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# Exploring Islamic Geometries

Maryam J. Al-Ainati

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# EXPLORING ISLAMIC GEOMETRIES

by

MARYAM J. AL-AINATI

Under the Direction of Tim Nichols

## ABSTRACT

Islamic design is a rich art form with spiritual and meditative meaning expressed through its infinite pattern. The iterative process of creating pattern, unified yet diverse, is an intricate geometric path conveying conceptual exploration. Process of form development in Islamic patterns defines its growing design, seeking explicit relationships between unity and multiplicity. As the grid expands and patterns unfold, new concepts are introduced for pattern exploration and formation. Reoccurring focal points of the Islamic geometries mark significant moments in which these patterns take form. By fusing traditional Islamic design fundamentals with contemporary concepts for interiors, I expand the realm of this rich art form from a two dimensional form to a three dimensional structure.

INDEX WORDS: Abstract art, Art culture, Contemporary art, Design process, Geometric pattern, Interior treatment, Islamic design, Meditative art, Pattern exploration, Play of light, Qur'an reflections, Sacred art, Structural design, Symmetry

EXPLORING ISLAMIC GEOMETRIES

by

MARYAM J. AL-AINATI

A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of

Master of Fine Arts

in the College of Arts and Sciences

Georgia State University

2012

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2012

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## 1 INTRODUCTION

Art is the mirror of a culture and its worldviews. In my experience, there is no case to which this statement more directly applies than the art of the Islamic world because of its deep connection with religion and the Middle Eastern lifestyle. Growing up, I was always fascinated with various styles of art that surrounded me. From the massive domes in its architecture, to interiors, fine arts and crafts, Islamic art's presence is infused in all aspects of the Middle East. Being exposed to the many forms of Islamic art has made it a part of me, coded naturally like culture. This drives me to explore the diverse realms of its art forms and traditions. Islamic art mirrors its culture and more importantly the spiritual realm, the universe, life, and the relationship of parts to the whole. With its different forms, I have gravitated more towards a specific type of Islamic art – the art of Islamic geometries.

As an artist my inspirations reflect on Islamic art, whether in structure, symbolism or aesthetics. These instilled grounds have always been an underlying motive to my creative drive. I remember as a young girl I would go by the window only to enjoy the lights and shadows being cast from the Islamic designed screen. Rays of light would filter through as geometric patterns covered the floor and sometimes walls, draping on surfaces as the sun set. The simplicity and complexity, balance and unity, have inspired me to not only carry on the artistic tradition, but to take part in Islamic design as well. Geometry has always been a subject of great interest to me. Like a decoded message to be solved, the geometries of Islamic art based on mathematical principals lead to rhythmic and infinite shapes and patterns. This passion for the arts motivates my designs and visions of this traditional art form in a contemporary interior setting.

Geometric patterns occur in rich profusion throughout the Islamic culture with a diversity of materials and cover numerous surfaces. The intricate geometric patterns that decorate the monuments of the Islamic world have always intrigued contemporary artists and art historians. These patterns, cleverly interlocking with each other, create unique compositions. The geometries on both sacred and secular objects, comprised of patterns, forms, and symbolism, are an integral part of Islamic history and culture. The solidarity of the geometries equates to the solidarity of family, culture and religion allowing for this art to be a quintessential representation of the Islamic lifestyle.

As my interest lies in process exploration and development, I am fascinated by their configurations. "Islamic geometric patterns are powerful visual compositions that explore hidden structures and lead to infinite grounds of pattern finding. Exploring and understanding these geometric grounds can lead to finding an Islamic geometric pattern that fits with-in a contemporary composition for a meditative interior reflecting a nexus universal language. These self-evident mathematical patterns with the esoteric philosophical values became the invisible foundation upon which the 'art' was built. This meant that the Islamic artist was not only versed in mathematics in the geometrical sense, but that mathematics was integral to his art as it was a 'universal' structure supporting the intuitive insights that characterize all true art. The great masters of this art were certainly motivated by and versed in spiritual disciplines that gave both content and meaning to their work and placed it in the tradition of aiding the viewer to raise his or her spiritual understanding."

(Critchlow, 1976)

## 1.1 Purpose of the Study

As I draw on the Islamic art, I aim to extend the Islamic vocabulary beyond its original framework, developing new narratives that reconfigure and challenge the original idioms, complying with the perception of contemporary use. A complex interaction is then at work; the platform from which my art emerges involves reflections from both the Islamic and the contemporary canons. By applying an art that speaks in a language marked with a mixture of accents, I design a pattern that stems from traditional form, yet is fitting for contemporary interiors.

Creating infinite harmonious pattern is nourished in the Islamic arts, recognizing in the geometry the unifying intermediary between the artistic and the spiritual realm. The foundation of Islamic art is based on established mathematic, artistic, and most importantly symbolic, conventions. The combination of the three gives these forms their Islamic design. Islamic design is a style and an expression that has been a signature to the arts of the Islamic world. Bound to the Islamic arts by a sense of direct kinship and the path of an exotic curiosity and interest, I intend to focus on hidden structures of geometries, visual strength and symbolic reference of geometric principles to truly capture its harmony. Exploring pattern formation and process of design development unfolds Islamic design's universal language as it reveals an art of sacred geometries. To expand the realm of Islamic geometries, my art must draw from the arts of my forefathers, the cultural inspirations and innovations, as well as the lesson of a classical background, the lesson of discipline, of style, and of technical control pushed to the limits of artistic mastery.

In the Arab world, math was treated not only as an exercise, but also as a functional system for organizing a number of practical operations. Religious observances such as the

daily times of prayer, the holy month of Ramadan, and divisions of inheritance, to name a few, are all part of the Islamic existence. Geometries connect math, art and religion as they depict the clearest representation of perfection. Math was also closely related to astronomy and astrology requiring a degree of precision for guidance before the advances in technology evolved. Similarly, math plays an essential role structuring the geometries of the Islamic arts as it reflects on religious and cultural ties.

A very strong link between art and mathematics is evident as the intellectual interplay of math and design create infinite patterns. Geometric patterns may be enjoyed purely as decorative art, or as a didactic experience of art and science in unity. Many of these are extremely elegant and convey something deeply profound about the aesthetic beauty of geometric forms. The calculations and organizations range from simple structures to complex detailed designs forming compositions that reveal beauty unparalleled by any other art form. This unified yet diverse form holds great significance to meditative art. Layering, interlocking and interweaving an arrangement of elements create geometric patterns that multiply reflecting the infinite. Exploring their structures and roots, Islamic geometric patterns can give added levels of contemplation to those understanding them, and perhaps those who might not.

The sacred art of the Islamic geometries is infused with spiritual and cultural symbolisms. Islamic geometric patterns all came from the same origin – a circle; the essence of all geometric forms symbolizing unity, multiplicity and the infinite. Circle compositions that formulate pattern in the Islamic arts are made-up of three main group formations; family of four, five and six point geometries (Figure 1). The family of four-point geometries, referred to as the *Divine Breath*, symbolize the foundation of creation,

liberating possibilities of the four elements: earth, water, fire, and air. With proportions fitting for curved surfaces, such as domes in mosques, Family of five-point geometries, *Divine Unity*, convey the five pillars of Islam. The family of six-point geometries, *Divine Creation*, is the ideal representation of the six days of God's creation to the universe as mentioned in the Holy Qur'an.

As the art of geometric patterns develop in the Islamic world, artists inevitably challenged themselves to discover ingenious ways of creating patterns derived from more circle group formations, such as a family of seven, nine, and eleven-point geometries among many more; aiming to expand the grounds for Islamic geometric patterns. Circle groups are the family of point-geometries a pattern generates from in the Islamic art, while circle compositions and geometric formation are the infinite pattern creations that derive from a specific circle group, or groups, holding certain point-geometries. As the geometries multiply, mirror and overlap, they create numerous geometrical arrangements of highly defined patterns; patterns that allow our minds to wander, looking beyond its aesthetic appeal, as one explores the geometries and is drawn into its meditative qualities.

In the pattern structures of the Islamic geometries are hidden fundamental shapes that lie, not very notable, within these structures. Family of four-point geometries reveals a square grid, five-point a pentagon grid, and six-point geometries sustain a triangular and hexagonal grid. The square in several cultures, as in the Islamic background, is symbolic of the physical world and experience or materiality. The triangle is symbolic of human consciousness and the principle of harmony; and the hexagon is of the Heavens. All approaches to the interpretations of shape representations lead to the same path of perception and observation. In all, geometric patterns of the Islamic arts are distinct. With

star shaped focal points, the ray-like qualities extend from the omnipresent centers of circle compositions to web geometries as they eco harmonious and rhythmic arrangements, as if radiating light from the heavens, making the star a fitting symbol for the Islamic arts.

Mathematically, artistically and symbolically rooted, Islamic geometric patterns hold cultural and spiritual content that develop initiatives to new artistic idioms as well as a renewed mastery of these ancestral arts – expanding the knowledge and possibilities in today’s contemporary settings. Driven by innate insights that characterize art, I strive to combine traditional and cultural theory within Islamic design framework to fit contemporary profile. My collaborative research goal is to create a geometric pattern that unravels a contemporary Islamic design composition, thereby leaving a lasting universal impression on the way one perceives Islamic forms in today’s interiors.

If the original artistic endowments can be sufficiently augmented, absorbing the new content, to express a contemporary perspective to pattern assimilations, then my art may well become what I aim for it to be, the art of contemporary Islamic geometric design compositions. Such attempt would entail a focus on process, pattern, design assessment and creativity to encompass a balance between the pragmatic desires for efficiency, symbolic reference and an aesthetic drive for beauty abundant in the Islamic arts.

## 1.2 Expected Results

With an expressive and explorative approach, my expected result is to create a form that not only encompasses traditional Islamic design, but a form that will allow these designs to evolve with contemporary interiors as a new and additional art of the Islamic geometries. Masterful over its material in a powerful simplicity of conception, design and effect, Islamic geometries can transform interiors giving an artistic, spiritual, and cultural



touch that may leave a lasting impression, captured in memory. As the contemporary Islamic design composition is introduced to an interior, the geometries are celebrated emphasizing their essence in formation, symbolism, and aesthetic appeal.

My design is to bring out the foundation of these geometries, process of pattern formation, and different ways to view them, expanding on to the realms of Islamic geometric compositions. Derived from the unity in mathematical compositions, artistic appeal essential in the Islamic arts, with the symbolisms and principles that seal a coded structure to all geometric forms in the Islamic art, the design unfolds discovering the limitless wealth of decorative and symbolic qualities that the geometries overlay. Their infinite pattern revealing process, unity in structure, multiplicity in form, and new perspective is fitting in a present content. A rich mixture of cultural background, origin of the geometries and a contemporary view of exploration is presented. Transforming and influencing interiors, a beautiful visual memory is manifested, conceived on its own patterns to be interpreted by the observer. The sophisticated qualities of geometric pattern unravel creating a contemporary Islamic art of geometries. In order to accommodate contemporary practices, intuitive drive takes its role allowing art to be an imprint and signature of the artist creating it. This new concept to the universally recognized work of art allows for added levels of contemplation. This sacred art has an effect that leads to a path of perception. The visual structure of Islamic art is rich and meditative, designed with matter that best embodies spiritual perspective. Stressing the essence of circle compositions, the design celebrates the geometries, their principles, and structures that give them their Islamic appeal. The intuitive drive for the design presents its visual choices mirroring a cultural art that stems from childhood memory and new perspective to the Islamic art. The

combination from both traditional and contemporary worlds reveal a composition that weaves in interiors both to preserve and expand the opus of Islamic art.

