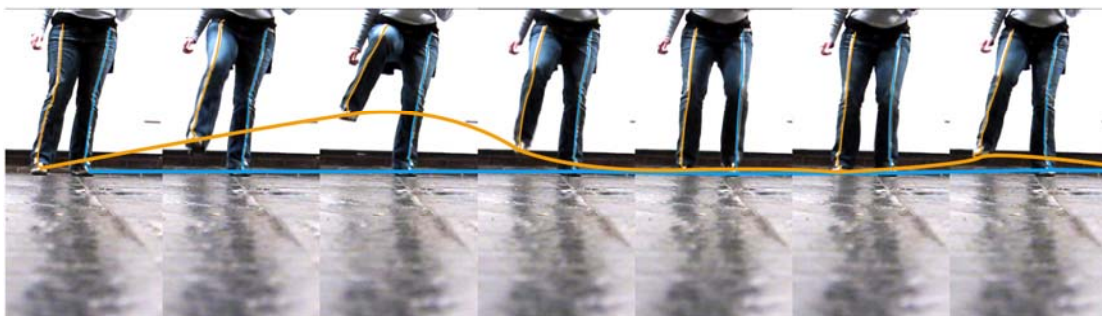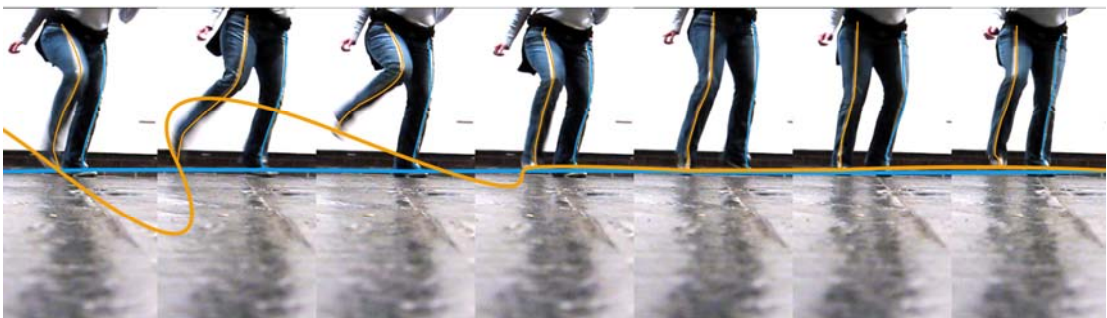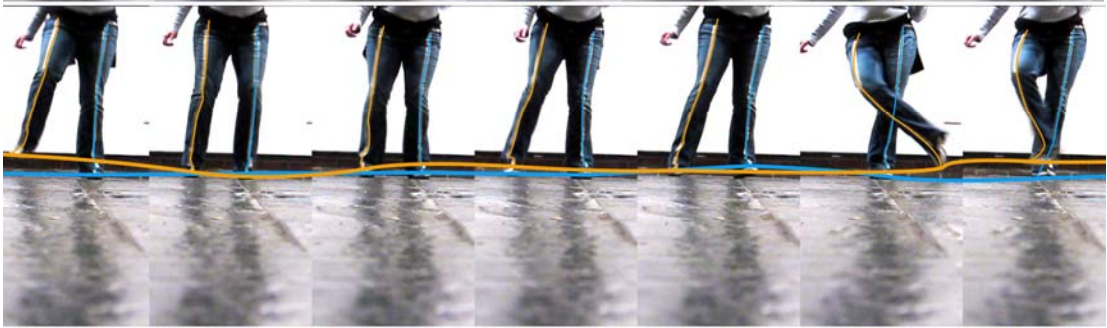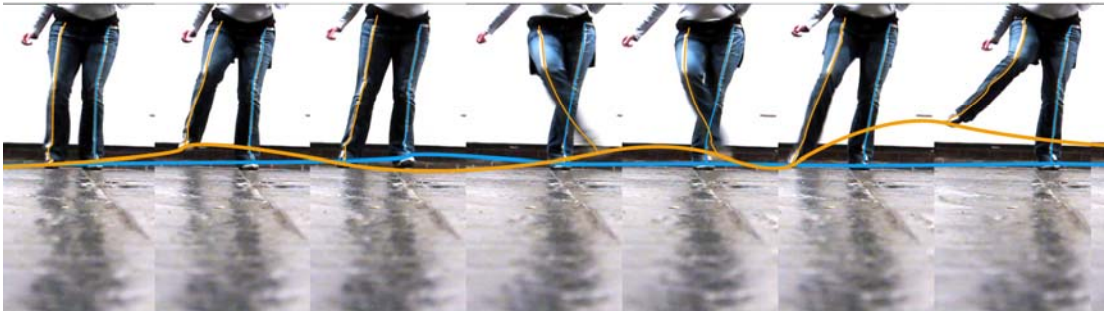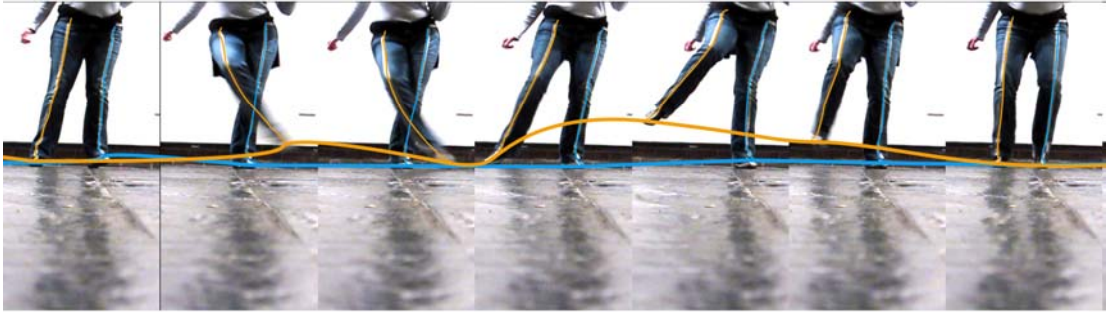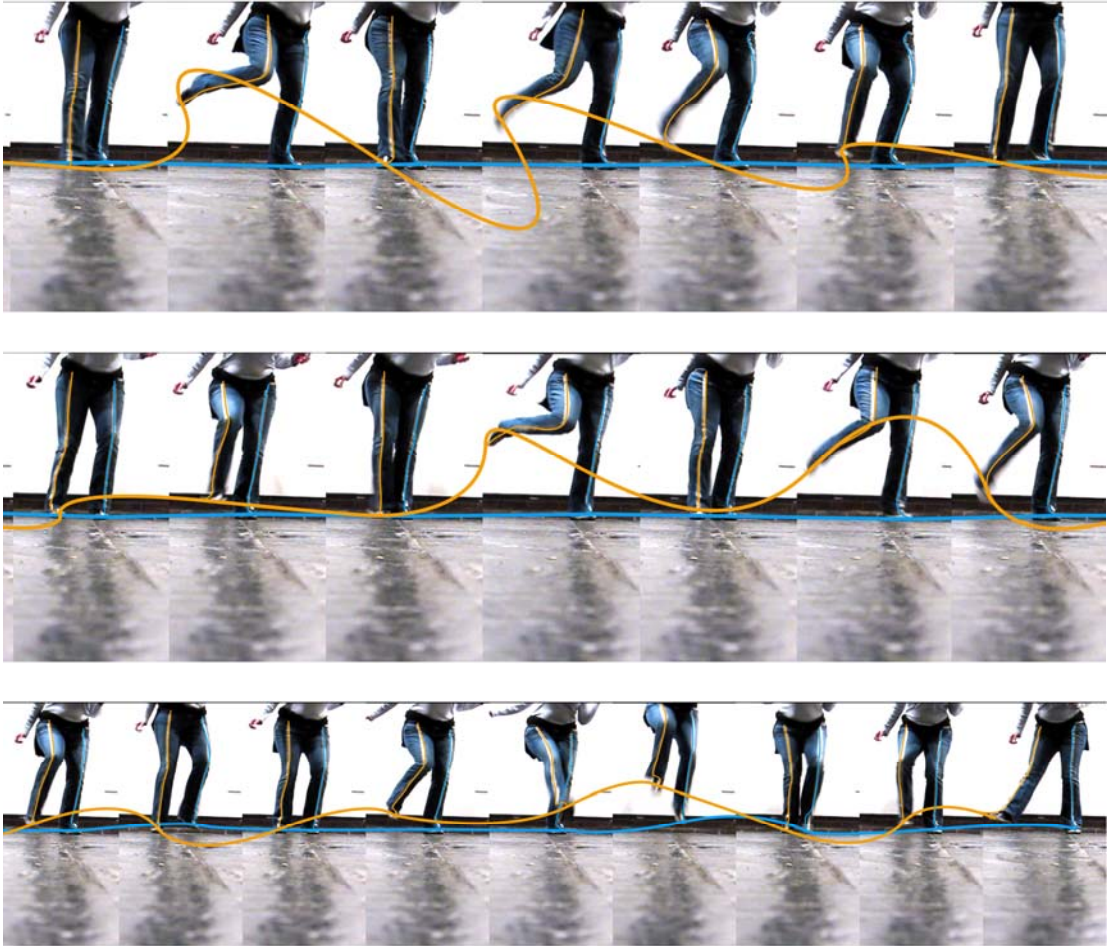
Figure 36: Tap dancing diagram of the "Get the Funk out" intro sequence
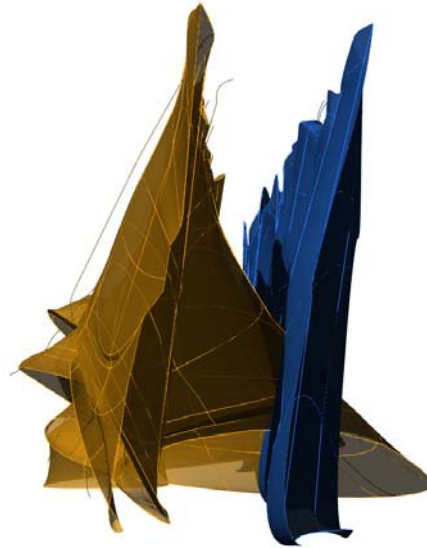
Figure 37: Elevation drawing of the entire tap-dancing sequence

Figure 38: Side drawing of the entire tap-dancing sequence
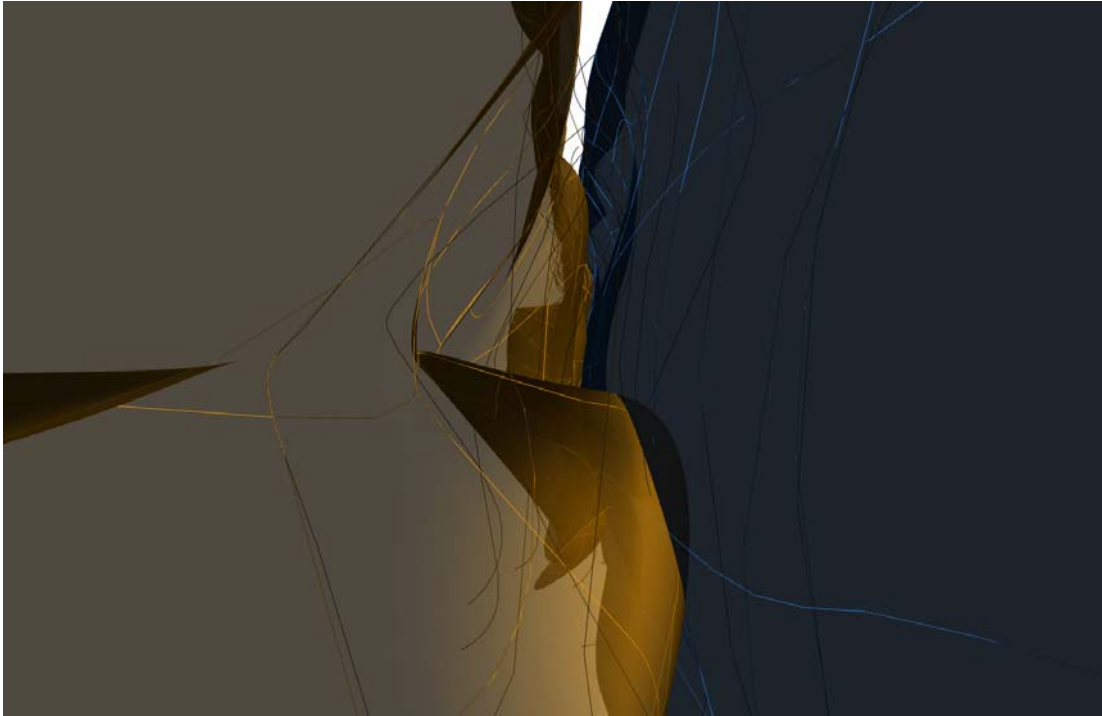
Figure 39: Spatial drawing of the entire tap-dancing sequence

Section 4: Formalized Music, Deconstruction in the Works of Iannis Xenakis

"Art, and above al, music has a fundamental function, which is to catalyze the sublimation that it can bring about through all means of expression. It must aim through fixations which are landmarks to draw towards a total exaltation in which the individual mingles, losing his consciousness in a truth immediate, rate, enormous, and perfect. If a work of art succeeds in this undertaking even for a single moment, it attains it goal. This tremendous truth is not made of objects, emotions, or sensations; it is beyond these, as Beethoven's Seventh Symphony is beyond music. This is why art can lead to realms that religion still occupies for some people.

But this transmutation of every-day artistic material which transforms trivial products into meta-art is a secret. The 'possessed' reach it without knowing its 'mechanisms'. The others struggle in the ideological and technical mainstream of their epoch which constitutes the perishable 'climate' and their stylistic fashion. Keeping our eyes fixed on this supreme meta-artistic goal, we shall attempt to define in a more modest manner the paths which can lead to it from our point of departure, which is the magma of contradictions in present music[95]. "

- Iannis Xenakis[96]

Iannis Xenakis is, without a doubt, one of the leading theorists that have sought to bridge the connection between music and architecture. While working in Le Corbusier's studio (1947 - 1959), Xenakis studied musical composition with the French composer Olivier Messiaen (1908 - 1992). Messaien advised Xenakis to seek musical inspiration in his Greek roots, his engineering background and work as an architect rather than being exposed to traditional music theory. This led Xenakis to rely on two central elements that sparked his innovation as a composer, the *Modular*, used to organize time, and the use of graph paper, to shape pitch envelopes and musical form.

Being exposed to the *Modular* at Le Corbusier's studio, he was able to draw many connections between it and music[97]. He experimented with the numerical proportions in his orchestra piece *Le Sacrifice* (1953), constructing the entire musical edifice on the basis of melodic series of 8 pitches. Each pitch had a duration value determined

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[95] Xenakis, Iannis, Formalized *Music: Thought and Mathematics in Music,* pp.1, translation by Christopher A. Butchers 1992 Pendragon press
[96] Iannis Xenakis (1922 – 2001) was a Greek modernist composer, musical theoretician, and architect. He was an influential composer of the 20th century as well as working in Le Corbusier's studio.
[97] Le Corbusier also made many references to music in the *Modular*

by the first 8 numbers of the Fibonacci series[98]. Contrary to traditional western

music, where the pulse of time is somewhat fixed throughout the piece, *Le Sacrifice's*

time durations varies throughout, allowing the mathematical properties of the

Fibonacci series to dictate it. On the auditory level, the rigid algorithmic approach

made the piece difficult to listen to and identify as "music".

This research proved fruitful in the design for the "undulating glass panes" that cover

the façade of the Monastery of La Tourette. It is ironic, however, that this celebrated

feature was due to budget restrains, as large glass panes were too expensive. To

prevent creating a dull façade of monotonous glass planes, Le Corbusier delegated

Xenakis to rearrange and play with the distances between the concrete casings to give

the façade an asymmetrical order. Regular window openings spanned the top floor,

letting it act as a metronome to the lower three floors that had a variety of what

Xenakis calls *densities[99]*, to form a triple layered polyrhythmic study of light and

shade, giving a phenomenological interior space filled with variety of light and

shadow patterns. The principle of stacking several independent layers of duration who

proportional relationships may vary throughout the piece would become the

cornerstone of the complex rhythmical polyphony in many pieces by Xenakis[100].

Xenakis also used numerical proportions in his first major composition, *Metastasis*

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[98] For an analysis of *Le Sacrifice*, see Andre Baltensperger, *Iannis Xenakis und die Stochastische Musik. Komposition im Spannugsfeld von Architektur und Mathematik* (Bern: Haupt Verlag, 1996): 231 – 234, and Makis Solomos, "Du project bartokien au son. L'evolution du jenue Xenakis", in *Presences de Iannis Xenakis*, ed. Makis Solomos, (Paris: Centre de documentation del la musique contemporaine, 2001): 15 - 29

[99] Xenakis emphasizes replacing the concept of rhythm by that of *density*

[100] On this aspect see Anne-Sylvie Barthel-Calvert, "Temps et rythme chez Xenakis: le paradoxe de l'architecture", in *Portrait(s) de Iannis Xenakis*, ed. Francois – Bernard Mache, (Paris: Bibliotheque nationale de France, 2001): 159 – 171

(1954), to determine temporal macro and microstructures within the piece. The number of bars of melodic subdivisions in the first part was determined by Fibonacci series, while the *Modular* intervenes on microscopic level to articulate both pitch and time in the second part. Metastasis is famous for massive glissandi at beginning and end of piece, with the transition occurring without interruption. The glissandi forms moments of unison, where all the musicians play the same tone, fold out to form gigantic clusters where all 46 strings play at a different pitch. This idea of continuity (sense of continuous but imperceptible transformation between two discrete sonic states, loud to soft - high to low - fast to slow) was a central theoretical preoccupation at time of Xenakis at the time. He thought about how a fluid transition between two sets of notes could be obtained. His answer came from his daily use of graph paper: He composed the music on graph paper instead of musical staffs and used graphical techniques to write it, where the vertical axis represents pitch and the horizontal axis represents flow of time. While composers would consider the discrete intervals between the tones of their scales (with twelve tones of the western tempered scale, and other region's music having different numbers of tones), by drawing straight lines between the dots on graph paper, Xenakis blended the intervals together, letting music focus on what is between those discrete intervals instead of one them. Contrary to traditional organic composition techniques, where one starts with cell (theme or chord progression) and out of it comes the rest of composition, Xenakis dealt with overall form and minute details simultaneously, doing away with notion of form as result of development.

Figure 40: Bar 309 - 314 of Metastasis

The famous drawing of Coda part of Metastasis (bars 309 - 314) features projection, in plane, of hyperbolic paraboloid. Despite its complex volume, two families of straight lines, called *ruled surfaces*, can define the warped surface, which makes it calculated easily. The paradigm was very popular in visual arts in 1950s, because it was considered a rational alternative for dry formal aesthetics of International Style, and meant to introduce idea of conceiving space through time. The Spatial sculptures of Naum Gabo are a clear example of this.

Figure 41: Sculpture of Naum Gabo

Metastasis was the literal sonic interpretation of that idea: *sound volumes* were created on a basis of straight lines (glissandi). However, on the auditory level, there is little notable difference from the glissandi in first part, organized numerically, and that from bars 309 – 314, organized geometrically[101]. The geometrical glissandi reveals that Xenakis had an experimental attitude towards musical composition, especially in writing music graphically, as the geometrical glissandi could not be

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[101] For a detailed analysis of Xenakis's use of glissandi in *Metastasis*, see Baltensperger: 295 - 311

imagined sonically beforehand[102].

After completing *Metastasis,* Le Corbusier and Xenakis worked together to employ the paradigm of ruled surfaces on the Philips Pavilion at the 1958 World Fair in Brussels.

Figure 42: Le Corbusier's Philips Pavillion

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[102] On this aspect, see Makis Solomos, *Iannis Xenakis* (Mercues: PO Editions, 1996): 25

Section 5: Deconstructing Pachelbel's Canon in Dmaj

Animations were explored that attempt to address the sensual experience of both Pachelbel's Canon in Dmaj and Um Kalthoum's "*Alf Leila wa Leila*". Wireframe animations were created to study the general linear form (figure 41 and 43), while light study animations were generated to attempt to replicate the crescendo in the music using light as a medium (figure 42).

In the Canon example, imagining that one is moving through a linear procession, each threshold corresponds to a chord in the piece - making the distance between each threshold and the other equivalent to a bar of music. The pizzicato strings are translated into small little light spots (seen on the roof on the wireframe model and as small spot lights in the light model), while the starting violin theme is seen as long light lines cutting through the model. With each theme being added to the canon, one of the planes on the hall starts to take a curvilinear form emulating the flow of the piece, until the piece reaches the crescendo main theme, where the form explodes with light.
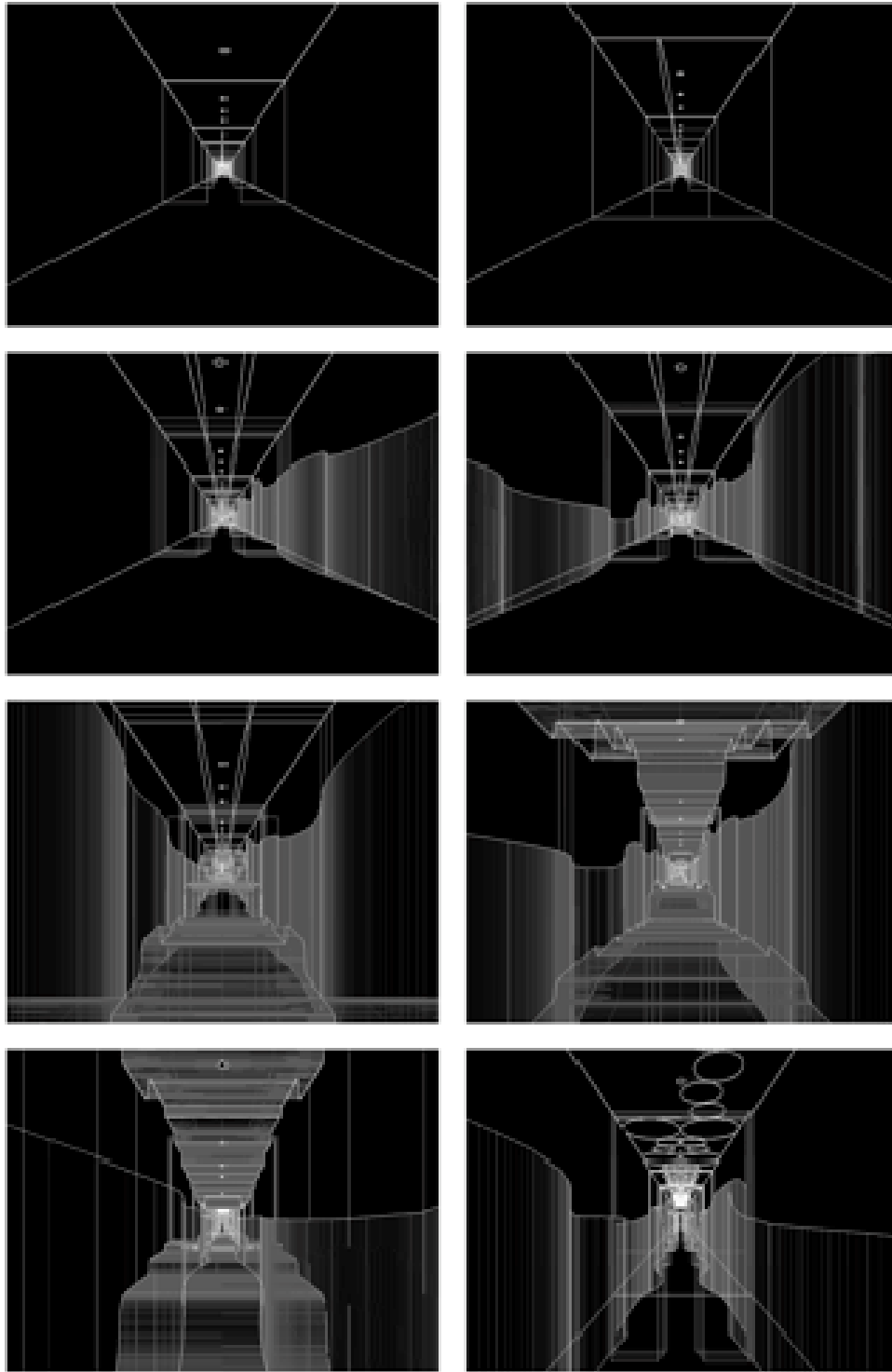
Figure 43: Wireframe deconstruction of Pachelbell's canon in Dmaj
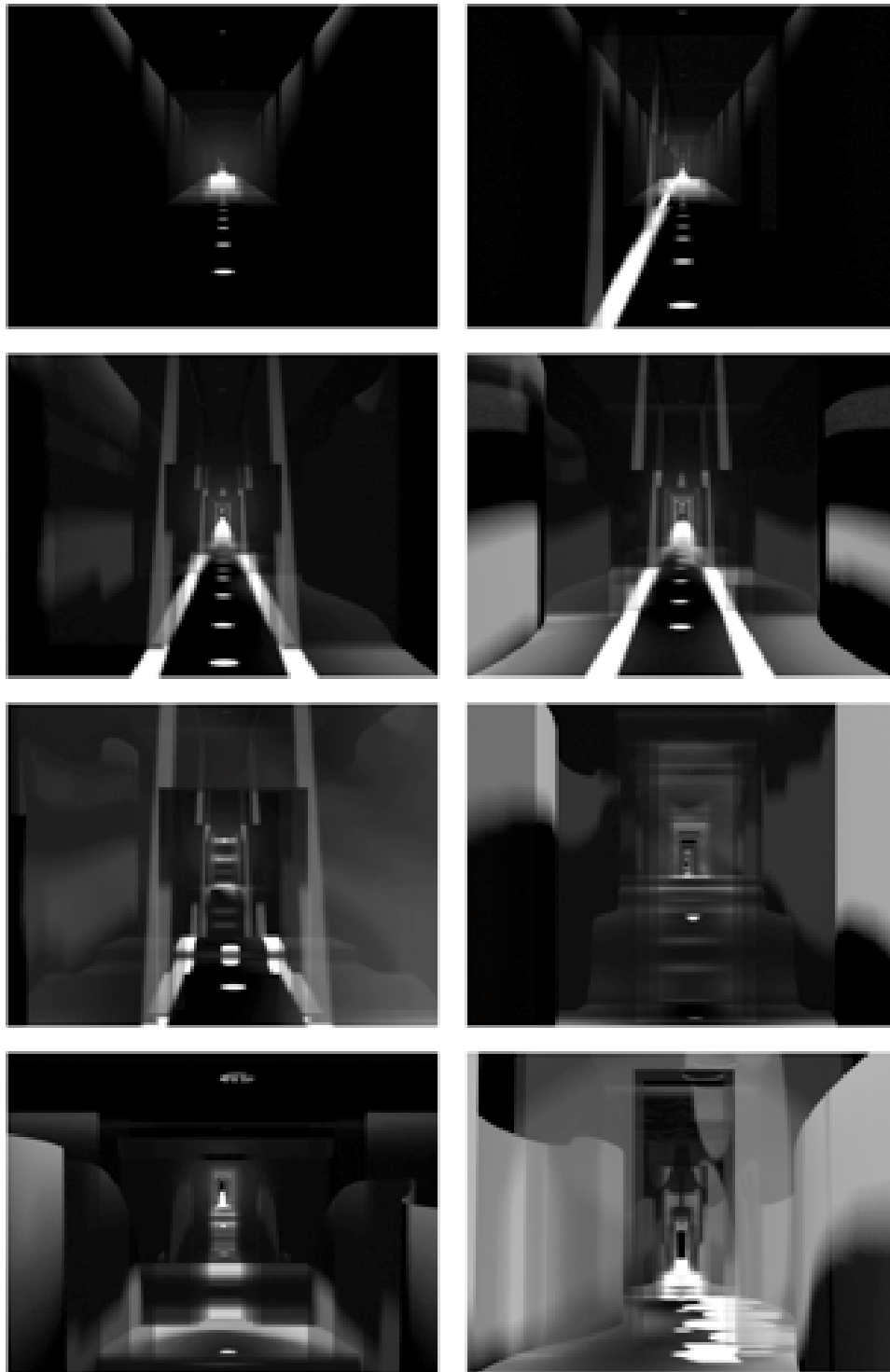
Figure 44: Light study / deconstruction of Pachelbell's canon in Dmaj

In the Arabic piece example (figure 43), also imagining that one is moving through a long linear procession, there is a lack of threshold like that of the Canon piece, because there are no chord progressions in the piece. The threshold is achieved by moving from one theme to the other, where the form abruptly changes as a response. Each plane corresponds to a different musical instrument – the oud for the right wall, the violin for the left wall, the bass for the ground plane, and the ney (wind instrument) for the roof plane, while the percussion is laid out in the center (The decision to layout the instruments that way was due to the mixing of the Jesse Manno recording of the piece, where the oud and bass were more noticeable on the right channel, and the ney and violin were more noticeable on the left channel). Heterophony is evident throughout the piece, which explains the need to model each of the instruments slightly different, where sometimes one instrument would reach a note faster than the other, or include minor improvisations in the piece, adding more texture and variation to the animation. Modeling each instrument the same way, although the pitch and rhythmic input of all instruments are all the same, would produce a monotonous experience, and would not be true to the piece, which is filled with these colors of variation and rich melodic texture.
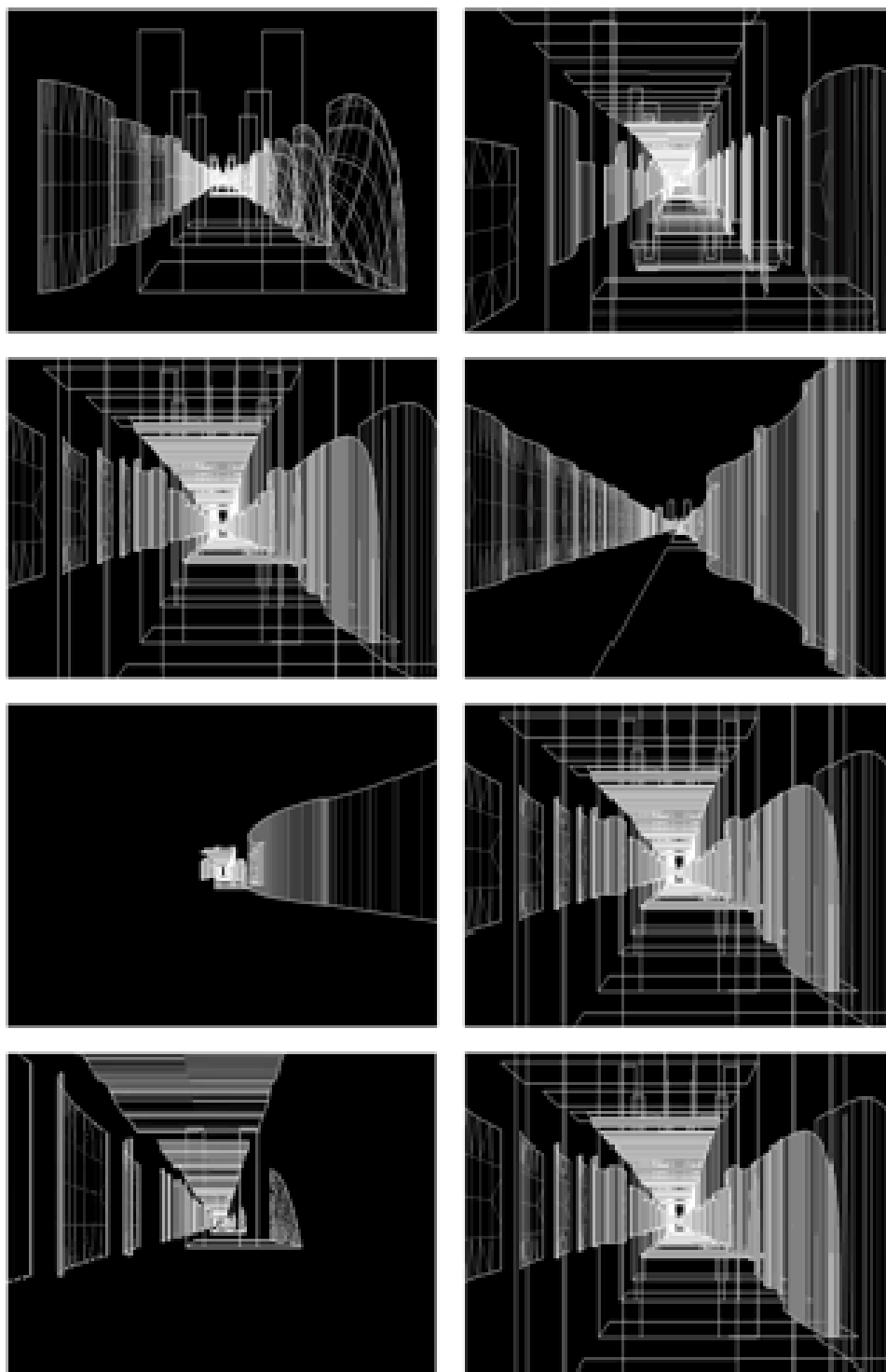
Figure 45: Wireframe Deconstruction of "Alf Leila wa Leila"

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Chapter 7: Mahmoud Riad's Cairo

On a recent trip back home to Cairo, I was engaged in conversation with a few relatives over the course of a welcome back dinner party. We were talking about specific developments that have been going around the country that they particularly found charming. Over the past decade or so, the image of the American suburb has been adopted by Egyptian developers, and planted on the outskirts of Cairo, with the intent of boosting up land value of the untouched desert surrounding the capital. A novel idea, since Cairo has been suffering from intense overcrowding density, the city of opportunities for many Egyptians. I believe that the statistic at the time was that 96% of the population was living in 2% of Egypt's land, mainly the Nile banks and delta. So creating satellite cities seemed like the way to go to solve this problem.

I digress...At the dinner, a phrase was used to describe one of these developments that really intrigued me: "it has become such a beautiful place, because you don't feel that phrase. Since when have the criteria for something being successful or beautiful been disassociating it with the surrounding context? Have we (Egyptians) become so ashamed of our country, our culture, our heritage, and ourselves that we feel the need to be identified as something other?

Unfortunately, there is a general sentiment in Egypt that whatever looks or sounds western are considered beautiful. Arabic pop music attempts to mesh Arabic singing

(using different musical scales and *maqams*) onto generic western chord progressions and western pop beats. I always felt a disconnect between both, since Arabic musical scales would often create slight cacophony when played on western chords (Arabic music itself is not based on chords but on heterophony[103]). Even our food is becoming more and more of a copy of other culture's cuisines. Homes now pride themselves in cooking Italian, Chinese, American...etc. It seems Ironic that restaurant moguls are now selling our cuisine back to us, marketing that the menu is composed of "home style Egyptian cooking", overcharging ten times more than the original cost. It just doesn't make sense to me.

While cross-cultural exchange has been around for centuries, the concept of complete westernization is relatively new. Many scholars attribute the initiation to Mohamed Ali's rule in the 19th century. Coming out of a cultural recession and an invasion by France, Egypt was in dire need of a paradigm shift, a boost in the country's cultural richness. Europe has just been experiencing it's own paradigm shift with the Industrial Revolution, so Mohamed Ali thought that a cultural exchange between Egypt and Europe would benefit the country. He started sending many young scholars to continue their education and be exposed to what he thought was a superior region. While some of these scholars came back preaching ideas that helped solve some of the issues lingering in society (Kassim Amin and his ideas of the liberation of women, and Mohamed Abdo's message of tolerance and compassion in religion), others started to apply European concepts without thinking about the consequences.

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[103] Marcus, Scott L., *Music in Egypt: Experiencing Music, Experiencing Culture* (Oxford University press, 2006)

The creation of Downtown Cairo, although is now considered one of Cairo's cultural hotspots, is an example of such. Taken after Hausmann's model of Paris is 1850, the downtown area (West el Balad) was designed to house Neoclassical and Baroque style buildings, where architects all-over Europe jumped at the chance to design in a foreign country with no obligation to respond to contextual buildings.

One of the fundamental ideas of Islamic Cairo is the creation of the inward centered street wall, where the entire street, including the facades of the buildings, becomes public property, and you can't tell where one building ended and the other started. You could not tell the rich man's house and the lesser fortunate one's house apart, as they all belonged to the same street wall. Houses faced an interior courtyard, where each could lavishly decorate according to their financial means. This created a block where the rich and poor can live side by side, where they are rendered equal outside between the street walls, praying side by side in the mosque. By creating these new European model cities, the rich (who are the only ones who can afford these lavishly decorated baroque buildings) moved out, leaving the poor behind in abandonment, creating, what Galal Amin[104] would call, a social mobility shift[105], and a tension between the two classes that would continue to grow and intensify as time goes by.

Such effects of globalization, I feel, are much more serious than just the mere image of it that we are reacting against. In Soundscape, R. Murray Schaffer makes an argument suggesting that the drastic conditions of traffic in third world countries are a

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[104] Galal Amin is a professor of economics at the American University in Cairo

[105] Amin, Galal, *Whatever Happened to the Egyptians?* Chapter 1 *Social Mobility*, pp. 7 -31 (American University in Cairo Press, 2000)

product of such effects of globalization[106]. Europe, having gone through the whole

Industrial and Electrical Revolution, are accustomed to the stop-go mentality of the

conveyor belt. He states that those in the third world, having not gone through the

whole industrial revolution process from the beginning, are still treating their cars as

horse carriages, attempting to finesse their way through traffic, rather than traveling

in one lane abiding by traffic regulations. If this is the case, then such cultural

exchange should be examined carefully before enforcing it to a region.

However, I am not advocating against cross cultural exchange and interchange. The

most exciting works of art and inventions have come through a marriage of two

elements that has been unprecedented. Oriental jazz brings an exotic blend between

Arabic musical scales and rhythms while being played under western "jazz" chords

and western instruments. Yet here a high level of proficiency in both musical styles

independently is need here to be able to identify where such a rub between the two

could happen and when would it be highly distorted. I firmly believe that rules are

made to be broken, but a conscious breaking of such rules to highlight a specific

condition would yield a more powerful result than a breaking of such rules due to

general ignorance or negligence.

Which brings me back full circle. Egypt, just like any other place in God's world, is a

distinct place. It seems to me, that an in-depth study of the characteristics of this place

is imperative and unavoidable before designing or composing anything that has to do

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[106] Schafer, R. Murray*, Our Sonic Environment and the Soundscape, the Tuning of the World*, pp. 83 (Destiny Books, Vermont, 1977)

with the country. Each place has different sensory characteristics, whether its what

you see in the urban and rural landscape, what you hear in the soundscape and regions

music and language, what you smell in the odors, what you taste in the food, or what

you touch in the ground, water, or air. Understand that, you understand the place, and

you appreciate the place.

Chapter 8: Evolution of Cairo

Section 1: Early Settlement of Fustat (AD 640 – 750)

Subsection 1: Introduction

The battles between the Byzantines, Persians, and Copts during the 6th and 7th

centuries in Egypt drove the urban population out of the city (called *Heliopolis* at the

time) and into the surrounding villages, leaving the city deserted[107]. This is one of the

reasons that the general population felt hostility towards the Byzantines, and explains

the rapid success of the Arab invasions. The Arabs have been intending to Conquer

Egypt after a Koran verse calls them to "Enter Egypt". Some claim that the monks at

St Catherine monastery even sent messengers to Prophet Mohamed, calling the

Muslims to liberate the country from the Tyrant rule[108]. The Arabs, Led by General

Amr bin Aas[109], brought a message familiar to the Christians and they advocated

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[107] For a detailed description of the civil unrest in the region, please see Raymond, Andre, *Cairo: City of History* (American University in Cairo Press, 2000), pp. 7 -13

[108] The monastery of Saint Catherine's in Sinai claim to have a parchment, signed by prophet Mohammed, that states that the Muslims would not interfere with life at the monastery and would not inflict harm upon Christians within the region. Verification of such a document is needed, since it is not documented that the Prophet has ever left Arabia (messengers from the monastery may have approached him in Arabia), and that he was illiterate and could not have signed the document (his finger print may have been used instead of the signing).
 However some scholars argue that the whole notion of his illiteracy has been misinterpreted; Karen Armstrong (*A History of God: The 4,000-Year Quest of Judaism, Christianity and Islam*, Ballantine Books, 1994) traces this claim back to his response to the Arch Angel Gabriel when he was asked to read, "*Iqra'a*", where the prophet's response was "ma ana be'kare'i". The response could be translated to both "I can not read" or "I am not an oracle", where Armstrong argues that the prophet may have understood "Iqra'a" to mean "to read the future".
[109] Amr ibn al- Ās (born c.583 - d. January 6, 664 CE) was an Arab military commander who is most noted for leading the Muslim conquest of Egypt in 640. He was a contemporary of Muhammad who rose quickly through the Muslim hierarchy following his conversion to Islam in the year 8 AH (629 CE). He founded the Egyptian capital of Fustat, and built the Mosque of Amr ibn al-As at its center — the first Mosque on the continent of Africa.

tolerance towards the "People of the Book". The Arrival of the Arabs started an era of religious freedom Copt Christians had not known for centuries[110].

The campaign started in December AD 639. The Arab army encamped at a small settlement in *Heliopolis*, renaming it *Ain Shams*. Surrender of Alexandra, Egypt's capital at the time, was signed in November AD 641, and a new capital, *Fustat*, was founded at the beginning of AD 642. The name *Fustat* is said to be derived from the Byzantine Greek word *phossaton* meaning "enrichment." Others derive the name from the Latin cognate *fossatum*, which may refer to place-name antedating the Arab arrival. While others trace the name's origin to the story when General Amr bin Aas choose not to take down his tent (fustat) when he left to besiege Alexandria because a pigeon had landed on its ridge, built a nest, and laid its eggs there[111].