## 2 EXPERIMENT

In order to study the geometries and their design process, their form, and the patterns I am focusing on the three main group formations in the Islamic geometries. The family groups represent the essence of Islamic geometries and offer the most direct avenue for explorative representations to offer the new 21<sup>st</sup> century. My purpose is to understand these coded structures that hold numerous geometric pattern in order to explore new possibilities in pattern formation. The geometric compositions reveal a grid defining the basis of these structural patterns. With clear rhythm to the patterns of the Islamic geometries, this study allows me to explore beyond the traditional Islamic designs by engaging different ways to amalgamate the geometries. In order to do so, a pattern would be derived from traditional form, pushing beyond the existing frame of Islamic geometries. Extending, combining, and adding new coded rhythms that derive from the studies challenge conventional thoughts leading to an abstract contemporary composition that houses traditional form and geometric constructs. Maintaining the reoccurring essential focal points in the geometries will help the structure maintain its Islamic appeal while creating a new explorative experience and effect.

## 2.1 Foundation Study

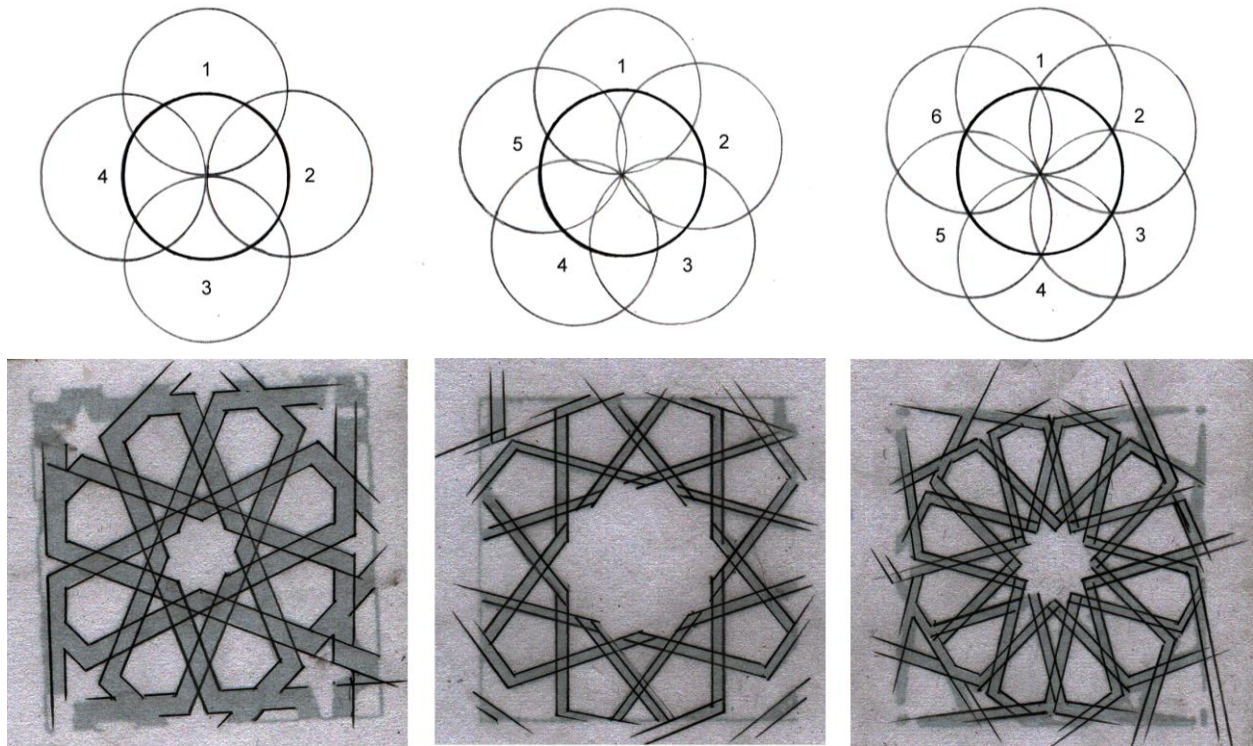


Figure 1. Original Components of Islamic Geometries

Studying the grid from which the art of Islamic geometries form and the multiplicity of their structure provide a ground from which my exploration stems. A strong foundation is necessary in order to apply the same vocabulary of codes that gives these structures their Islamic appeal. Although calculated, the mathematical qualities of the Islamic geometric structures are visually fluid in their forms. By focusing on the three main traditional Islamic design groups made up of four, five, and six point geometries, I explore their geometric formations, circle compositions, and the collaboration of both. These categories will help breakdown each structuring aspect of Islamic geometric pattern, under which I focus on their original form, explorative transformation process, and my take on exploring these sacred geometries three dimensionally.

The geometric formations vary from simple to complex organized structures that explore the multiplicity and unity of an arrangement of elements creating elegant infinite patterns and design variations. I start by recreating Islamic geometric designs of the original art form laying the grid from which these geometries emerged. Elements guided and bound by the grid, extend and multiply as the pattern grows dense. Layering, overlapping and interweaving of elements create rich intricate patterns that are based on mathematical principles. The process of these highly detailed patterns is both an intuitive and a calculated exploration.

Focusing on the growing pattern of the design, I arrange a sequence of process studies that highlight the transformation from original form to a three dimensional exploration. Grounded in geometric principles, my exploration expresses the multiplicity of the design geometries as they unfold a new emblem of Islamic art. The geometries led to more pattern explorations when addressing a new formation process to the applied elements. With a clear display of the process stages of the geometries, one can identify and contemplate to the pattern detail.

The new pattern explorations highlight the original structured grid of Islamic geometries as the arrangement of elements reveal a new charted composition. The composition is an art reflecting original geometries, process development, and a ground for new explorative designs. Although the structures of the geometries are fixed, their form and infinite pattern is fluid, as the play of light casts shadows that accentuate the layered arrangement of elements.

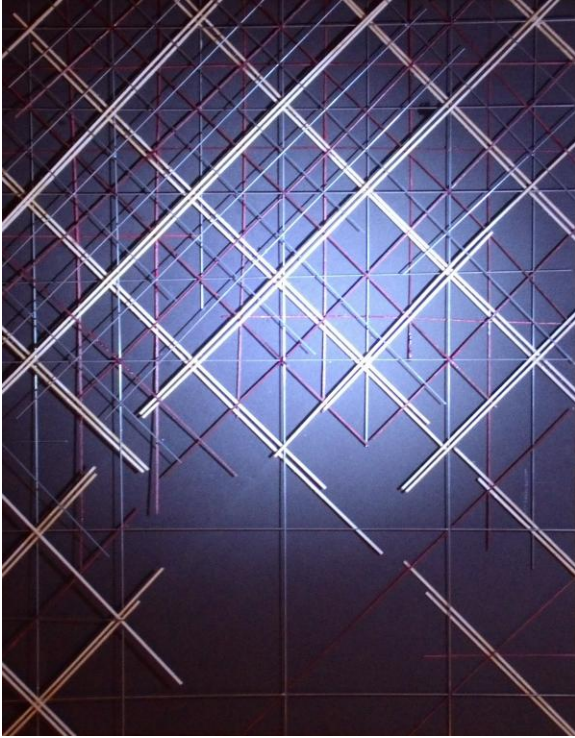


Figure 2. Line Exploration: Original Formation, 4-point geometries

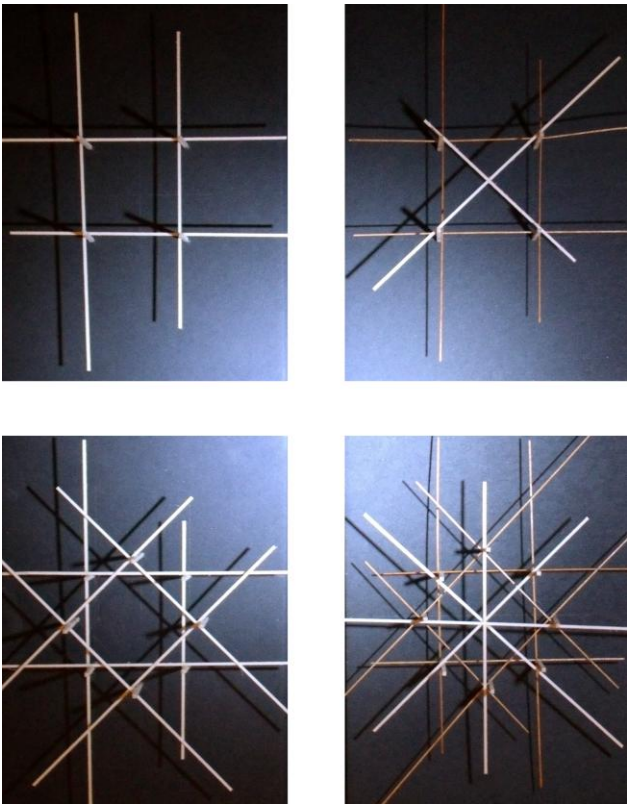


Figure 3. Line Exploration: Transformation Process, 4-point geometries



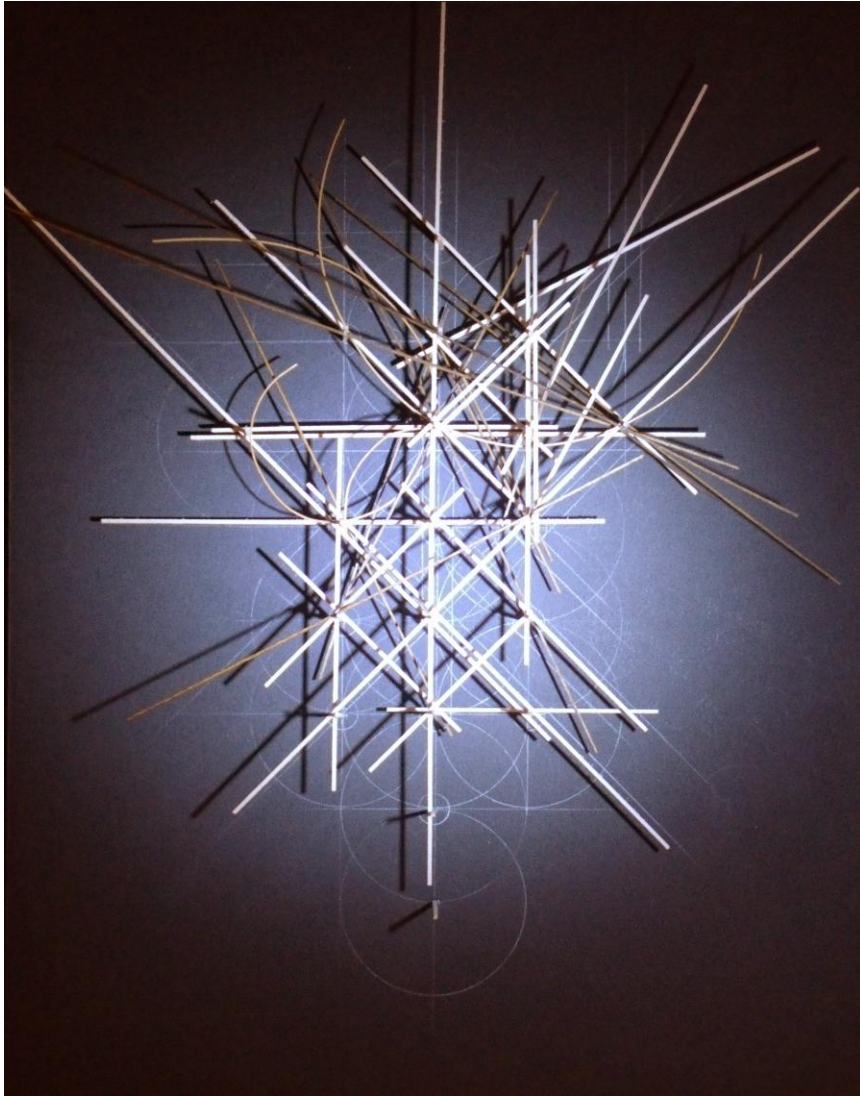


Figure 4. Line Exploration: Pattern Finding, 4-point geometries

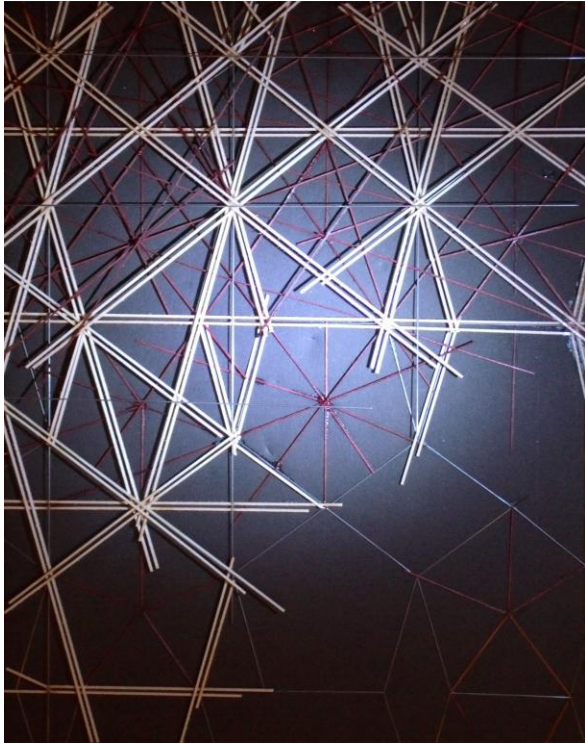


Figure 5. Line Exploration: Original Formation, 5-point geometries

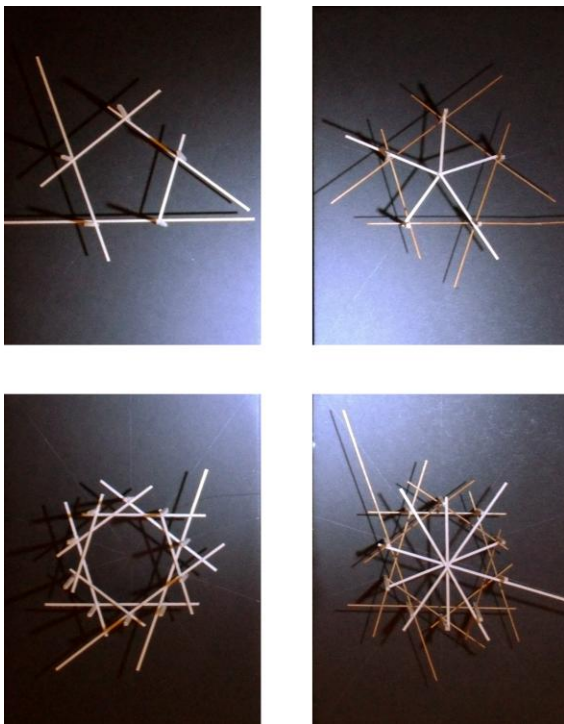


Figure 6. Line Exploration: Transformation Process, 5-point geometries

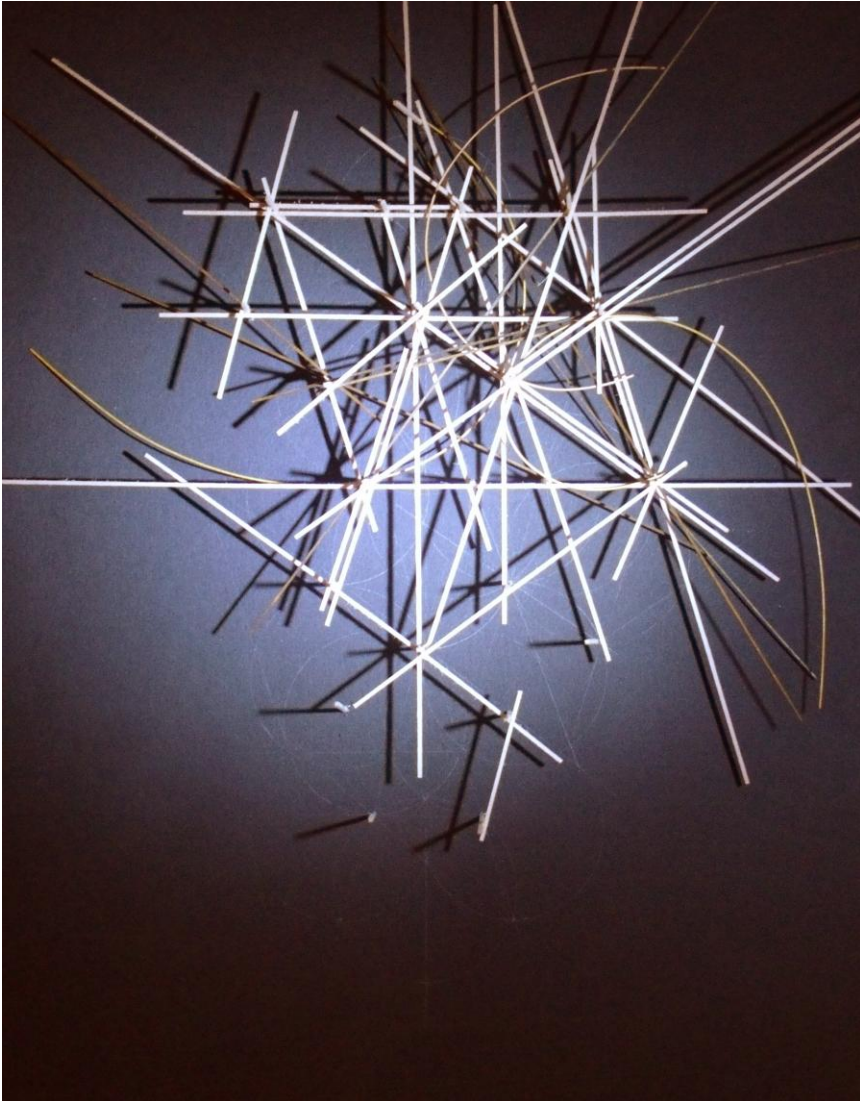


Figure 7. Line Exploration: Pattern Finding, 5-point geometries



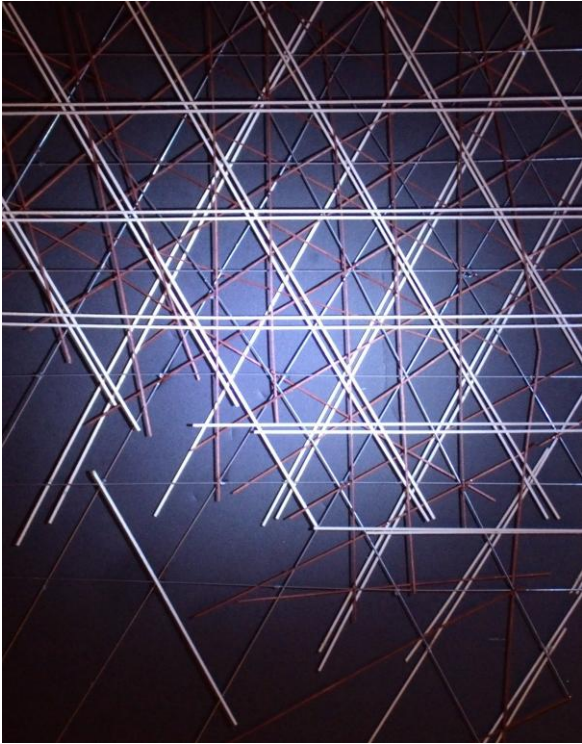


Figure 8. Line Exploration: Original Formation, 6-point geometries

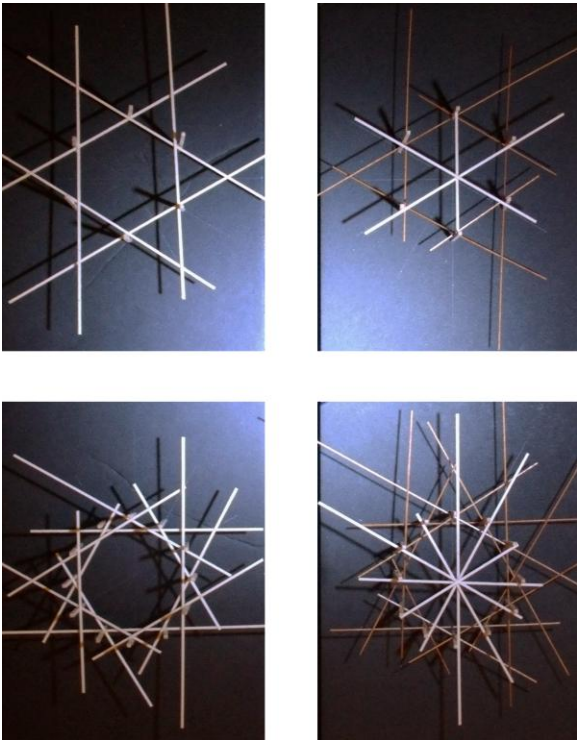


Figure 9. Line Exploration: Transformation Process, 6-point geometries

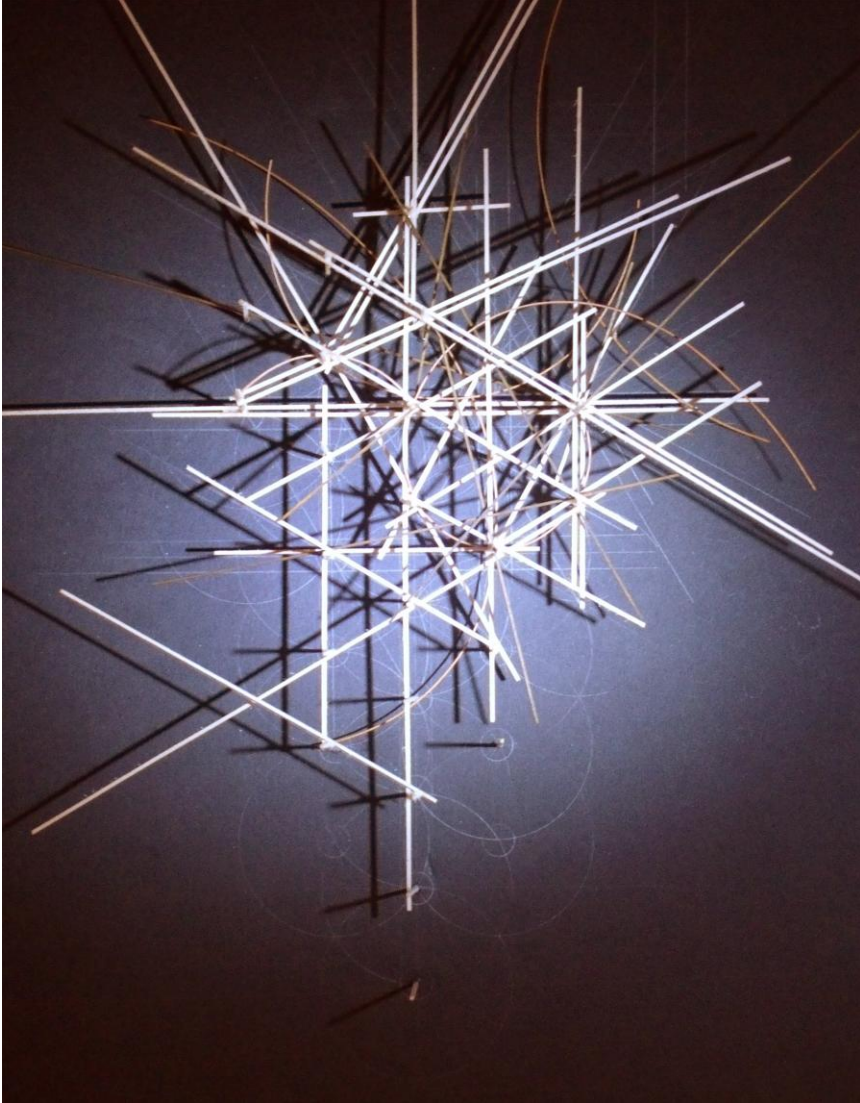


Figure 10. Line Exploration: Pattern Finding, 6-point geometries

Circle compositions are usually considered to be the 'hidden grid' structuring the elements that create pattern geometries. For most Islamic geometric artwork, the visual structure is of selected line elements drawn from the organized arrangements of a circle group. Few patterns reveal hints of these circle compositions that the geometric grid is derived from. Understanding geometric circle compositions aids in viewing the rules of the coded structures, giving infinite possibilities to its organized rhythms.

With reoccurring omnipresent centers, the circle is a focal center point underscoring the function of the elements in geometric pattern and structural formation. The traditional form of the family group circle compositions of four, five, and six point geometries is an organized arrangement of harmony and proportion. Equally spaced and aligned, each circle is a focal point to a sprout of organized geometries. Clear visual presentation of single units of circle groups evolve into a three dimensional exploration of the structures. The circle group units transform by evenly raising its outer corners of the individual circles, while maintaining the shared focal point the center of circle group. Like a blooming flower, these compositions reveal a concave structure to experiment with in a three dimensional exploration of the Islamic design.

From the original two dimensional layout to its three dimensional structure, this exploration of growing form develops to an abstract new formation of circle compositions in the Islamic design. The form expands as the 'peeling' of the two-dimensional form transforms into a three-dimensional exploration. With light casting on the explorative design, shadows drop laying yet another ground of circle arrangements to observe.