Subsection 2: Site Selection

The site chose for the new capital was on the eastern bank of the Nile. This could be a possible continuation of Ancient Egyptian tradition of leaving the western bank of the Nile for religious and funerary monuments, and agriculture[112]. Another reason would be that Caliph Omar gave Amy strict instructions to not include a barrier of water

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[110] J. Jarry, "L'Egypte et l'invasion musulman," *Annales Islamologiques* 6 (1966). Jarry shows that one must look beyond the division between the Melchite Greeks and the Monophysite Copts to understand the Christian reaction to the Arab conquest – for instance, to the rifts between various sects and factions such as the "Blues" and the "Greens".
[111] Raymond, Andre, *Cairo: City of History* (American University in Cairo Press, 2000), pp.11
[112] The western bank did include a small urban population in both *Jizah* and *Memphis*.

between the new capital and the Medina (capital of Arabia)[113]. The location of the new capital allowed control of agriculture production of the Delta.

Subsection 3: City Organization

In accordance to Arab tradition, Fustat was a camp-city organization. The city was divided into sections for different tribal unites of the army, making it a loose conglomerate of tribal concessions rather than an organized urban settlement. The total area of the city measured between 600-800 hectares[114]. It is most likely that the early inhabitants of these cantonments lived in temporary shelters that gradually transformed into houses[115]. Amr built the first mosque in Egypt, the Amr bin Aas mosque, right on the Nile's edge. The mosque was built in the center of the city, allowing the rest of the city to take form around it, and letting the mosque serve as the main religious node of the city.

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[113] Amr did, however, provide a connection to Arabia by water when he reopened the old Red Sea Canal (*Khalij*) in AD 643
[114] Raymond, Andre, *Cairo: City of History* (American University in Cairo Press, 2000), pp. 14
[115] Raymond, Andre, *Cairo: City of History* (American University in Cairo Press, 2000), pp. 15
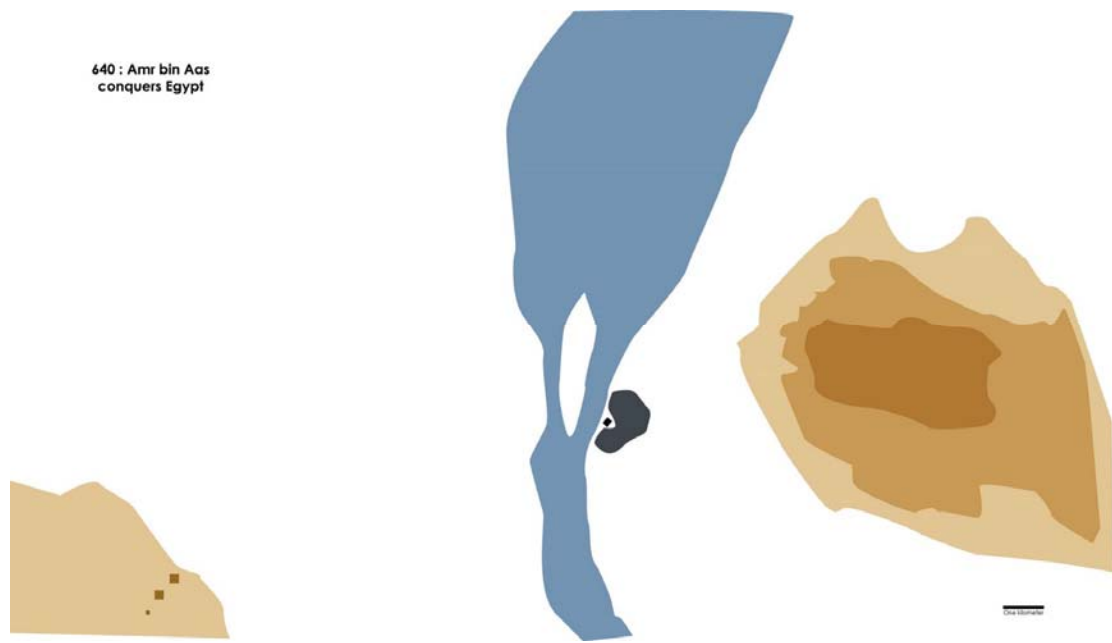
Figure 46: Cairo circa AD 640

The extent of the city probably did not change much until the end of the Umayyad period; settling inhabited quarters more densely and occupying spaces previously left vacant between cantonments easily accommodated the increase of population. The blocks of land granted to the tribal military groups were probably gradually turned into neighborhoods, which each neighborhood taking a different form depending on the character of each cantonment. According to Wladyslaw Kubiak, the number of Arabs living in Fustat was around 30,000 in AD 670, and increased to 50,000 in AD 750 with a total population of 200,000[116].

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[116] Abu Salih, *The Churches and Monasteries of Egypt,* ed. And trans. B.T.A. Evetts (London, 1895); Clerget, *Le Caire* , 1: 112; Wiet, *L'Egypt arabe,* pp. 39, 43, 57, quotation p.58; De Lacy O'Leary, *The Saints of Egypt* (New York: Macmillan, 1937); Kubiak, *Al-Fustat,* pp.80-83, 131; Gayraud, "Istabl-Antar," pp. 82 – 83.
It should be noted that the total population of 200,000 is not including slaves, clients, and Copts.

113

Subsection 4: Streets in Fustat

Archaeological excavations uncovered street from the Umayyad period. These streets were narrow, spanning 5 - 6 meters at most, but more often being only 2 - 3 meters wide, and sometimes even 1 meter wide. The streets widen at crossroads, which were sometimes very complex (one intersection with seven streets or alleyes was found near the mosque of Abu al-Su'ud)[117]. They were few streets paved; they were usually rested directly on leveled rocky soil, with an accretion of dirt, dust, and debris forming the surface layer, the one exception was *Darab al-Balat* (Pavement street). Streets traced irregular courses, which was understandable given the origin of the street system. The streets took on names reflection the commercial activities taking place, or after important monuments or characteristics of streets' inhabitants (examples like *Suq al-Hammam*, street of Public Bath, west of the Amr bin Aas mosque, and *Zuqaw al-Ashraf*, Nobles' Alley, between the Amr bin Aas mosque and *Suq Barbar*)[118].

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[117] Raymond, Andre, *Cairo: City of History* (American University in Cairo Press, 2000), pp. 21

[118] On the mosque of Amr, see Kubiak, *Al-Fustat,* pp.95-96, 106-107, 111-116; idem, "The Circulation Tracks of al-Fustat," *African Bulletin* 28 (1979); K.A.C. Creswell, *Early Muslim Architecture,* 2 vols, (Oxford: Clarendon Press, 1932 – 1940), 2 171 ff. ; Doris Behrens-Abouseif, *Islamic Architecture in Cario: An Introduction* (Leiden: E. J. Brill, 1989), pp. 47-49

Section 2: al-Askar, The First Palatine City (AD 750 – 870)

Subsection 1: New Towns of Islam

Islamic new towns were classified into two main types:

- Cantonment Town: Army camps that are eventually developed into permanent cities. They are relatively unplanned, meager in public amenities, and unembellished aesthetically. _Fustat_ is an example of this type.

- Princely Town: Founded to mark the birthplace of a dynasty. They are usually located outside mainstream of economic vitality, making it a center of consumption rather than one of trade and production. Future cities of _al-Askar_, _al-Qatai_, and _al-Qahirah_ are examples of this type.

Subsection 2: Decline of _Fustat_

The creation of the palatine cities north of _Fustat_ in later years did not mean that the city was extending northward; the former capital would be abandoned and new capital would be formed to take its place. Starting with Governor Abd al-Aziz, an attempt was made to move the center of government to _Helwan_ in AD 689 (perhaps to escape the plague in _Fustat_). The attempt was unsuccessful because the distance from _Fustat_ was too great.

The reign of the last Umayyad, Marwan II, ended in Egypt in AD 750, and the Abbasids came to power shortly after. The Abbasid prefect, Abu Aun, founded a palatine city north of *Fustat* in AD 751. This should not be attributed to the fact that a fire destroyed a large portion of *Fustat* in the same year, but because the Abbasids wanted to establish a new command and control site different than that of *Fustat*[119]. The new city was named *al-Askar* (the Cantonment).

Subsection 3: Selection of the Site

The site chosen was an unbuilt area north of Fustat, below Jabal Yashkur, between Kawm al-Jarih to the south, with the bridge of Dike (Qantara al-Sudd) over the Khalij to the west, and the bridge of Lions (Qanatara al-Siba) to the north. The center of the city was the governor's residence (Dar al-Imara). The city was completed by building a mosque (Jami al-Askar) in AD 786. Beautiful houses were built around the core, and markets sprang up in response to the demand created by the presence of the court and army.

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[119] Raymond, Andre, *Cairo: City of History* (American University in Cairo Press, 2000), pp. 24

750 : The Askar
Settlement
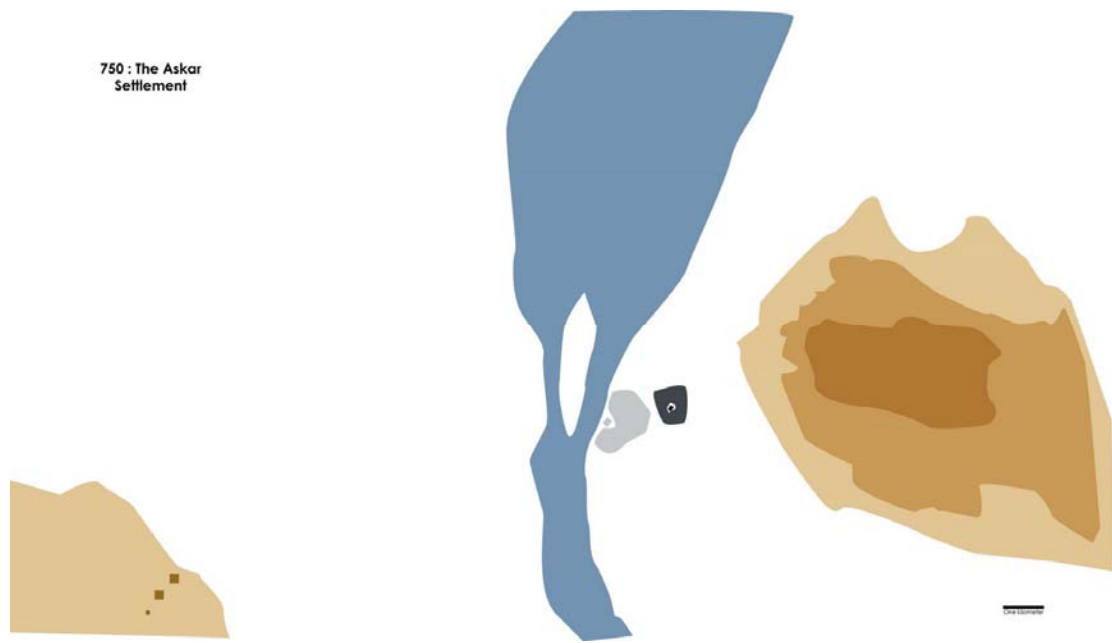
Figure 47: Cairo circa AD 750

No archaeological trace of al-Askar was found, which presumes that the city has

limited success[120], while at the same time, Fustat had slowly been resuming progress.

Al-Askar remained a political and administrative center until the arrival of the

Tulunids.

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[120] Raymond, Andre, *Cairo: City of History* (American University in Cairo Press, 2000), pp. 24

Section 3: al-Qata'I (AD 870 – 905)

Subsection 1: Introduction

The appointment of Ahmed bin Tulun[121] as prefect in AD 868 came at the end of a

long period of political strife. The country had just been through the last and most

violent of Christian uprisings in Egypt, the Bashmurite rebellion of AD 832 in the

Nile delta between the river's Rosetta and Damietta branches[122]. The Byzantines

successfully attacked Damietta in AD 863, until an Arab led revolt assumed control

back in AD 866-868. Bin Tulun was to then establish authority in Egypt and even

conquer Syria in AD 878. This marks the first time since the Roman conquest that

Egypt was constitute an autonomous state[123].

Subsection 2: Site Selection

Bin Tulun decided to build himself a palatine city detached from the previous ones[124].

He laid the city out a slight distance northeast from al-Askar. The boundaries were

the new mosque of bin Tulun on the east, birakt al-Fil (pond of the Elephant) to the

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[121] Ahmad ibn Tulun or Ahmad ibn ūlūn (September 835 – March 884) was the founder of the Tulunid dynasty that ruled Egypt briefly between 868 and 905 AD. Originally sent by the Abbassid caliph as governor to Egypt, ibn Tulun established himself as an independent ruler.

[122] Maqrizi, *Khitat*, 1:304 – 305 wrote that "from then on, the Copts were obedient and their power was destroyed once and for all; none were able to rebel or even oppose the government, and the Muslims gained a majority in the villages."

[123] Raymond, Andre, *Cairo: City of History* (American University in Cairo Press, 2000), pp. 26

[124] Salmon, Georges, "Etudes sur la topographie du Caire. La Kal'at al-Kabch et la Birkat al-Fil," *MIFAO* 7 (1902), 2 – 4; Wiet, *L'Egypte Arabe*, p.61; Gayraud, "Istabl – Antar," pp. 70 -72

north, sanctuary of Zayn al-Abidin to the south, while Jabal Yashkur rose at the center. The new city was named al-Qata'i (the Wards), which suggests a link to Samarra (bin Tulun's home town) because the city was divided into quarters known as wards. Kubiak estimates the site to be 270 hectares.

876 : The Tulun Period
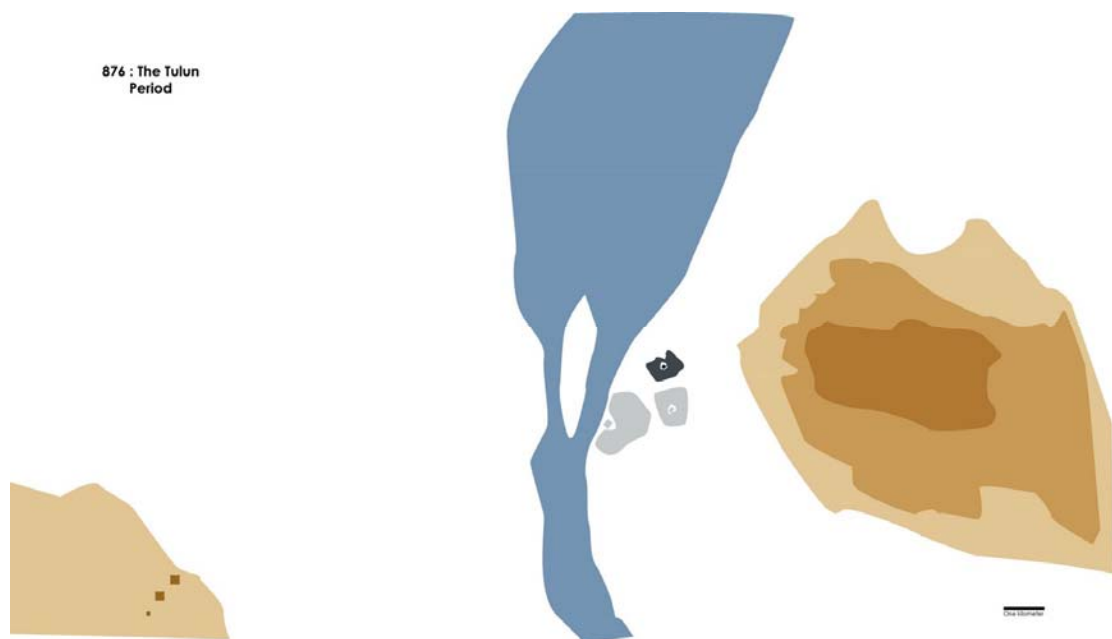
Figure 48: Cairo circa AD 876

Subsection 3: Decline of al-Qata'i

The city was destroyed by the time the Abbasids took Egypt back from Tulunids, ending their dynasty, in AD 905. Reasons for its destruction and complete abandonment was that it was located a considerable distance from the Nile so it could not develop as an autonomous economic center, and it was located a considerable

distance from Fustat with large nonurban space in between so it could not become an extension of that city. Only the mosque of bin Tulun survives.

Section 4: al-Qahirah, Fatamid Cairo (AD 971 – 1170)

Subsection 1: Introduction

The Fatamids took over Egypt in AD 969, with the army being led by Jawhar el Siquilli[125], on orders by Caliph al-Mui'zz[126]. They were adherents of Ismailism[127] (a branch of Shiism[128]) coming originally from Syria. The dynasty name is derived from the name of the daughter of Prophet Mohamed, Fatima. Prior to the invasion of Egypt, they had led successful missionary efforts in North Africa.

Subsection 2: Site Selection

In selecting a site for the new city, Jawhar had several choices: he could follow the Tulunid example and remain at a distance from the Nile, or do the opposite and settle near the river, or he could choose to go south and extend from Fustat[129]. In the end, he

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[125] Gawhar the Sicilian (born c. 928-930, died 992) also called al-Rumi (the Greek) main transliteration: Gawhar as-Siqilli al-Rumi was the most important military leader in the Fatimid history. He founded the city of Cairo and the great al-Azhar mosque.

[126] Maʿād al-Muʿizz li Dīn Allāh (932–975), also known as al'Moezz, was the fourth Fatimid Caliph and reigned from 953 to 975. It was during his caliphate that the center of power of the Fatimid dynasty was moved from Ifriqiya (northern Africa) to the newly conquered Egypt.

[127] Ismāʿīlism is a branch of the Islamic faith, and is the second largest part of the Shīʿah community, after the mainstream Twelvers (*Ithnā ashariyya*). The Ismāʿīlī get their name from their acceptance of Ismāʿīl ibn Jaʿfar as the divinely appointed spiritual successor *(Imām)* to Jaʿfar aṣ-ṣādiq, wherein they differ from the Twelvers, who accept Mūsà al-Kāẓim, younger brother of Ismāʿīl, as the true Imām.

[128] Shia Islam is the second largest denomination of Islam, after Sunni Islam. Shīʿah Muslims, though a minority in the Muslim world, constitute the majority of the populations in Iran, Azerbaijan, Bahrain and Iraq, as well as a plurality in Lebanon and Kuwait.

[129] Raymond, Andre, *Cairo: City of History* (American University in Cairo Press, 2000), pp. 36

chose a sandy plain north of the Tulunid city, bound on the east by the Muqattam Hills, bounded on the west by the Khalij. The site had no prior buildings except for a small Coptic monastery and a small castle built by a previous Umayyad prefect. The site had an advantage of being beyond the reach of the Nile's floods and course shifting, and remained at a distance from Fustat where the native Christian and Sunni Muslim population lived. The arrangement left an empty area between the new city and Fustat, which the army would camp in during construction.

971 : Gawhar el
Siquili's Cairo

One kilometer
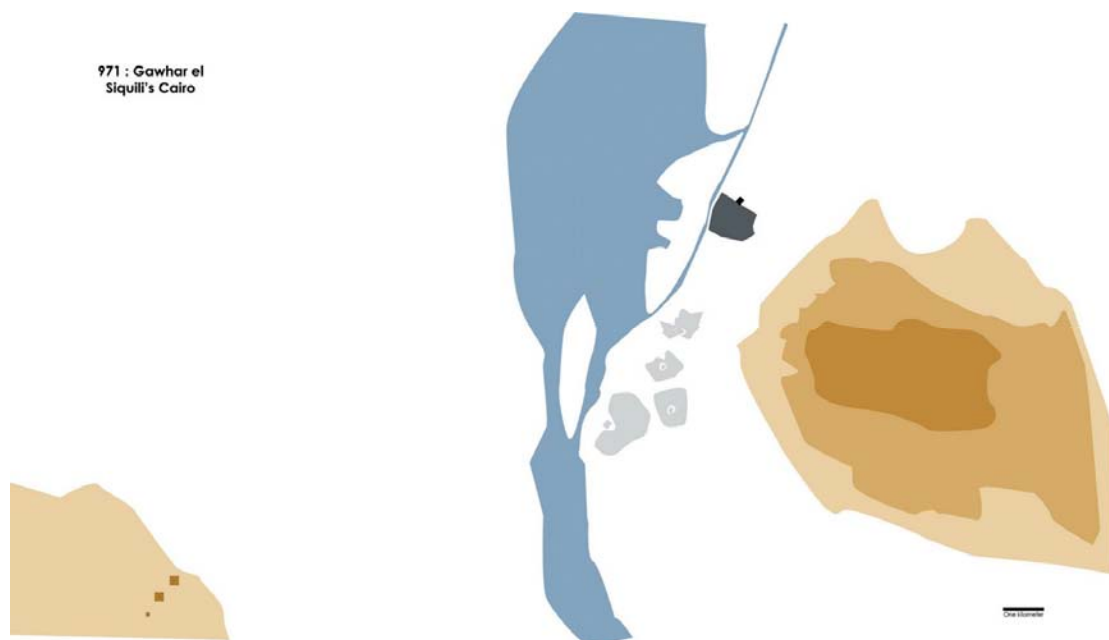
Figure 49: Cairo circa AD 971

Subsection 3: Description of City

Sources claim that al Mu'izz gave instructions to build a city called Qahira (Cairo) that would rule the world. Another tradition says that the city was first called al-Mansuriyaa (the Victorious) and was later renamed to al-Qahira (the Conqueror)

when al Mu'izz arrived four years later[130].

The Original outline of the city's ramparts was wide enough for two horses to walk on. The ramparts were made of large sun-dried mud bricks (labin) and was a nearly perfect rectangle oriented on a rough north-south axis enclosing an area of 136 hectares. The wall was penetrated by eight gates: two on the north (al-Futuh and al-Nasr), two on the east (al-Barqiyaa and al-Qarratin), two on the south (Zuwayla and Faraj), and two on the west along the Khalij (Sa'ada and Qantara). Several aspects of the new city were anticipated from earlier Fatamid cities of Mahdiyaa and al-Mansur, on the Tunisian coast, like the locations of the palaces within the city (Mahdiyaa), and the names of Bab Zuwayla and Bab al-Futuh (al-Mansur)[131].

Al-Qahira provided quarters for tribal contingents of the Fatamid army, which were placed in cantonments, similiar to those of Fustat[132]. They lived in relatively close quarters, entering through a gate, and separated from one another by empty spaces. A number of the army's contingents were quartered outside the city limits for lack of space (Husayniyaa, a suburb of Cairo, owes its name to the tribal contingents quartered there). The general structure of the city was strictly organized by Jawhar from the start: Shari al-Azam and Qasaba formed the north-south axis, while secondary streets intersected the straight thoroughfare. These secondary streets let to various contingents of Fatamid army houses. The contingent areas would gradually

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[130] Janet Abou-Lughod mentions that both al-Mansuriyaa and al-Qahira both translate to victorious, Abu-Luhod, Janet L., *Cairo, 1001 Years of the City Victorious* (Princeton University Press, 1971)
[131] K.A.C. Creswell, "The Foundation of Cairo," *Bulletin of the Faculty of Arts* (University of Egypt) 1 (1933); J. M. Bloom, "The Origins of Fatimid Art," *Muqarnas* 3 (1987)
[132] Raymond, Andre, *Cairo: City of History* (American University in Cairo Press, 2000), pp. 38

developed into city quarters, filling in empty spaces in between.

Section 5: Cairo under the Ayyubids (AD 1174-1258)

1174 : Salahildine
conquers Egypt
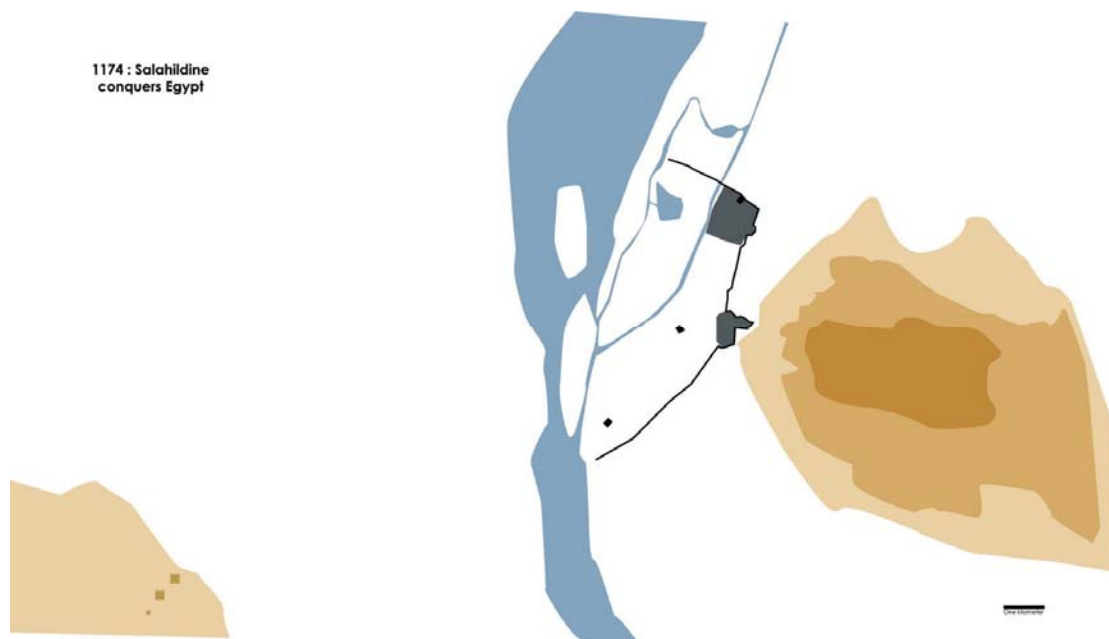
Figure 50: Cairo circa AD 1174

Subsection 1: Introduction

Saladin was originally a vizir under the Fatimid caliph al-Adid (1169 - 1171). It took

him a little over two years to rise to power. He achieved a coup d'etat on the 10th of

September 1171, and following the caliph's death on the 12th of September 1171, and

the death of his son Nur Al-Din on the 15th of May 1174, Saladin asserted his right to

the throne. Fortunately for him, the Ismaili Fatamid failed to impart their Shite faith

on the mass Egyptian population, so the transition of the region into a Sunni capital

was not protested. Thus, the new typology of the madarasa (school), which was an

experiment conducted elsewhere in the Muslim world for the maintenance of

theology, was now transported to Egypt. The Ayyubid period is known for the brilliance of the Muslim military power in confrontation of the crusaders over Jerusalem.

Subsection 2: Building of The Citadel and the Wall of Cairo

Saladin decided to build a citadel on a projecting platform on the Muqattam Hills, one kilometer from the south wall of Qahira, in 1176. Many reasons led to this decision; the new government desired to build a new capital for itself, one that encomapses all of the past capitals of Fustat, Askar, Qata'I, and Qahira. It could very well be argued that Saladin desired to erase all memory of the Fatamid culture and history, by building allover their region.[133] There were also many concerns about security that may have prompted the mass construction of the Cairo wall, both externally as well as internally. The presence of the Franks in Palestine and Syria constituted a permanent threat to the new Capital, and Saladin was weary of a revolt against him by partisans of the fallen Fatamid dynasty.

Saladin ordered the citadel to be built at the center of the Muqqattam promontory. The site was chosen for hygienic reasons, as legend has it. Supposedly, Saladin placed bits of meat in different part in the capital, and the meat placed on the Muqqattam Hills stayed fresh the longest, and therefore concluded that the air was healthiest at that location.

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[133] Maqrizi, *A History of the Ayyubid Sultans of Egypt,* trans. R.J.C. Broadhurst (Boston: G.K. Hall, 1980), p.89

124

Subsection 3: Transformation of Qahira and Fustat

The wall of Cairo did not conform the two cities of Qahira and Fustat into one urban entity; they still evolved as two separate and somewhat contrasting entities. The Ayyubid army seized the palaces of the Fatamids, where its residences (the remaining princes of the Fatamid dynasty) were forced to live in segregated residences, to ensure that the race would eventually die out. The palaces were then either converted into barracks or residences for army personnel and the ruling class, or demolished. The city did not change much in terms of urban structure during the Ayyubid period, perhaps due to the continuous wars with the Franks. The construction of the Cairo wall did provide a framework for growth during the following Mamluk era.

Fustat on the other hand, saw a period of great decline. The city saw great destruction by a mass fire in 1168, and was further abandoned during the 1200-1201 draughts and famine. During the Fatamid era, although weakened by continuous emigration to Qahira, Fustat still remained a great commercial and economic center. The building of the Citadel and the Wall of Cairo, offered the old city a new hope and promise for redevelopment and economic stimulation. This did not happen, and the old city was left in decay for the entire Ayyubid period.

Section 6: Mamluk Cairo (AD 1258 – 1517)

Subsection 1: Introduction

Slaves in Muslim countries at the time were a very perplexing phenomenon. As opposed to the common accepted idea of "slave", a practice of a system of collective forced labor and harsh treatment[134], these individuals were the ones who were awarded the highest ranking and most prestigious military and administrative positions, even all the way to the sultanate[135]. Such "slaves" (or Mamaluk in arabic, plural: Mamaleek) were recruited from the Circassian, Turcoman, Mongol, and Turkish people of the Caucasus and Russian Steppes, possibly for the region's long admired warlike nature.

The idea of recruiting those that would end up with all the power seemed to be a noble one, since this, theoretically[136], should eliminate the desire for the Mamluk sultan to want to pass power to his descendants[137], and in fact it was forbidden to do so. This prohibition may have encouraged charitable, and architectural, activity on

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[134] The Qur'an and The *hadith* (sayings of the Prophet Mohamed) order Muslims to treat slaves fairly, while Islamic law establishes protections for them (Paul Veyne, *Le pain et le cirque* (Paris, 1976), p. 728; R. Burnschvig, "Abd", in *The Encyclopedia of Islam,* 2d ed., Leiden: E. J. Brill, 1960 - , 1:25 - 41

[135] The major sources for the Mamluk period are Maqrizi, *Kitab al-suluk li ma'rifat duwal al-muluk* (Cairo: Lagnat al Ta'lif, 1936 – 1973)

[136] This proved to be not the case, as from between 1290 and 1382, seventeen descendants of Sultan Qalawun (1279 – 1290) succeeded to the throne, and Sultan Barquq's (1382 – 1399) son Faraj (1399 – 1412) also succeeded to the throne after his death.

[137] Ibn Iyas, *Historie des Mamlouks,* p. 19; Maqrizi, *Khitat,* 2; 213-214; R.S. Humphreys, "The Emergence of the Mamluk Army," *Studica Islamica* 45-46 (1977); Barbara Flemming, "Literary Activities in Mamluk Halls and Barracks," in *Studies in Memory of Gaston Wiet,* ed. M. Rosen-Ayalon (Jerusalem, 1977); U. Haarmann, "Arabic in Speech, Turkish in Lineage," *Journal of Semitic Studies* 33 (1988); J.-C. Garcin, "Le systeme militaire mamelouk," *Annales Islamologiques* 24 (1988)

part of the mamluks[138].

Starting during the Ayyubid period in Egypt, the Mamaleek were adopted by a sultan or emir and were admitted into his house, to prepare for the greater role they would play in the army or administration of state. Their schooling included classical Muslim eduction (Quran recital, understanding of shari'a[139] law...etc), rigorous training in arms and military sports, and the study of Arabic. Once the slave completed his eduction and reached manhood, he was set free, and could officially adopt the title of Mamluk.

Subsection 2: Urbanization of Qahira

As the Ayyubids before them, The Mamluks continued to gradually transform the Fatamid Palaces into other types of buildings; religious buildings replaced some, other by commercials spaces, or even residences in some examples. Sultan Baybars[140] (1260 - 1277) drew documents in 1261 stipulating certain parts of palaces belonging to the public treasury.

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[138] Raymond, Andre, *Cairo: City of History* (American University in Cairo Press, 2000), pp. 113
[139] Islamic law based on the teachings of the Quaran
[140] Baibars, or al-Malik al-Zahir Rukn al-Din Baybars al-Bunduqdari (nicknamed Abu al-Futuh (1223 – July 1, 1277, Damascus), was an important Mamluk Sultan of Egypt and Syria. He was one of the commanders of the forces which inflicted a devastating defeat on the Seventh Crusade of King Louis IX of France and he led the vanguard of the Egyptian army at the pivotal Battle of Ain Jalut in 1260, which marked the first substantial defeat of the Mongol army. His reign marked the start of an age of Mamluk dominance in the Eastern Mediterranean and solidified the durability of their military system. He managed to pave the way for the end of the Crusader presence in Syria and to unite Egypt and Syria into one powerful state that was able to fend off threats from both Crusaders and Mongols

1257 : The Mamluk Period

One Kilometer
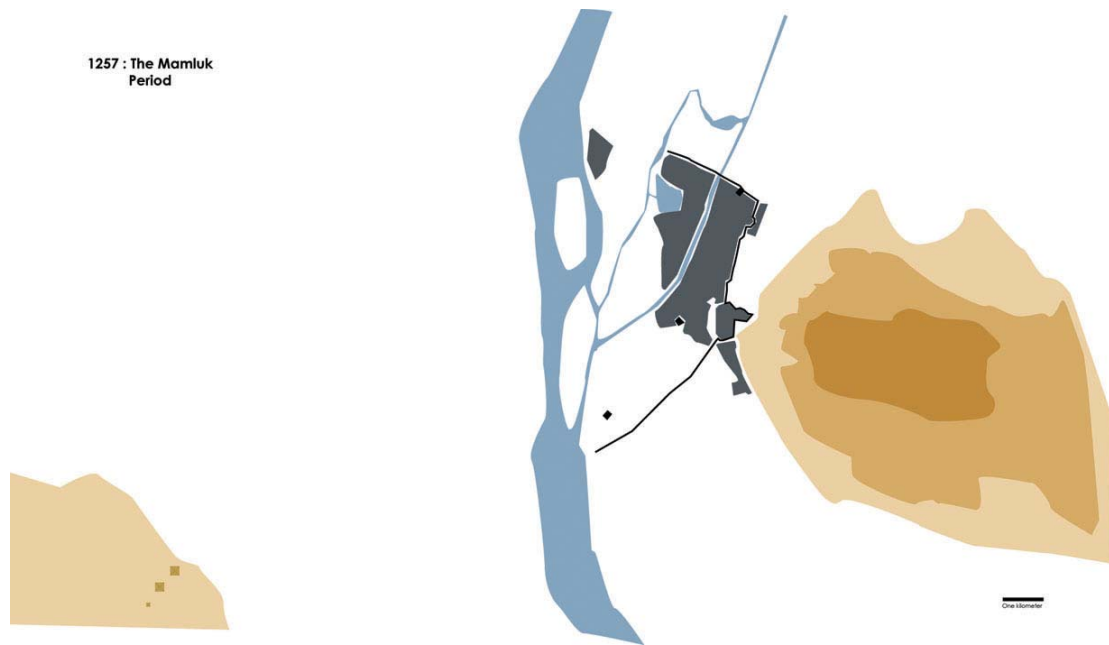
Figure 51: Cairo circa AD 1257

Northern Expansion[141] from Qahira start with Baybars, when he built a large mosque

about 700 meters NW of Bab al-Futuh. The mosque, located on a road to Syria and on

route of annual pilgrimage, opened the way for urbanization what is to become the

Husayniyya quarter, becoming the city's northern suburb. This development was

benefited from digging up a new canal in 1325, *Khalij al-Nasri*[142]. The new *Khalij*

started 1,200 meters west of the old canal and joined it North of the mosque of

Baybars. Maqrizi describes this new suburb to be full of suqs (markets) and

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[141] On the northward expansion see Doris Behrens-Abouseif, "The North-Eastern Extensions of Cairo under the Mamluks," *Annales Islamogique* 17 (1981), though the authoer overestimates the extent of urbanization (Andre, Raymond); Maqrizi, *Kitab al-Suluk*, 2:240, 251, 260-262; Raymond and Wiet, *Les marches du Caire,* p.210; J. Bloom, "The Mosque of Baybars," *Annales Islamogique* 18 (1982); Leonor Fernandes, *The Evolution of a Sufi Institution: The Khanqah* (Berlin, 1988)

[142] The digging of Nasiri canal was entrusted to Emir Arghun and was completed between 15 April and 12 June 1325. The canal left Nile at Mawridat al-Balat opposite the northern tip of Rawdah Island. It flowed north, parallel and 150 meters to west of *Khalij al-Hakimi,* then veered NE at Maqs and joined the old canal at the height of the mosque of Baybars. It was5 kilometers long and large enough for boats carrying cargo to navigate it. It was large enough for pleasure boats during the flood season. The canal made installation for irrigation systems possible and brought water to *Birkat al-Ratli* and turned it into an area of summer residence

residences. He describes the streets to be full of vendors, pedestrians, food sellers, jugglers, and acrobats.

The westward shift of the Nile opened up huge areas for development, leaving large ponds that would later be reconfigured, as sites for villas and residences, like Birkat al-Azbakiyaa[143] and Birkat al-Nasiriyya. To promote urban development between the two canals (an area of 600 hectares), Sultan Nasir[144] conceded grants to several emirs. The emirs would make certain improvements to the area in return, as well construct basic buildings (mosques, baths, shops...etc). The development seemed to be active in the south zone between the two canals[145], near Birkat al-Nasiriya, but deemed more modest farther west[146].

The development in and around the Citadel reinforced an urbanization trend that started by the Ayyubids in the southern district. Some gradual development had already been started by the renovation of the bin Tulun mosque by sultan Lajin[147] (1296 – 1298) in the late 13th century[148], but the development received a big boost after Sultan Nasir's policies. He gave grants to encourage parceling and settlement of land near Birkat al-Fil. The erection of monuments promoted urban development

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[143] Maqrizi, *Khitat*, 2: 146-148; idem *Kitab al-Suluk*, 2:261, 539; idem, *Histoire des sultans mamlouks,* 4:269; Doris Behrens – Abouseif, *Azbakiyya and its Environs, from Azbak to Isma'il, 1476 – 1879* (Cairo: IFAO, 1985) pp. 9-10

[144] Al-Nasir Muhammad (Epithet: al-Malik al-Nasir Nasir al-Din Muhammad ben Qalawun) (Nickname: Abu al-Ma'ali)b. Cairo 1285, d. Cairo 1340, Was the ninth Mamluk sultan of Egypt who was inaugurated three times, from December 1293 to December 1294 , from 1299 to 1309 and from 1309 till his death in 1341 .

[145] The area boasted polo ground (*Maydan al-Mahar*) built by Nasir in 1320

[146] Probably because the course of the Nile was unstable at that point

[147] Lajin , royal name: al-Malik al-Mansour Hossam ad-Din Lajin al-Mansuri (d. January, 16, 1299, Cairo) was a Mamluk sultan of Egypt from 1297 to 1299. The descendants of Lajin are still living in Egypt; they form one of the largest families in Egypt. The name is now Lasheen instead of Lajin

[148] Salmon, Georges, "Etudes sur la topographie du Cairo. La Kal'at al-Kabch et la Birkat al-Fil," *MIFAO* 7 (1902), 16-17; Raymond and Wiet, *Les marches du Cairo,* p.210

along the main arteries of the south zone, as the sultan urged the emirs to build large mansions to encourage a trend to be set, he thought that these mansions would become the core around which people would be clustered. His programs and policies would continue actively after his death. Maqrizi describes many houses built along the avenue joining Bab Zuwayla to Saliba street, and mentions several modest suqs, the most magnificent of which was Dar al-Tuffah (hall of apples) built outside Bab Zuwayla, where all the fruits of Cairo were sold. The sight and smell suggested paradise according to Maqrizi[149]. Nasir's effort to promote urban development met with more lasting success in the southern zone, perhaps because of the continued developed that has already been sketched out under the Ayyubids[150].

There were a considerable number of soldiers and courtiers resided in the Citadel. Nasir built four water wheels on the Nile in 1313 to bring water to those in need at the Citadel. The site chosen on the Nile probably corresponded to the later aqueduct intake location. The water was carried to Saladin's wall, and channel led it to the Citadel. New construction also was undertaken on the Citadel, under Baybars, Qalawun[151], and Nasir. They all shared the view of making the Citadel a palace zone[152]. Baybars built the "House of Gold", Hall of Justice (*Dar al-Adl*) and quarters for mamluks, Qalawun built the dome (*qubba*) and residence for viceroy (*na'ib*), and Nasir built residential complex as southern enclosure of Citadel.

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[149] Maqrizi, *Kitab al-Suluk,* 2:131, 543, 807: Raymond and Wiet, *Les marches du Caire,* pp.131,141,183
[150] Raymond, Andre, *Cairo: City of History* (American University in Cairo Press, 2000), pp. 128
[151] Saif al-Din Qalawun Al-Salihi (also Qala'un or Kalavun) *epithet:* al-Malik al-Mansour Saif al-Din Qalawun al-Alfi al-Salihi al-Najmi al-Ala'i (b. c. 1222 – d. Cairo November 10, 1290) was the seventh Mamluk sultan of Egypt. He was in the Bahri line and ruled Egypt from 1279 to 1290.
[152] Raymond, Andre, *Cairo: City of History* (American University in Cairo Press, 2000), pp. 113

Section 7: Ottoman Cairo (AD 1517 – 1805)

Subsection 1: A New Political System

The Ottoman period began with the defeat of the mamluk army under Sultan

Tumanbay (1516 – 1517). The Ottoman rule known as a foreign tyrannical rule

responsible for the decline of Egypt, where it was reduced to simple province after

conquest, one of thirty-two, with thirteen of them within the Arab world. However,

Cairo retained an eminent position as the second city of the Ottoman Empire after

Istanbul.