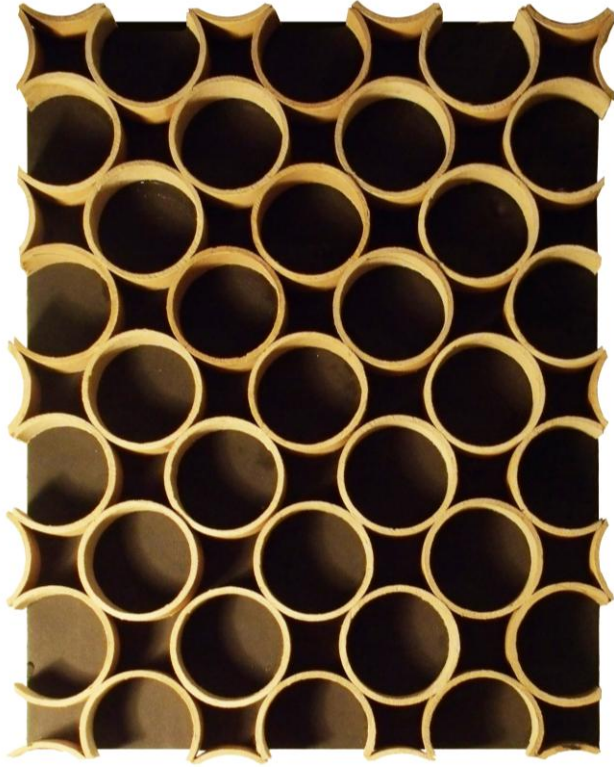


Figure 11. Circle Exploration: Original Formation, 4-point geometries

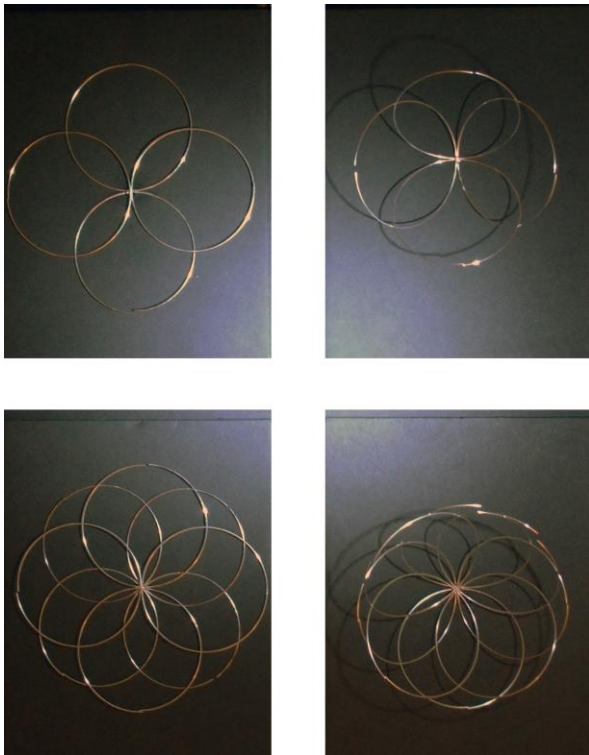


Figure 12. Circle Exploration: Transformation Process, 4-point geometries



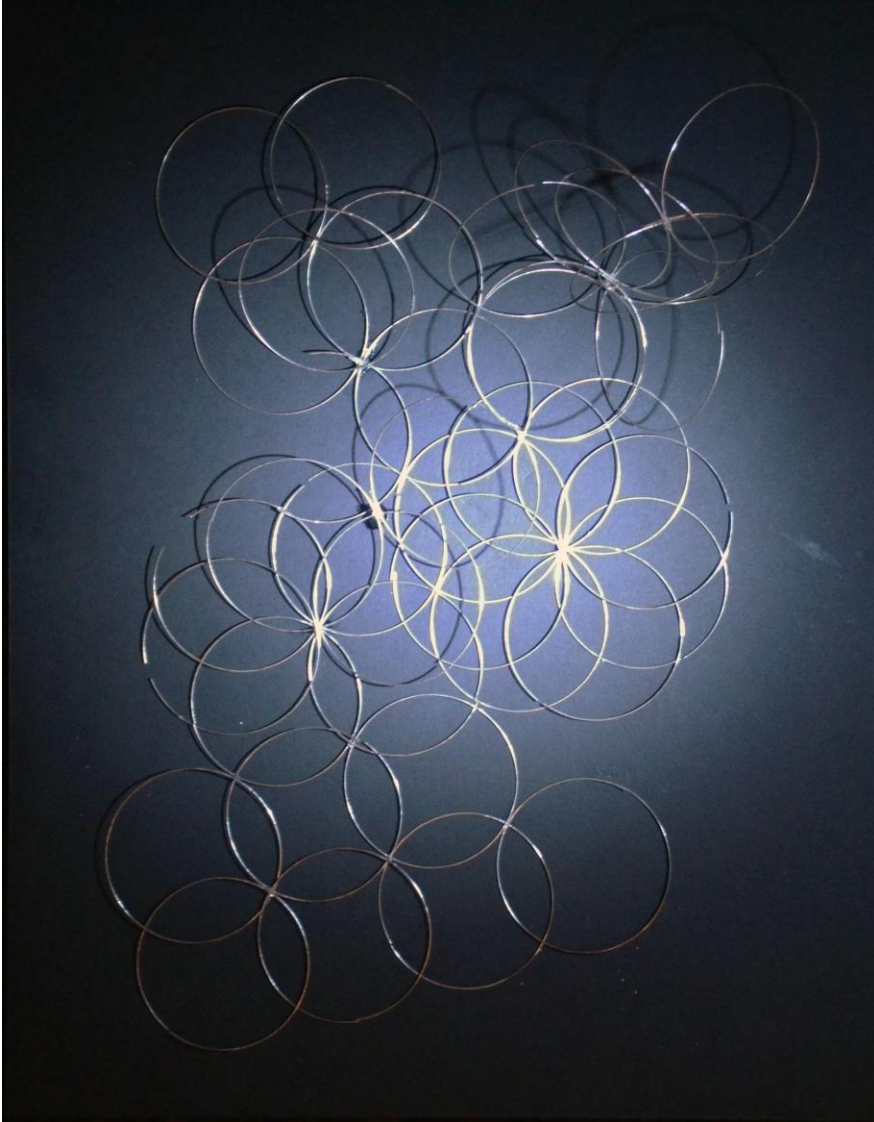


Figure 13. Circle Exploration: Pattern Finding, 4-point geometries



Figure 14. Circle Exploration: Original Formation, 5-point geometries

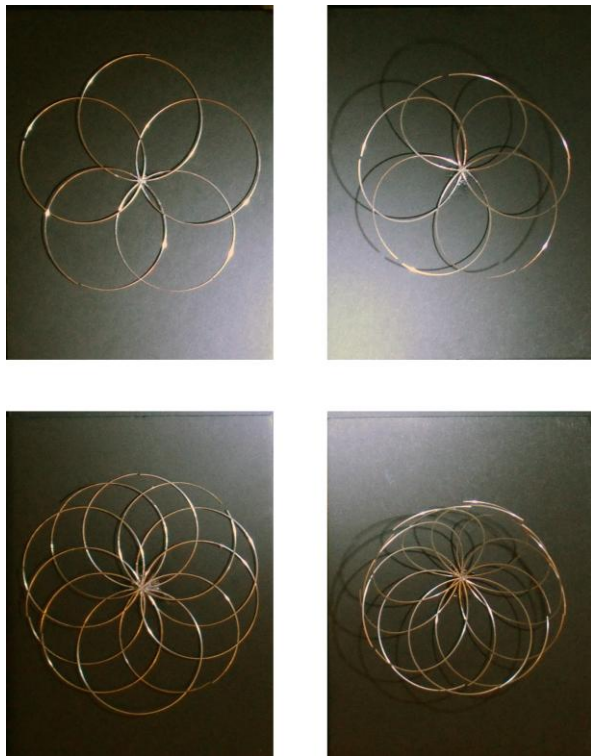


Figure 15. Circle Exploration: Transformation Process, 5-point geometries



Figure 16. Circle Exploration: Pattern Finding, 5-point geometries





Figure 17. Circle Exploration: Original Formation, 6-point geometries

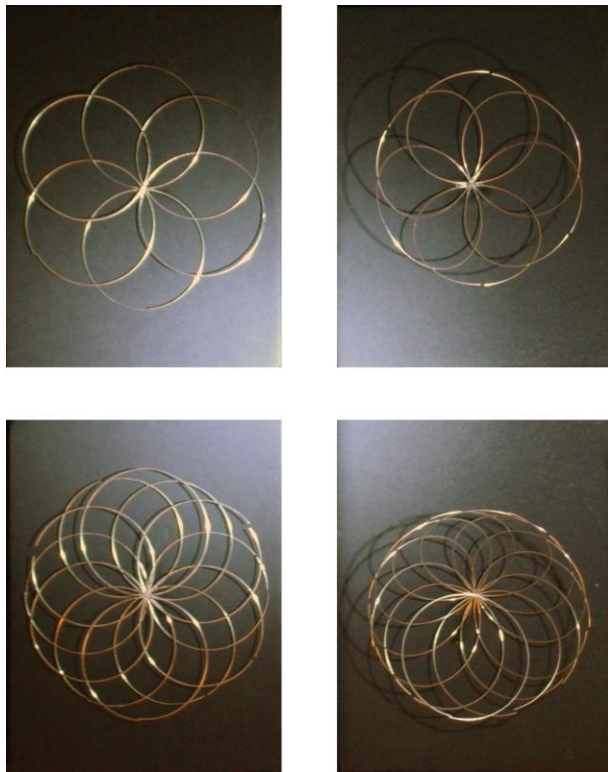


Figure 18. Circle Exploration: Transformation Process, 6-point geometries





Figure 19. Circle Exploration: Pattern Finding, 6-point geometries

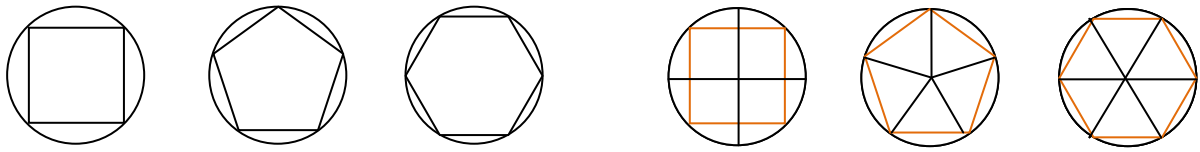


Figure 20. Geometric Series: Collaborate Design

Lines and circles applied under geometric codes structuring Islamic arts may or may not be visible. By exploring both structures that define their formations and engaging them in a composition of four, five, and six-point geometries uncovers a coded canvas. The dense collaborate composition sets a precedent for the developing exploration to be unraveled. My prior explorative studies of line arrangements in geometric formations, as well as the grouping of circle compositions, took more of an intuitive three dimensional path rather than a fixed mathematical trace. In this collaborative study of form development, I will expose both lines and circles that ground the traditional forms and define their geometries in order to derive a calculated code for a three dimensional display of the Islamic art of geometry.

Applying geometric codes instead of abstract contortions towards a three dimensional form striving for an art to evolve with visual qualities of Islamic geometries. A progression from the original form carries the calculated pattern to its new three dimensional arrangements of geometric principles. The transformation is a calculated process as interplay between the ray-like elements and the circle compositions reflect on one another. The new code findings are applied with direct ties to the shape taking form in space based on its evenly divided point geometries, found as the principles take form.

Table 1. Three Dimensional Calculations: 4-point geometries

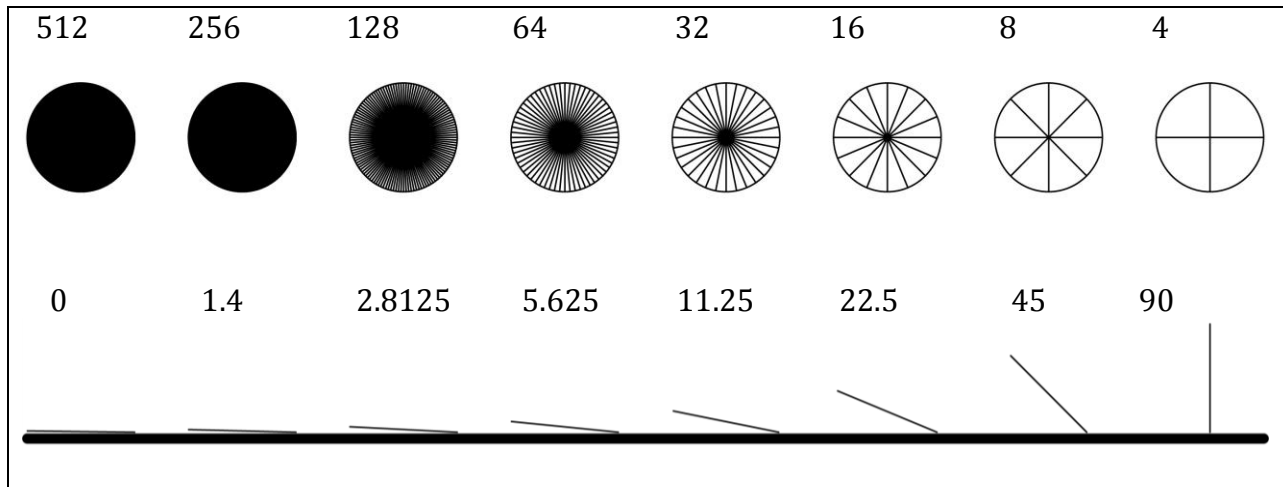


Table 2. Three Dimensional Calculations: 5-point geometries

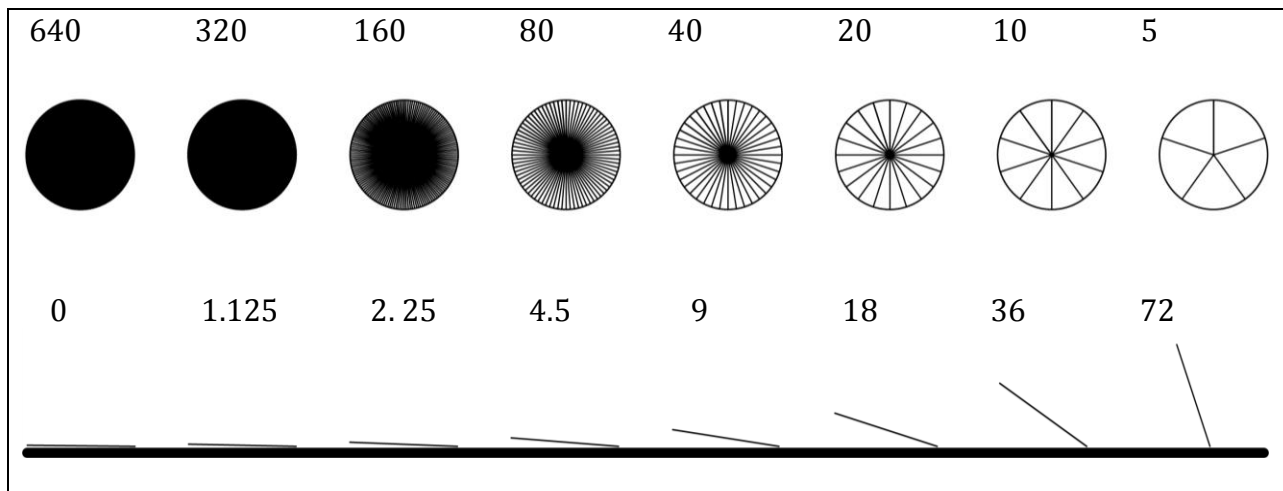
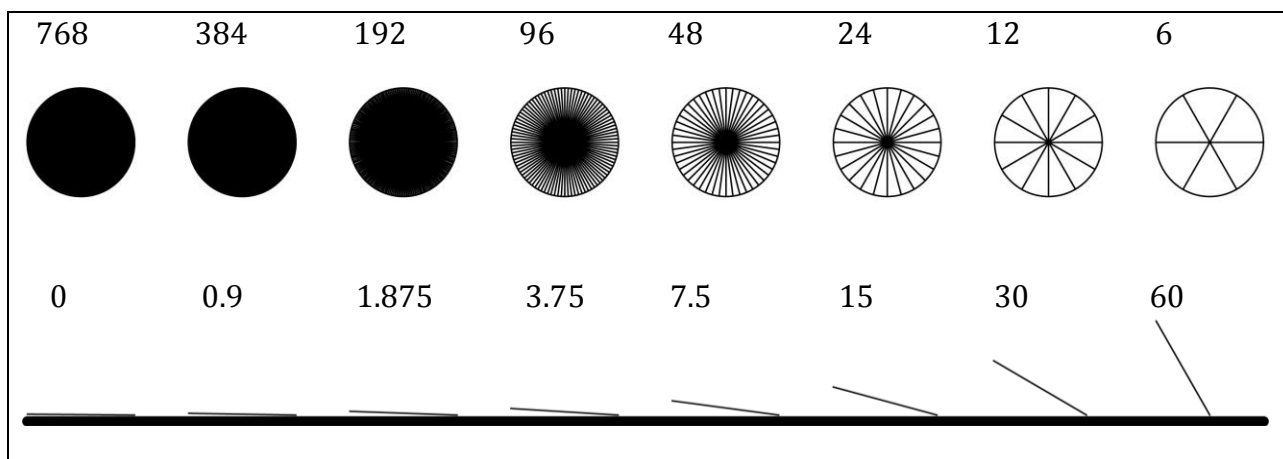


Table 3. Three Dimensional Calculations: 6-point geometries



The diagram shows the calculated systems to the three dimensional formation. Similarly to the two dimensional coded structures, the three dimensional forms are rooted from a circle and the point geometries it holds. Point geometries divide the circle into angles; angles that set a three dimensional structure to the form expanding from the set two dimensional grid of geometries. The angle is determined by both the number of line geometries that divide the circle, and the angle of the circle that grounds these geometries.

With the four-point geometries, for example (Table 1), the  $360^\circ$  of a circle is divided into four parts leaving  $90^\circ$  degree angles, or,  $360 \div 90 = 4$ . Next multiple of the four-point geometries is  $4 \times 2 = 8$ ; now I divide the 360 by 8 equaling  $45^\circ$  - the angle in which the shape takes form three dimensionally. The following multiple is  $8 \times 2 = 16$ ;  $360 \div 16 = 22.5^\circ$ , etc. As the number of rays double, the angle of the circle peeling from the two dimensional canvas decreases. The same formula applies to the five and six-point geometries respectively.

With the understanding of geometric principles of the underlying grids and methods used, I applied added rules to imply a three dimensional design composition to find a three dimensional Islamic geometric pattern. This exploration investigates the connection properties, scale, and relationships of points, lines and angles taking form in a three dimensional composition.