The new political system had difficult start; the Ottoman regime faced revolts from

the Mamluk emirs, Janim and Inal in 1522, and Ahmad Pasha in 1524. These revolts

forced Ibrahim Pasha, vizir of sultan Suleyman, to reconquer the country. Ibrahim

Pasha remained in Cairo for three months organizing the governmental entities to rule

Egypt: the *kanunname* (edict) established military organization of the province and

civil administration; the *beylerbey* (prerogatives of governor) whom lived in the

Citadel, the *diwan* (workings of the council), and the *kashif* (governor) or *shaykh* in

case of Arabs of Upper Egypt.

Subsection 2: Cairo Under French Occupation

Little urban change occurred in Cairo during the period between Napoleons arrival in 1798 and the accession of Ismail Pasha in 1863. However, upon their arrival the French destroyed the Ottoman administrative system, which the allowed new ideas of Mohammed Ali to be later established, and the whole future of Egypt to be determined.

The governing bodies that the French put in place represented a compromise between their favored modern principles and some local customs they had to take into account if they wanted native cooperation. They divided Cairo into eight administration districts, the outlines of which only partly take natural boundaries into account[153]. Such information is passed down as history due to a document known as the *Description de l'Egypte* map. The map documented the districts, which in Arabic was mentioned as *khitat.* This Arabic name is full of symbolism; it was the name used for concessions demarcated in Fustat at the time of the Arab quest, and then in Qahira at the time of it's founding.

The districts were useful for the administration of the city and for the levy of taxes. The expedition documents mention district commanders, which were undoubtly French, yet natives may have assisted them.

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[153] Andre Raymond admits puzzlement as to why Cairo wouldn't be divided into two districts along the axis of the Qasaba. The city was instead amputated of the southern portion. The Khalij formed a boundary only along its northern half, where it is the (approximate) line of demarcation for districts IV and VI, with district III drawn as to straddle the Khalij (Raymond, 2000)

Section 8: Mohammed Ali's Cairo (AD 1805 – 1882)

Subsection 1: Introduction

Mohammed Ali arrived Egypt in 1801, during the last days of the French occupation. At that time, he was only an officer in the Albanian corps of Ottoman army. He managed to seize power in Cairo and obtain elevation to pasha in 1805. He eliminated the old Mamluk aristocracy in 1811[154], and conquered all of Hijaz, Palestine, and Syria by 1831. Finally, the sultan recognized him as a hereditary pasha of Egypt and ruler of Sudan in 1841.

Subsection 2: Development of Alexandria / Stagnation of Cairo

Alexandria replaced Cairo as the center of International Trade in Egypt during Mohammed Ali's reign, and the small town that acted as an outer port expanded rapidly[155] to become Cairo's rival. This was possibly due to Alexandria's prominent location on the Mediterranean, with direct axis to the European industrial revolution. On the other hand, very little change occurred in the urban development of Cairo during the entire reign of Mohammed Ali (1805 – 1849).

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[154] In March 1811, Mohammed Ali conducted a massacre of the mamluks, ridding him of the old elites within Cairo. Twenty four beys and undetermined number of lesser dignitaries lost their lives in a passageway leading from the Citadel, where they had been invited for a ceremony. Only one Mamluk (el alfi) was able to escape. In 1812, Mohamed Ali had almost all of the Citadel's Mamluk buildings destroyed.

[155] Raymond (2000) documents the population of Alexandria growing from 10,000 inhabitants by the beginning of Mohammed Ali's reign, to 105,000 inhabitants in 1848 (including 5,000 foreigners) and 232,000 in 1882 (including 49,000 inhabitants)

The greatest innovation in Cairo was the division of the city into precincts, known as *athman* (eighths) in Arabic. Such a division was borrowed from the French civil administration. Shaykhs were in charge of the *athman*, which brought them into direct contact with the police and the authorities. At the lowest level, the shaykhs of these *athman* continued to play decisive role in urban affairs.

Subsection 3: Later Development of Cairo

By 1830, a number of public works were undertaken to prepare way for future developments. These preparations were attributed to Ismail Pasha, son of Mohammed Ali. Mounds of debris surrounding Cairo were leveled along the north and west borders. Some 160 hectares were subject to grading and planting in the zone between the city and the Nile, behind flood dike, which facilitated future urban development project. Many of the lowlands were filled in, like Birkat al Fil (only partially), Bikrat al Ratli, Birkat Qasim Bey, and the Azbakiyya Pond. The drainage of the pond made it possible for the creation of a Eurpean-style garden, which was overlooked by new palaces, and hotel additions, like the Orient and Shepherd's hotel. The filled in land would be later called "Garden city".

The irregular network of streets remained the biggest hurdle of modernization at the time. This is when carriages started to make an appearance in the city, and the nature of traffic had to be altered by these economic and technological developments. The Authorities considered how to open city to circulation, and two new streets were proposed by administration. The first led from the Muski Bridge to al-Azhar quarter,

which was perhaps a reprisal of the French plan. This cut through the old city from west to east, and opened the business district to European merchants. This would eventually be named the new street (Sikkat al-Jadida). The road was 8 meters wide, a very generous size at time. The process of acquiring lots and demolishing the buildings that stood in way began in 1845, and a portion of the road opened to traffic in 1849.

The second intervention was a much more ambitious project. The street intended to pierce the city diagonally from the Azbakiyya Pond to the Citadel. It was later named Mohammed Ali Boulevard (Sharia Mohammed Ali), and would be famously known as the musical instrument market in the twentieth century. The project started in 1845, with the razing of the cemeteries near the Azbakiyya Pond.

Slowly, the old city began to transform into a new image, as all the new buildings were in a foreign style to local traditions. A new style appeared with a prohibition against the mashrabiya and advocated the use of glass windowpanes, which was claimed to be for safety reasons but probably to legislate "modernism" in Cairo. Such a style, one that was half European and half Turkish, was accompanied by foreign spatial strategies in the organization of interior spaces. In 1847, under the supervision of the army, the buildings in Cairo received postal numbers.
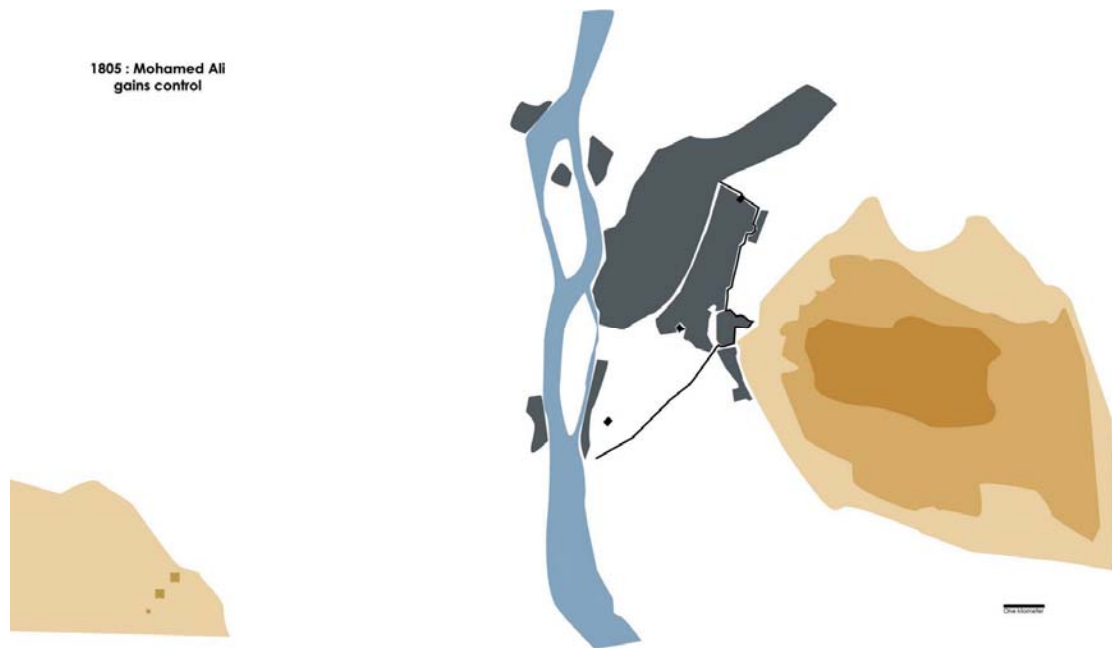
1805 : Mohamed Ali
gains control

One Kilometer

Figure 52: Cairo circa AD 1805

Subsection 3: Westernization Under Ismail (1863-1879)

Ismail pasha was the first ruler in nine centuries to make overall plan for city's development. Echoing Western Haussmannian[156] models, the new urbanism was determined on an organization of space in which street system had primacy, the urban geometry was based on the grid, and prior knowledge of structures to be built was necessary. This new concept of urban development privileged perspective and alignment, imposing new architecture based on buildings with standard apartments, organized on western models. Such development could only occur in new spaces, requiring Cairo to expand beyond limits of traditional city.

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[156] In reference to, Georges-Eugène Haussmann, who called himself Baron Haussmann, a French civic planner, whose name is associated with the rebuilding of Paris. He was born in Paris (March 27, 1809–January 11, 1891) to a Protestant family from Alsace. Many believe that the neighborhood now called Downtown Cairo, the same neighborhood this subsection is referring to, used Haussmann's Paris as a model. The khedive actually met Haussmann, during his stay in Paris in 1846, and toured his finished projects and work sites with him (Raymond, 2000).

Khedive Ismail's ambitions were realized in time for the inauguration of the Suez Canal in 1869. He felt the need to impress the Europeans dignitaries, and transformed the city into streets with European-style façades. The new plan was directly inspired by the Haussmannian model, consisting of a network of straightened widened thoroughfares connecting to squares (maydan / pl mayadeen). The new street extended to the desert east of Cairo. Due to the lack of time and money, construction had been limited to a vacant zone northwest of the old city, between road to Bulaq, Bab al-Luq, road to Old Cairo, and bank of the Nile, comprising an area of 250 hectares. The sector would give city a facade of "urban respectability" while old city remained unaltered. The new portion of the city was established rapidly because the land was previously prepared by Ibrahim pasha (1830). Once the street systemhad been established, the khedive started offereing land free to anyone who would build a structure over 2,000 Egyptian pounds in value. The area's development in 1874 measured 104 hectares, with streets making up 30 percent of the area, and buildings 13 percent, with the rest being vast garden spaces.
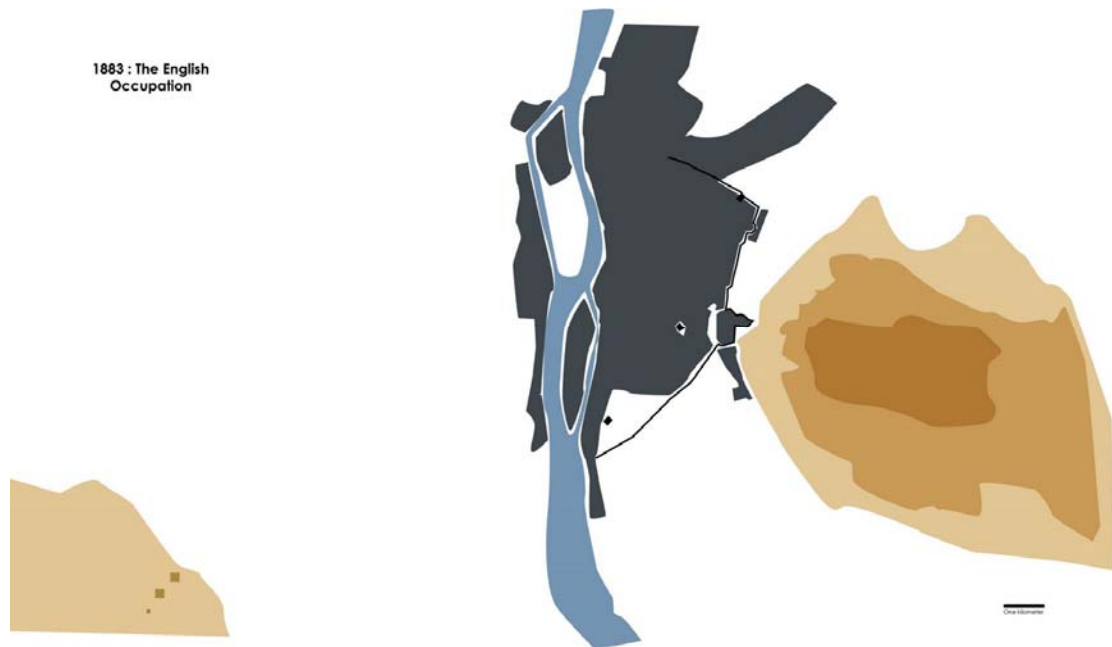
Figure 53: Cairo circa AD 1883

Subsection 1: Introduction

The British occupation of Egypt in 1882 was initially intended to be temporary. The

purpose of the invasion had been to restore political stability to Egypt, that came

under fire with the Ahmed Orabi revolts against Tawfik Pasha, under a government of

the Khedive and international controls, which were in place to streamline Egyptian

financing since 1876. The occupation officially ended in 1936, with Egypt's

recognition and invitation to join the League of Nations. The world war forced Britain

to keep army forces in Egypt, which did not vacate the country until 1954.

Subsection 2: Population Growth and the new Social Mobility

During the first half of the twentieth century, Cairo experienced a rapid population growth phenomenon. The population increased from 374,000 in 1882 to 1,312,000 in 1937, an increase of 250 percent over fifty years, while the previous increase over the preceding eighty-four years was of 26 percent[157]. A large flux of foreign population could be attributed to the sudden increase. The foreigners were mostly Europeans, largely encouraged by the British occupation, most of which belonged to four main colonies: the British, the French, the Greeks, and the Italians.

The British formed a self-contained community, largely professional and middle class. Magdi Wahba[158] notes that they took pleasure in simple activities, like gardening in the Maadi and Zamalek neighborhoods, setting up flower shops, libraries, and antique boutiques. They enjoyed polo at the Gezira Sporting Club, in which officers of the cavalry regiments quartered at the Qasr al-Nil barracks participated. It is safe to say that their presence in Egypt was completely parasitical, as they had little encounter with the overall culture of Cairo; they contributed little to the evolution of the Cairean culture, and left no traces of their occupation that is noticeable today.

The French were a smaller group than the British. The French speaking community was much larger than the actual French colony, as the French language was considered chic and those that speak it of a higher class caliber, echoing sentiments

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[157] All numbers and population figures borrowed from (Raymond, 2000), pp. 319 – 321.
[158] Author of "Cairo Memories", in *Studies in Arab History,* ed. D. Hopwood (London, 1990)

put for by the Mohammed Ali family a century before. These were in the Tribunals and legal profession, the banks, the Catholic groups, Fouad University (later renamed Cairo University), the royal family (with the exception of King Fouad, who preferred Italian) and the Egyptian plutocrats, the department stores, the Suez Canal, the newspapers and the press...etc. Reaffirming the notion that Cairo was intended to be "the Paris on the Nile"[159].

The largest colonies belonged to the Greeks and the Italians, who actually mixed in with the Egyptian population, and you could still find traces of those families still living in Cairo and Alexandria today. Both formed stratified communities, yet the Greeks were much more introverted. Their presence and brilliance in Alexandria overshadowed the Cariean Greek community. They had their own local Newspapers in Cairo, but they were like parish bulletins, full of local news and obituaries[160]. The Italians formed a "quasi-proletariat of garage mechanics and chambermaids to an intellectual aristocracy centered around the Mixed Tribunals[161], Vittorio Emmanuele Hospital, and the very rich architects, builders and bankers."

Subsection 3: Urban Development Under the British Occupation

All this rapid growth in population implied construction of a massive scale. The urban projects that were executed around Cairo (such as the infilling of the ponds and

[159] A local vernacular term used by the upper class to promote the image of Cairo, later used by Cynthia Myntti in her publication "Paris Along the Nile: Architecture in Cairo from the Belle Epoque", American University of Cairo Press, 2003
[160] Wahba 1990, pp. 105 -111
[161] These Mixed Tribunals were courts established in 1876 for matters concerning all foreigners. Under the terms of the Conventions of Montreux (1937), which abolished the Capitulations, the Mixed Tribunals were to be phased out after a transition period of twelve years

leveling of the hills) allowed the old city to accommodate new inhabitants, and it was quickly saturated and hundreds of thousands of new Caireans turned to the north and west for open settlement space. Cairo's built up area went from 1,000 hectares in 1882 to 16,331 in 1937.

The new settlements were problematic. The Nile posed a barrier to those expanding westward, as the size of its annual flood made riverbank land inhospitable. The open areas to the north were too far from the center of the city, and the lack of water hindered its urban development. These problems were resolved by a number of new interventions to the city. The Aswan Damn built in 1902 allowed Cairo to control the Nile's flood, allowing both increase in agricultural production and the stability on the shores of both the Jezirah and Rawdah islands, which later became popular and valuable land for settlement. A modern mass transit system was established between 1894 and 1917 under Baron Empain, introducing the Tramway system and the arrival of automobiles (1903). These triggered the creation of the new suburb of Heliopolis, which is also attributed to Baron Empain.

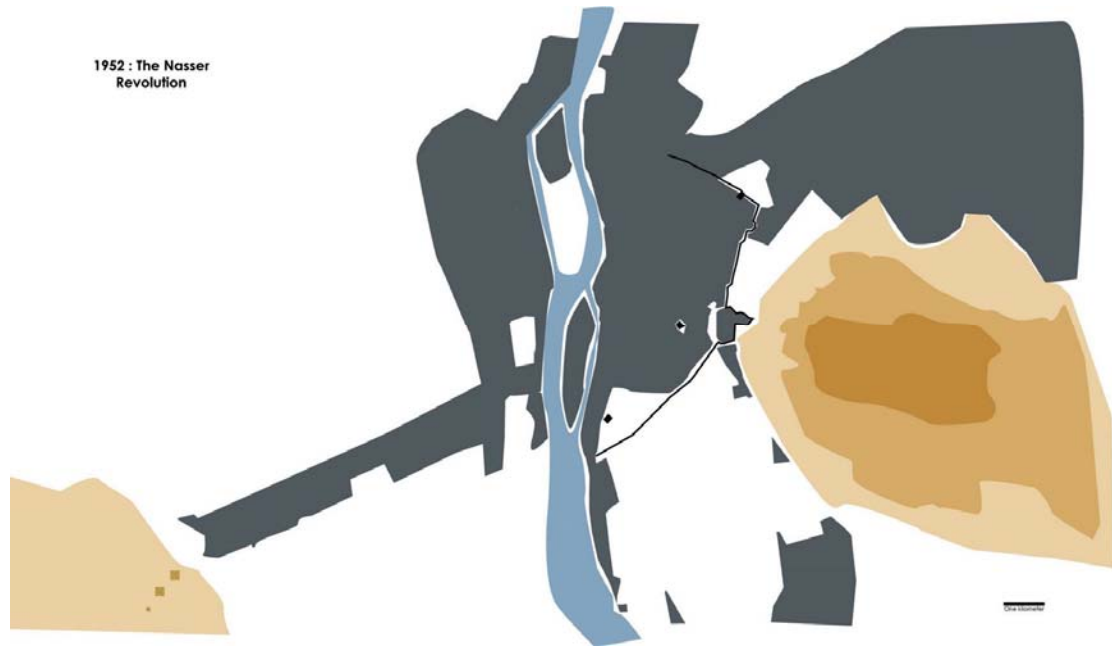## Section 10: Post Revolution Cairo (AD 1952 – Present)

1952 : The Nasser
Revolution

Figure 54: Cairo circa AD 1952

The revolution of 1952, under Nasser and the "free army officers", was a catalyst that drove out most of the foreign population in Egypt, with the British army finally withdrawing their troops in 1954. The abdication of the throne by King Farouk in 1952 gave the "free army officers" a chance to control the ruling of Egypt. King Farouk's son, Ahmed Fouad, was only ten years old when he became King, but he was a mere figure, if that, and the true leadership was given to Mohamed Naguib, leader of the "free army officers." In 1956, Egypt became a republic under the Leadership of Gamal Abd el Nasser, who initiated a string of decrees that dictated the course of Egypt's future. The nationalization of the Suez Canal and the campaign to regulate farm land and give a large percentage of the land to the farmers who were employed in it, prompted yet another social mobility phenomenon. This social

revolution prompted a powerful current of urban migration of the rural residents into Cairo, which continued to be the tradition well into the 21st century. The population is now listed in some demographic databases as 17 million (17, 035,000)[162] in an area of approximately, 1,600 km, with a density of 13,420 per kilometer square[163].

Cairo could not support the new wave of inhabitants, which led many to start building on cultivated land. According to the urban planner Galila el Kadi, 8,900 hectares of farmland were lost to development between 1945 and 1982. To combat such development, the government began encouraging urban development and expansion toward desert lands. Today, Cairo extends 65 kilometers to the west (6th of October City) to the east (Badr City) and 34 kilometers from the north (Shubra) to the south (Hilwan). The built-up area covers 20,791 hectares (some estimate 32,000 hectares)[164].

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[162] Includes the Governorate of Al-Qahirah (Cairo) and the cities of Al-Jizah (Giza) and Shubra al-Khaymah (Shubra El-Kheima). Figures compiled by Demographia [World Urban Areas (500,000+): Population, Density]

[163] These figures don't include those who enter Cairo during the work hours and live in satellite communities outside the metropolitan area. Those numbers are very difficult to gather, as there is no proper documentation for such workers, but some reports suggest a total of 6 million extra inhabitants in Cairo during the work hours.

[164] All numbers and figures taken from Raymond (2000)

The ever-expanding city is still suffering from nightmares of growth. Over the turn of the century, the city started experimenting with suburban sprawl, courtesy of DDG[165], a fad that still continues until today. Although the developers of these gated communities pride themselves of having over 90% sales, the occupancy rate of such towns are not even close to half of that. Most businessmen purchase these units for future investment. The problem is that this new development is not concerned with building new communities, slowly taking over valuable land, closing off any opportunity for the city to grow.
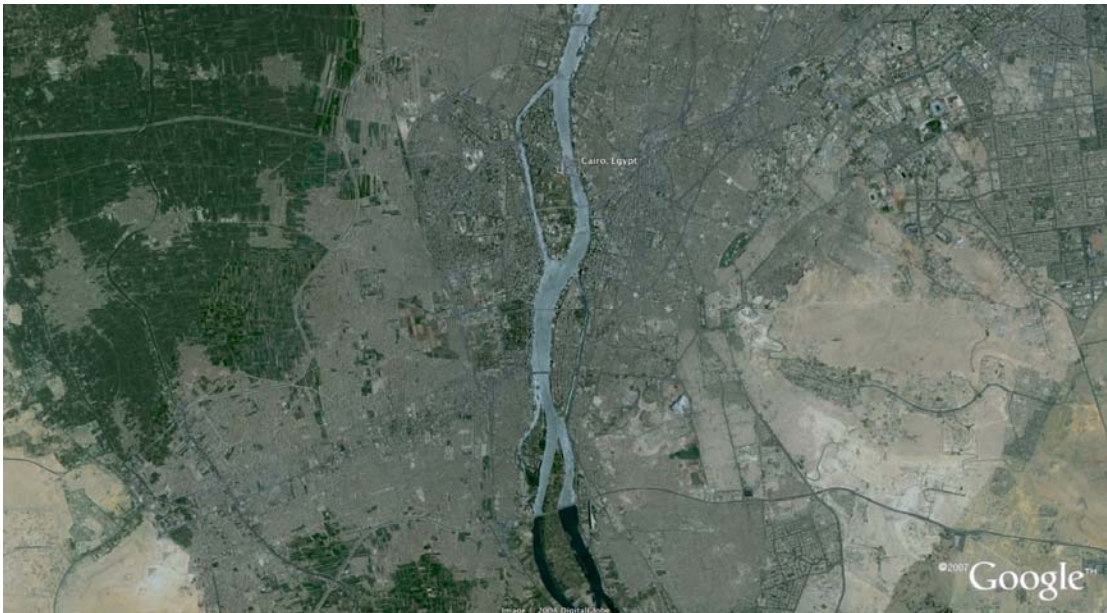

Figure 55: Aerial image of Cairo circa AD 2007

One of the problems the city faces today is the surge of the slum, would seems to spread out throughout the city like weed. The hope is that some of these gated communities would escape these slums, along with the heavily congested traffic, but

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[165] DDG (Design Development Group, Inc) planned the first suburban-gated community in the 6th of October district, naming it *Dreamland*.

these slums (ashwa'eiat in Arabic, literally meaning "the random") will soon catch up

with the gated communities and fill in any blanks left in by the sprawl.

Chapter 9: Deconstructing Cairo

Section 1: Initial Diagrams

The following are a series of diagrams, displayed during the A01 thesis meeting (10/20/2008), that start to document and diagram the site in an objective manner.
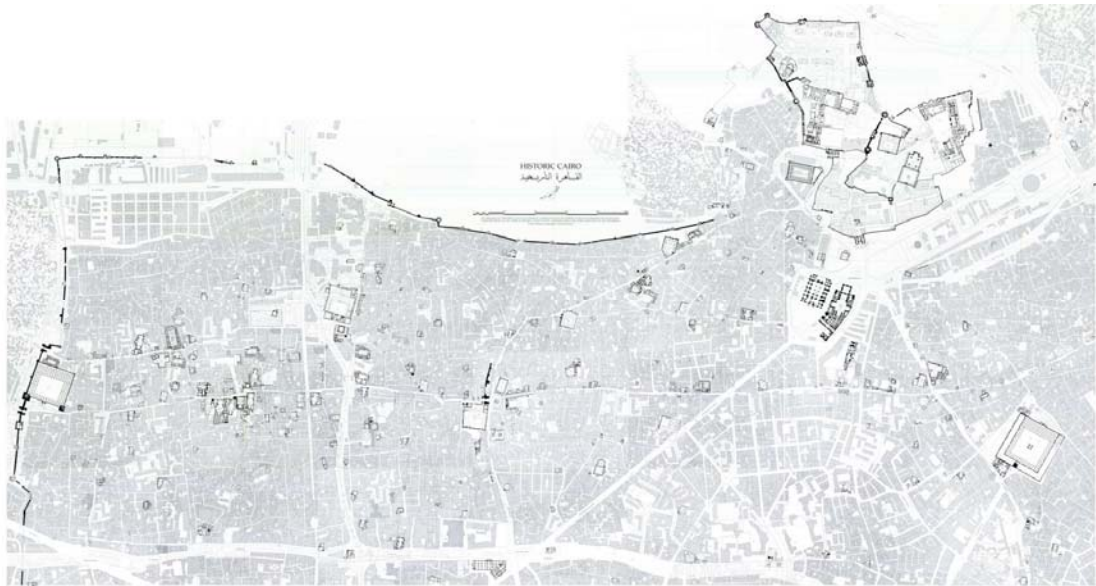

Figure 56: Nicholas Warner's map of Historic Cairo

The above diagram is a plan of Mamluk Cairo as it stands in the beginning of the 21st century, compiled from Nicholas Warner's Monument of Historic Cairo [166].

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[166] The map chosen is taken from Warner, Nicholas, *The Monuments of Historic Cairo: A Map and Descriptive Catalogue (American Research Center in Egypt's Conservation)*, 2005. The map shows the modern day remnants of what used to be Mamluk Cairo (reaching its urban zenith in the 15th century). Map designed and prepared in co-operation with the Supreme Council of Antiquities, for the Egyptian Antiquities Project of the American Research Center in Egypt. Completed in March 2001 under USAID GRANT no. 263-G-00-93-0089-00. © 2001 American Research Center in Egypt.

Figure 57: Main access roads in Historic Cairo

The above diagram highlights major traffic axis within the city, creating a distinction between pedestrian and automobile traffic. It should be noted that although el Mu'izz street is highlighted as autombile street, automobile access is highly regulated and considered very light to make it more pedestrian friendly.
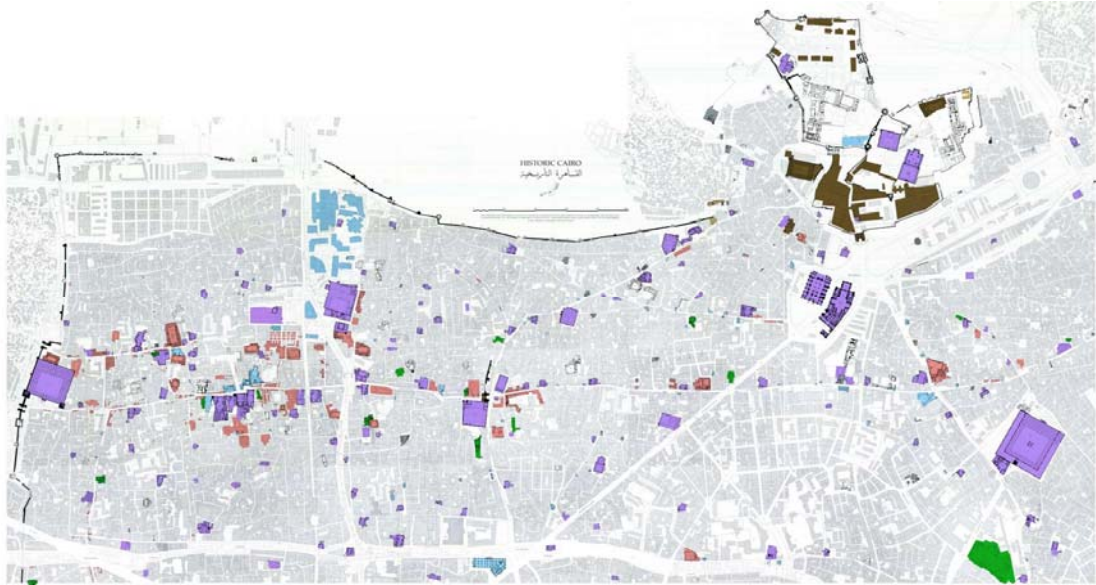
Figure 58: Building types and uses in historic Cairo

The next diagram highlights the various building types and uses within the historic

city. It should be noted that the diagram is incomplete; it was compiled by limited

amount of information that I have, and will be added onto within this thesis year.

Purple marks the Religious use, Green the leisure use, Blue the educational use,

Brown the municipal / defense use, and Red marks the commercial use. The

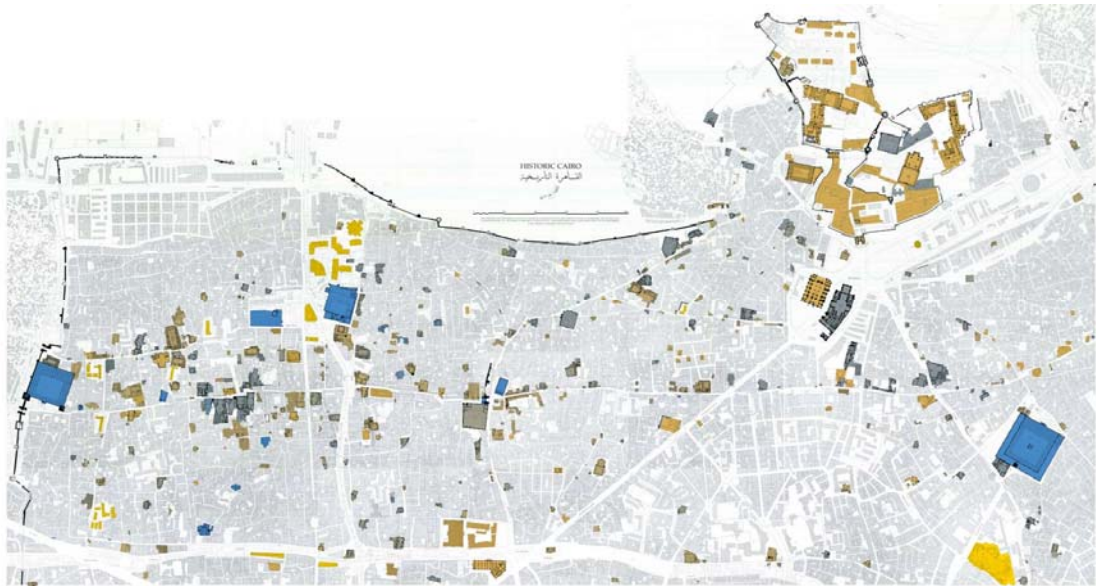uncolored buildings are meant to be residential use at this point.

The above series distinguishes between the various time periods where the buildings were erected. Starting with the Fatimid Period (969-1174), the Ayubbid Period (1174-1257), the Bahri Mamluk period (1257-1392), the Circassin Mamluk period (1392-1517), the Ottoman period (1517-1805), the Mohamed Ali period (1805-1956), and the Post-Revolution period (1956-present). The monuments highlighted in bright blue depicts the Fatimid Period, while the bright orange depicts the Post-Revolution period

Section 2: Cairo's Aural Configuration

The next two diagrams deal with acoustic space. It was mentioned that Cairo was planned out so that each individual house would be in hearing reach to the mosque's call to prayer. This diagram tests this claim. The small orange dots marks the spot of the minarets within the city, while the large faded yellow circles maps out the threshold of where the call to prayer would be hold, meaning anything outside that circle wont hear the mosque's call to prayer. The diagram was based on a simple physics equation on the intensity of sound: each time the distance is doubled the intensity level is divided by four. Knowing that any sound made by a human being cannot exceed 80dB (without amplification), the outer large circle marks the point where the sound has reached 20dB (audible whisper).

Figure 60: Extent of the call to prayer outreach in Historic Cairo

Interestingly enough, there were a few patches of space that are not within audible reach to the call to prayer. At first, I was disappointed that the theory would therefore by false. However, if you look closely to the map, you would notice that the eastern area is a post revolution grid addition to the city, near the southwestern corner is a Mohamed Ali extension (emulating Hausmann's Paris), and the western part of the city includes a number of Synagogues, which leads me to believe that the area was Cairo's Jewish quarters.

Figure 61: Extent of the call to prayer in Historic Cairo highlighting the denser clusters of *adhans*

The following diagram is similar to the one before, but it focuses more on the intensity of the mosque clusters. Notice how the cluster is intensified around both the Qalawun / Barquq complex and around the Rifa'i / Sultan Hassan mosques near the citadel.

Chapter 10: Design Strategies

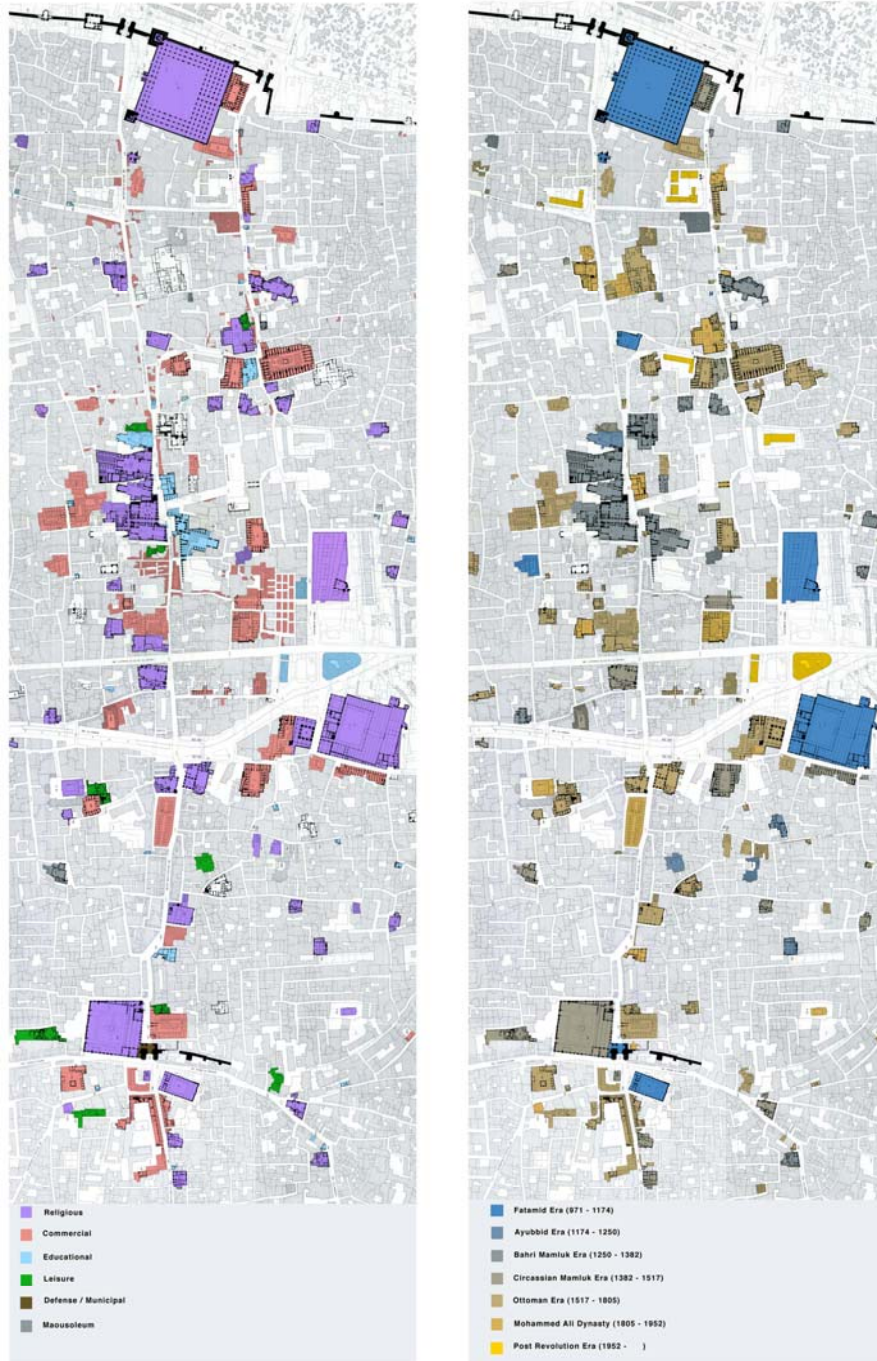## Section 1: El Mu'izz Street Reprise

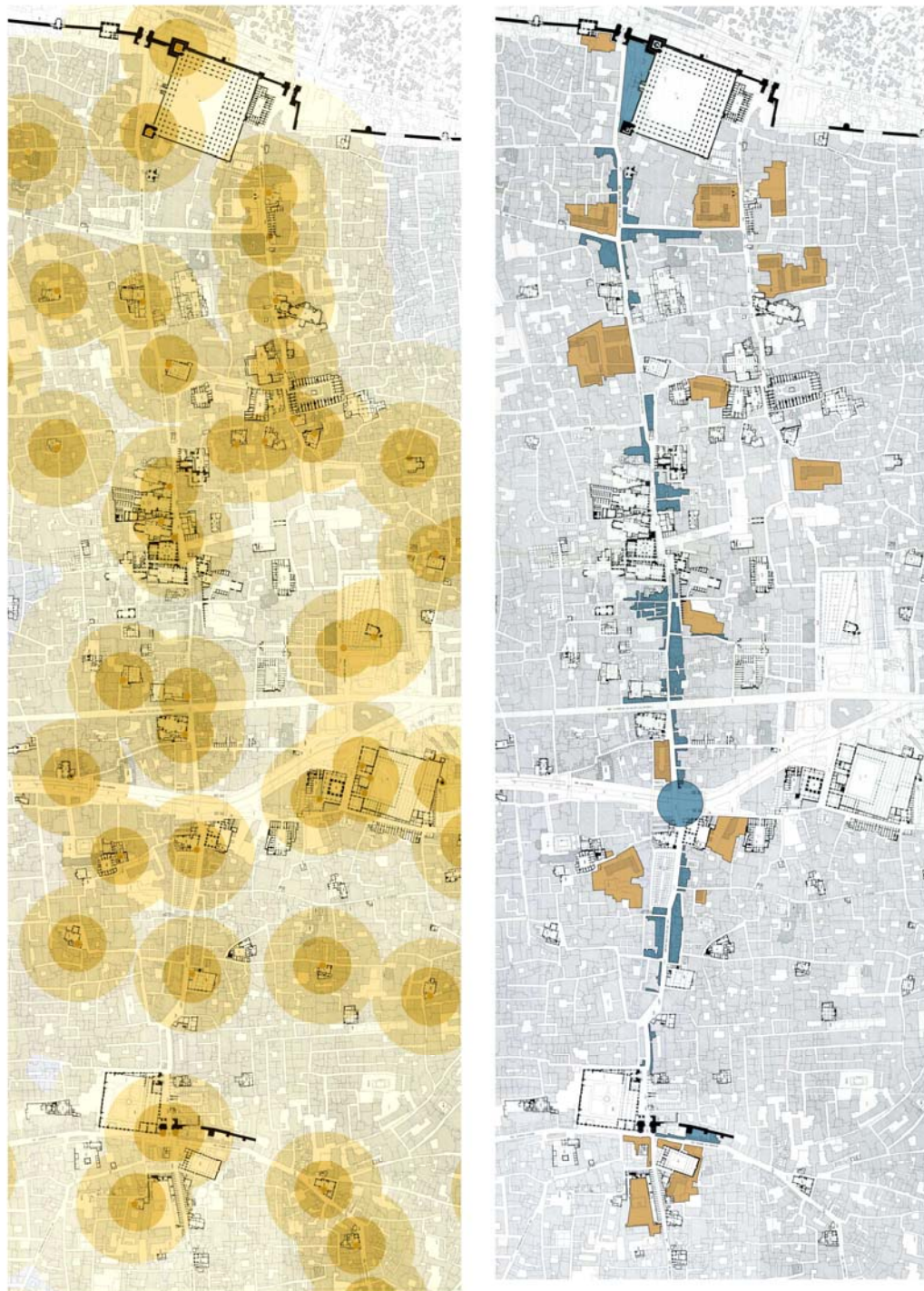**Figure 62: Building type and timeline diagrams of al Mu'ezz street**

Figure 63: *Adhan* **extent and soft sites diagram of al Mu'ezz street**
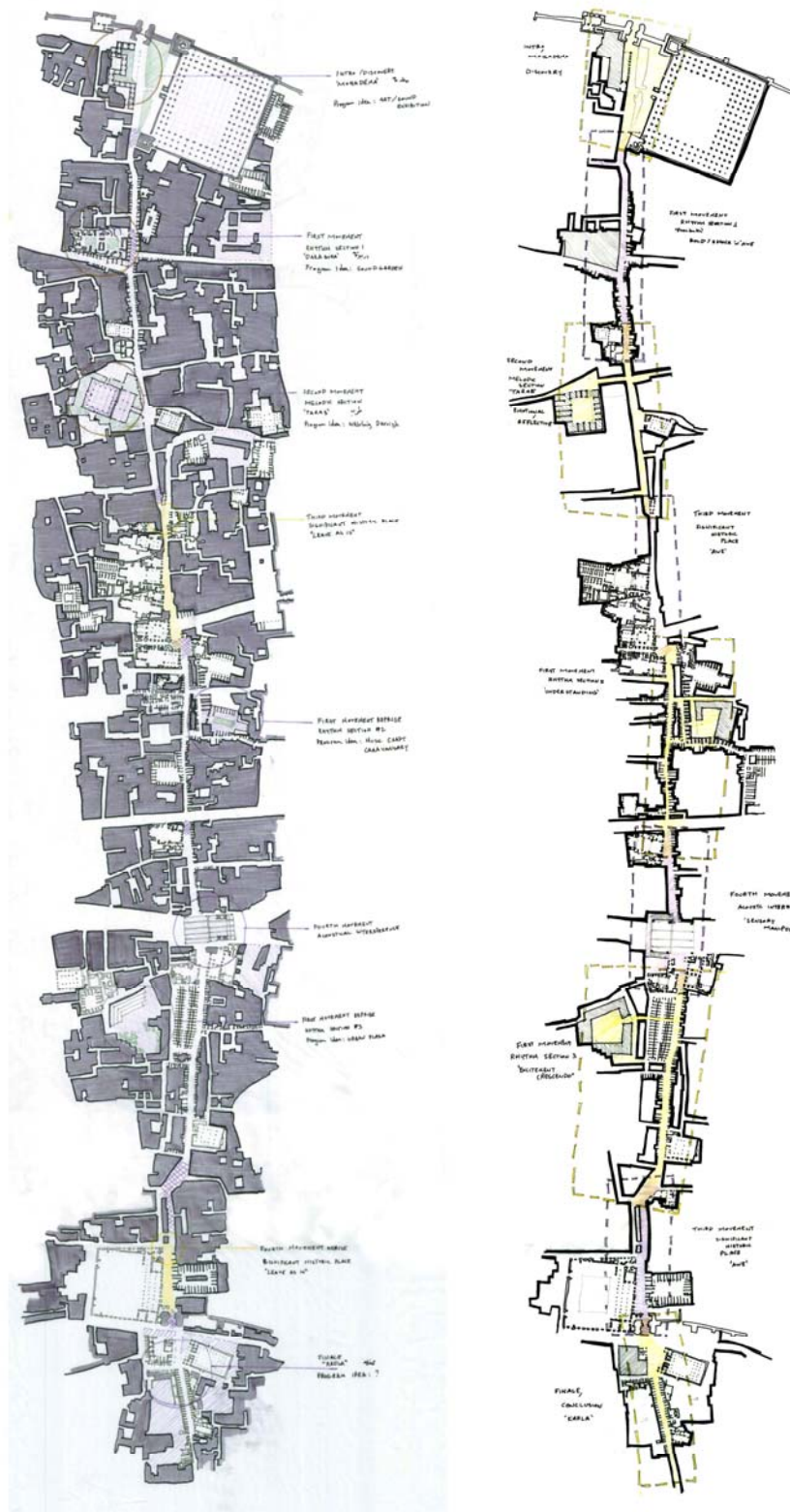
Figure 64: Masterplan of interventions

Section 2: Precedents

The following precedents are taken from Machado and Silvetti's[167] portfolio, and

were chosen due to their non-programmatic urban / architectural intervention nature.