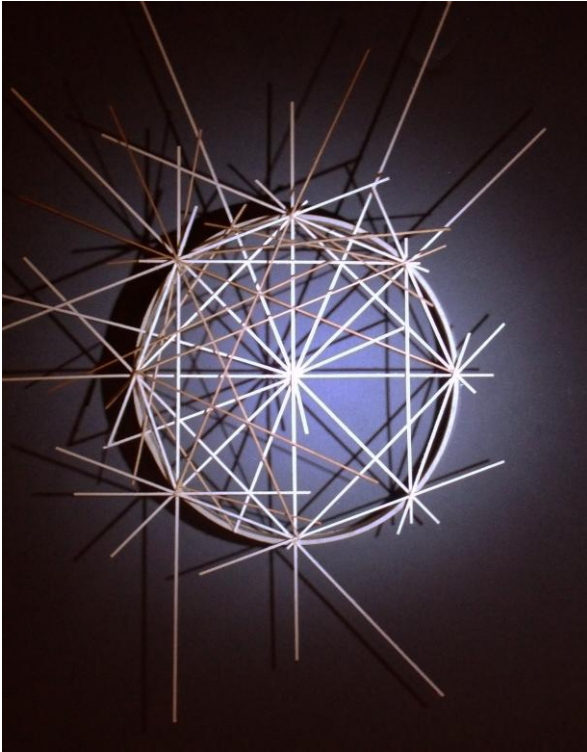


Figure 21. Combined Exploration: Original Formation, 4-point geometries

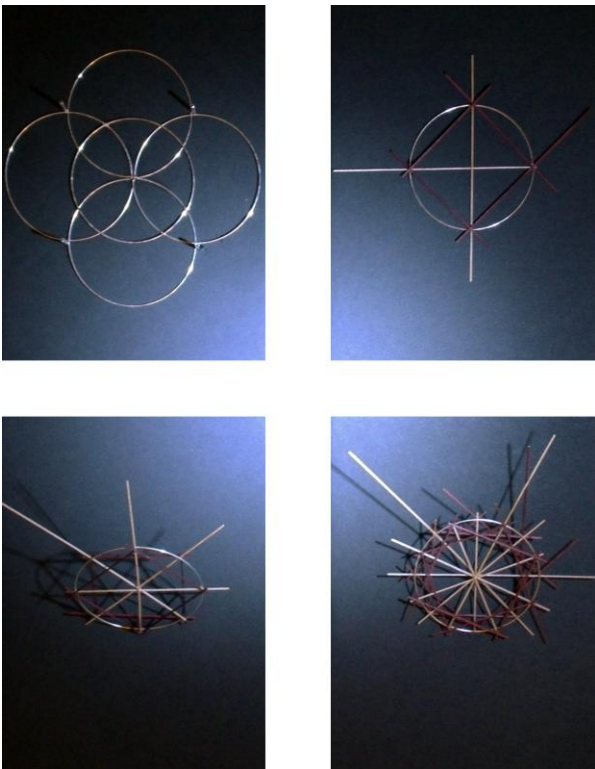


Figure 22. Combined Exploration: Transformation Process, 4-point geometries

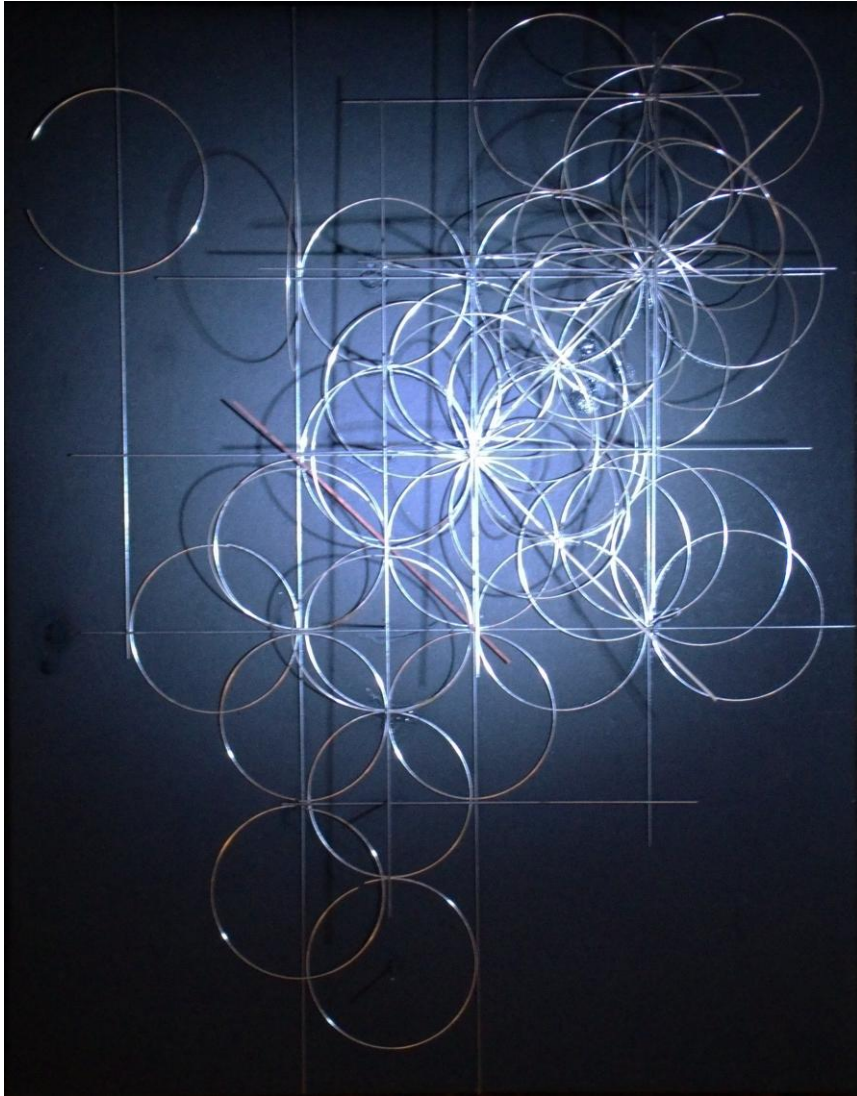


Figure 23. Combined Exploration: Pattern Finding, 4-point geometries





Figure 24. Combined Exploration: Original Formation, 5-point geometries

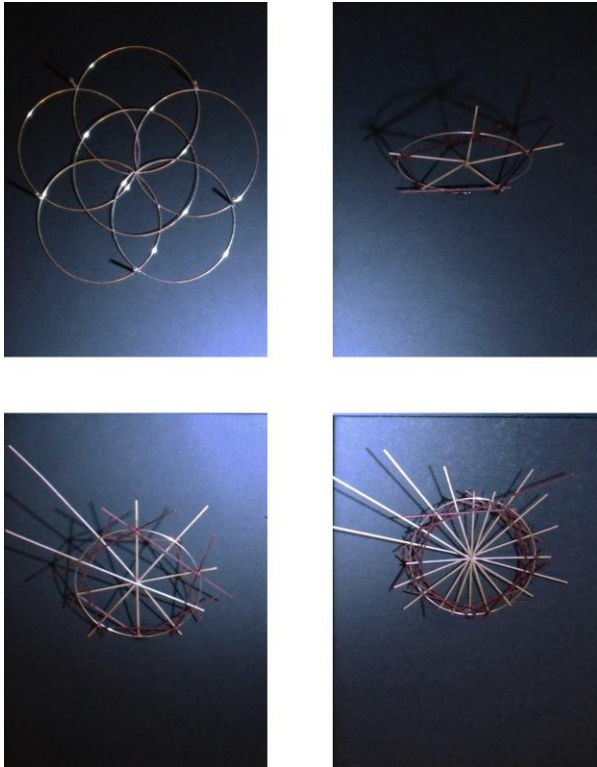


Figure 25. Combined Exploration: Transformation Process, 5-point geometries

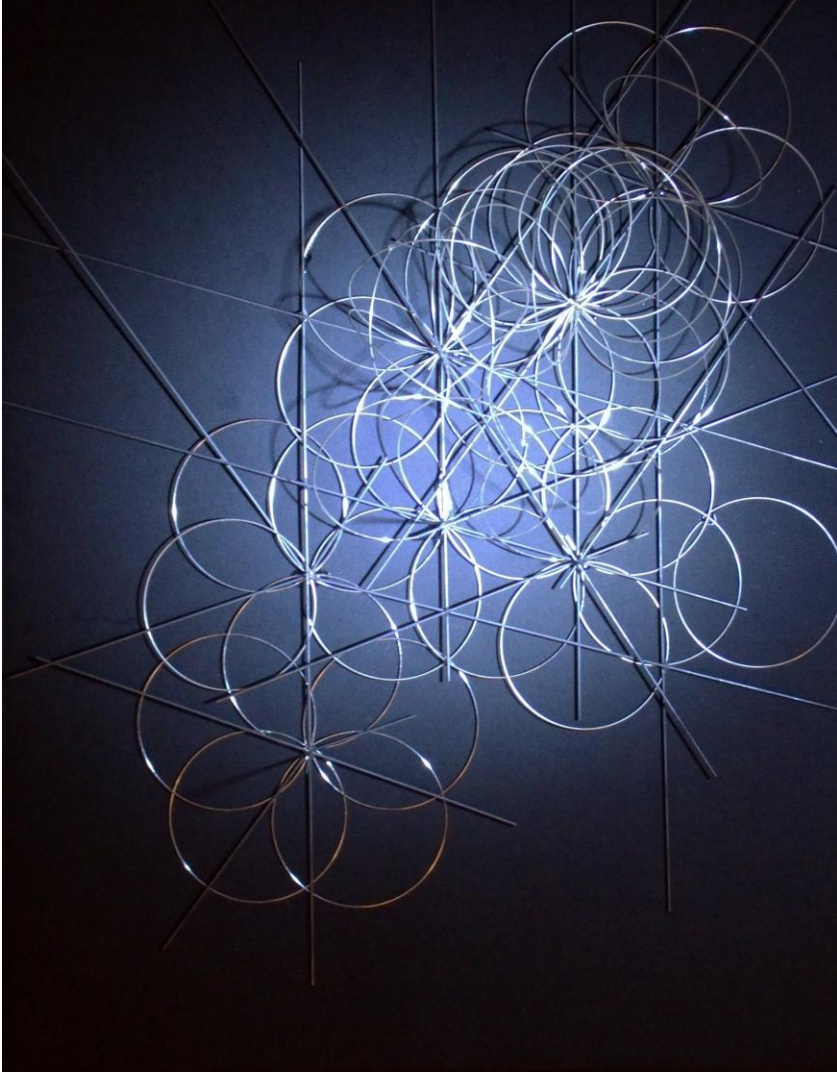


Figure 26. Combined Exploration: Pattern Finding, 5-point geometries



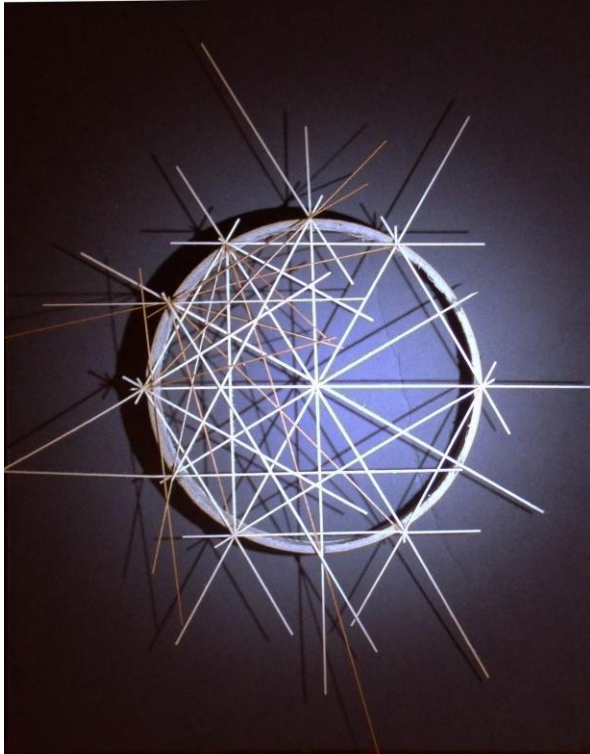


Figure 27. Combined Exploration: Original Formation, 6-point geometries

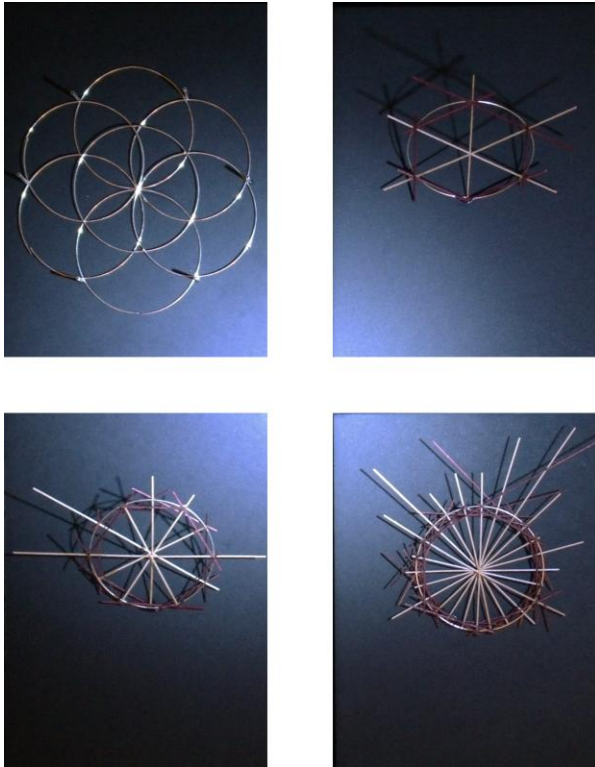


Figure 28. Combined Exploration: Transformation Process, 6-point geometries

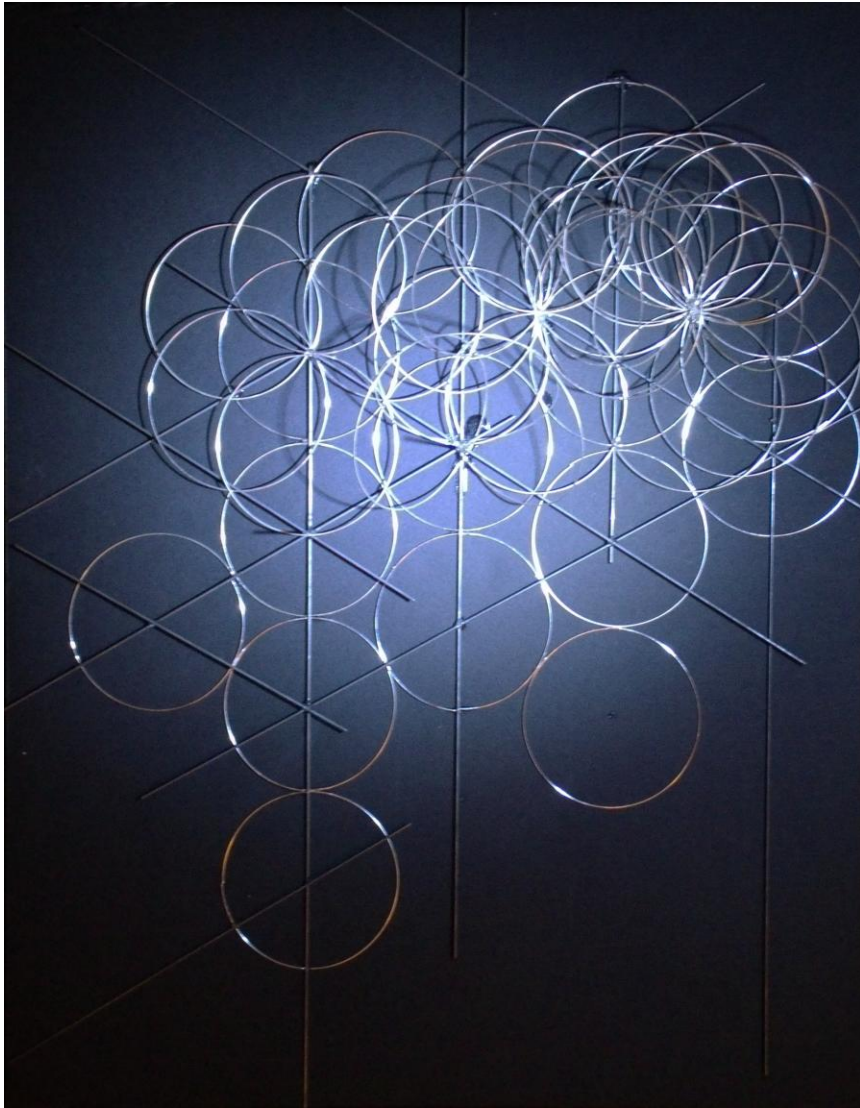


Figure 29. Combined Exploration: Pattern Finding, 6-point geometries

The explorations highlight the original, transformation process, and results of Islamic geometric studies as they take three dimensional forms. Line formation as well as the circle family composition study led to a three dimensional abstract composition. But, in the collaborate study of the series; a calculated path was taken similarly to that of Islamic geometric patterns. Both non-calculated and calculated, the form has a fluid nature. The explorations whether intuitive or calculated code, carry a pattern. This explorative process of organized arrangements gives clarity to the notion of Islamic geometric pattern as a complete yet infinite perfection. This is also a characteristic of the new findings of a three dimensional pattern as its forms multiplies with no apparent ending.

As light is cast on the line and circle compositions, shadows lay a blanket of the three dimensional geometries adding new rhythms to the aesthetically, mathematically, and symbolically driven design. "As an architect, interior designer, and artist, Maryam Al-Ainati's complex designs transport viewers into a meditative state. Influenced by the mathematic and geometric features of Islamic