Figure 65: Existing and Proposed plan of "The Steps of Providence"

Figure 66: Plan of Citadel Square, Beirut

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[167] Rodolfo Machado and Jorge Silvetti are the founders of Machado and Silvetti Associates, a Boston-Based firm, designing projects big and small from museums to libraries to public spaces.

155

Figure 67: Perspectival Images of Citadel Square, Beirut

Section 3: Walk Through Mu'izz Street

Subsection 1: Zone 1, Moqadema (Introduction)

Upon entering the site through the Bab el-Fath gates, one is surround by a triangular

space, fronting al-Hakim mosque. The mosque was built during the Fatamid era

(construction was between 990 - 1013), and has two distinguishing features: the

entrance and minarets. The entrance in the northwest facade is derived from the

earlier Fatamid monument, a mosque in Mahdia (Tunisia), the first capital of the

Fatamids. The stone minarets, one embedded in the Fatamid wall of Cairo, while the other faces the triangular space, are unique in appearance and character.

The first zone, similar to the first act or movement in music, is about discovery. The *Moqadema* (introduction) is the movement in Arabic music that summarizes or hints at specific themes or moods that the rest of the composition would eventually allude to. The idea of the *Moqadema* would work best in this zone, as it already feels as a welcoming space, funneling the visitor into the journey and promenade of el Mu'izz il Din street.

Along with the idea of discovery, the programmatic element included in this zone was intially set up to become an visual / sound art exhibition. There is a strong movement of a new generation of Egyptian artists who are redefining the notion of Egyptian Art. The paradigm of Egyptian art has too long been seen as cliché paintings depicting historic and touristic sites, or cultural images of the rural areas along the Nile. These artists, many of whom are also musicians, are fighting against that in an attempt to produce work that reflect their own inner struggles and issues coming from living in Cairo. They have started a front, calling themselves the "Icatalyst" group. Their venues are not always appropriate to the statements they are making, so this architectural intervention would house an exhibition for them, and those that are interested in exploring ideas of the visual and sound art, and the correlation between both.
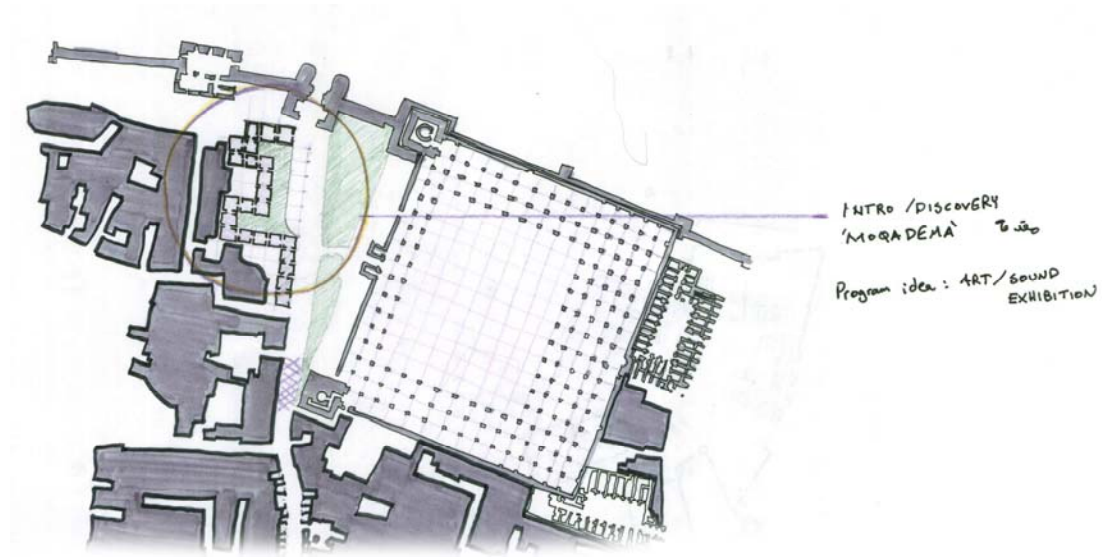
Figure 69: Zone 1, *al Moqadema*

Currently, a workshop building blocks off the axial condition that one would expect from such a grand entrance; one is then confronted by a perpendicular street and must make a choice, to turn right or left. The triangular space is reached after a little maneuvering from the visitor, turning left upon entering the gate. The idea of the slight jog to reach the space is concurrent with the ideas of privacy in architecture of the region, where such a zigzagging corridor could provide privacy to those in the figural space. However, the way the workshop building does is quiet weak, as a right turn would lead the visitor into the neighboring, less preserved, slums of the area. The plans compiled by Nicholas Warner shows that there in fact used to be a building that would prevent the right turn, and lead the visitor into the private triangular figural space. This criteria guides the location of intervention in this zone

Figure 70: Panoramic images of the *Moqadema* zone

An amalgamation of audio-visual experiences of the site, composed to give observers a feel of what its like walking down this path, was set up for this thesis. This video can be found at http://www.youtube.com/watch?v=2mBQwm7t7Ro . Stills of the animation will be featured in this section, starting with figure 69.
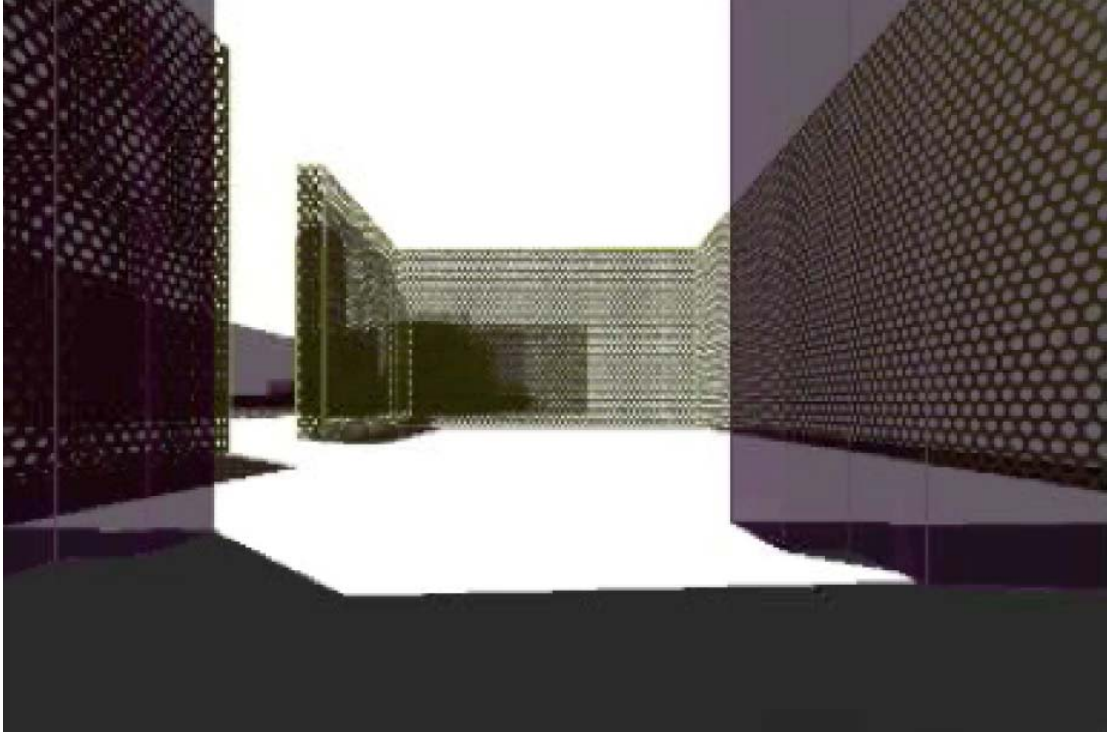
Figure 71: Entrance through the gate (*bab al fatah*), site animation still
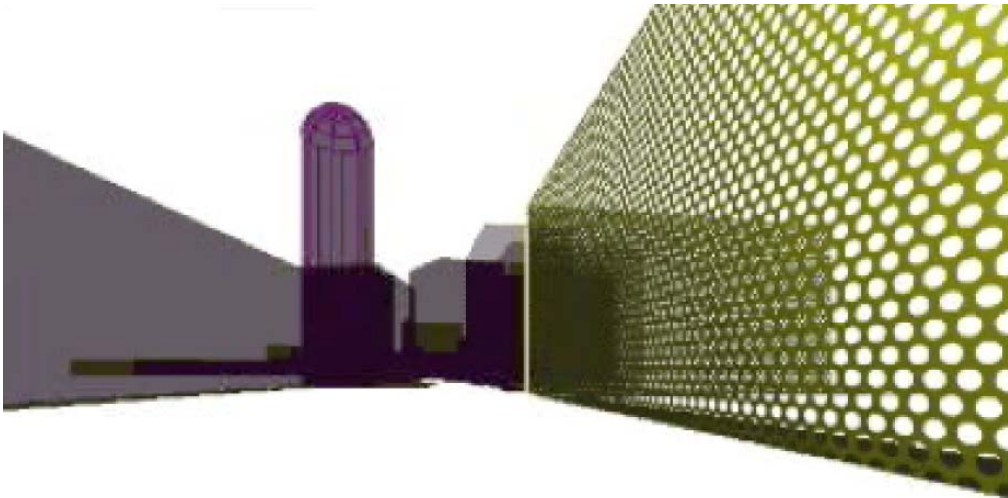

Figure 72: Zone 1, *al Moqadema*, site animation still

Subsection 2: Zone 2, Rhythm Section #1 (The soundscape and the

soundgarden)

The second zone is the first "Rhythm Section" zone. It is thus named because of the

number of shops aligning the street facade on both sides of the street. These shops

either set up a visual rhythm while walking through the street, or the sounds

emanating from the workshops lay down ambient rhythmic patterns that affect the

visitor's movement. While the first zone is all about discovery, this zone is labeled the

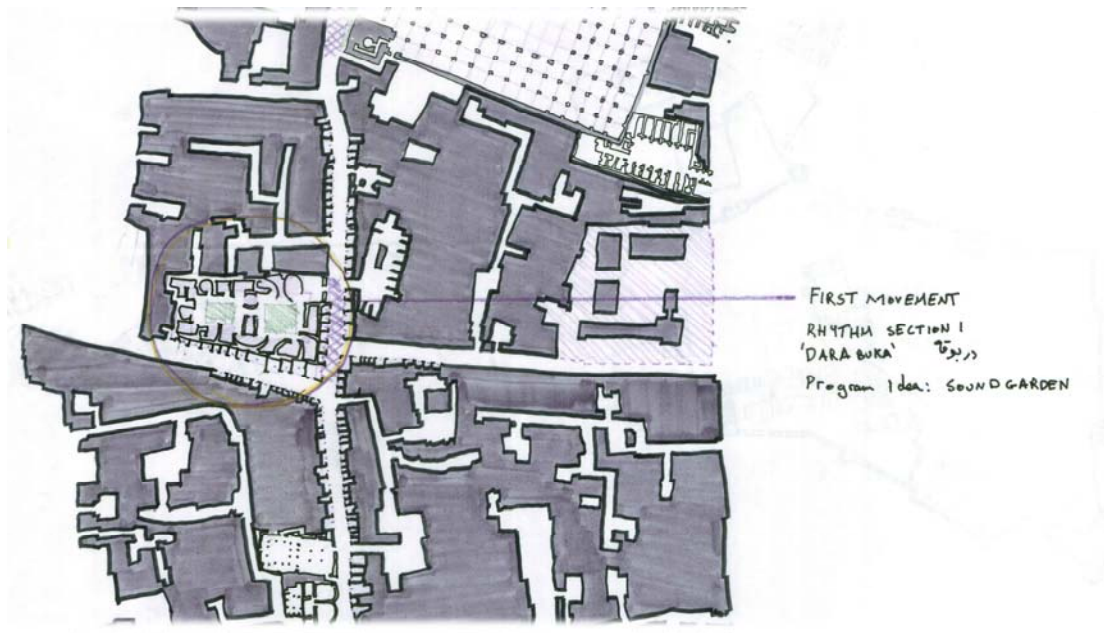"bold / shocking" zone, the attention grabbing area.

Figure 73: Zone2, rhythm section #1 (the soundscape and the soundgarden)

Figure 74: The threshold between Zone 1 and Zone 2

The transition between the first and second zone is and example of the reason for the meandering street in the Islamic city. The minaret of al-Hakim mosque serves as a focal point upon entering the triangular space. At this point, one feels in an enclosed well-defined space, the neighborhood of the "Moqadema" zone. As one starts to move southward onto the street, the enclosed spaces starts to fold out, and the street that seemed to terminated at the minaret, now seems to continue southward, and another minaret[168] slowly appears, marking the transition to the second zone. The minaret here serves as a threshold between both zones.

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[168] This minaret belongs to the Mosque and *Sabil-Kuttab* of Sulayman Agha al-Silahdar (1837 – 1839).
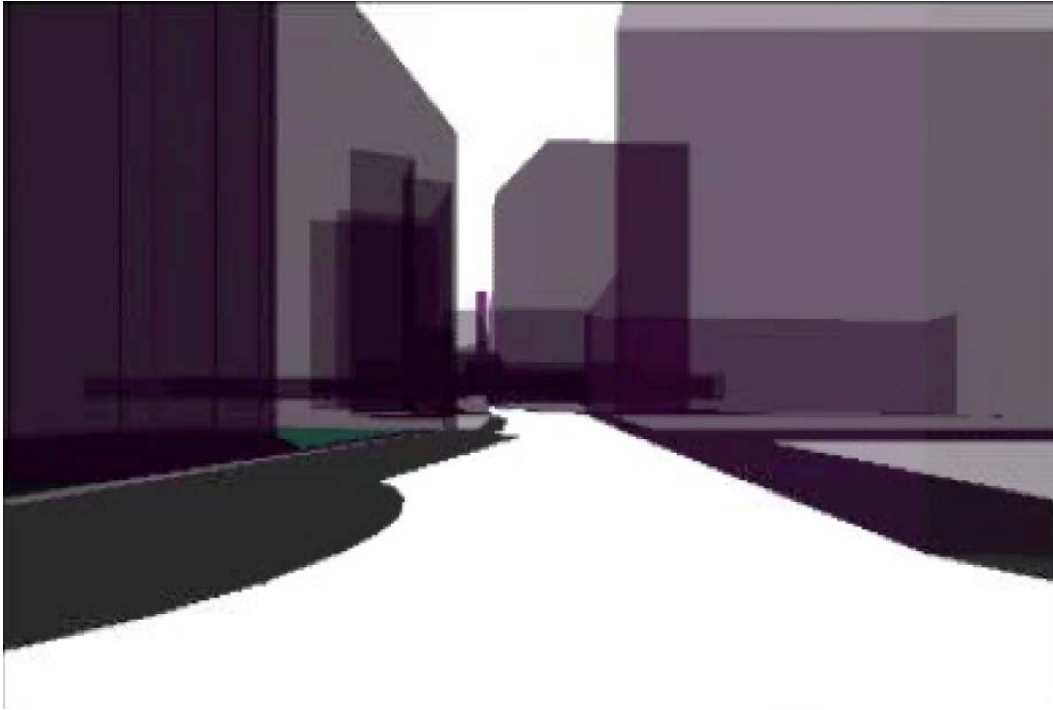
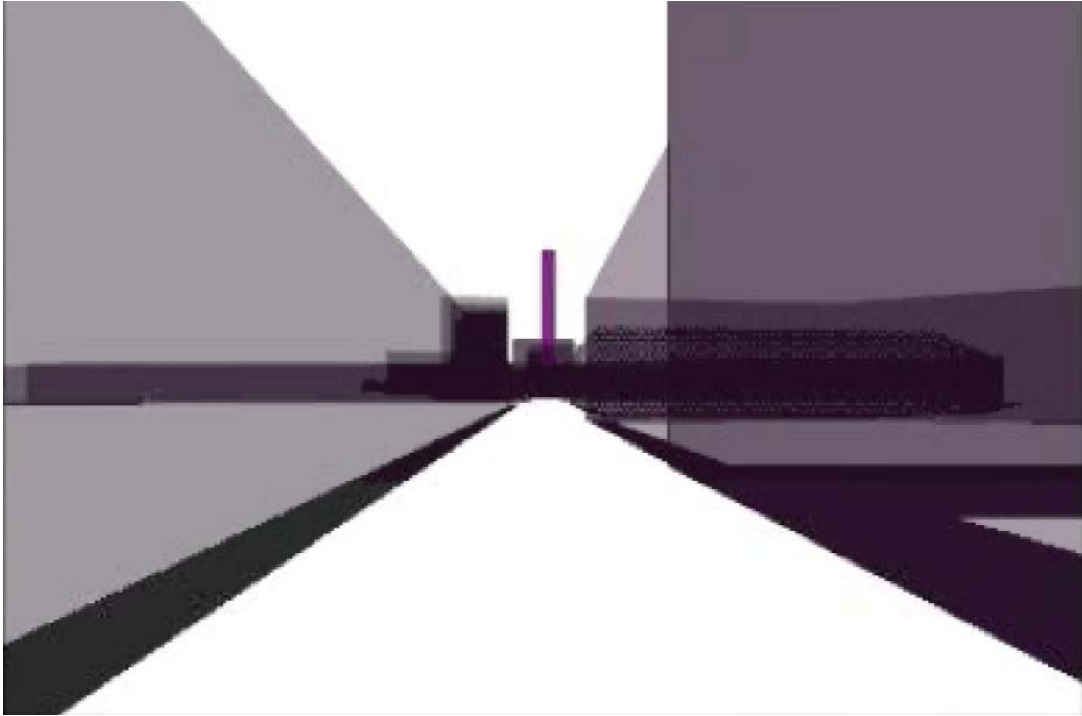Figure 75: Threshold into Zone 2, site animation still

Figure 76: Images of Zone 2

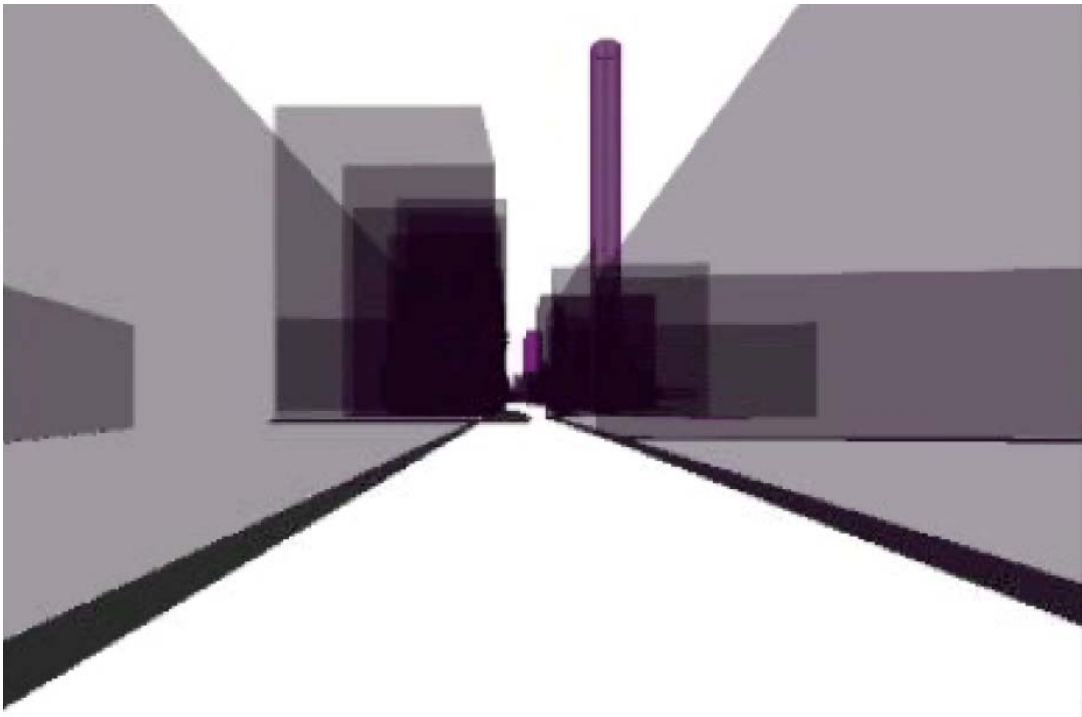**Figure 77: Thoroughfare of the street along Zone 2, site animation stil**

Figure 78: View of the mosque of Suleiman Agha al-Silahdar, threshold into Zone 3, site animation still
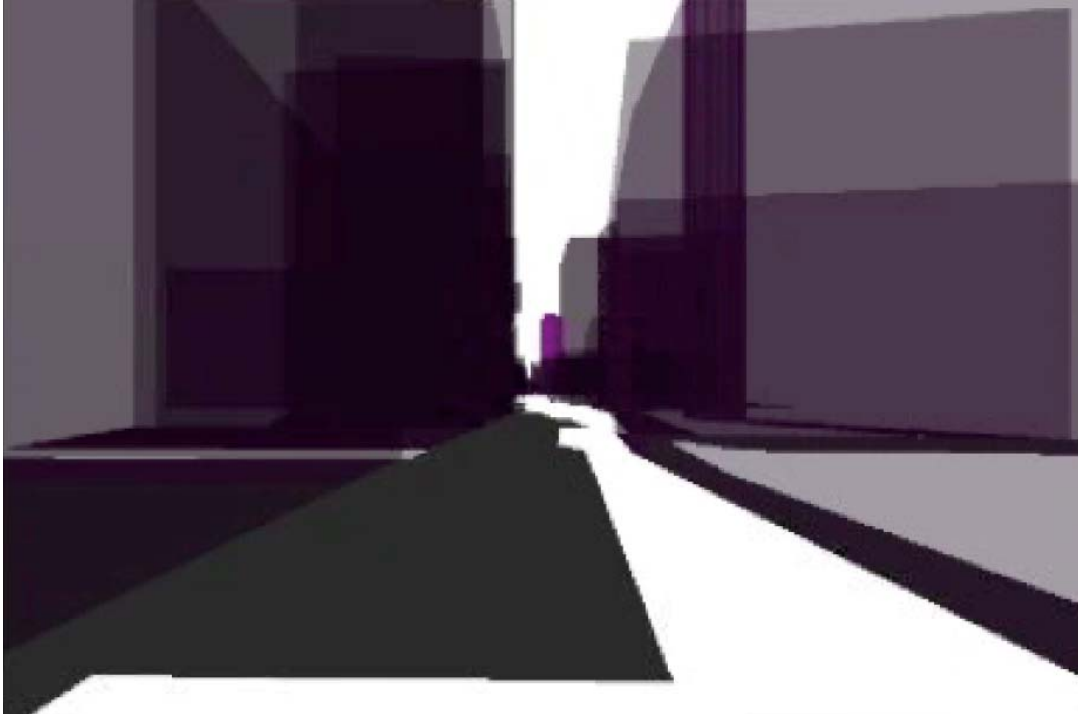
Figure 79: Threshold into Zone 3, site animation still

The programmatic element in this zone is projected to be a "sound garden"; an area where sound is used to define space, as opposed to odors in regular gardens. Because the acoustics in Arabic and Egyptian music has never really been studying like that of the Classical concert halls, the music is usually played either around cafes, or in concert halls based on western acoustics. Although both venues have totally different acoustics, the music is rarely altered. The sound garden hopes to challenge that.

The question becomes where the sound garden becomes a hub that utilizes the sounds generated from the site, or be entirely isolated from the site and act as a set of acoustic obstacles that test the Egyptian musician, allowing him to create new dimensions in music. In the latter case, the sound garden here becomes the musical

instrument, just like the Roman Catholic Church and the creation of the Gregorian chant[169].

Figure 80: Bernhard Leitner's *Le Cylindre Sonore*

"Sound is no longer exclusively the instrument of musical expression, designed with precision, it becomes a building material in the creation of space." - Bernhard Leitner[170]

An example of such a sound Garden would be Bernhard Leitner's *Le Cylindre Sonore*, a cylindrical space located within *Parc de la Villete*, conceived as a hub or transitional space within the landscape. The space uses sound as the primary element to provide the transition between the north and south sides of the park. It is built up as a double cylinder: The outer wall acting as a retaining wall and acoustical buffer, while the inner wall containing 8 perforated - precast concrete panels. There is enough space between the inner and outer wall to act as an acoustical chamber,

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[169] For more on architecture as a musical instrument, please see Rasmussen, Steen Eiler, *Experiencing Architecture*, (MIT Press, 1964) Blesser, Barry / Salter, Linda-Ruth, *Spaces Speak, Are You Listening? Experiencing Aural Architecture* (MIT Press, 2007)

[170] Martin, Elizabeth, *Pamphlet Architecture: Architecture as a Translation of Music* (Princeton Architectural Press, 1994)

with three speakers mounted at different heights, serving as a resonator. The sounds

produced encourage visitors to stop, listen, linger, and reflect before continuing their
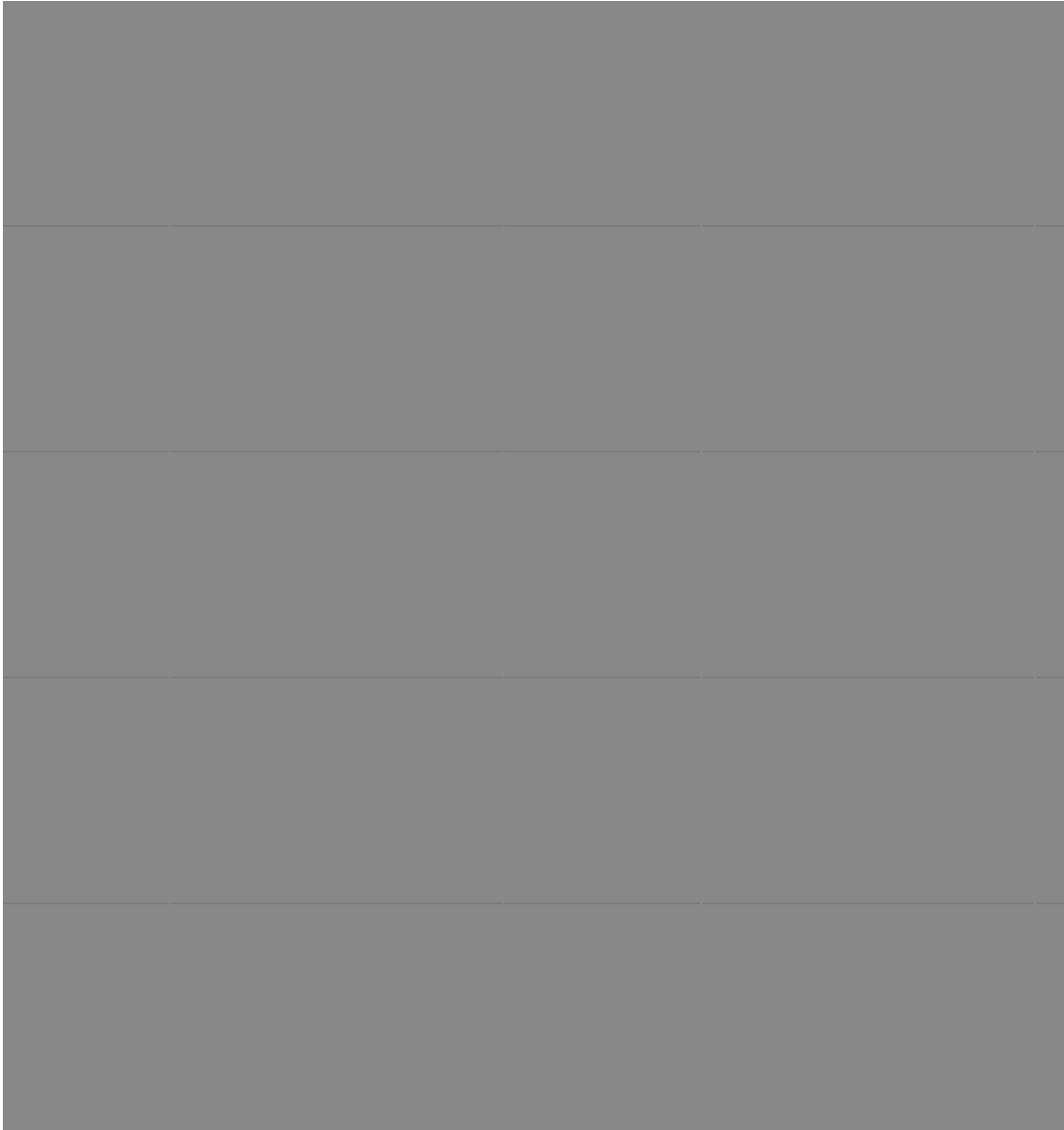
journey through the park.

Figure 81: The soundboxes of *Le Cylindre Sonore*

The following diagram projects how such soundboxes can be placed throughout the

entire street, allowing the pedestrians have an interactive relationship with the sounds

of the site.
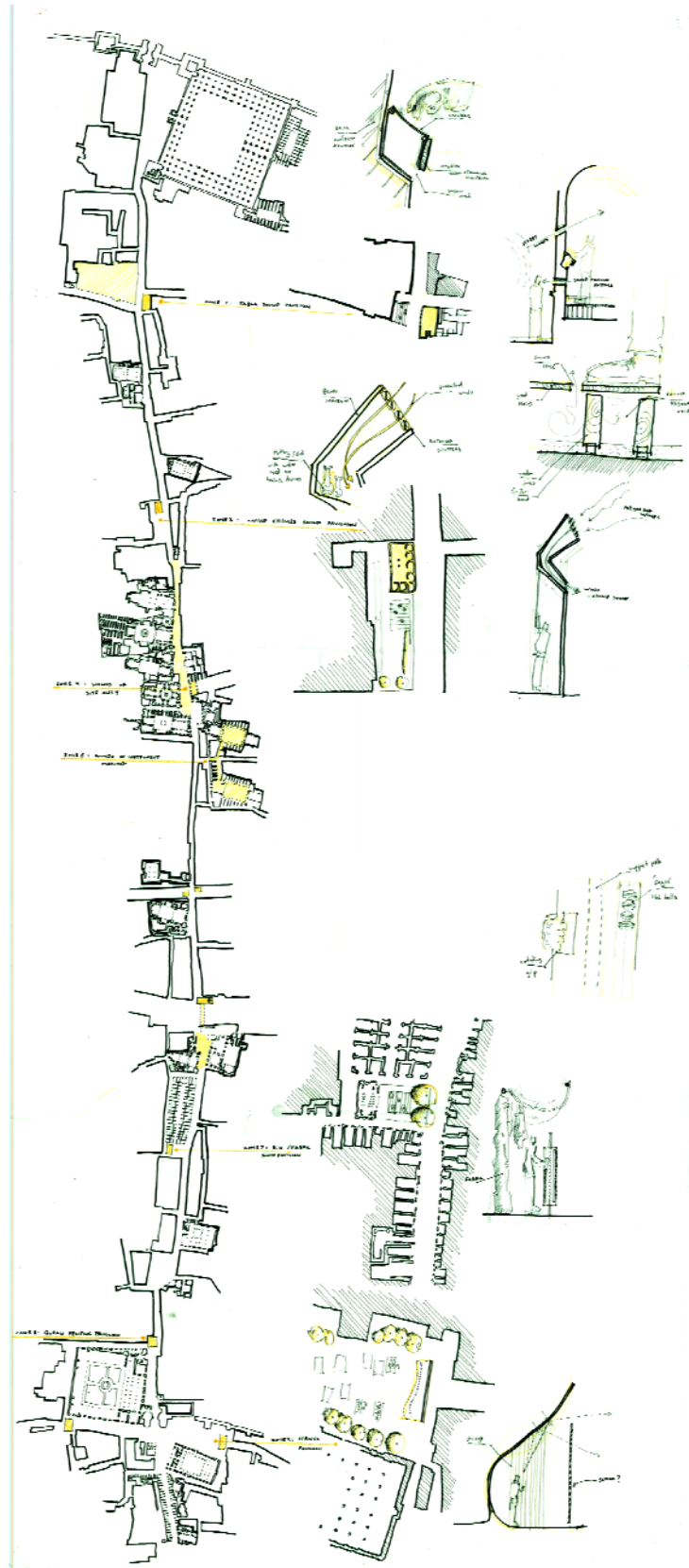
Figure 82: The Soundgarden

Subsection 3: Zone 3, Melodic Movement #1 (Enter the Main Theme)

SECOND MOVEMENT
MELODIC SECTION
'TARAB' طرب
Program idea: Whirling Dervish

Figure 83: Zone 3, Melodic Movement #1 (Enter the Main Theme)

The third zone is dubbed the second movement, the Melodic section. This part of the street houses more variety, in building height, street width, building type and use. Initially, this seemed to be the most suitable zone to experiment on the different *Maqams*, and their emotional content, of Arabic music and their proportions. The programmatic element here is listed as a whirling dervish, a spiritual center for the Sufi faith.

Figure 84: Images of the threshold between Zone 2 and 3

The transition between both the second and third zone is also by the visual axis of the minaret. Once one reaches the minaret of Sulayman Agha al-Silahdar, the minaret of the mosque of Hassan al-Sha'rawi Katkhuda appears, pulling you in to the third zone. The mosque of Sulayman Agha al-Silahdar here acts as a threshold. Although the threshold isn't as apparent and obvious as that of the minaret of al-Hakim in the first zone, the threshold is nonetheless apparent because of the visible difference between two zones in terms of character.
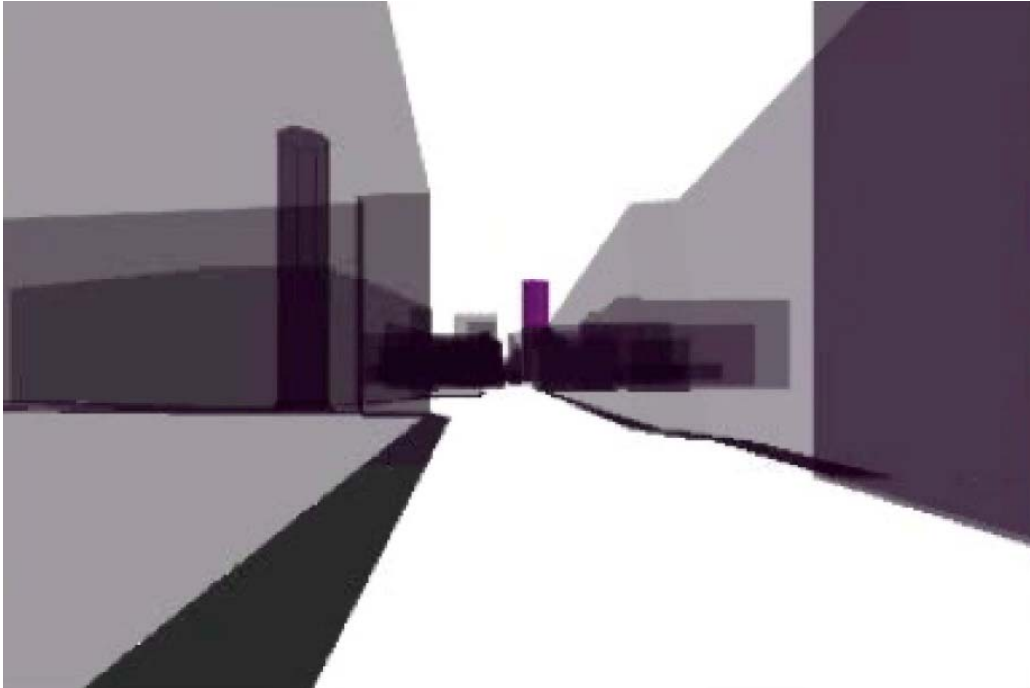

Figure 85: Images of Zone 3

Figure 86: Zone 3, site animation still

Figure 87: Zone 3, site animation still

Subsection 4: Zone 4, Significant Historic Place

The fourth zone, the significant historic place, is a zone that requires no intervention at all, as it already fully possesses its own magical character, from the use of the ottoman Sabil-Kuttab of Abd al-Rahman Katkhuda as the entrance point (also serving as a threshold between zone three and four), to the meandering, zigzagging, road infront of the Barquq / Qalawun complex (all rotated slightly to face Mecca) creating a series of funneling spaces within the street, to the termination of the axis at the side facade of the Qalawun mosque. As the triangular space facing al-Hakim mosque in the first zone, the street appears as an enclosed space upon exiting the Mosque of Barquq, with the Sabil-Kuttab terminating the view at one end, and the side facade of the Qalawun mosque terminating the view at the other. The Qalawun mosque projects out onto the street, leading the street to shift center points at the end of the zone, and also allowing the side facade of the mosque lead the way into the new zone as one starts to move southward from the Barquq mosque.