art, Al-Ainati's work aspires to create an organic experience for her viewers by challenging them to look beyond the lines. The patterns, symbols and forms that comprise her sculptures are an integral part of Islamic history and culture, and can be found on both sacred and secular object. By breaking down and recreating these patterns, Al-Ainati is able to focus on the process and explore the basic components that give these configurations their appeal. Boundaries between inner and outer worlds break down as light, shadow, and nature reflect from her "growing designs." Al-Ainati's arrangements are a form of guidance that evokes the charting of the stars – a disciplinary practice and prayer – while their repetitive qualities remind us of unity in nature." (Dano, 2011)

## 2.2 Exploration

The geometric explorations unfold the original compositions extending the formations from the grid arrangements. I now use this geometric study in the collaboration of family groups towards an effect that carries through the mathematical, aesthetic, and spiritual core of the Islamic design. By focusing on circle compositions, I apply the three main family groups in conjunction to one another for a juxtaposed pattern to form.

Engaging in exploring the root to Islamic geometries, I bring the family groups together as a structure in effort to surface their spiritual essence. A space that encompasses its meditative qualities transcends one to a spiritual experience within a structure of geometric arrangements. The physical experience is essential to an audience because of its immense effect of physically engaging the body spiritually – to engage the Divine. The structural form applies to the positions of prayer in the Islamic faith for spiritual meditation and prayer. Being that the five daily prayers are based on the angle of the sun, the structure is designed to correspond to the shadows it would cast to the interior of the structure creating an effect viewed only from within. The search for this effect is an immeasurable field making it interesting to delve into the geometries that entail mysteries and bring into question infinite pattern as well as religion and spirituality.