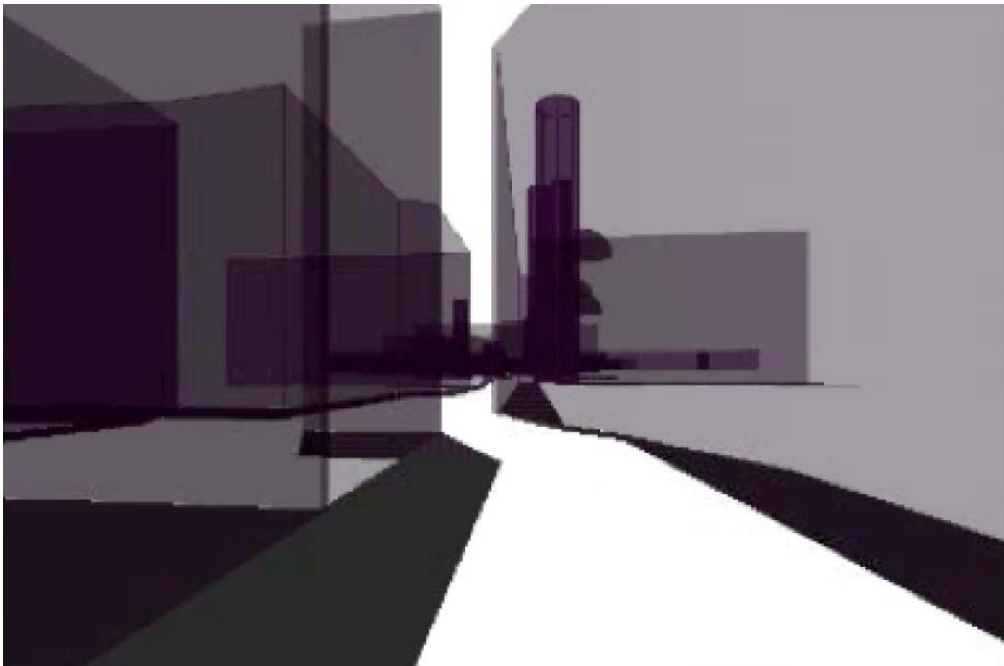**Figure 89: Images of threshold between zone 3 and 4**

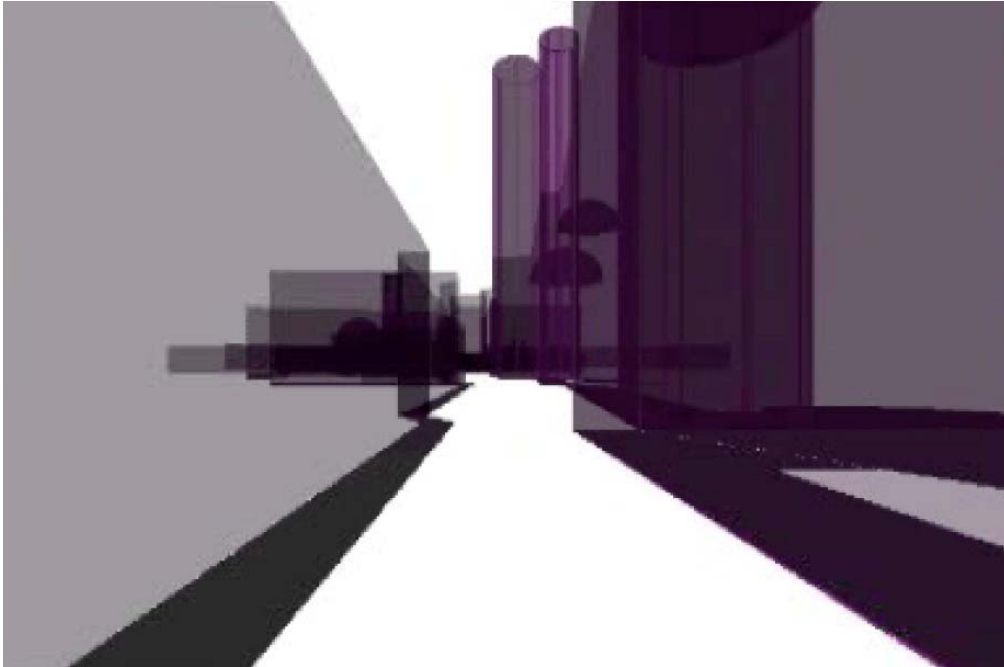**Figure 90: Threshold between zone 3 and 4, site animation still**

Figure 91: Palace walk, Barquq / Qalawun complex, site animation still

Figure 92: Palace walk, view towards threshold between zone 4 and 5, site animation still

Subsection 5: Zone 5, Rhythm Section #2 (*Masmudi Sagheer*)

Upon leaving the awe inspiring Significant Historic Place, the street becomes

narrower and lined up with shops once more, thus naming it the second Rhythm

section (Rhythm Section Reprise). The area is in close proximity to Khan al Khalili

(located east of the street), an ottoman bazaar that is considered a large value tourist

hotspot today. This particular zone houses both the jewelers market (Wikalat al-

Gawahargiya) and the slave market (Souq al-Abeed) where the Mamluks were sold.

There are other stores dispersed along the street, like a few clothing stores, frame

stores, and musical instrument stores.

FIRST MOVEMENT REPRISE
RHYTHM SECTION #2
PROGram Idea: MUSIC CRAFT
CARAVANSARY
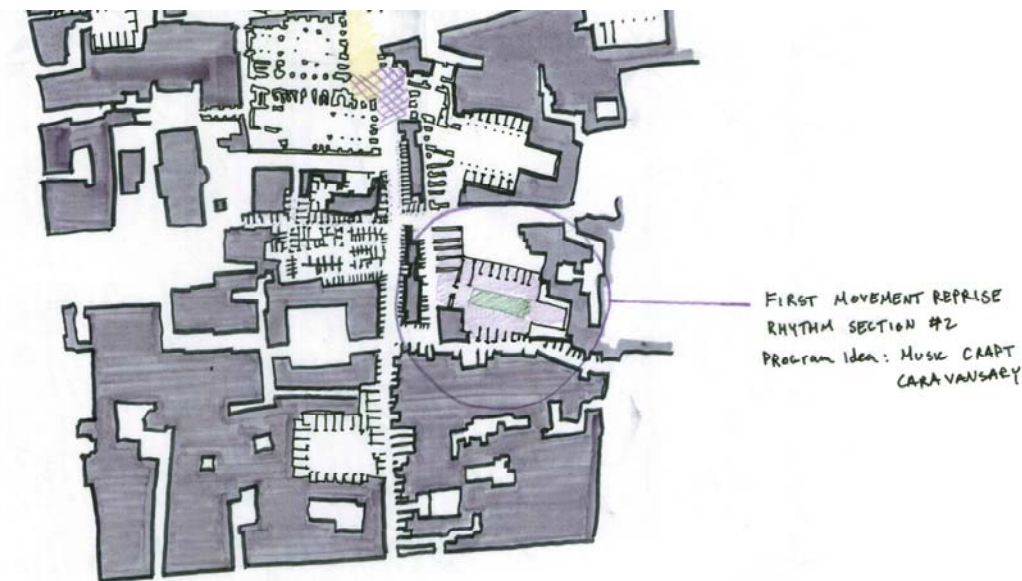
Figure 93: Zone 5, Rhythm section #2 (*Masmudi Sagheer*)

The Musical craft center / Caravansary seems to be a good fit as a programmatic

intervention in this zone. While the first Rhythm Section is to be the "Bold /

Shocking" zone, this Rhythm Section is devoted to "understanding". The tradition here is the shopkeepers / craftsmen would engage in conversation (haggling is only part of it but not all) about the product and how it's made, giving the tourist a deeper look and understanding about the culture. The musical craft center would thus serve as both an educational and commercial node, with possible living quarters in the above floors and a performance space in the courtyard. The site chosen is an abandoned empty lot, used for trash dumping today.

The zone is also named the *Masmudi Sagheer* rhythm section due to the rhythmic layout of the stores along the street, signifying the start of Khan el Khalili, replicating a rhythmic formation, which is similar to that of the Arabic Rhythm *Masmudi Sagheer.*

Figure 94: *Masmudi Saghir* **Rhythm**
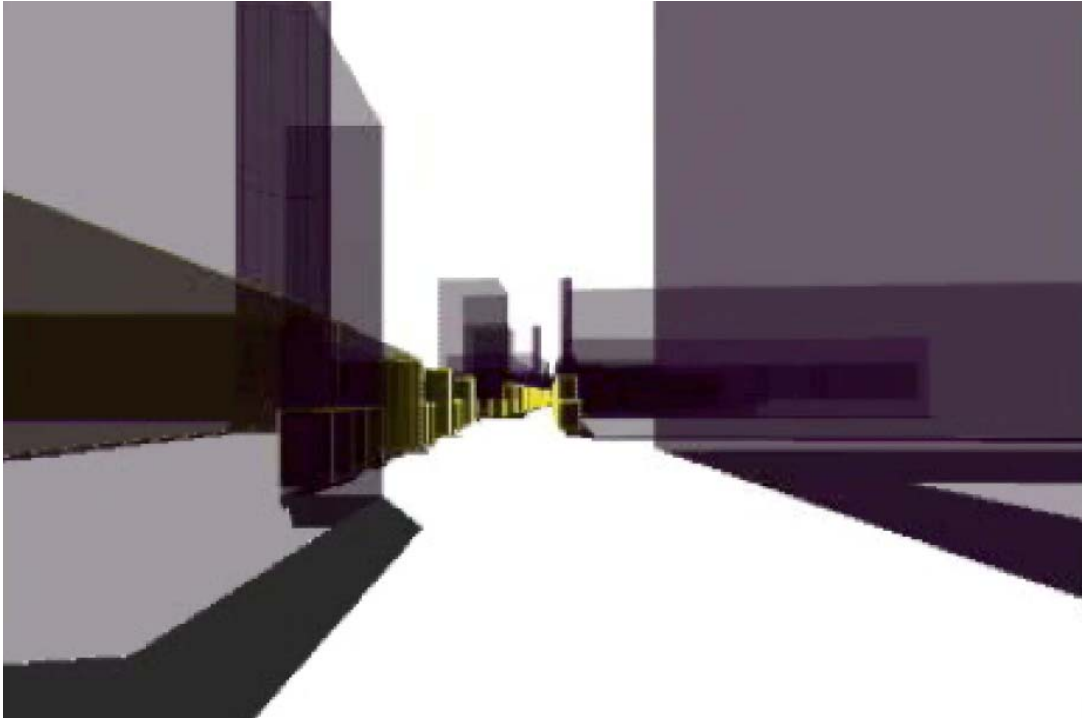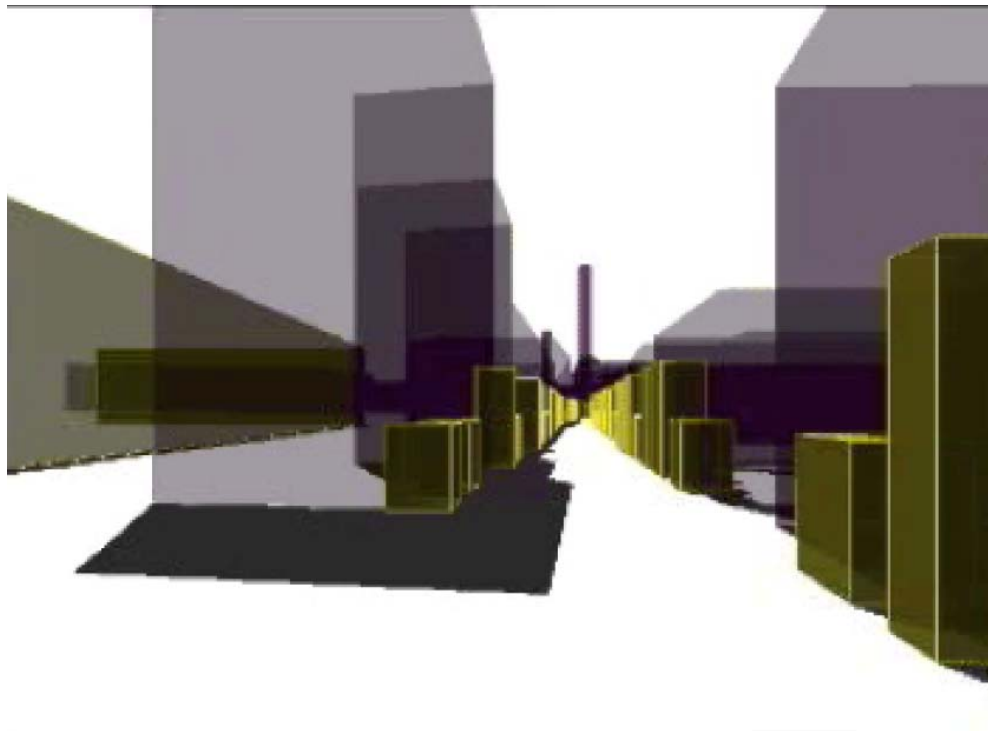
Figure 96: Start of Khan el Khalili street, with stores following the *Masmudia Sagheer* rhythm, site animation still

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Subsection 6: Zone 6, Melodic Movement #2 (The Sensual Garden)

Unfortunately, Al-Azhar Street has plowed through the Qasaba Street in the twentieth century, disturbing the promenade experience. Al-Azhar Street is a major thoroughfare of modern Cairo, and is a road that many drivers seek to avoid because of its heavy congestion. The cars produce a lot of pollutants, whether visual, aural, or olfactory, which is ironic because it is close by both the spice and perfume market, both located on the Qasaba street. This portion of the street used to be one the zone of heightened sensory perception, a crescendo of the senses if you will.

Figure 98: Zone 6, Melodic Movement #2 (The Sensual Garden)

A bridge, awkwardly located, allows the visitor to cross Al-Azhar Street, to pass through Al Ghuri complex, which serves as a gateway back to the Qasaba Street. The use of overhead planes is frequent in both sides of the interrupted Qasaba, with overhanging drapes and fabric by the perfume and spice market, and an overhanging wooden roof structure on the south side of the Qasaba, by the al Ghuri complex. The intervention here applies another overhang on Al-Azhar Street, acting as an acoustic canopy, trying to minimize, or at least utilize in a musical manner, the noises produced from the street. Here the urban designer acts as musical arranger, manipulating the existing sounds of the site to make it work in a pleasing blend of tones.

Figure 99: Threshold into Zone 6, site animation still
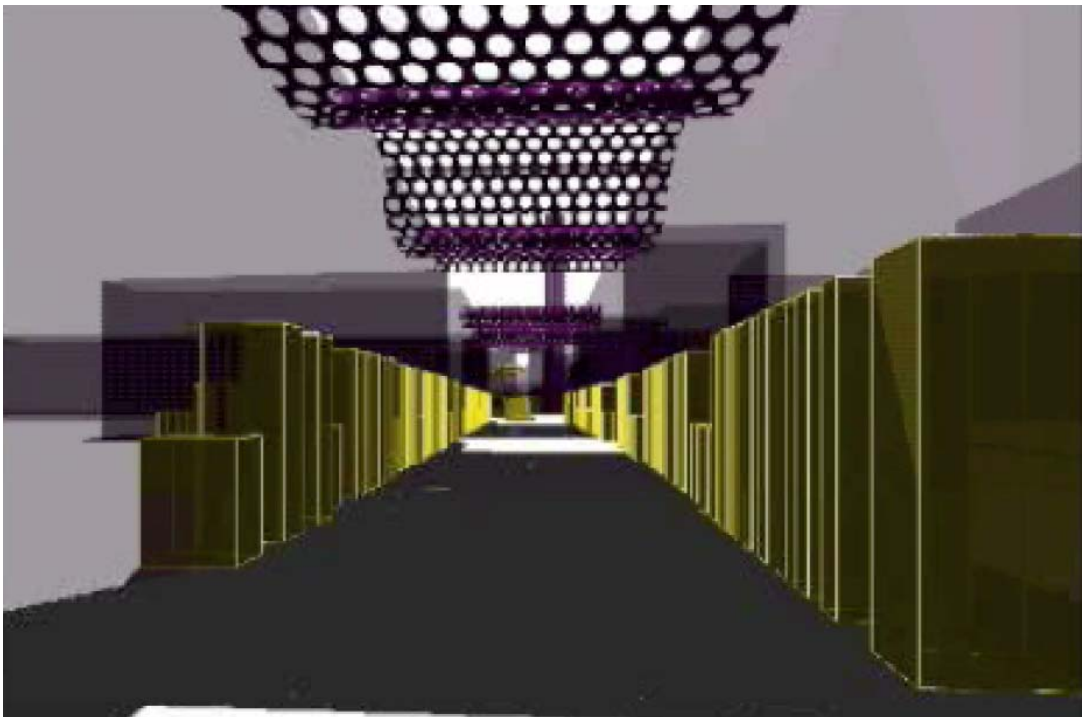
Figure 100: Stores of the spice market with fabric overhangs, site animation still
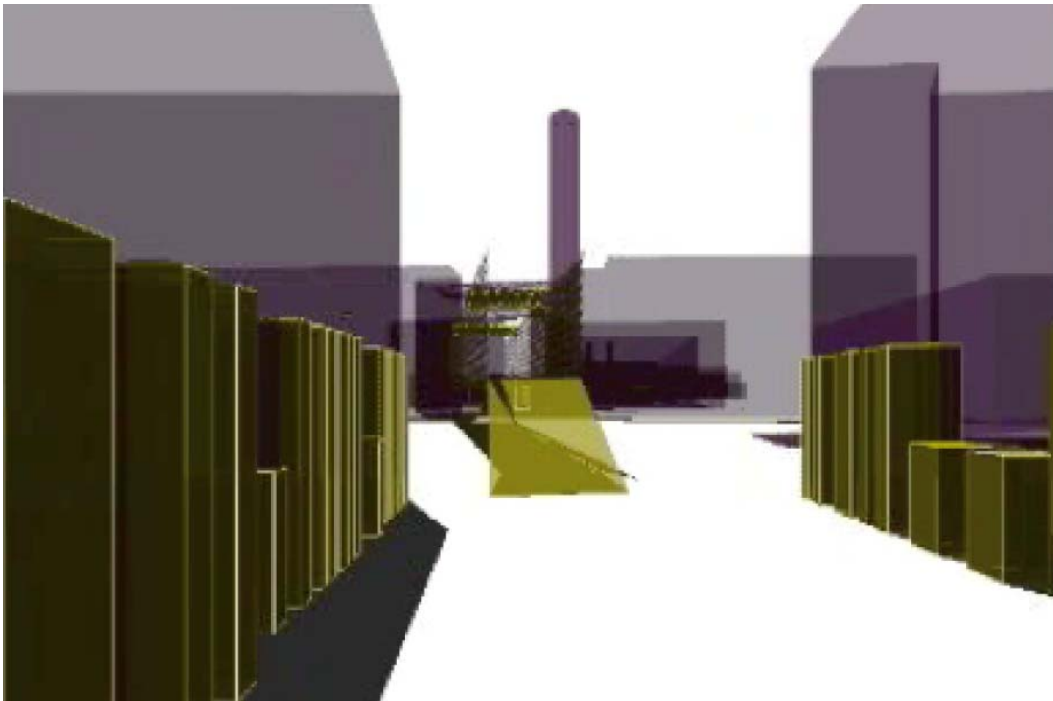
Figure 101: New bridge over al-Azhar intersection, site animation still
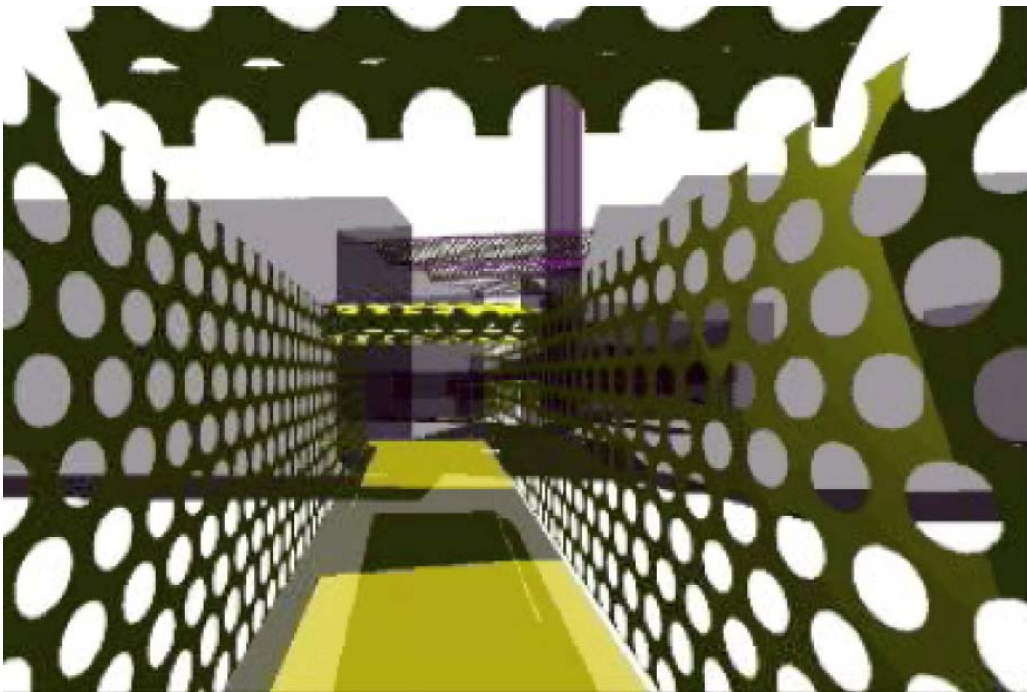
Figure 102: New bridge over al-Azhar intersection, site animation still
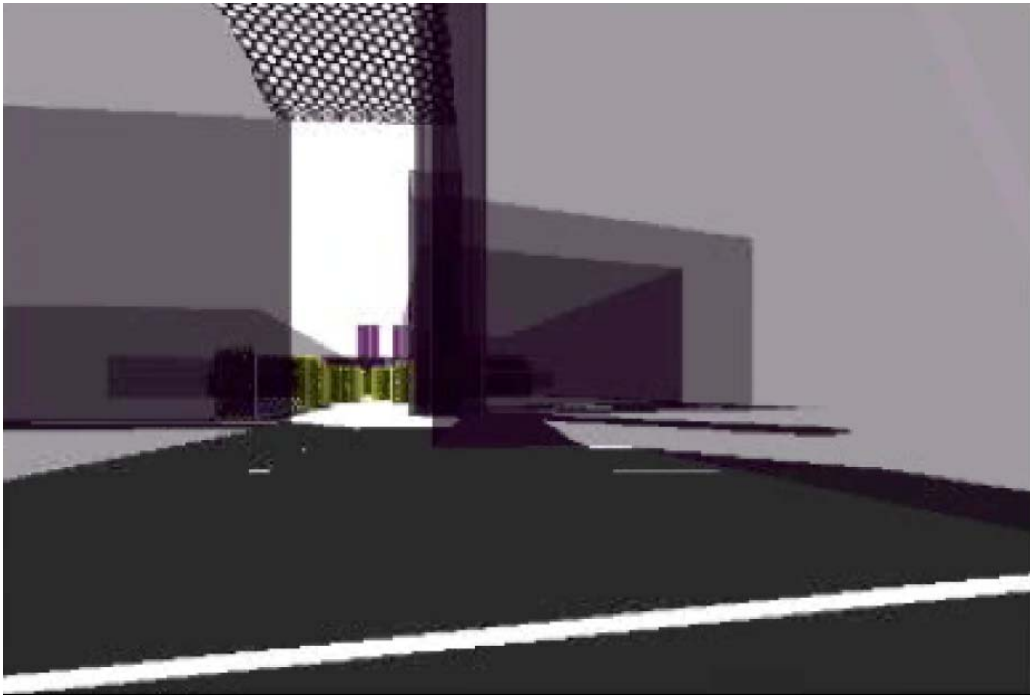
Figure 103: al-Ghuri complex, site animation still
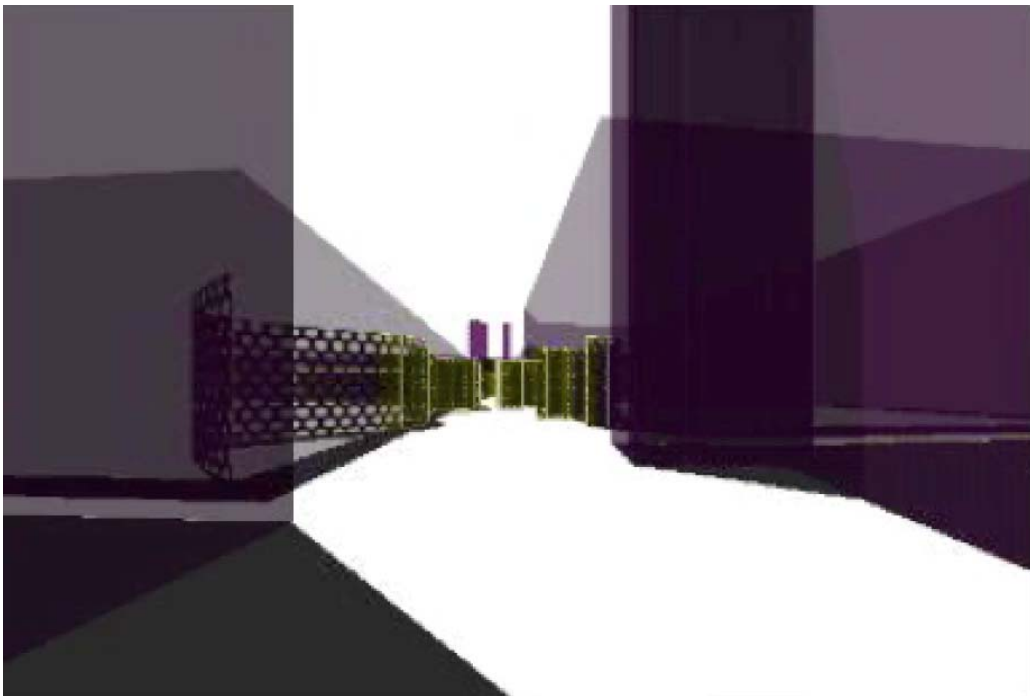
Figure 104: Threshold into zone 7, site animation still

Subsection 7: Zone 7, Rhythm Section #3 (the fabric market)

FOURTH MOVEMENT
ACOUSTICAL WTREFERENCE

FIRST MOVEMENT REPRISE
RHYTHM SECTION #3
Program Idea: URBAN PLAZA

Figure 105: Zone 7, rhythm section #3 (the fabric market)

After passing the al-Ghurri complex gate, one enters the third and last Rhythm section

zone, this one dealing with "crescendo". The market in this area is mostly of fabric,

and the store merchants let their merchandise hang on the street, creating a layering

effect of draping fabric as one moves through the street. The zone is a little chaotic

and not well preserved (the Aga khan foundation has been much more successful in

preserving the street on north of al-Azhar Street). There are huge expanses of open

space that are used as garbage dumps. The street terminates at a beautiful ottoman

Sabil-Kuttab, with a curving facade, allowing the street to curve along the facade and enter the next zone, the second Significant Historic Place.

The intervention here is projected as an urban plaza, situated in a large abandoned area west of an ottoman caravansary placed right after al-Ghuri complex. The question here becomes how does one transition from a seemingly chaotic market street, into a quieter urban space, yet still achieving the effect of crescendo. The plaza also runs the risk of being treated as another garbage dump if it is not properly designed and utilized, so another question arises, what kind of program can be placed to feed that open space?
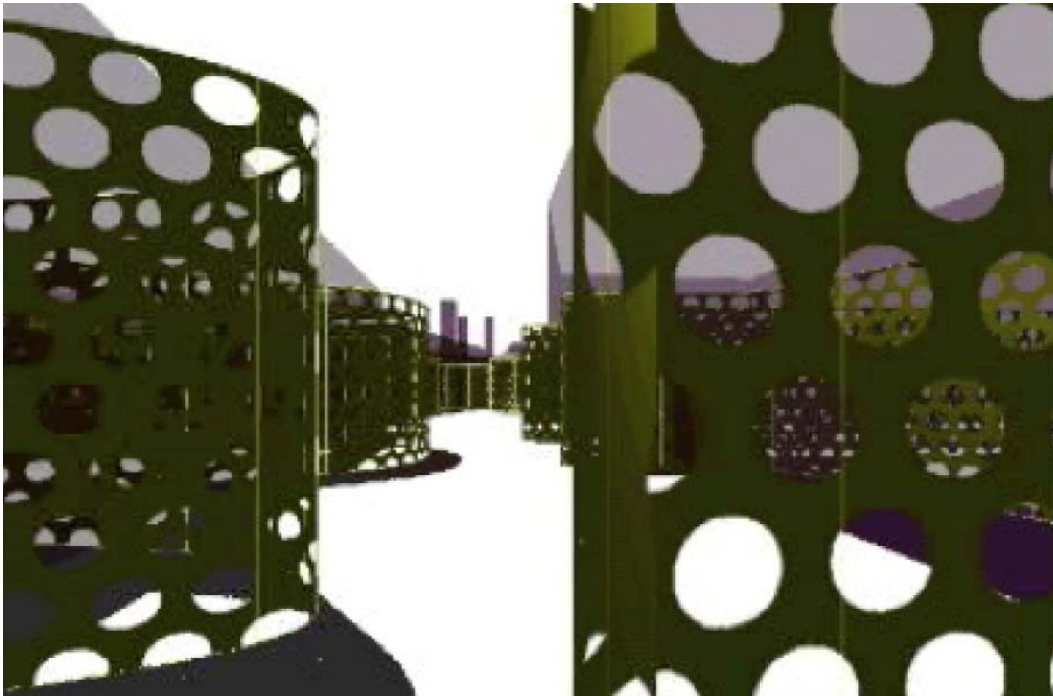
Figure 106: The fabric market, site animation still
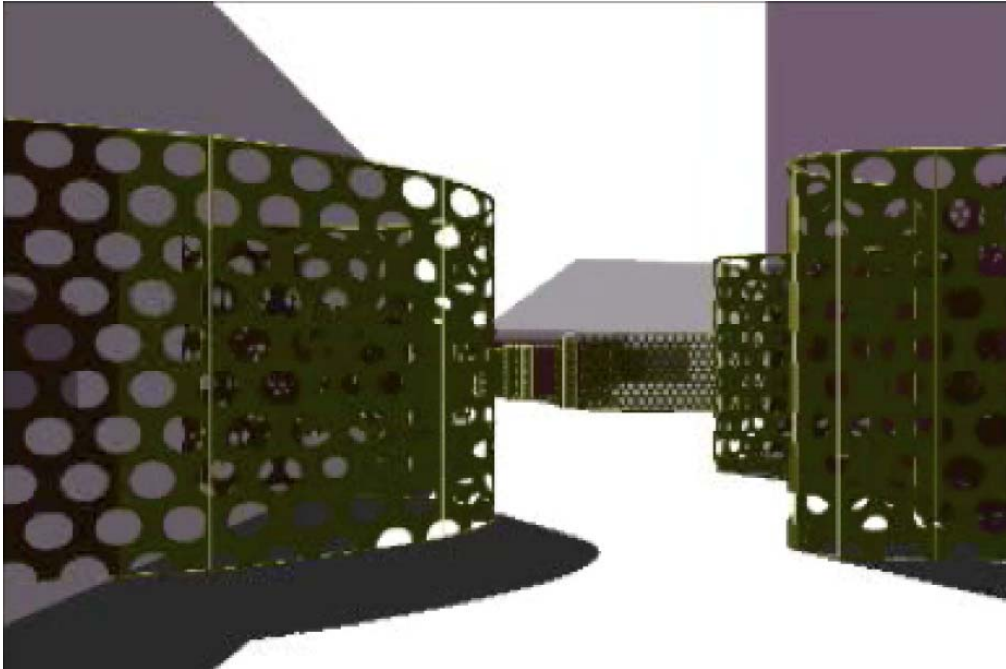
Figure 107: The fabric market, site animation still
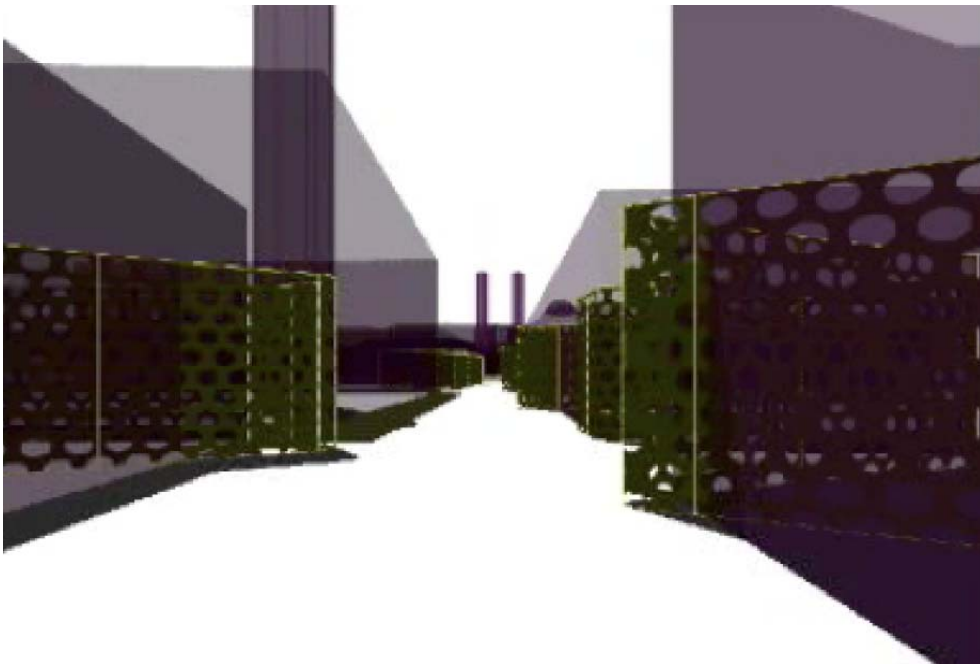
Figure 108: The fabric market, site animation still
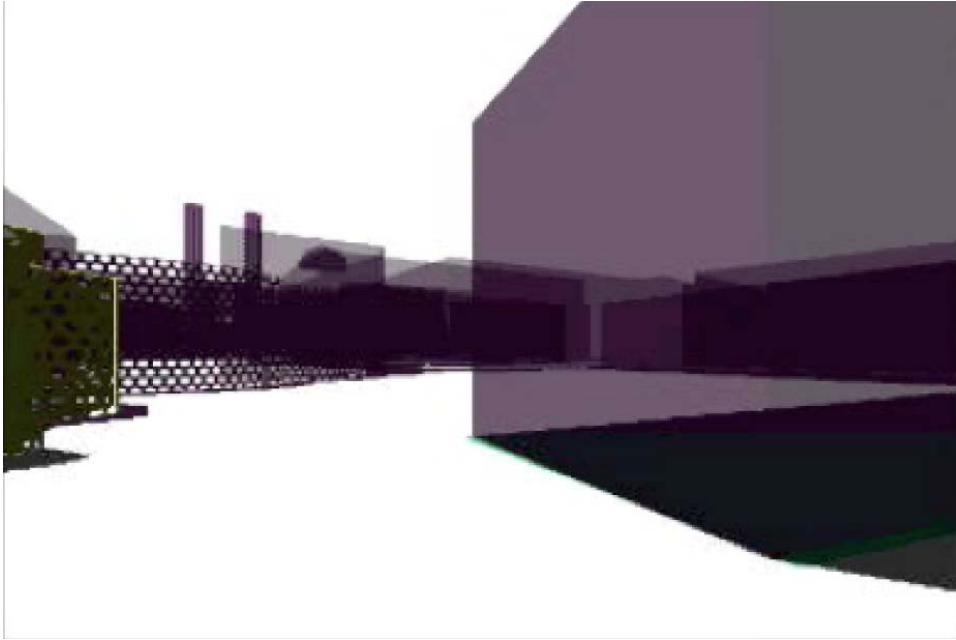
Subsection 8: Zone 8, Significant Historic Place #2

FOURTH MOVEMENT REPRISE
SIGNIFICANT HISTORIC PLACE
"LEAVE AS IS"

The second and last Significant Historic Place of this street ends at the opposite

Fatamid gate, Bab Zuwayla. The image of standing infront of this gate, with its dual

minarets marking the exist, and the stone steps of Sultan Mua'ayyad mosque with its large stone wall of pink and grey courses of stone, has been the poster image for Islamic Cairo for centuries. There has been hundreds of artwork produced of this particular moment, capturing the essence and scene of this magnificent site. While it is unfortunately run down and not as well preserved as one would hope, it still captures a powerful feeling being in such a space.
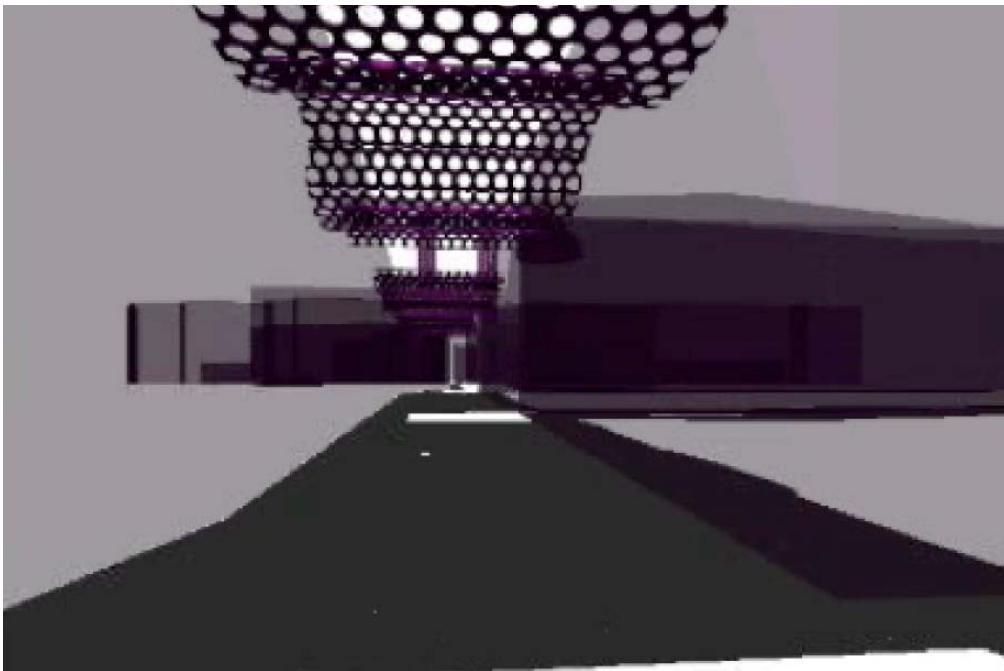
Figure 111: Threshold into zone 9, with overhanging fabric, site animation still
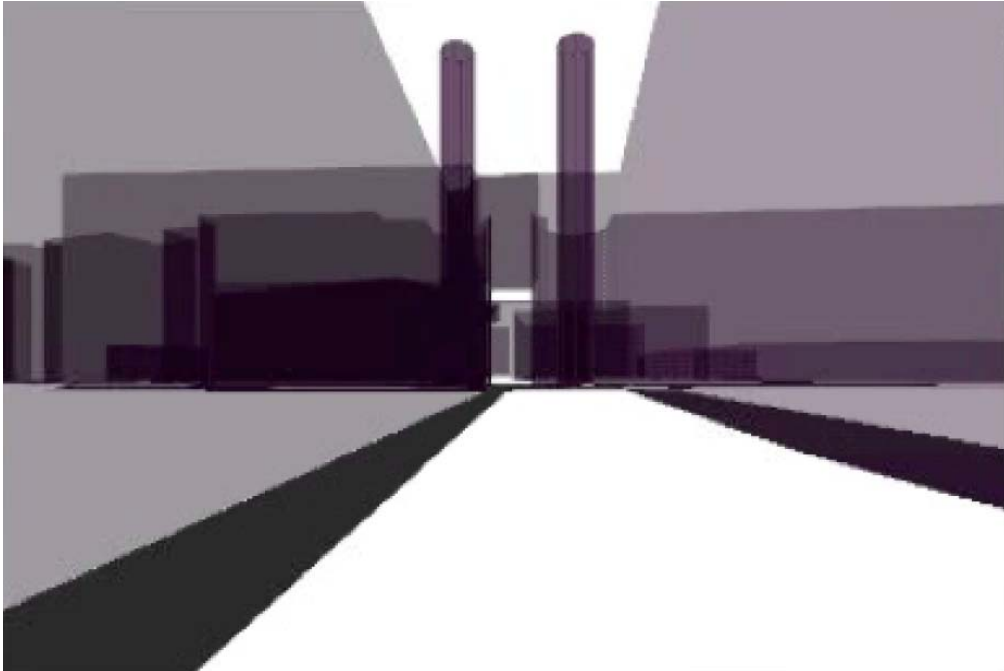
Figure 112: View towards Bab Zuweila, site animation still
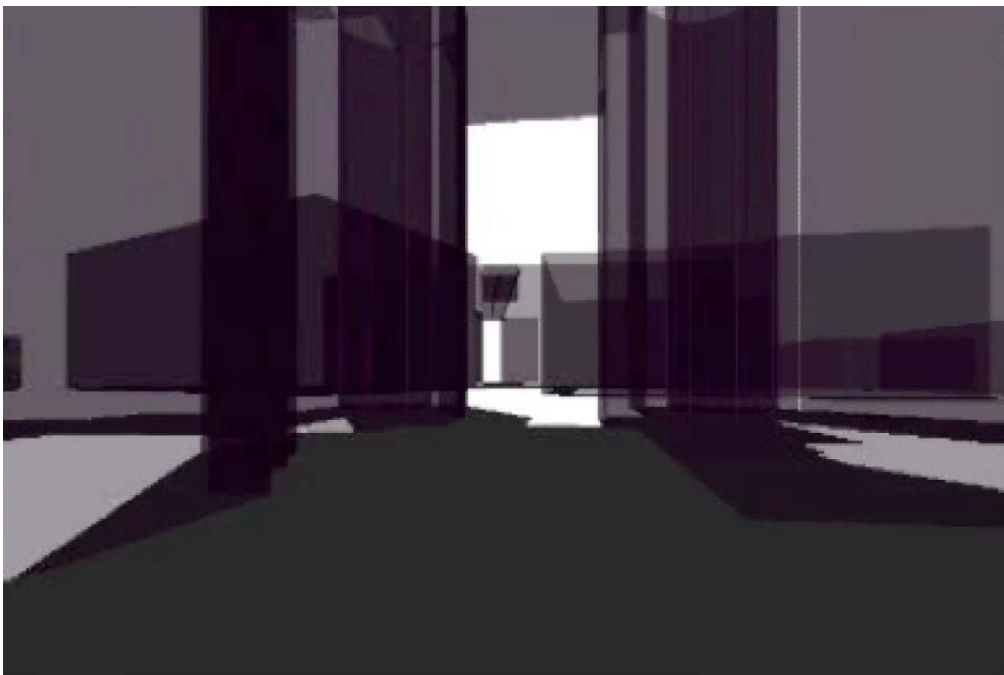
Figure 113: Bab Zuweila, threshold into zone 9, site animation still

Subsection 9: Qafla (Finale)

Which brings the project at a close at the Qafla (Finale). Although the significance and power of Bab Zuweila serves as a mighty crescendo, the street still continues south and is funneled into the tent makers market (Khayameya). As concurrent with Arabic music, the finale usually serves as a decelerating piece, a chance for the audience to re-gather their thoughts and emotions that have been pushed into the sublime by the earlier pieces.
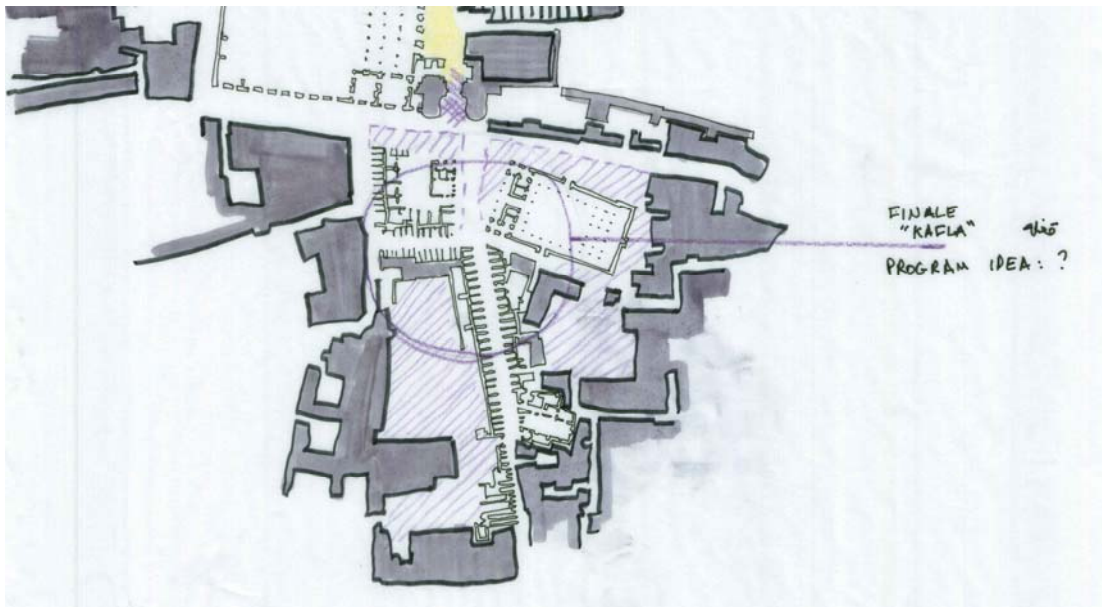
The question here becomes, what programmatic element would fit in such a finale. Suggestions for a school of music or cultural center have been discussed, however these two programs seem to fit with the crescendo aspect of the street, and this finale is more like the aftermath of the crescendo. Suggestions about a profane program, like apartment buildings or office space have been discussed, a program that leads the visitor back to the normal routine of life. Such a profane program would still include

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elements and ideas derived from Egyptian and Arabic music, to help aid later architects' series of investigations and urban interventions that should occur continuing south the street, letting the kafla inteverntion act as a principle of the second man.

Figure 115: Zone 9, Qafla, site animation still

Figure 116: *al Khayameya,* site animation still

Subsection 9: Masterplan modifications

After a number of site visits and a series of iterations of the masterplan, a number of changes have been made to the nine-zone plan. First, the *moqadema* zone is no longer a arts center, but a center for Arabic *Maqams* called *al Masmaa'* (will be discussed in depth in the later chapters). The soundgarden remains the same as previously discussed. The intervention in Zone 3 was replaced, as the soft site turned out to be an elementary school, and the major change would be the redesign of residential building facades (especially the modern ones that lack in character). Zone 4 is still untouchable, while the musical instrument workshop in Zone 5 is expanded to include the demolished site of of al-Salih Najm al-Din Ayyub, which will be used as a school of music. Zone 6 is unchanged, while the urban plaza intervention in Zone 7 was removed, because the site chosen is now housing many carpenter workshops and storage spaces for the fabric market. The intervention in Zone 7 is now pushed down in the threshold area between Zones 7 and 8, and acts as another cultural center (along with *al Masmaa'*) for the area. The two cultural centers by the North and South gates of the city become the anchoring nodes, letting Zone 8 become the Qafla, as well as the second significant historic place. This removes the pressure from Zone 9, allowing it to become what it was historically, a fruit market, named "Maqrizi's Hall of Apples"[171].

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[171] The information describing this zone in history was passed down to us by the historian al-Maqrizi.

ZONE 1
*Moqadema
(Introduction)*

ZONE 2
*Rhythm Section
#1 (The Sound-
scape and the*

ZONE 3
*Melodic Section
#1(Enter Main
Theme)*

ZONE 4
*Historical Signifi-
cant Place #1*

ZONE 5
*Rhythm Section
#2 (Masmudi
Sagheer Dara-*

ZONE 6
*Melodic Section
#2 (The Sensual
Garden)*

ZONE 7
*Rhythm Section
#3 (The Fabric
Market)*

ZONE 8
*Historical Signifi-
cant Place #2*

ZONE 9
*Melodic Section
#3 (Maqrizi's hall
of apples)*

Figure 117: The nine-zone plan

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Figure 118: Final iteration of the masterplan

Figure 119: Zone 9, Maqrizi's hall of apples, existing site

Figure 120: Zone 9, Maqrizi's hall of apples, proposed site

Chapter 11: Design Proposal

Section 1: Main Ideas and Principles

> Subsection 1: Animations revisited

Pairing some the animations that were conducted on both Western classical music and

Arabic music in the earlier chapters together I found to be very revealing. My

expectations were that the differences between Arabic and western music in respect to

rhythm and musical intervals would be apparent in these animations. They are not.

What is apparent however is how the musical structures differ from one another. The

Canon piece is very cyclical in nature, there is a simple chord progression that goes

on and on, which acts as a central unifying element, and the themes and variations are

being applied on to it. This cyclical composition style is common in western classical

music, and gives birth to our modern song - the cyclical nature of the verse/chorus

organization, everything referring back to the chorus. The images show the bass and

pizzicato strings line acting like a module throughout the entire piece, where all the

vertical elements are overlaid on top of it. The Arabic piece is much more episodical

in nature, where 7 themes are clearly distinguishable, with no common thread linking

them.

Another distinguishing element in the Canon piece is the evidence of harmony; the vertical elements that are on the same coordinates on the Y-axis differ in height, as each row of vertical elements work in harmony with the next. The Arabic piece does not include any harmony at; all the vertical elements on the same coordinates are of the same height. Traditionally, Arabic music is devoid of harmony, yet it achieves its rich sound through a process of heterophony. This is possibly because Arabic music is of unequal temperament, while western music is of equal temperament. Equal temperament is a system of tuning in which every pair of adjacent notes has an identical frequency ratio, which makes harmony possible in western music. Heterophony, on the other hand, is a type of musical texture that refers to the practice of two or more musicians simultaneously performing slightly different versions of the same melody. Each version would be characterized as improvised or ornamented versions of the melody. This is evident in the animation as each row on the Y-axis, although more or less the same in height, have very slight variations of the same theme, giving the form its rich texture.

Subsection 2: Architecture Comparisons

One can then make the comparison between this idea of musical structure with some of the architecture of the same period. The comparisons have been made the Central "big room" space of Palladio, with the series of courtyards, or episodes, of the ottoman house.
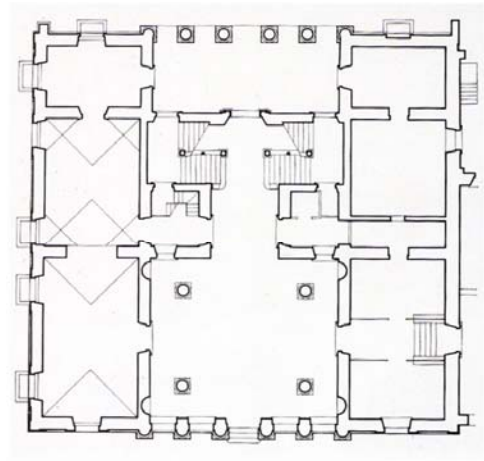
Palazzo Antonini in Udine   Beit Al Suhaymi in Cairo
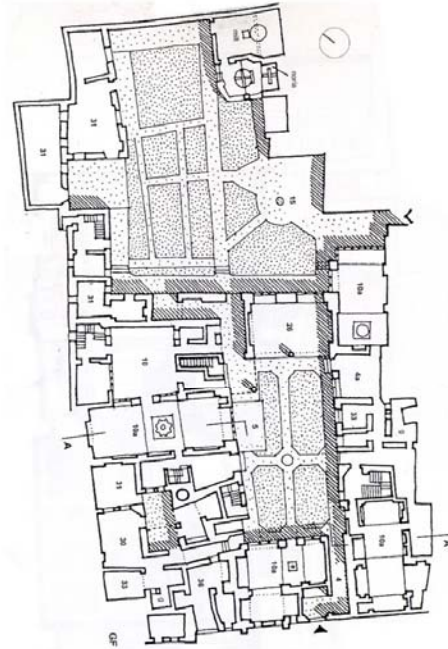
Figure 121: Comparisons between Palladian and Ottoman Architecture

Subsection 3: Animation Conclusions

Both animations seem to favor the linear understanding of space, which limits the

possibilities of how one could relate both music and architecture. This very well

could be due to the difficulty the author had trying to visualize these sequences in

anything but linear form. It seems that once a musical piece is picked, the linear

composition becomes inevitable. However, if one models ideas from the music, as

opposed to the music itself, other possibilities may emerge. On the other hand, since

time, and thus architecture, is experienced in a linear motion, the relationship between

both may be strictly seen as an experiential movement and crescendo through space,

where the second series of animations (Music as an Inspiration for Architecture – Rational Expression) provides more fruitful results.

The series of animations were very helpful to visualize different conceptual composition agendas that can be argued have stemmed from the culture in general. The animations highlighted certain attributes in the musical form that was previously taken for granted, like the cyclical nature of the canon and the episodical nature of the Arabic piece. This is where the defamiliarization process is effective – by translating the music from the aural arena into the visual, one starts to become more aware of these specific attributes, and how they may be related to existing architecture. The rhythmical animation of the Arabic piece (figure x) is full with heterophony, and reminds the observer of the streetscapes in Islamic streets.

What is surprising is that the expected conclusions were very different than the actual conclusions. Since both Arabic and Western music have different attitudes towards musical scales and rhythms, it was expected that these attributes would manifest in the animations. On the contrary, these become very difficult to see or grasp through what has been produced, as the differences between both seem to be very minute to distinguish by the naked eye. This led the author to conclude that the differences between both rely more heavily on attitudes toward music in general, and less about these technical aspects. More animations are expected to be composed that deal with proportion, acoustics, and synesthesia.

Subsection 4: Design Proposal

 Using the episodical ottoman house as a paradigm, the proposed building is set to explore the ideas of the Maqam in Arabic music172. The idea behind using musical concepts as a design framework is hoping to combat the excessive power of westernization and globalization that has been sweeping Egypt by storm for the last 200 years or so. The hope is to find clues within the region's music to help push the architectural evolution in another direction, one more unique to its place and context, in hope to achieve cultural authenticity.

It is important to note that by using the episodical ottoman house as a paradigm, this idea of linear sequence explored in animation would have to be eliminated from the proposal. Early studies and schemes tried to apply a linear sequence to the design, yet it seemed too forced and contrived. By using something as esoteric as the *Maqam* as a conceptual framework in the design, it allows each visitor to make up their own linear promenade, as if each visitor plays their own music with their own experience through the building.

Section 2: The Relationship Between Music and Architecture

In the beginning of this research, it was mentioned that this relationship between both arts could be divided into five different sections (through proportion, rhythm, acoustics, synesthesia and deconstruction). There is also another way of dividing each

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[172] Egyptian pop music is not part of this research, as it blends a lot of western musical concepts, and has been argued by many scholars that it lost its "authentic oriental spirit". Definitions of authenticity of the music are based upon the works of Al Farabi, Safi – el din, Owen Wright, Henry George Farmer, Scott Marcus, Jonathan Holt Shannon, and the proceedings of the Cairo Congress on Arab Music in 1930.

thinker's attitude towards the relationship, which is what actually influences what; is it the music that directly influences the architecture, or vice versa? Figure xxx documents the research that has been done on the subject, and highlights how each personality views the influencing factor. More often than not, it is apparent that none of the arts actually directly influence each other, but that they both share a common principle, which is that of proportion according to Pythagoras and his followers throughout history, color according to Isaac Newton and his followers, and Rhythm according to authors of the east like Nader Ardalan.

Examples where one art form directly influencing the other results in a highly subjective outcome and highly specific to the conditions of the translating artwork. Steven Holl's Stretto House is highly dependant on Bela Bartok's "music for string, percussion, and celesta", and one cannot make any general observations and conclusions that may help in future designs. In this thesis, it was important to stay away from using specific musical pieces as a foundation for the design to avoid the product being solely about that specific piece and less about the idea of music in Arabic culture in general. Choosing a specific piece would also be a difficult task, as it raise questions as to why this piece, and not that piece, and could lead to design decisions being made just because "that's how the music plays it".

Ultimately, the main goal of this thesis is to explore how both arts relate in a more general level, to be able to come up with a vocabulary or alphabet that would help aid

designers in the future to build upon. This is the reason why the concept of the

Maqam is picked for the common factor between both arts.

Section 3: The Role of Defamiliarization

Many believe that cultural authenticity means adhering to cultural conceptions of their past - heritage. Heritage, to them, evokes images of customs, habits, and materials from their past. On the other hand, ethnomusicologist Barbra Kirshenblatt - Gimblet[173] suggests that heritage usually features "the obsolete, the mistaken, the outmoded, and dead, and the defunct" within society.

Janet Abu – Lughod asks "whose tradition?" when communities start "excavating the past to invent the new"[174]. What part of heritage or tradition is worth keeping, and how could it be utilized? This rationalization of tradition is the conceptual basis within which critical regionalist thinkers and architects work upon. The idea of "defamiliarization"[175] is brought into play here, where traditional or regional elements are used slightly differently, to "make them strange", so that the participators or observers would become more aware of them. The term is borrowed from artist Viktor Shklovsky in his essay "Art as a Device", where defamiliariziation (or ostranenie) is an artistic technique of forcing the audience to see common things in an

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[173] Kirshenblatt – Gimblett, Barbara, "Theorizing Heritage" *Ethnomusicology* 39 (3): 367 - 80
[174] Abu – Lughod, Janet, "Disappearing Dichotomies" *Traditional Dwellings and Settlements Review* vol. 3, no 2, spring 1992
[175] "Defamiliarize" is a term used by Victor Shklovsky, a member of the Russian Formalist group in revolutionary Russia. The concept of "Defamiliarization" in critical regionalism is addressed in Tzonis, Alexander, and Lefaivre, Liane, paper on Critical Regionalism at the first International working seminar on Critical Regionalism, in 1989, College of Environmental Design, California State Polytechnic University, Pomona (Proceedings edited by Spyros Amourgis)

unfamiliar or strange way, in order to enhance the perception of the familiar.

This concept of defamiliarization does not only address formal or visual characteristics in architecture. It is hypothesis of the author that defamiliarization of a visual symbol could sometimes spark negative reactions with the general public, and reduce the understanding of the architecture into a series of images as opposed to an experiential sequence. The architecture of Hassan Fathy is commonly understood as a visual recreation of Arab heritage and Egyptian farmer village life, as opposed to an architectural byproduct of using local materials and craftsmen while adhering to the region's climate. The sad reaction towards Fathy's New Gourna village (1946), where only his own house survives out of 70 dwellings that were built, is a product of public reaction and resentment against anything that looks Arab. The unfortunate sentiment of "west is best" allowed the New Gourna locals to tear down the village and replace it with, what they believe is western, concrete boxes.

Is quest then becomes defamiliarizing the invisible? This project aims to discuss the use of this concept to defamiliarize music, removing it from its sonic context and placing it into an architectural setting. This method would be used to extrapolate conceptual ideas embedded in the music of the region, and apply it to the architecture, in hope to achieve authenticity within the architecture, without adhering to the common visual cues and traditional motifs that architects seem to have been abusing.

Subsection 1: Introduction to *Maqams*

The *Maqam* (plural *Maqamat*) is the foundation of all melody in Arabic music. Both compositions and improvisations in traditional Arabic music are based on the *Maqam* system, which can be realized with either vocal or instrumental music, without the necessity of a rhythmic component. *Maqams* are a set of tones played successfully that sets the general mood and character of the musical piece. Each *Maqam* has its own set of traditions that define relationship between the tones, their habitual patterns, and their melodic development. The nearest equivalent in Western classical music would be a musical mode (e.g. Ionian, Dorian, Phrygian...etc.)

The word *Maqam* in Arabic means place, location, or rank. The term first appeared in treatises written in the fourteenth century by Al-Sheikh Al-Safadi and Abdulqadir Al-Maraghi. This modal system characterizes the art of music of countries in North Africa, the Near East, and Central Asia. The modal system is called *Makam* in Turkish and Assyrian music, *Dastgah* in Persian music, *Mugam* in Azerbaijan music, *Meqam* in Kurdish music, *Shash Maqom* in Uzbek music, and *Muqam* in Uyghur music.

Arabic *Maqams* are based on a musical scale of seven notes, and repeats at the octave. Unlike the chromatic scale in Western classical music, the Arabic scales, which Maqams are built from, are not even-tempered (sometimes referred to as microtonal). Most *Maqams* include a perfect fifth and a perfect fourth like the modal

scales of Western classical music, but the remaining tones may or may not exactly fall on semitones. Many *Maqams* include notes that can be approximated with quarter tones, while the twelve-tone system in Western classical music are of half tone increments. The tone are rarely precise quarters, they usually fall somewhere between the quartertone and its nearest semi tone, which makes writing Arabic music a problematic feat. Another peculiarity of the *Maqams* is that the same note may not always be played with the same exact pitch, which contributes to one of the many intricate qualities of Arabic music, heterophony. For these reasons, *Maqams* are mostly taught orally, and by extensive listening to the traditional Arabic music repertoire.

Subsection 2: *Maqams* used in Design

They are many *Maqams,* but the ones that I have chosen to focus on in this exploration are *Rast, Bayati, Hijaz, Saba*, and *Sikah*; the same five that are traditionally used for the call to prayer in Islam

Subsection 3: Tetrachords (*Ajnas)*

Maqams are made up of smaller sets of consecutive notes that have a very recognizable aural pattern and convey a distinctive mood. Such a set is called *jins* (plural *ajnas*), and is Arabic for gender or kind. The *Ajnas* are the building blocks for all *Maqams.* In most case, a *jins* would be made up for 4 subsequent notes (a tetrachord), although there are some cases of ajnas with 3 subsequent notes (a trichord) and with 5 subsequent notes (a pentachord).

Subsection 4: Transposing *Maqams* into Architectonic Form

Each of these *Maqams*, because of the structure and spacing of their musical intervals, have different characters and personalities, those that can be translated in architectonic elements. Figure (118) lists each *Maqam* with its attitude towards proportion, light, pattern, acoustics, material…etc.

Figure 122: *Maqams* corresponding to Architectonic form

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Section 5: al-Masma'

Subsection 1: The Place for Listening

The building is called "el *Masma*", which could be translated into "the place for listening", or "the listener". It is intended to be a place where one goes to learn about these *Maqams*, to listen to others playing music, reciting Quran, or practicing the call to prayer using these *Maqams*.

Traditionally, the knowledge music has been passed down by a master to apprentice system, music was not documented, the culture was much more aural based, which goes with the claim that Cairo is an aural based community, where the whole city is in aural reach of the call to prayer.

Al Masmaa' hopes to become a new typology, part school, part museum, part performance space. It is a multi-program space where one goes to learn about the art of *Maqam* in Arabic and Islamic culture.

Subsection 2: Meaning of *al Masma'*

The root of this word is [s – m – ͨ] from the verb [samaͨa] meaning *to listen*. Arabic is a templatic language; word formation is derived by inserting the root consonants into a template or pattern, where the melody (represented by vowels) of the word is predictable. The root consonants carry the semantic meaning of a word.

By inserting the three-consonantal-root into different templates different parts of speech and words that carry different semantics are generated. The template of the word is based on the template or pattern of [al-maf^{c}al] which the language uses to denote a place; [al] is not part of the template, it is the definite article '*the*'. Words like, [al-ma^{c}bad] '*the temple*', [al-masjad] '*the mosque*', [al-maskan] '*the residence*', [al-marsam] '*the studio*' derive from [^{c}abada] '*to worship*', [sajada] '*to prostrate*', [sakana] '*to reside*' [rasama] '*to draw*' respectively. By adding the prefix [ma] along with the second vowel and re-syllabifying the three-consonantal-root according to the given template [maf^{c}al] one can generate the place name related to the meaning of the root. The coined word refers to the place where one can listen. In linguistic representation the consonants and the vowels are represented into different tiers and at the last step of the derivation the tiers are conflated.

Segmental tier

Syllable skeleton tier maC-CVC = maf^{c}al   maC- CVC =

masma^c

Vowel tier   a   a
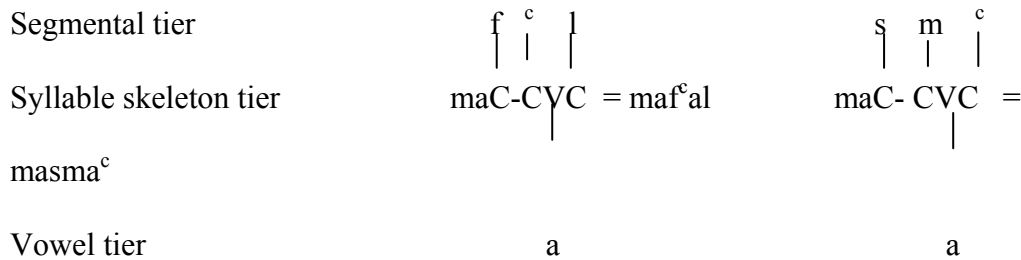
Figure 123: Linguistic breakdown of *al Masmaa'*

Subsection 3: *Al Masmaa'* and the Search for Modernity

Although the specific word of al *Masmaa'* is not a word generally used in the Arabic language, it does not mean that such a word could not be constructed. The *place for listening* is intended to be a new paradigm for program space for an Arab world in search of modernity.

In *Among the Jasmine Trees,* author Jonathan H. Shannon presents an ethnomusicologist study of modern Syria, in search of 'authenticity of the oriental spirit and heritage' that seems to have been long lost. Shannon questions how does one achieve authenticity within modernity, not against it[176]. Among one of the aspects of the "oriental spirit" is the acquirement of *tarab. Tarab,* which can be very loosely translated to feedback in English, is the process where the listener achieves an emotional or spiritual high by the music that they are engaged in. In Ottoman court music, the closest comparable genre of Arabic music to Western classical concert music, the audience could even shout out declarations of emotional connection with the music, tarab, at the performers, and shouting would not be considered interruption, but more of applause, feedback, and interaction. It is interesting that such a performance diagram is very similar to the one that Iannis Xenakis developed, in his search to create a bigger collaboration between musician and audience.

What can be taken from this musical example is the importance of interaction between the performer and the audience, the performer in this case being al Masmaa'. In the design process, the consideration for interaction and flexible program is important, where all the design framework of the building is constructed, and the visitors and users are the insemination that creates the architecture.

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[176] Shannon, Jonathan Holt, *Among the Jasmine Trees: Music and Modernity in Contemporary Syria*, Wesleyan University Press, Middletown, CT 06459, 2006

Section 6: Urban Intervention Schemes

The Project is organized around five clusters of rooms, each one depicting one of the 5 maqams. Now that both the site and the _Maqam_ concept were established, it was time to address how both these issues would connect with one another both urbanisticly and conceptually. In designing these urban interventions there are two constant variables: its relationship to the wall and city gate, and the idea of creating five different nodes of space. Each of these interventions vary in their attitudes towards entrance, whether its entrance to al Masmaa' or towards Islamic Cairo in general.
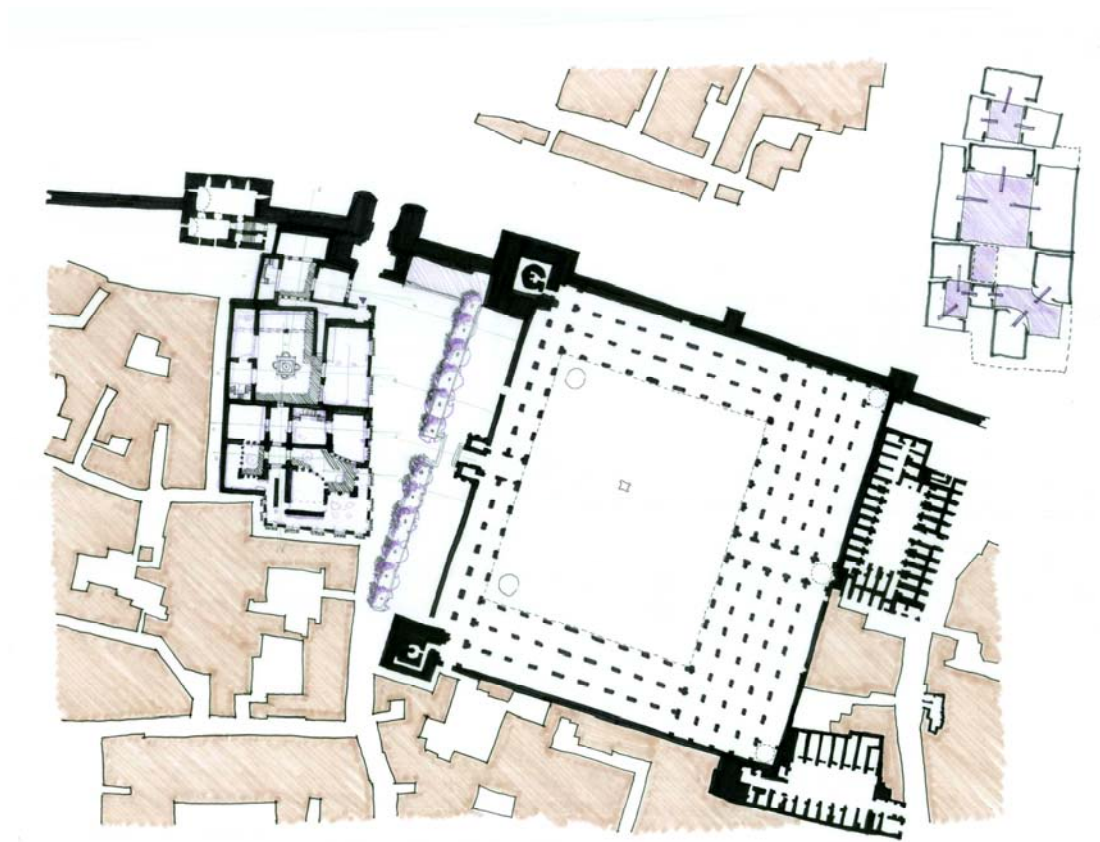
Subsection 1: Scheme 1

Figure 124: Urban Configuration of _al Masmaa'_, scheme 1

This first scheme is actually a variation of the existing site condition. The building footprint of the existing site is respected, and the addition of the western annex is following the footprint of a previous building that was demolished sometime within the last century. The current condition has one facing a blank wall directly before entering the city, having to move left in order to enter the triangular space in front of al Hakim mosque. This jog may seem awkward, but it's important to remember that such a jog is not uncommon in the residential architecture of the city, where this is done in order to achieve privacy as one does not gain a direct view into the main living space upon entering, but needs to pass in a series of spaces, or maybe even a corridor, before getting to the main space. This jog also allows one to perceive a sense of enclosure when standing right in front of the mosque entrance, as the city gate portal becomes hidden, and one feel secure in this elegant triangular enclosure. All these schemes take that idea to mind in designing the entry sequence to both al Masmaa' and the city.

What makes the current condition seem awkward is the view of the run down rubble of the deserted and demolished area of the city (the ghetto area) on the right hand side upon entering the city. This is the reason why all of these schemes attach a western annex to building, while connecting that annex to the wall is a symbolic move suggesting that al Masmaa' is a monument that is part of the Islamic culture, and also a move that resembles that of the southern gate, *Bab Zuweyla*, where in the 15th century, the Mamluk sultan Al Muayyad Sheikh attached his mosque to the gate, and had the mosque minarets go on top of the gate instead of the mosque, integrating both

structures into one mega structure which, could now be argued, has become a prominent image of Islamic Cairo.

In this scheme, the entrance to al Masmaa' is directly on axis with the entrance of the gate. The interior circulation is through a series of corridors, as one also faces a blank wall upon entering. Each of the *Maqam* rooms represent a courtyard in this scheme, where a cluster of rooms would be looking on.

Subsection 2: Scheme 2
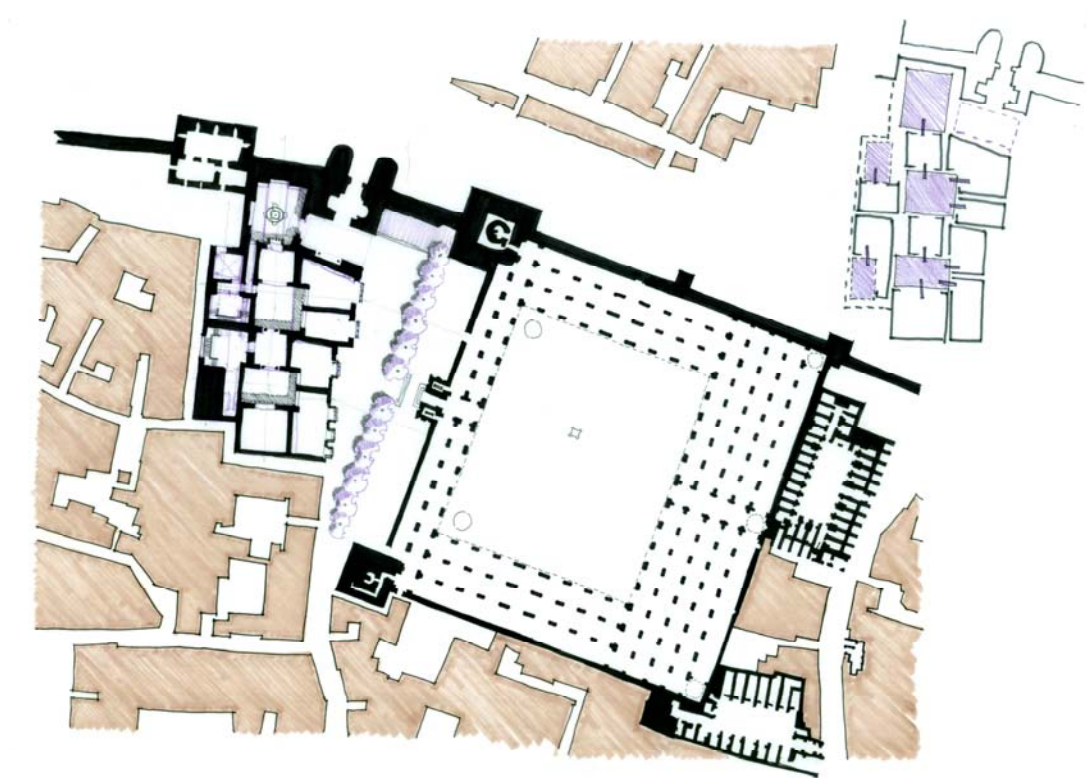
Figure 125: Urban configuration of *al Masmaa'*, scheme 2

This scheme is a variation of the previous scheme, where the existing footprint is left as if (with the exception of the addition of the western annex), and the entrance space

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is left unaltered. The difference is that the entrance is now located on the western

wall, as opposed to on axis, leaving the southern wall free to include a map of the city

or something of the sort. Instead of entering to a network of corridors like the

previous scheme, one find themselves in one of these *Maqam* rooms upon entrance,

allowing for a transition space before entering the institution, with a fountain in the

middle of the room for purification or something of the sort. The placement of the

Maqam rooms allows each of these courtyards to be figural, as opposed to some of

the awkward spaces generated in the previous scheme.

Subsection 3: Scheme 3
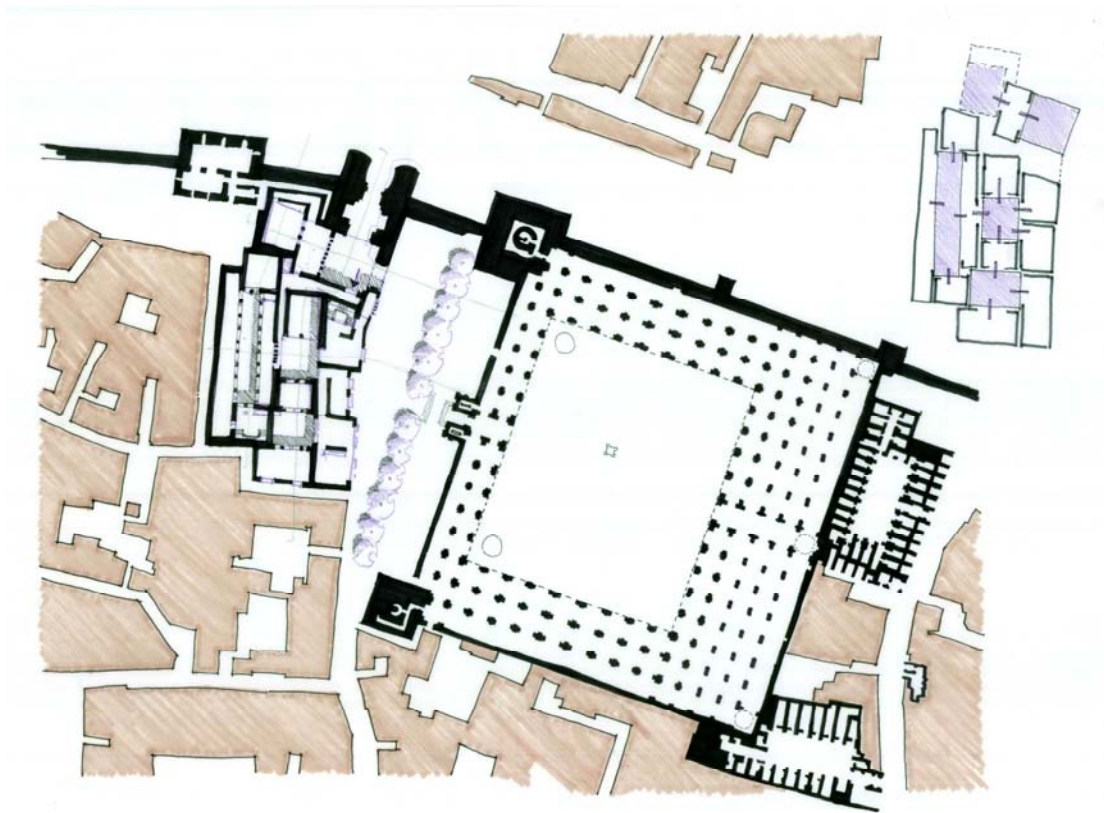
Figure 126: Urban configuration of *al Masmaa'*, scheme 3

A variation of the previous scheme, except instead of entering the first *Maqam* room through the small space after entering the city gate, the *Maqam* room becomes that space, allowing the visitor to step into the realm of the institution before going back out into the street. This is a much bolder move than the other two schemes in respect to entry sequence, as it definitely engages the visitor more dynamically, and forces them to become aware of the institution.

The scheme is also a variation of the very first scheme in respect to the entrance to *al Masmaa'*. The entrance is also along the southern wall, only shifted slightly to avoid being on axis with the city gate, and one finds themselves entering to a series of corridors before entering any of the *Maqam* spaces.

Subsection 4: Scheme 4
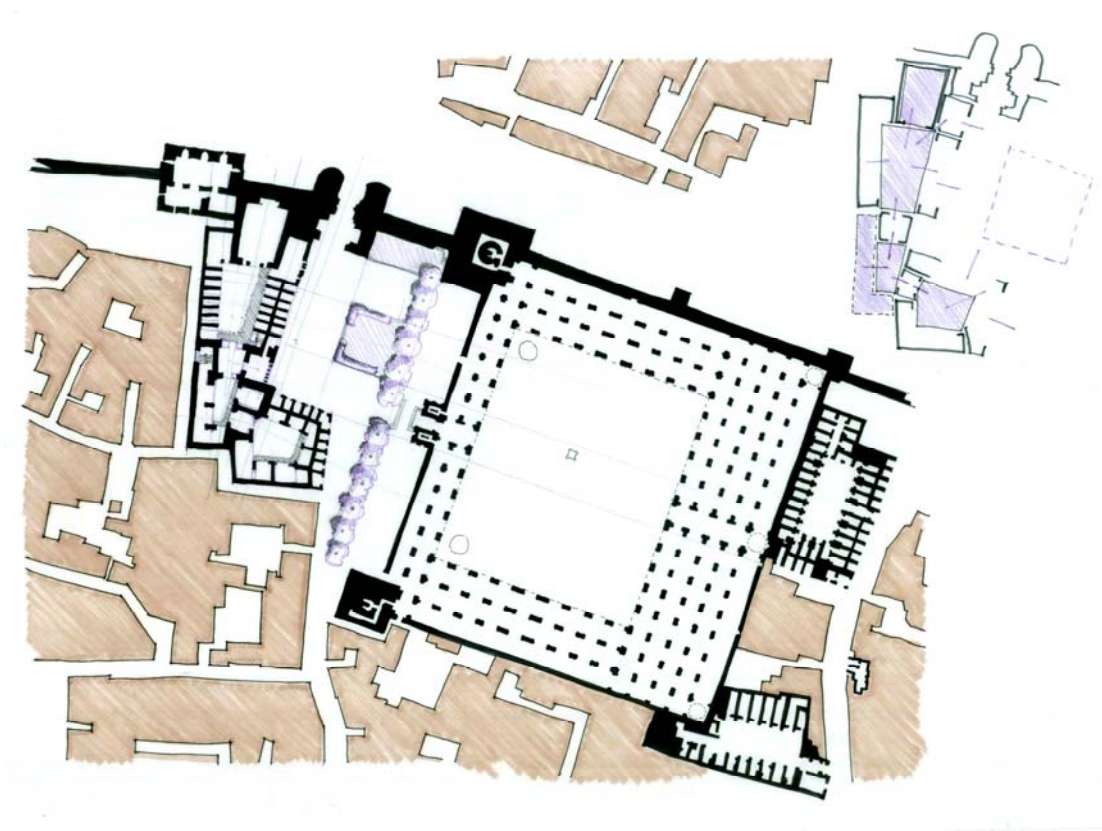
Figure 127: Urban configuration of *al Masmaa'*, scheme 4

This scheme is very different than any of the other three. It pushes back the entrance

wall far back, so the new wall is on axis with the southern portion of the mosque's

entry portal, creating a square open space in front of the mosque instead of the

triangular one, with a garden in the middle perhaps, and then the space funnels back

into the street and continues on. The building footprint becomes a distorted L-shaped

building, and the sequence of the spaces becomes much more linear than any of the

other schemes.

While creating a large setback for the building seemed like a much more gracious

entry towards the city, the transformation of the triangular space to a square seemed

to kill the essential qualities of the site. All ideas of privacy and seeing a full enclosure while one is in the middle of the site are now all gone. So the rest of the schemes return to emphasize the majesty and significance of the triangular / trapezoidal space.

Subsection 5: Scheme 5

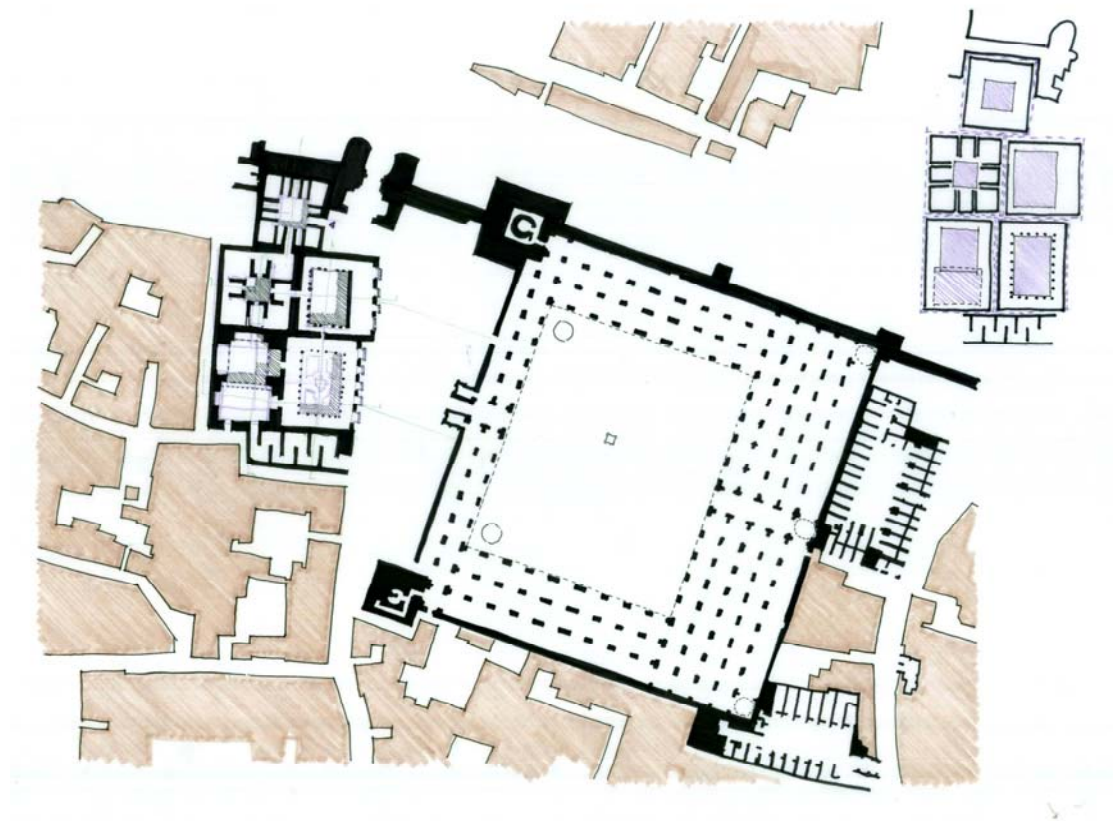**Figure 128: Urban configuration of *al Masmaa'*, scheme 5**

This scheme, more than any other, presents a very clear boundary of each of the rooms. The idea of the in-between spaces in all the other schemes, although they provide for a richer experience, is very difficult to control and regulate. As a designer, it was very difficult to come up with a set of rules that would govern and justify the

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existence and location of these in-between spaces. This scheme was generated as a

response to that, a complete opposite setting where there are no in-between rooms,

just five enclosures, each one depicting a *Maqam*. This scheme is heavily influenced

by Charles Correa's Jawahar Kala Kendra in Jaipur, India, where the building form

emulates the formation of the 9 square grid of the city of Jaipur, and each square is

both a formal and conceptual structure of its own.

      Subsection 6: Scheme 6

Choosing one scheme out of the 5 proved to be a difficult ordeal. They all were mere

exercises in space making, and none seemed to have brilliance over the other. It was

difficult to decipher which scheme would work better for the program at hand, as

there were no real concrete parameters or functional requirements for the new

typology of al Masma' that would value one scheme over the other.

Another layer of relationship with Arabic music is added to the Architecture here.

Each of the fives rooms now correspond to tetrachords as opposed to *Maqams*. From

section 3 in this chapter, it was explained how each *Maqam* is made up of two or

more tetrachords. Some tetrachords can be grouped together, where other could not,

and furthermore, some of the tetrachords that can be grouped together only if one of

them becomes the lower tetrachord and not vice versa (e.g. Sikah and Hijaz can be

grouped together if Sikah was the lower tetrachord, composing *maqam Huzam*, but

very rarely does Hijaz become the lower tetrachord with Sikah tetrachord

following[177]). If both tetrachords can be reversed (i.e. they can be formed one way or another) then the connection would be called a direct connection, where visual axis will be given into both rooms (*Rast* can look into *Bayati* and *Bayati* can look into *Rast)* as well as access between them can be granted. If it is only a one sided connection, this becomes an indirect connection, where visual axis will only be given to one room (*Sikah* can look into *Hijaz* and *Bayati* but not vice versa), yet not access will be given to the rooms unless one passes through a room that grants access to both (in the case of *Sikah*, one must pass back through *Rast* to get access to either *Bayati* or *Hijaz*). This layer of information provided the framework for the sequencing between the rooms.
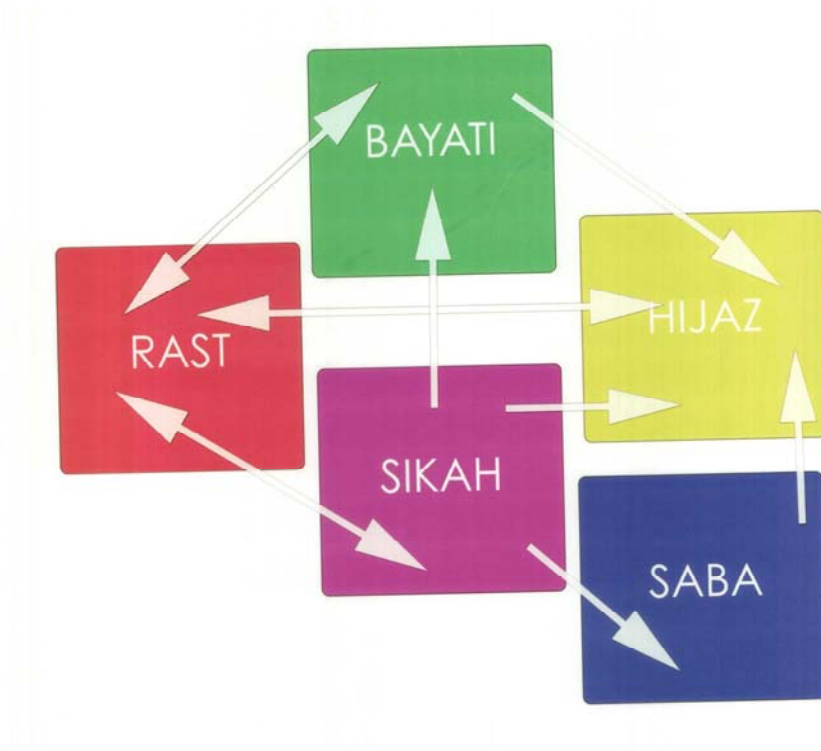
Figure 129: Relationship between tetrachords in *Maqam* formation

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[177] Although *maqam Hijaz* actually ends in a *Sikah* trichord, it should be noted that it actually follows the *Rast* tetrachord, and is considered a tertiary *jins* added to the maqam.
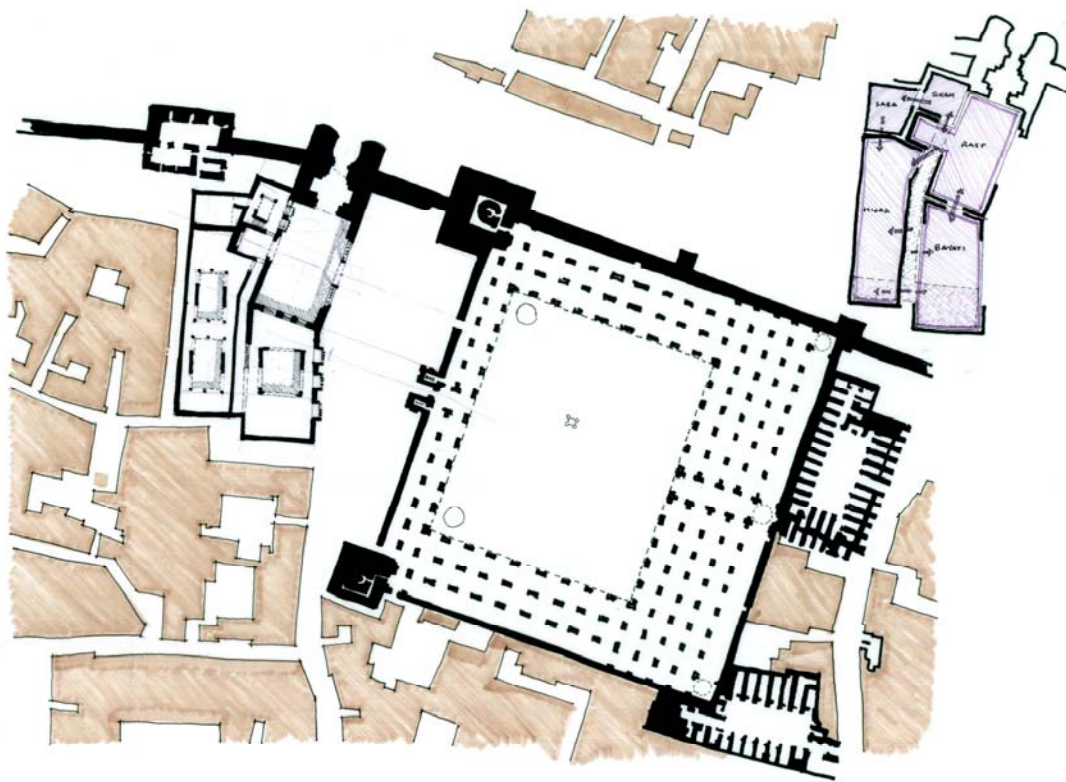
Figure 130: Urban configuration of *al Masmaa'*, scheme 6

None of the other five schemes could directly be used here, as the previous schemes suggest more of a sequential promenade and this one prefers a networked organization, so a hybrid of three previous schemes were used to create scheme 6: the simplicity and clarity of the spaces of each room in scheme 5, the notion of entering the space immediately into one of these rooms in scheme 2, and pushing back the building envelope from the entry gate in scheme 4.
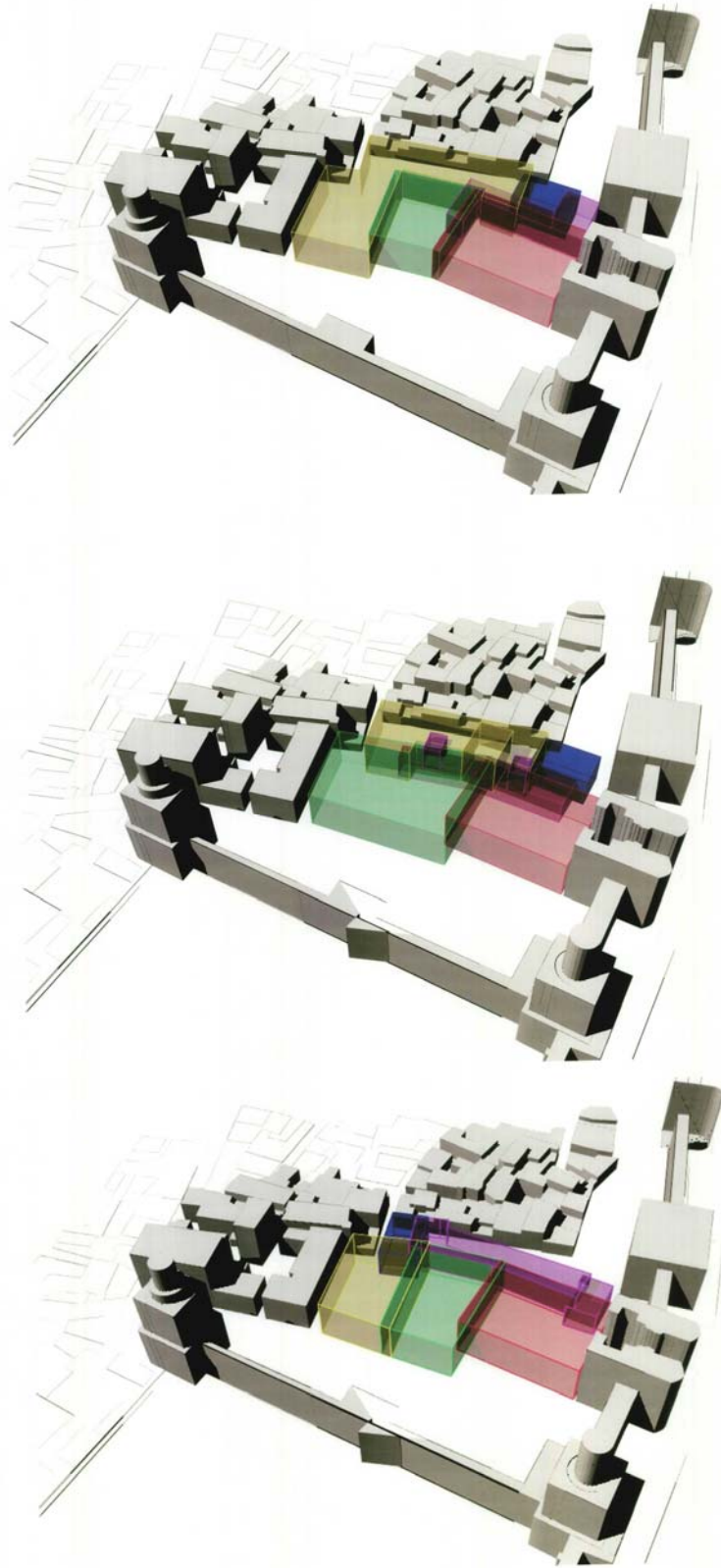
Figure 131: 3D Variations of scheme 6

Section 7: Final Design

Subsection 1: Sequence Through Spaces
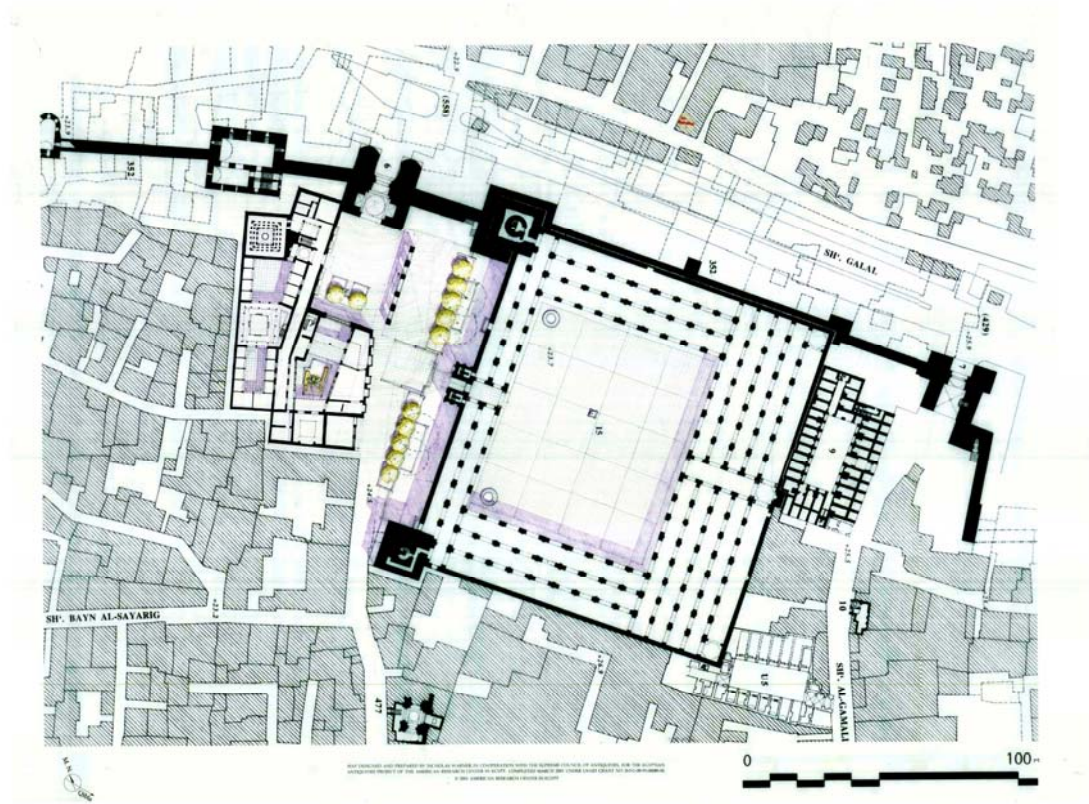
Figure 132 Plan of *al Masmaa'*

Upon entering the Northern gate, one finds themselves inside the *Rast* room. *Rast* is

the most celebrated *Maqam* in Egyptian music, used in most nationalistic and many

folkloric songs, and figure (118) in section (4) of this chapter shows how it responds

to architecture acoustically as the space that allows the sounds of the site to dictate it,

a symbolic move to suggest that the sounds of Cairo are of *Maqam Rast*. The *Rast*

room functions as a pivot between the street and al *Masmaa'*, an ambiguous in

between space, serving both in public realm of the street and the private realm of *al*

Masmaa'.

The challenge was how to make the *Rast* room serve as an enclosure on its own, yet provide a strong sense of direction allowing traffic to flow through to the street. The current solution creates a large setback, as opposed to the existing condition, closes off the west wall which now serves as an entrance to *al Masmaa'*, and keeps the east wall a free standing element, offset to allow views to the mosque minaret, which acts like a drawing in device, like many other minarets that exist along the street.

Figure 133: Perspective of the *Rast* room, taken upon entering the city gate

The offsetting of the eastern wall allows for such an ambiguous space, as it truly can be argued both that the space belongs to *al Masmaa'* and the rest of the city. In the earlier schemes (see scheme 3 and 6 in the previous section), such an ambiguous reading was difficult as attaching the eastern wall gave rendering a reading of the

space being very private, and belonging solely to *al Masmaa'*. A series of variations of the entry sequence was tested out before reaching to that point. The last iteration calls for another layer of ambiguity in addressing the triangular space; as the wall enclosures gives the spatial definition, the space is subdivided into three different sections using floor patterns, which allows the floor materials of the mosque to spill out onto the space, making a presence on the street and signifying the entry sequence to the mosque. There was an idea that the other floor material pattern would be radial with the city gate being the center, which allows one to trace their location relative to the gate, and as one approaches the street, the radius expands wide enough that it is no longer seen as a curve, but as a straight line, marking the slow and gradual transition between the urban space to the rest of the street.

From the *Rast* room, one can enter the building and navigate through all the other spaces[178]. The *Bayati* room is the room with many attitudes towards space, adhering to the notion that *Maqam Bayati* is one that many different variations occur, one that scholars don't agree on a distinct character, but many agree that the *Maqam* has different flavors. This is clearly seen in variation of spatial enclosures and façade treatments in the room.

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[178] It should be noted that the small vestibule or lobby area that one enters to from the outdoor *Rast* room is also considered part of the *Rast* space. The design of the interior facades would have reflected that, yet unfortunately, this degree of design development was not achieved at the culmination of this project. Nonetheless, it is important to see that lobby area as part of the *Rast* family.

The *Hijaz* room has a very distinct and clear difference between the smaller and larger elements, adhering to *maqam Hijaz's* interval pattern size (1/2 - 1 1/2 - 1/2). One can see such a spatial difference in section, where the first floor is actually 3 times taller than the ground and second floor.

The space allocated for the *Hijaz* zone is very narrow and long, due to the site constraints. It was decided that both *Bayati* and *Rast* front the triangular space in front of al Hakim Mosque, so that the façade of the *Bayati* space becomes the main façade of the street, as the *Rast* portion only functions as a gate. In earlier schemes, the triangular space of the mosque would also be given an association with yet another *Maqam*, *maqam Nahawand*, one that's tetrachord has a direct connection with all of *Rast, Bayati,* and *Hijaz.* While a direct architectural connection was easy to establish

with both *Rast* and *Bayati*, the *Hijaz* connection was problematic (trying to move the rooms around so that *Hijaz* could have frontage on that space seemed very contrived spatially, but the scheme was nevertheless tested out as seen in figure x). A few earlier iterations saw the *Hijaz* room to house a large tower, a few meters lower than the minaret towers of al Hakim mosque, just to have a visual presence from and to the triangular space. That idea was also abandoned early in the design process, as the tower presented a whole set of problems that was not within the scope of this thesis exploration, and that it's purpose was to allow a musical correspondence to come through, one that probably wouldn't have much of an effect in the first place.
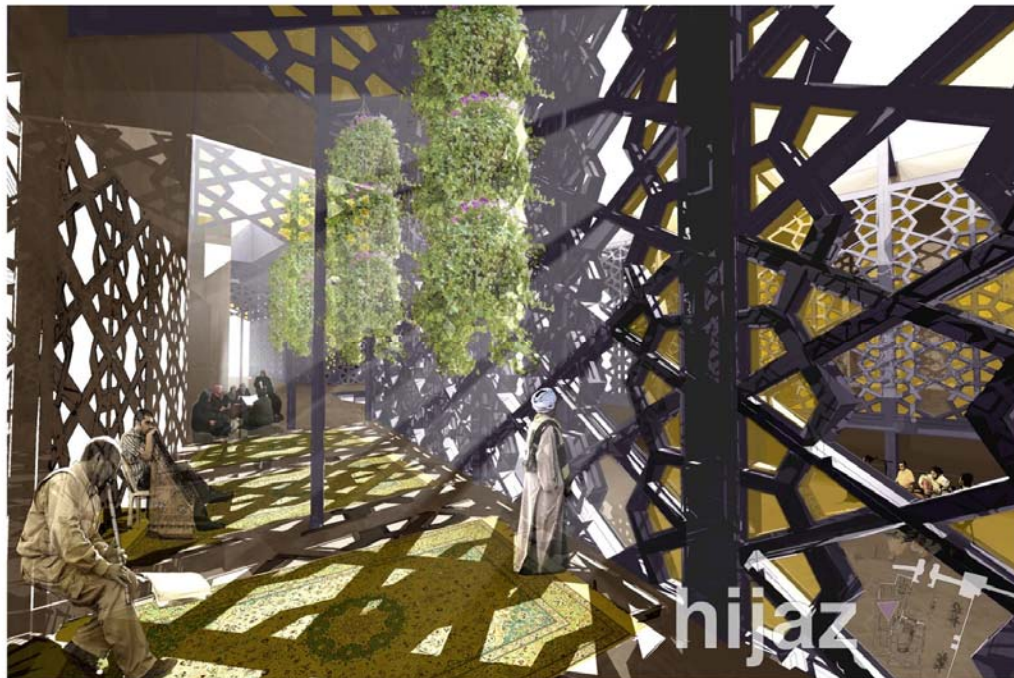
Figure 135: Perspective of the *Hijaz* room

The problem of the long nature of *Hijaz* zone still existed. The latest iteration of the design process divides the space into three sections, all of them equal in width, but vary in length. The idea of dividing the space into three sections is a play of the

symmetrical nature of the *Hijaz* tetrachord, where two courtyards flank a large roofed space.

Figure 136: Perspective of the *Saba* room

Saba is the *Maqam* attributed to music of sadness. It is probably the room where musical inspiration was allowed in design the most. Although it adheres to proportional aspects that are distinct to that *Maqam,* the reflecting nature of the mode is very clear in the space. The thermal baths in Vals, by architect Peter Zumthor, was used as a precedent in general mood and choice of materials. The room is designed to utilize acoustics to create a vast echoing room, using sound reflecting materials like marble, with a minimal source of light creeping into the building from the dome, and a small fountain in the middle of the symmetrical room. The effect here is created so that the sound of dripping water would resonate in the space as one sits by a column and becomes immersed in contemplation.

Figure 137: Perspective of the *Sikah* room

The *Sikah* room serves as an above floor, tight, gallery space, peeking views into all

the rooms. Both these notions adhere to concepts of the *Sikah maqam*. First of all, the

Maqam has the narrowest range out of all five; pieces in *Sikah* rarely go beyond one

octave, while the other *Maqams* extend beyond, so an architectural correspondence

would naturally be the narrowest of all the other rooms. The *Sikah* tetrachord is the

only tetrachord that has a connection would all the others, but has an indirect

connection to both *Bayati* and *Hijaz*, meaning *Sikah* can peak view into both rooms,

but not vice versa. This idea also coincides with principles in traditional Islamic

architecture, as the *Sikah* portion of al Masmaa' can be considered the *haramlik*[179]. In

order to ensure the privacy of women in the Arabic house, the *haramlik* is the portion

of the house to which is inaccessible, or not as directly accessible, to the visitor, while

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[179] The Arabic word is a play of the phrase "*haram aleek*" which can translate into "that which is forbidden for you".

the women of the house can peek views through screens into the living room area, the

salamlik[180], which is the portion of the house that is accessible to visitors.

Subsection 2: Generation of Character

The most contributing factor that led to the generation of character is the application

of the *Maqam* interval proportions onto the vertical surface of the rooms. There are

two layers of proportion applied to each façade of these spaces. First, the proportions

of the diaphragms of the floor slabs correspond to the tetrachord proportions. There

are three floors (ground – first – second), so the heights of each floor represent an

interval (not a note)[181]. The figures below highlight the differences between these

proportions as they correspond to each of the *Maqam* rooms. The tetrachod /

diaphragm proportions are shown in yellow.

The second layer of proportions deals with the design of the overlaying façade. These

proportions stem from the interval proportions of the whole *Maqam.* Every major

move within the façade, whether it's a cornice line, window openings, or applied

fixtures like lighting applications or planting boxes, occurs within these set

proportional systems.

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[180] The Arabic word is a play of the phrase "salam aleekom", which is the phrase one uses as hello in the Islamic world.

[181] It is important to make sure that one is able to distinguish the difference between a note and an interval. This aspect may be an important one that differentiates architecture from music: Notes are but points in space, whereas the intervals between them can be considered lines. In music, it is these points that are celebrated, where in architecture, it is the intervals that are more spatial. Each floor plane represents a note, whereas the heights in between represent the interval.

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To avoid both proportional systems clashing together, the second proportional layer has been flipped; the first layer has the lowest note on the ground plane and the highest note on the roof plane, as one experiences movement through building bottom up, while the second layer has the lowest note on the highest point of the façade with the highest note on the lowest point of the façade, as one generally views facades from up to bottom.
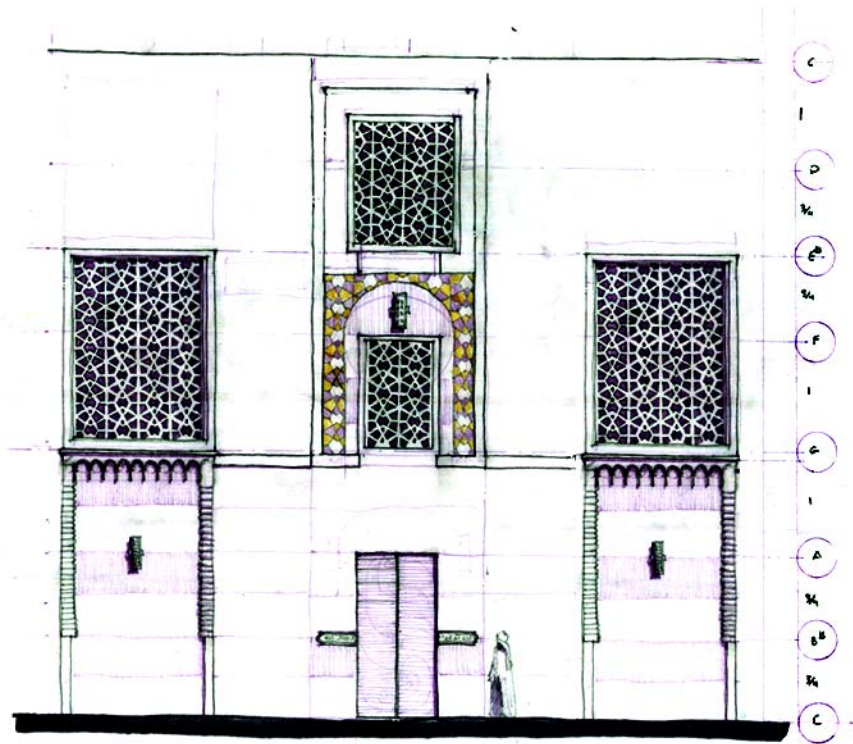

Figure 138: Detailed Façade of the *Rast* room
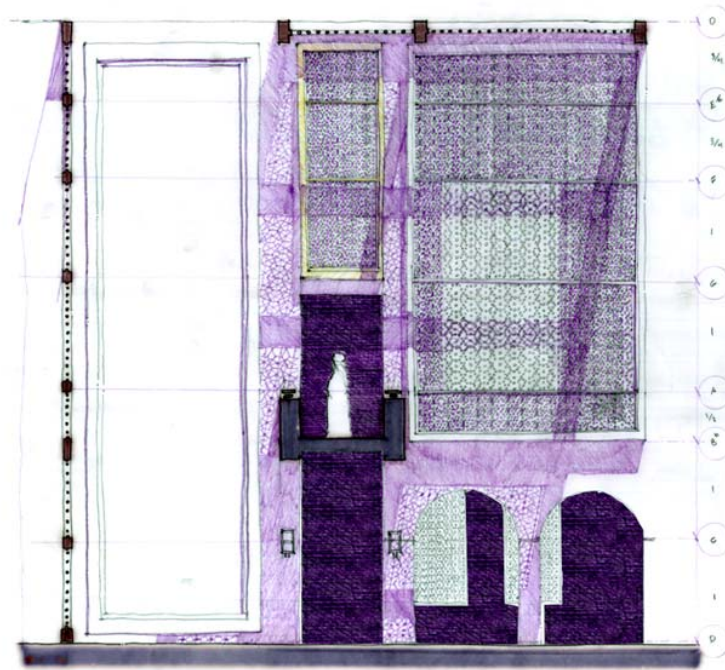
Figure 139: Detailed Façade of the *Bayati* room
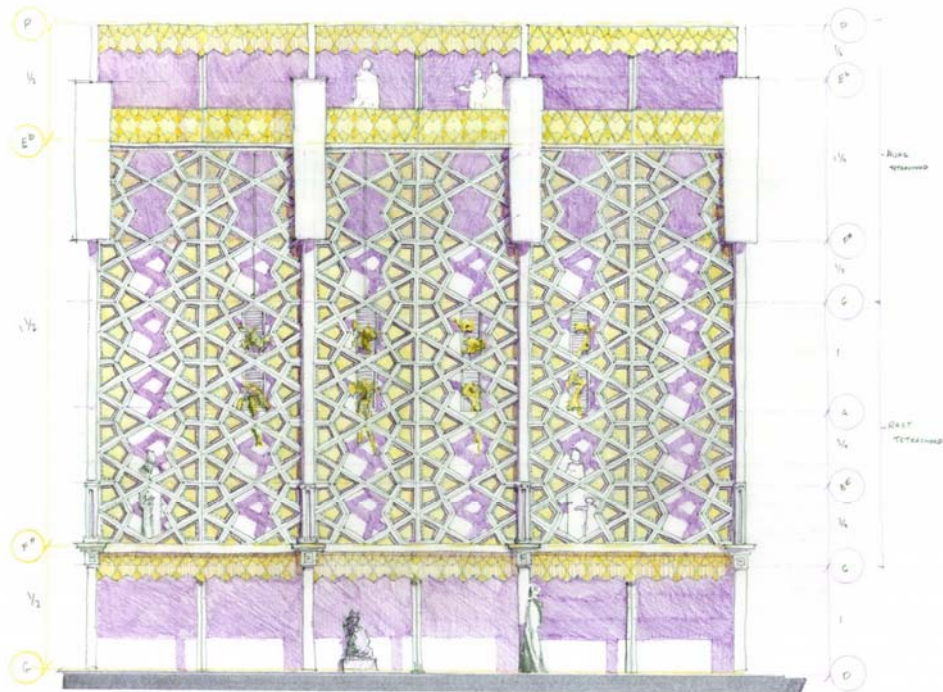
Figure 140: Detailed Facade of the *Hijaz* room
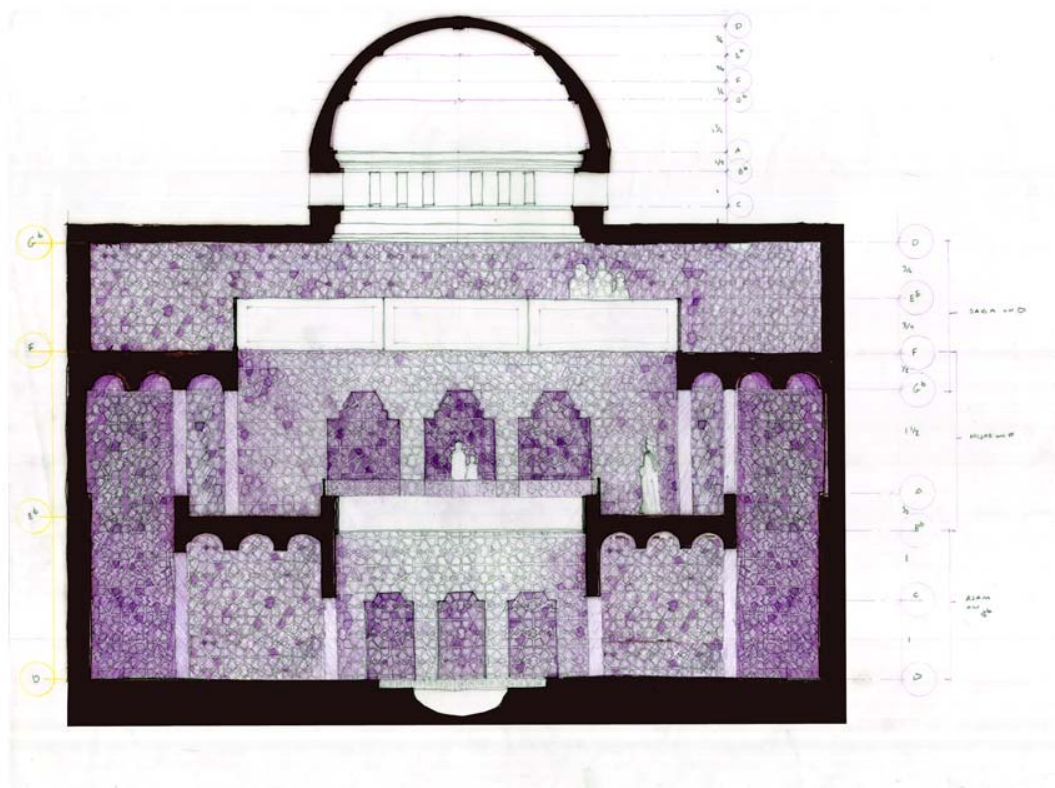
Figure 141: Detailed Façade of the *Saba* room
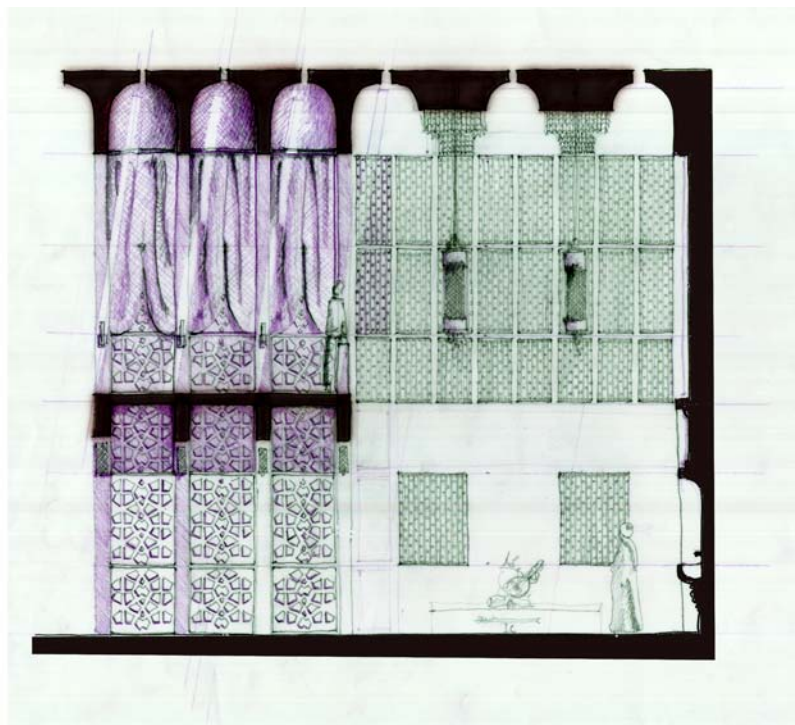
Figure 142: Detailed Façade of the *Sikah* room

Such studies have also been done on a number of minarets that exist along the street, which interestingly enough, all seem to adhere to the same interval proportions as *Maqams*. The first drawing on the left depicts the minaret at it actually exists, while the one next to it on the right is how it would be had it ideally been designed using such *Maqam* intervals, depending on which *Maqam* is closest to the existing condition (notice the minute difference between both). The other minaret drawings are exploring how the structure would look like had it used other *Maqam* intervals[182].
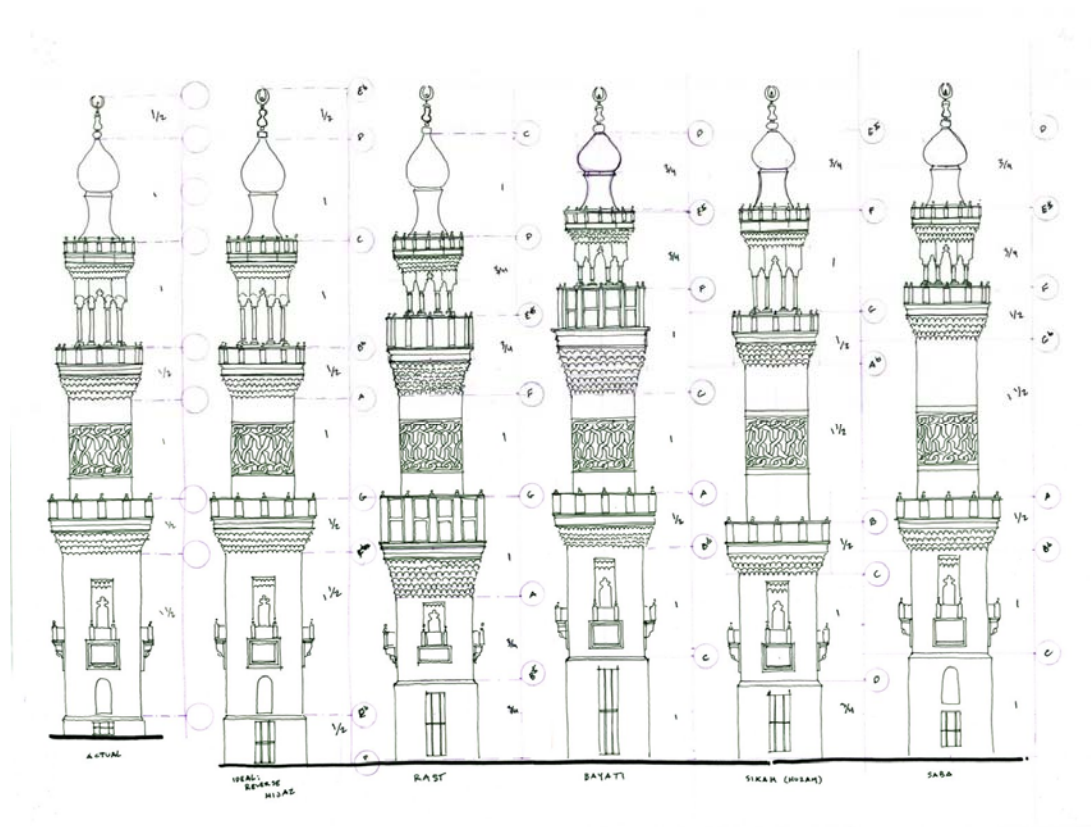
Figure 143: Minaret of Faraj bin Barquq (*Hijaz*)

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[182] The five *Maqams* used are, in order, *Rast – Bayati – Hijaz – Sikah – Saba*. The first *Maqam* used directly after the existing condition is the ideal condition had it been designing using the exact *Maqam* dimensions, which means *Rast* is not always first in the drawings.

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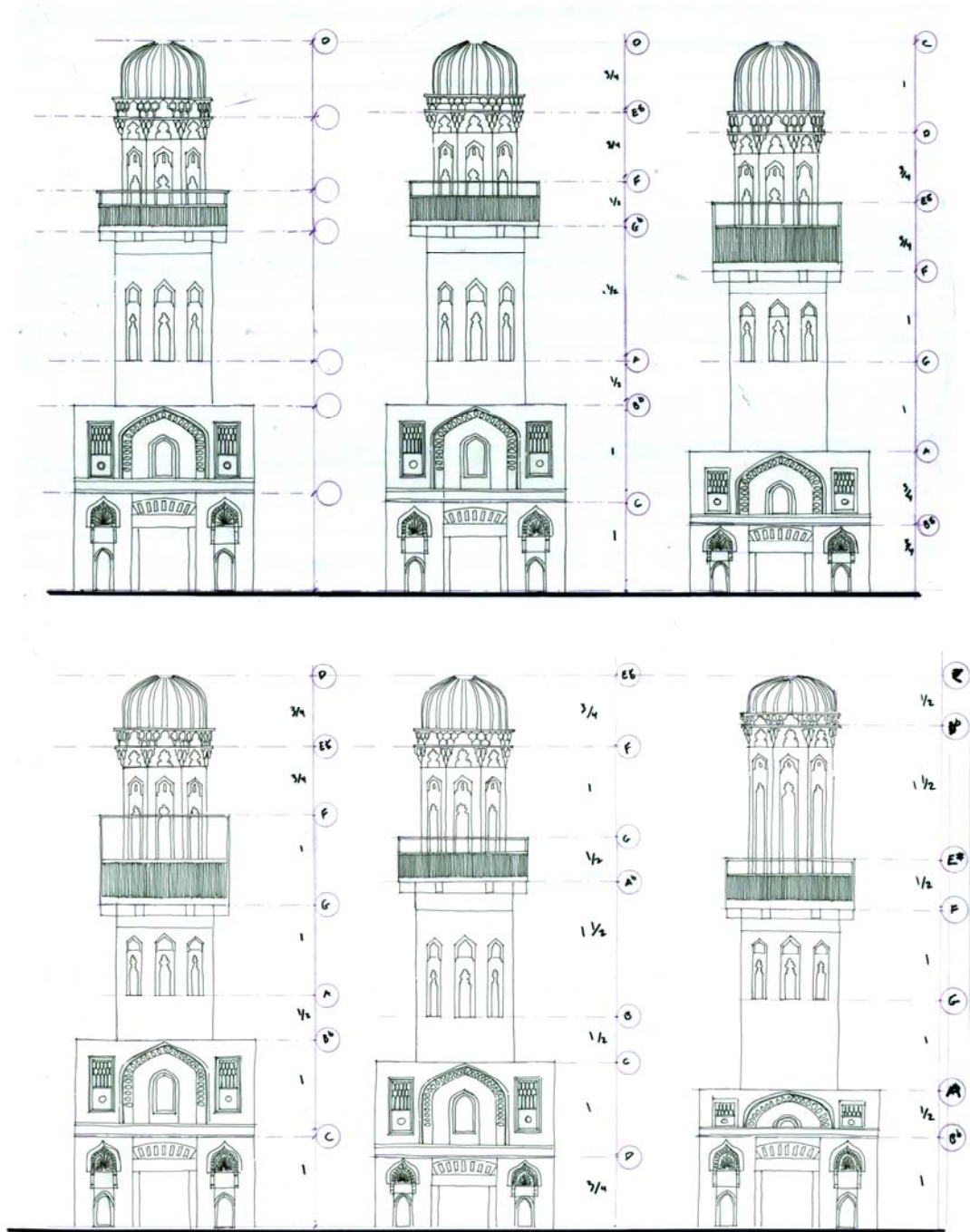
Figure 144: Minaret of al-Salih Najm al-Din Ayyub (*Saba*)

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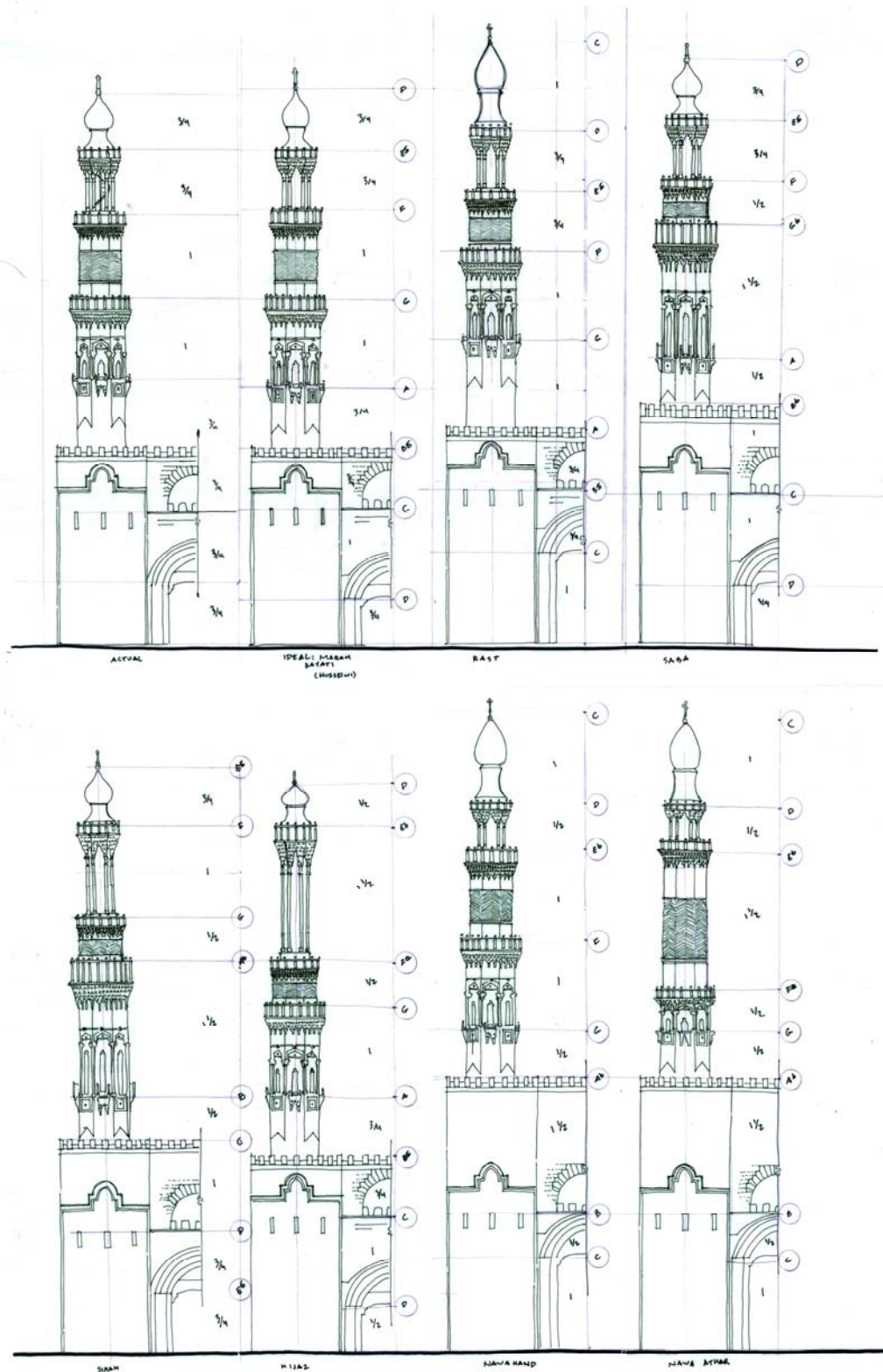
Figure 145: Minaret of al-Mu'ayyad at Bab Zuweila (*Bayati*)

Subsection 3: Final Presentation Drawings

The following are drawing presented at the A6 public review on April 21st, 2009, at the University of Maryland.

Figure 146: Exploded Section Perspective of al Masmaa'

Figure 147: Section through *Rast* and *Bayati*
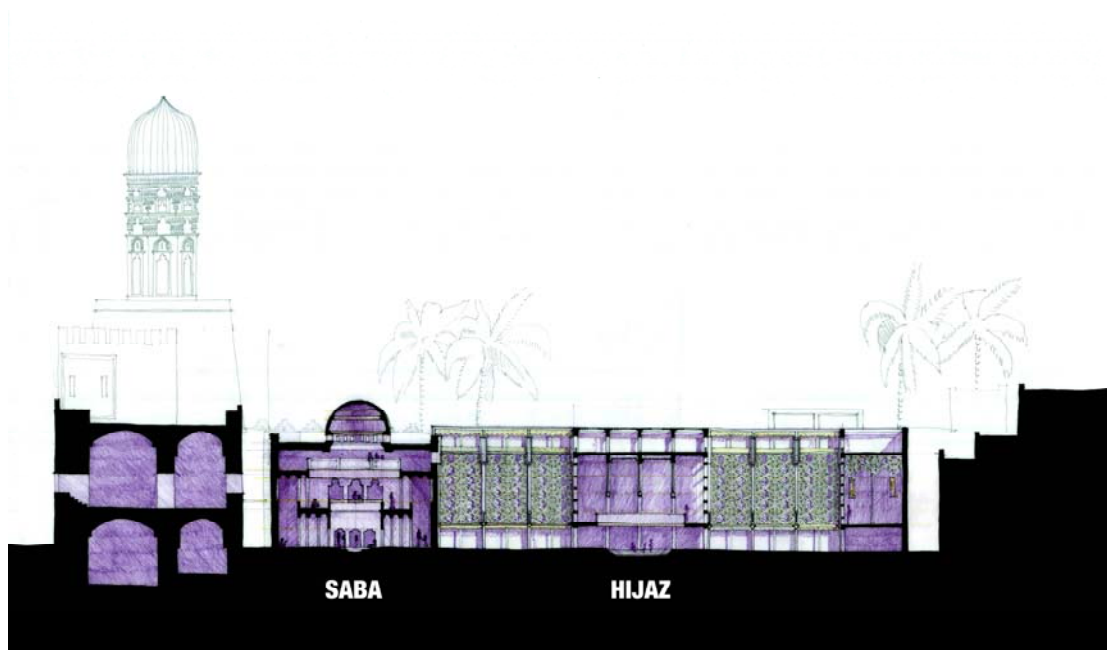
Figure 148: Section through *Saba* and *Hijaz*

237
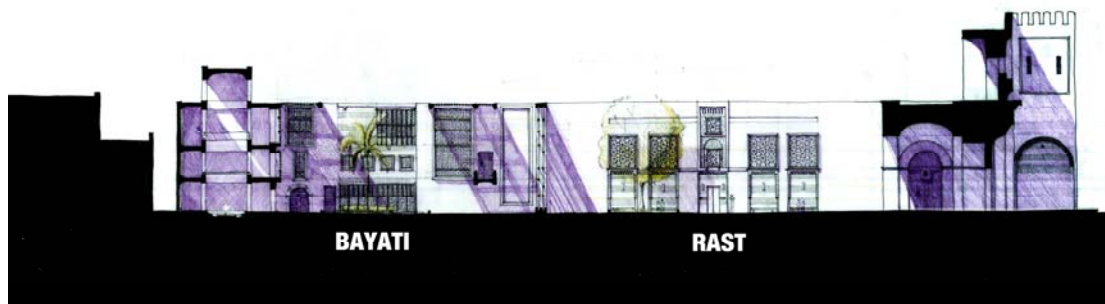
Figure 149: Reverse section through *Bayati* and *Rast*
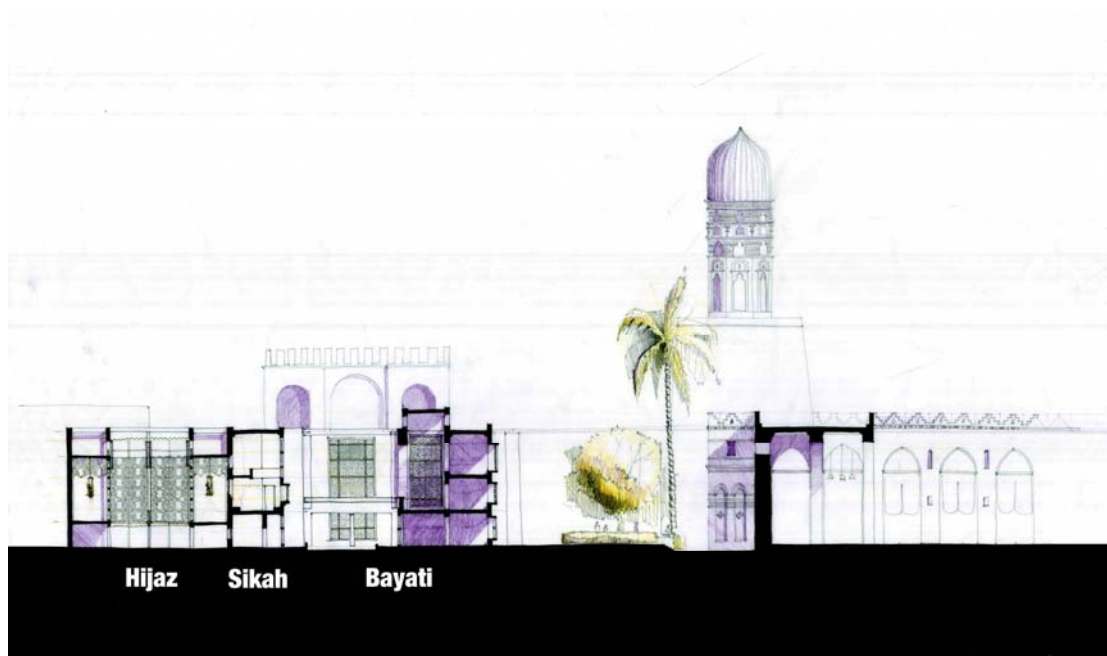
Figure 150: Transverse section through *Hijaz*, *Sikah*, and *Bayati*

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Figure 151: Perspective of *Rast*

Figure 152: Perspective of *Rast*

Figure 153: Perspective of *Bayati*
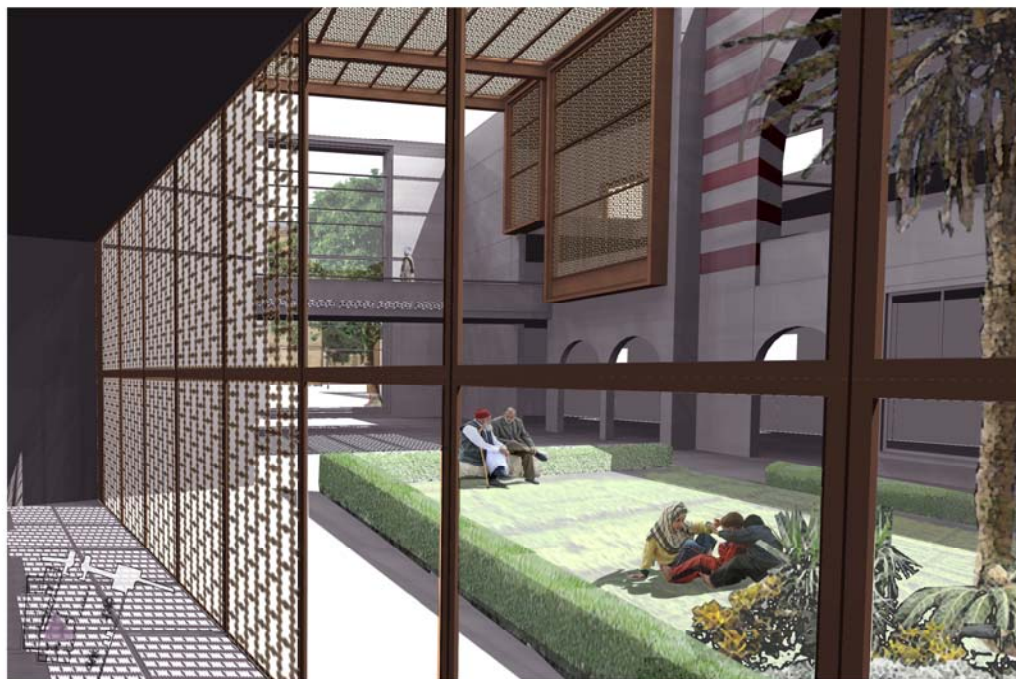
Figure 154: Perspective of *Bayati*

Figure 155: Perspective of *Hijaz*

Figure 156: Perspective of *Hijaz*
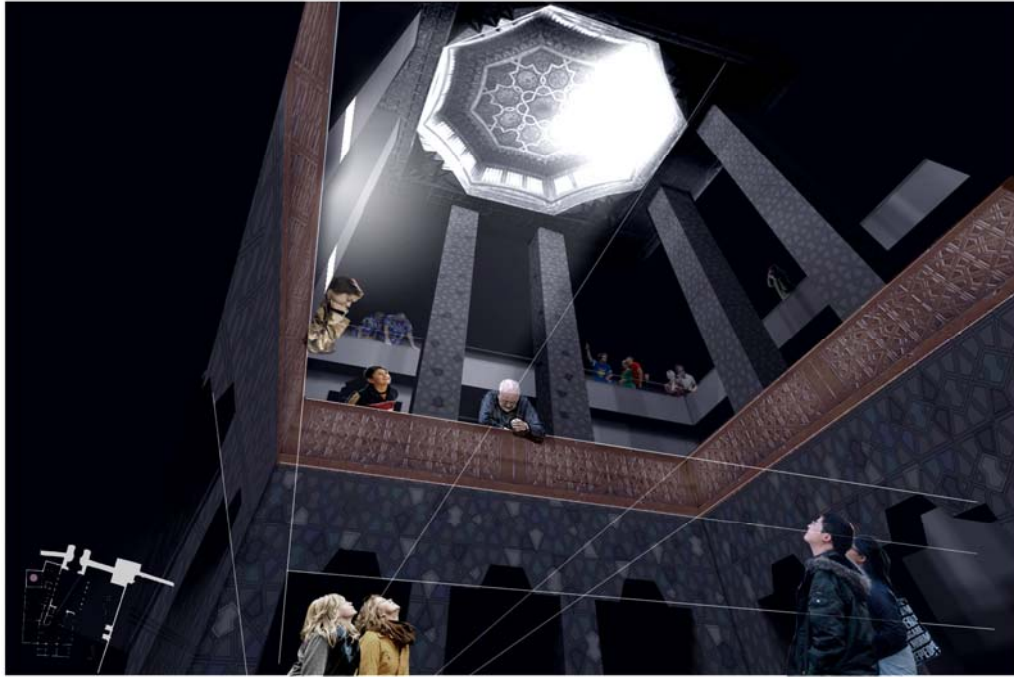
Figure 157: Perspective of *Saba*
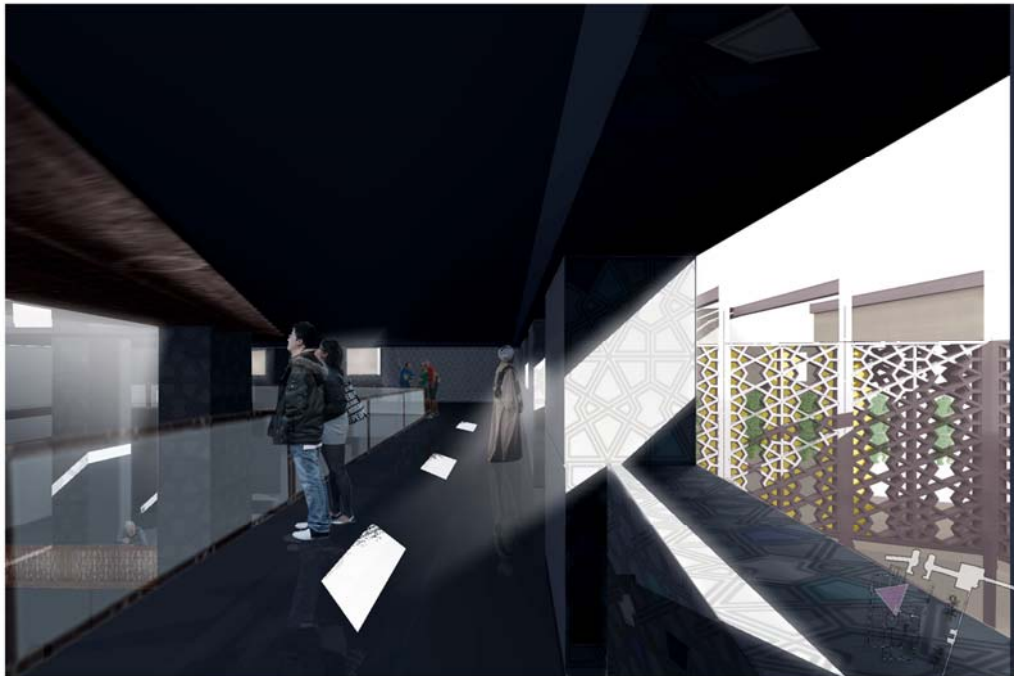
Figure 158: Perspective of *Saba*

Figure 159: Perspective of *Sikah*

Figure 160: Perspective of *Sikah*

Chapter 12: Reflections and Conclusions

Section 1: The Question of Success

Throughout this thesis exploration, the question of success kept on being reiterated; how does one measure the success of such a design process? Is the success of the process measured against the accurate translation between one art form to another, seeing the process as a mathematical equation, with only a few possible outcomes? The design framework is set out in figure x in section xx could be seen as a catalogue, where all the designer needs to do is apply the equation accurately to get the "correct" design.

Then there is the question of the nature of *al Masmaa'*; is the *al Masmaa'* project meant to be seen as an exercise in translation, where it provided a venue to test out the ideas of applying musical concepts into architectonic form, in hope to find parallels in architecture and music, and on a larger scale, culture in general. In this case, the program element is irrelevant, as this process deals with character and could be applied to any program in the Arab world. Or is it really a new programmatic paradigm, a new typology that addresses the needs of today's Egyptian Arab culture, whether in revival of the *Maqams* in Arabic music or the creation of a space for interaction for those that deals in the *Maqam* craft. This case, the program is being very dependant on Music.

The notion that all these questions were raised in the first place proves the Success of this project. It is this ambiguity about the purpose of al Masmaa' that people can start

to understand it in many different ways. It is all of the above, and provides sufficient

evidence for it conceived as many different things in one.

Section 2: Multiple Programs Spaces of al Masmaa'

Although the Program of the thesis was never really an issue at start, it seems to be

come an important element by the end of the thesis. The thesis was only interested in

exploring using musical concepts to generate a character more in tune with the

surrounding context. The program was an afterthought, created from the research and

exploration of the music. None of these spaces were actually designed to fully

accommodate the program at first, and the program needed to be retrofitted into *al*

Masmaa'. By allowing the program to slowly evolve, it provides a unique opportunity

to redefine the role of program, and to allow it to be dictated by the activities within.

In al *Masmaa'*, there are a number of activities that can suggest a number of different

readings of the overall program.

Subsection 1: *al Masmaa' as a Space for Learning*

Traditionally, the concept of "school" in the Islamic world is very different than that

of the western world, as mentioned before in this document. Knowledge is

traditionally passed down in a master to apprentice system, while there were Quran

teaching sessions in buildings known as *kuttab*, where young children would gather

round a sheikh and they would learn how to recite the Quran, sometimes using one of

the *Maqams.*
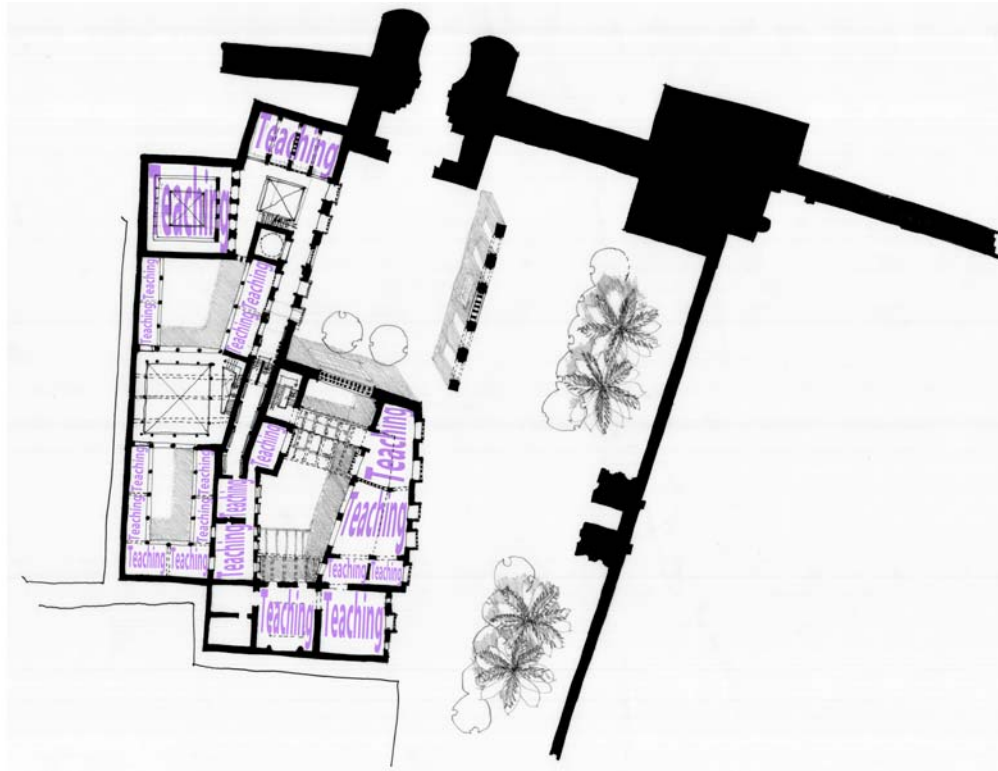
Figure 161: *Al Masmaa'* **as a space for learning**

Al Masmaa' features many different settings that could be used as learning spaces. The *Rast* room, although it seems that it can't be seen as anything but a non-program urban space, can be seen as the space where one learns through the interaction with others. Knowledge is passed down in this room in a very indirect way, through observation and conversation, but passed down nonetheless. The *Bayati* room seems to be the setting that is most attuned towards a learning space, as it has the most variety of proximities of space[183], from spaces that could accommodate larger groups of people within a learning session, to more intimate settings for a one on one student teacher interaction. The *Hijaz* room does not have the range of spaces like *Bayati,* but it has two settings, either accommodating larger groups, or smaller one or one, or

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[183] The term "proximities of space" is borrowed from Edward T. Hall's *The Hidden Dimension,* Random House, 1969

even just for one person, practice / study room. The general quality and character of the *Saba* room lends it to be regarded as a study area, or encouraging a one on one interaction without the one on one spatial setting. The *Sikah* area accommodates many rooms with a much more intimate proximity, encouraging solely one on one private tutoring.

Subsection 2: *al Masmaa' as a Space for Exhibition*

To be able to see al Masmaa' as an Exhibition Space, or museum, one really needs to rethink the concept of the museum. A *museum* is a "permanent institution in the service of society and of its development, open to the public, which acquires, conserves, researches, communicates and exhibits the *tangible and intangible* heritage of humanity and its environment, for the purposes of education, study, and enjoyment", as defined by the International Council of Museums[184]. While the artifacts need to be *tangible* it does not necessarily need to be *visible*. What would a museum of music, that only used sonic music as an artifact be like? While this specific project does not go deep enough asking that question, it does start to suggest a paradigm shift regarding museum typology dealing with the invisible qualities of music.

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[184] "ICOM Statutes". *INternational Council of Museums*. Retrieved on 2008-04-05.
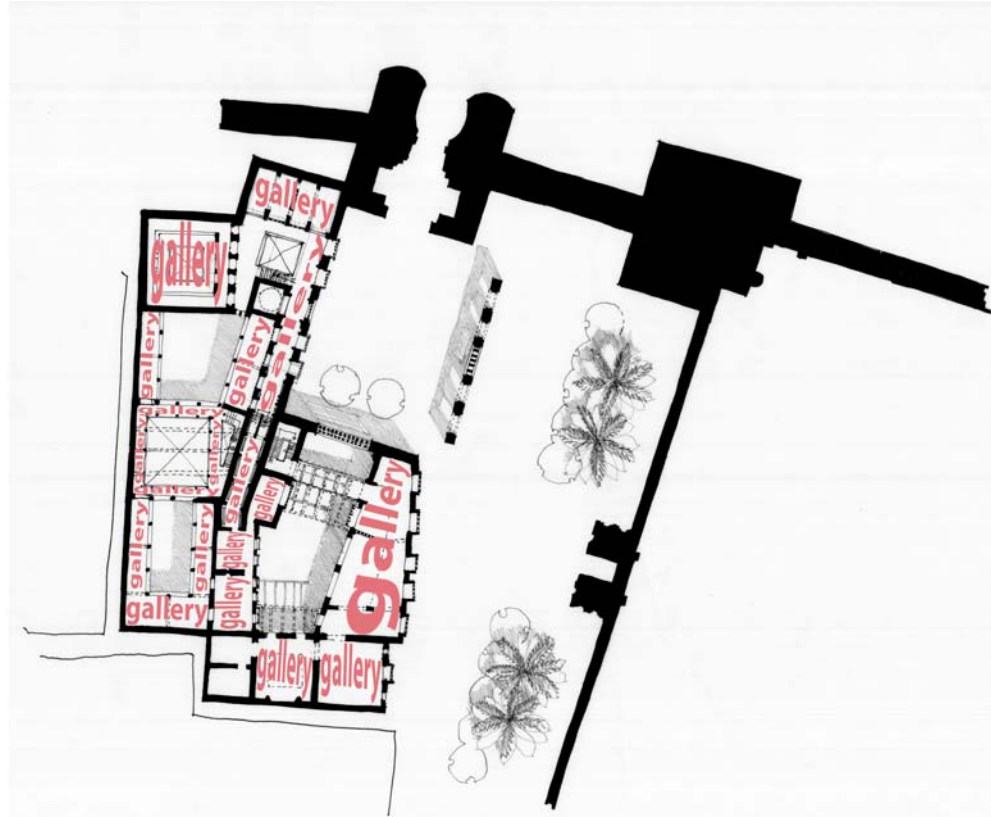
Figure 162: Al Masmaa' as a Space for Exhibition

Subsection 3: *al Masmaa' as a Space for Performance*

It sort of goes without saying that performance would be an important aspect of *al Masmaa',* even if the space is meant to be a learning or exhibition space, a major activity will always be the performance of these *Maqams,* in Quran recitation, or call to prayer practice, or even just simply playing music. The issue with the space would be acoustical control, as the use of very loud PA systems, something that Egyptians just love abusing, would turn *al Masmaa'* from a respectable institution to a cacophonic sound zoo in an instant.

Figure 163: *Al Masmaa'* **as a space for Performance**

The first rule to stop that from happening is to eliminate the use of the electronic

acoustical amplification, and allow the acoustical qualities of each room to dictate

how these rooms would be used. The second is to make sure that sounds from each

room don't overlap with each other like that of the call to prayer within Cairo (see

figure xxx), unless this is desirable. This is in fact desirable in the *Rast* room where it

is designed to allow the sounds of the surrounding urban context to mix in, allowing

the space to be conceived as part of the city. The *Hijaz* room also allows overlap of

performances, although the overlap exists only in that space and does not allow for

overlap between rooms, as it has three main performance platforms. This setting

would encourage musicians to utilize this setting to come up with different attitudes

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in both performance and improvisation, as well as different attitudes about the interaction with the audience. While the *Bayati* and *Saba* room are self-sustaining acoustic space, it's the *Sikah* room that divides both the *Bayati* and *Hijaz* (the heavy masonry construction enveloping the *Saba* room divides it acoustically from all the other rooms in *al Masmaa'*). *Sikah* acts as a buffer between both of the other rooms, allowing overlap into the *Sikah* space when desired, and uses fabric curtains and shutters to eliminate the sound when it is not desired.

Subsection 4: *al Masmaa' as a Space for Gathering*

Musicians meet and interact in settings like clubs, concert venues, and sometimes recording studios. None of these places were really meant for interaction, and when it happens, it is usually minimal due to the dominance of other activities within the place. The club is too noisy, and filled with dancing and drinking, the recording studio is too intimate and does not encourage group gathering and mass discussion. This gathering space is very much needed though, as you see young musicians occupying the street right in front of these venues on the streets of Cairo. Their image is tainted, with the elderly calling them *bums,* just because of their choice of hangout space.

The idea of hangout space is not uncommon in Egypt. The Gezira Sporting club, established in the 1920's by Cairo's high society, is now the most common and most popular hangout area for children, teenagers, and adults. Although initially a sporting club, the most common activity is that of just doing nothing and hanging out. Some of

Cairo's most esteemed intellectuals would go and be engaged in various discussions about politics, culture, and business…etc. This is what *al Masmaa'* tends to be for the musicians, a place solely for them to interact and communicate ideas with one another.

Figure 164: *Al Masmaa'* **as a space for gathering**

Through discussions and interviews with many musicians during this research process, many musicians in the United States saw value to a typology of *al Masmaa'* in their own neighborhoods. The general typology in the United States, or any other country for that matter, would not be called *al Masmaa'*, nor even its translation "the place for listening" as it loses some of the richness in translation, but it would be called "the soundgarden" a term used before in this document to describe the al Mue'zz street of Cairo in general. It would then be interesting to see how these

soundgardens would differ according to region, for example, how would the blues / jazz scene in Chicago differ from it's southern counterpart, Mississippi. Such research would be vital pursue this further.

Subsection 5: *al Masmaa' as a Space for Reflection*

Early in the design process, the program was set out to be what was called "reflective pods" where the spaces are designed solely to promote and encourage reflective contemplation. This idea seemed to trickle down to the new program of *al Masmaa'* where a lot of the spaces can be used as "reflective pods". This is also in line with "hangout" space of the previous subsection, where instead of groups of people gathering in one of these spaces, individuals would sit alone in some of the more intimate spaces to hangout with themselves, and let the voices in their heads converse with one another (in a none threatening way of course). This idea of contemplation and reflection is found in numerous examples in the Egyptian culture, traditionally where people would sit individually in the mosques and offer prayers to God, or in a more modern secular setting, in places like the Gezira Sporting club, where individuals would sit on the boundaries of the golf course and horse track race, staring into the green landscape (a rare occurrence in modern Cairo).

It must be noted that these spaces were never meant to be used as hangout or reflective spaces, but it seems that this is a reoccurring theme within the culture, and maybe such spaces should be addressed as such. *Al Masmaa'* provides the groundwork that starts to suggest the development of such spaces.

Subsection 6: *al Masmaa' as a Multi-Program Space*

Each of the *Maqam* rooms seem to be more perfectly suited for one activity more so than any of the others. The *Rast* room seems to be designed for an urban gathering space; the *Bayati*, because of the wide range of proximities of space, seems to be more in tune for learning spaces; the *Hijaz*, because of the three different platforms and the opportunity of mixing the sounds together, seems to be more in tune for performance spaces; the *Saba*, because of the nature of its character, seems to be more in tune for reflective spaces; the *Sikah*, because of the small intimate spaces and long corridors, seems to be more in tune for exhibition / gallery spaces.

Subsection 7: *al Masmaa' as a Non-Program Space*

Aside from all the activities that can occur within *al Masmaa',* the spaces are meant

to start revealing how both architecture and music can have a common principle

between them. The idea of defamiliarization of music is a very important factor here,

in hopes to combat architectural globalization, or better yet architectural

westernization. Unfortunately, much like architectural westernization, there has been

a process of musical westernization as well, and these concepts of *Maqams* are in

danger of extinction. Such defamiliarization of the musical concepts only work then

with repeat visitors, after students and scholars come and study these *Maqams* over

extended periods of time, which is why the need was felt to allow the program of the building to become related to these *Maqams* in some shape or form.

Figure 167: *Al Masmaa'* **as a non-program space**

The building then starts to reveal itself layer by layer, as one starts to make these connections, encouraging one to go back out to rest of the city, with this new eye and insight to such details, to make further connections within the architecture, and more broadly with the culture, in hope to understand themselves better as Egyptians, and in hope to understand ourselves better as Arabs.

It was generally felt that *al Masmaa'* is an example of positive ambiguity, where there is sufficient evidence to convince one that the thesis is about a number of different very complex issues, as it was discussed in previous sections throughout the document. Confusion still looms over a few who don't understand why the program was much more simple and straight forward, like a concert hall for example. Other than such program elements are part of a western bias, not existing in this part of the world traditionally, we must remember that we are also addressing a site housing a group of religious conservatives, some very fundemental. They very well might not like the fact that this is new intervention is soley for performance, or a music school, or a cultural museum. By leaving it abstract and flexible, each one of these groups can coexist in this place, all thinking that they have the right to belong here, and this place belongs to them, avoiding the Bilbao[185] affect, which such an intervention can cause.

The main issue that still is evident is the issue of traditional motifs. Although it was stated at the beginning of the thesis that this process would combat the motifs that have been overused by modern Islamic architects, at some point in the design process, such motifs were embraced to an extent. It was seen that motifs and ornamentation play an immense role in the generation of character, but to what extent do these motifs serve such a purpose? Where is the fine line between the motif that generates

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[185] The Bilbao affect is where inhabitants of a certain place feel that a particular recent addition of architecture in their city is not one that they built themselves (*we built),* but one that was built for them (*they built*), and thus losing any hoping of making a contextual and emotional attachment to it. This term refers to Frank Gehry's Guggenheim in Bilbao (1997).

character and is important to the architecture, and the motifs that are decorative and unnecessary? This is the question that will have to be carried through as this research continues, hoping that the next iterations of these studies would really push the envelope further in the architectural evolution of Arabian cities and cultures.

Appendices

If needed.

Glossary

Adhan: Muslim call to prayer.

Ajnas: (singular: jins) a set of three, four, or five stepwise pitches used to build an Arabic *maqam*, or melodic mode. They correspond to the English terms trichord, tetrachord, and pentachord. A *maqam* is made up of two or more *ajnas*.

Askar: Soldier

Athman: "Eighths", administrative divisons

Aulos: an ancient Greek musical instrument.

Ayubbid: a Muslim dynasty of Kurdish origin which ruled Egypt, Syria, Yemen, Libya, southern Anatolia, the Hejaz and northern Iraq in the 12th and 13th centuries.

Bab: door, gate

Bahri Mamluk: was a Mamluk dynasty of mostly Kipchak Turkic origin that ruled Egypt from 1250 to 1382 when they were succeeded by the Burji dynasty, another group of Mamluks. Their name means 'of the sea', referring to the location of their original residence on Al-Rodah Island in the Nile (*Bahr al-Nil*) in Cairo.

Bayt: house, party of emirs

Bayati: a *maqam* commonly used in the Arabian music repertoire.

Bin: Son of

Birkat: pont

Circassin: a term derived from the Turkic *Cherkess* (*Çerkes*) and is not the self-designation of any people, in Turkish the word *Cherkess* can be translated, *Cher* means soldier, and *Kess* means cut, so *Cherkess* means soldier cutter. The term applies only to the Adyghe people.

Darb: Alley

Defamiliarization: the artistic technique of forcing the audience to see common things in an unfamiliar or strange way, in order to enhance perception of the familiar. A basic satirical tactic, it is a central concept of 20th century art, ranging over movements including Dada, postmodernism, epic theatre, and science fiction.

Diwan: Council

Dominant: fifth scale degree (the most "pronounced" harmonic note after the tonic)

Fatamid: an Arab Shi'a dynasty that ruled over varying areas of the Maghreb, Egypt, Sicily, Malta and the Levant from 5 January 909 to 1171. It was the fourth and final Arab caliphate. \ The term *Fatimite* is sometimes used to refer to the citizens of this caliphate. The ruling elite of the state belonged to the Ismaili branch of Shi'ism. The leaders of the dynasty were also Shia Ismaili Imams, hence, they had a religious significance to Ismaili Muslims. They are also part of the chain of holders of the office of Caliph, as recognized by most Muslims, the only period in which the Shia Imamate and the Caliphate were united to any degree, excepting the Caliphate of Ali himself.

Haramlik: 'forbidden place; sacrosanct, sanctum', related to *ḥarīm* 'a sacred inviolable place; female members of the family' and *ḥarām*, 'forbidden; sacred') refers to the sphere of women in a usually polygynous household and their quarters which is enclosed and forbidden to men.

Hijaz: a *maqam* named after a region in Saudi Arabia, used to mark solemn occasions, commonly used in the Arabian music repertoire.

Iwan: open hall or room

Jabal: mountain

Jins: see *Ajnas*

Khan: caravanserai

Leading tone: seventh scale degree (the scale degree that "leads" to the tonic

Madrasa: School, college of Islamic Law

Mamluk: "owned"; also transliterated *mamluq, mameluk, mameluke, mamaluke, marmeluke* or *mamluke*) was a slave soldier who converted to Islam and served the Muslim caliphs and the Ayyubid sultans from the 9th to the 13th centuries. They were mainly Kipchak Turks[1]. While Mamluks were purchased, their status was above ordinary slaves, who were not allowed to carry weapons or perform certain tasks. Mamluks were considered to be "true lords," with social status above freeborn Egyptians.[2] Over time, they became a powerful military caste often defeating the Crusaders. On more than one occasion, they seized power for themselves; for example, ruling Egypt in the Mamluk Dynasty from 1250–1517.

Maqam: a modal structure that characterizes the art of music of countries in North Africa, the Middle East and Central Asia. In this area we can distinguish three main musical cultures which all belong to the Maqam family, namely the Persian, the Arabic and the Turkish.

al Masma': The place for listening (the soundgarden)

Mediant: third scale degree (the "middle" note of the tonic triad)

Moqadema: Introduction

Ney: Reed end-blown flute.

Nomos: the daemon of laws, statutes, and ordinances, in Greek Mythology.

Oud: Short-necked, fretless Arabian plucked lute having five or six courses of strings.

Qafla: Closing section or music phrase in instrumental and vocal improvisations and pre-composed genres.

Qasaba: avenue

Quibla: direction of Mecca

Quadrivium: the four subjects, or arts, taught in medieval universities after the trivium. The word is Latin, meaning "the four ways" or "the four roads": the completion of the liberal arts. Developed by Martianus Capella, the quadrivium consisted of arithmetic, geometry, music, and astronomy. These followed the preparatory work of the trivium made up of grammar, logic (or dialectic, as it was called at the times), and rhetoric. In turn, the quadrivium was considered preparatory work for the serious study of philosophy and theology.

Rast: a *maqam* commonly used in the Arabian music repertoire.

Riqq: Small tambourine.

Saba: a *maqam* commonly used in the Arabian music repertoire.

Sabil: Fountain

Sabil-Kuttab: Small Quranic school

Salamlik: the portion of an Arab / Turkish palace or house reserved for men.

Sikah: a maqam commonly used in the Arabian music repertoire.

Soundscape: a sound or combination of sounds that forms or arises from an immersive environment. The study of soundscape is the subject of acoustic ecology. The idea of soundscape refers to both the natural acoustic environment, consisting of natural sounds, including animal vocalizations and, for instance, the sounds of weather and other natural elements; and environmental sounds created by humans, through musical composition, sound design, and other ordinary human activities including conversation, work, and sounds of mechanical origin resulting from use of industrial technology.

Subdominant: fourth scale degree (a fifth "below" the tonic)

Submediant: sixth scale degree (the "middle" note of the subdominant triad)

Supertonic: second scale degree (the scale degree immediately "above" the tonic)

Synesthesia: from the Ancient Greek σύν (syn), "together," and αἴσθησις (aisthēsis), "sensation" — is a neurologically based phenomenon in which stimulation of one sensory or cognitive pathway leads to automatic, involuntary experiences in a second sensory or cognitive pathway.

Tabla: Goblet-shaped drum

Taqsim: Instrumental improvisation

Tarab: A state of musical rapture or ecstasy.

Tetrachord: a series of four tones filling in the interval of a perfect fourth, a 4:3 frequency proportion. In modern usage a tetrachord is any four-note segment of a scale or tone row. The term *tetrachord* derives from ancient Greek music theory. It literally means *four strings*, originally in reference to harp-like instruments such as the lyre or the kithara, with the implicit understanding that the four strings must be contiguous

Tonic note: the first note of a musical scale in the tonal method of musical composition.

Trivium: the three subjects taught first: grammar, logic, and rhetoric. The word is a Latin term meaning "the three ways" or "the three roads" forming the foundation of a medieval liberal arts education.

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