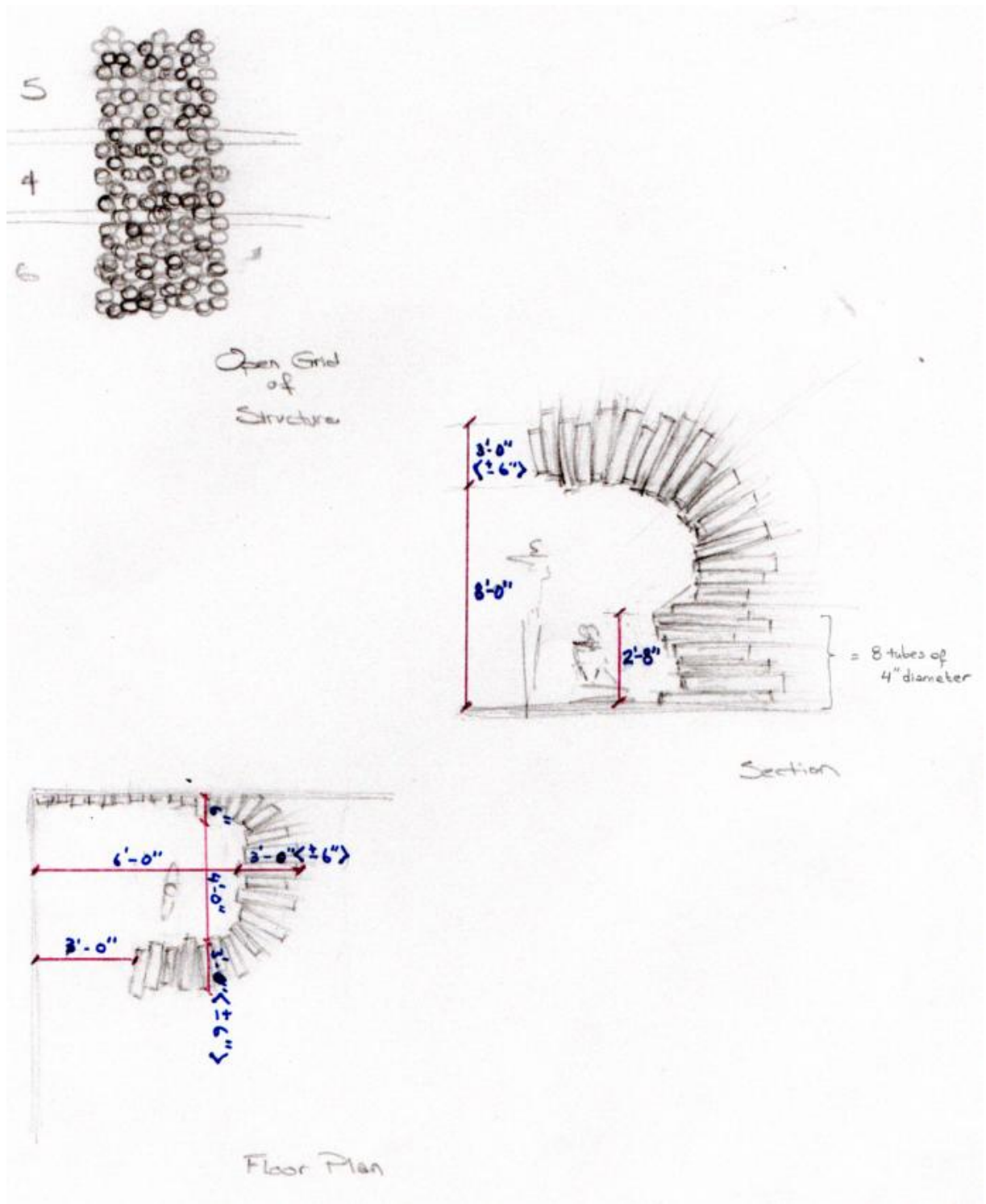


Figure 30. Structure Design

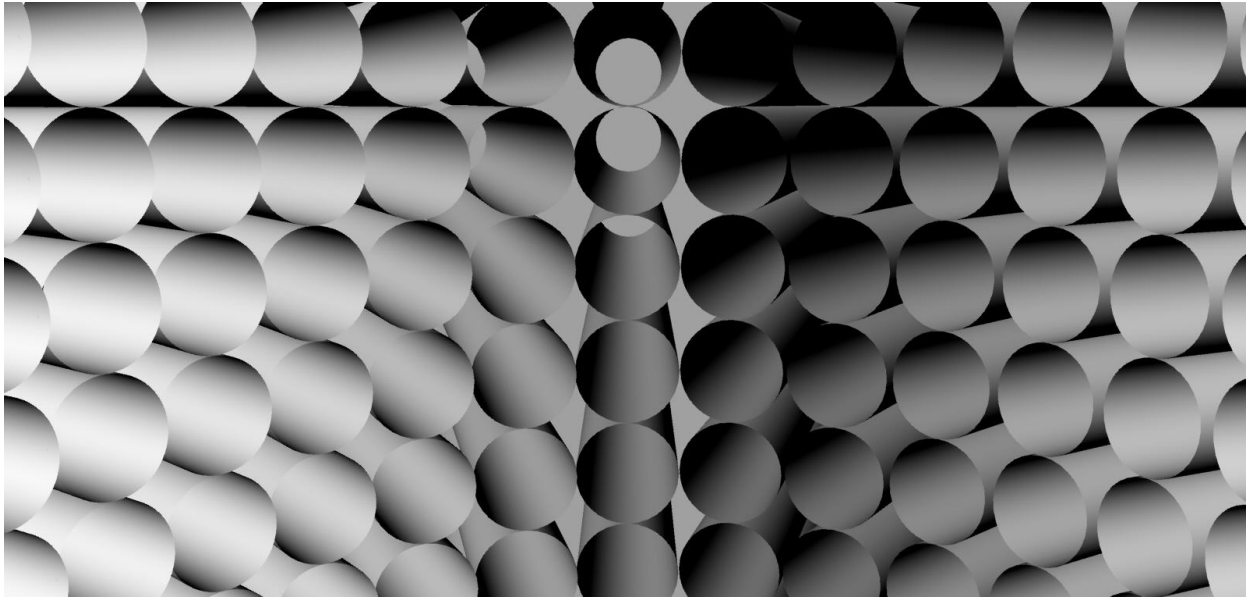


Figure 31. Structural Arrangement

The form of the structure is inviting yet personal. Designed with a low entry way, one must bow down as an act of respect to this meditative space when entering. Light interacts with the structure as it filters thru the structure casting shadows of the circle composition in various directions. A pattern drapes like a blanket over surfaces, covering the wall and floor, changing as the direction of light entering the structure shines from different angles.

The arrangements in the structural formations are of the four, five and six circle compositions. The base of this structure is of the six-point circle compositions. Gaps between the circles are in close proximity allowing minimal light and view from the outside giving privacy to the observer. Another reason for this composition to be the base is that it is the most structurally stable for support. The family of four-point compositions is the next layer of design which is more suitable for a mild exposure of light to penetrate the structure. The top layer is a five-point circle composition due to its flexibility to curve like a dome, permitting most exposure from above, as if open to view the heavens.



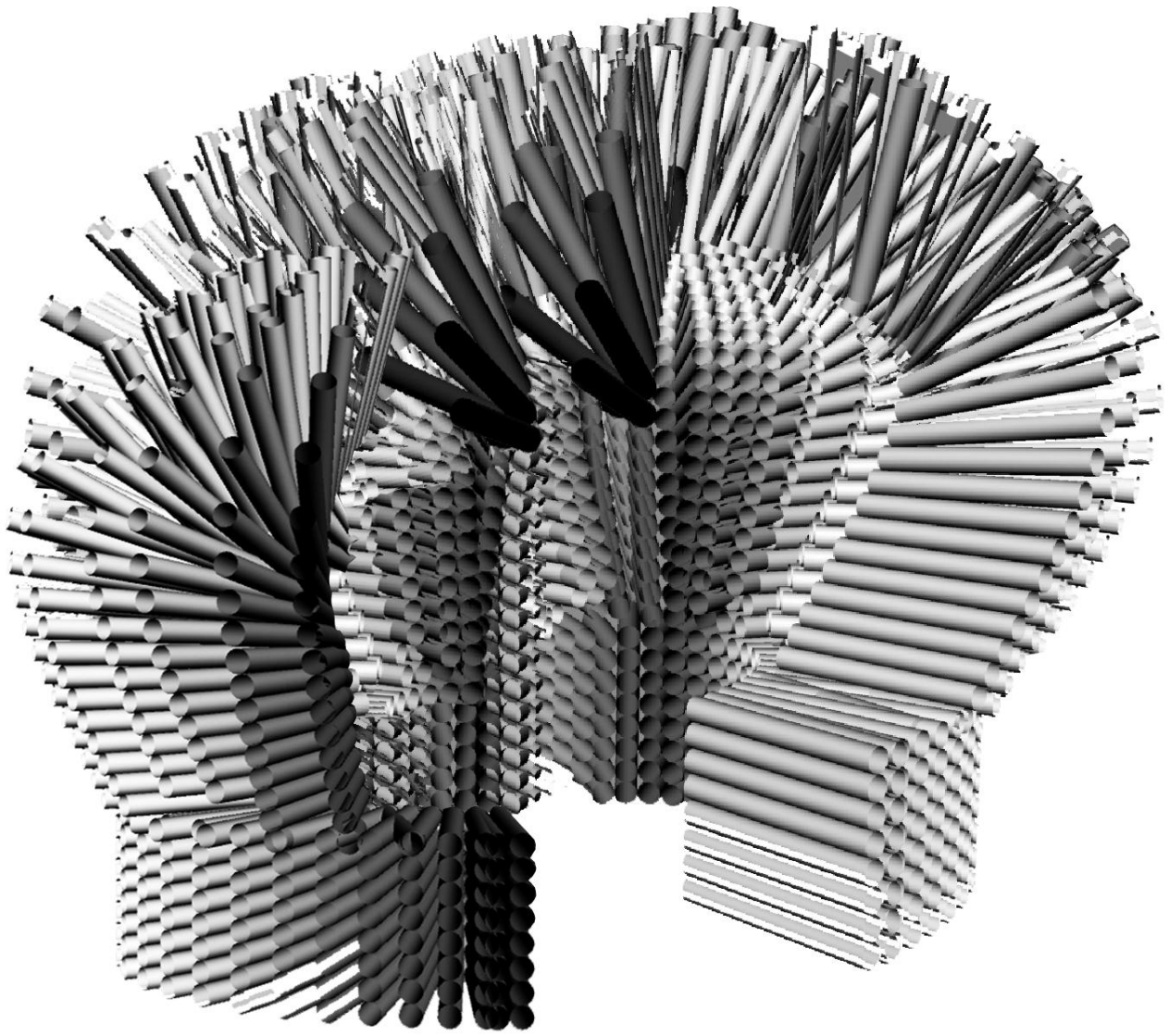


Figure 32. Sectional Perspective Model

Exploring with circle compositions further, I combine the family groups together by layering them. As the layers overlap, a new pattern is formed. A common point where the overlap circle is in perfect alignment, in all 3 family groups, is the starting point of the overlap geometries as there form grows to an infinite pattern stemming from its center.

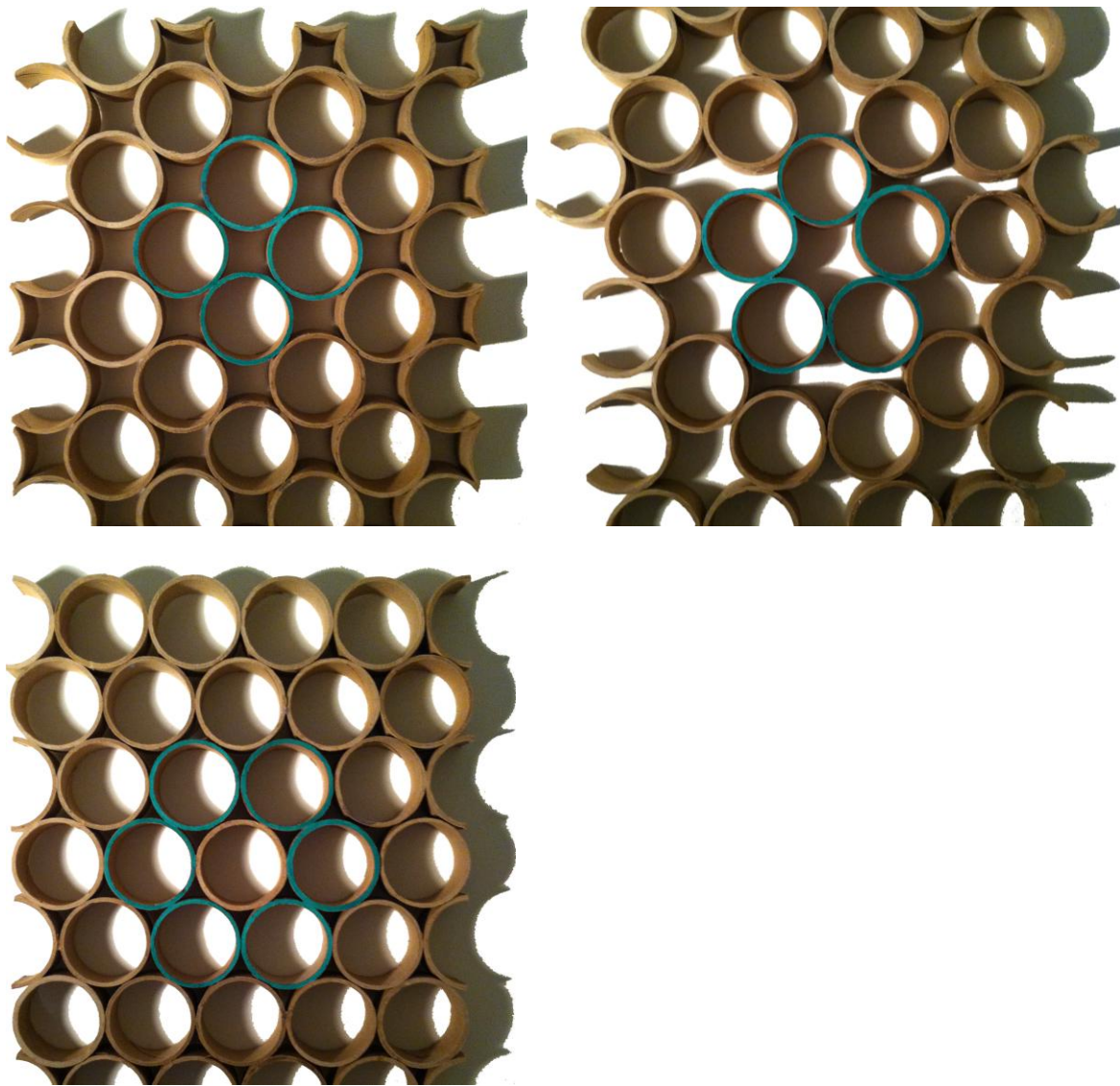


Figure 33. Circle Compositions 4-5-6



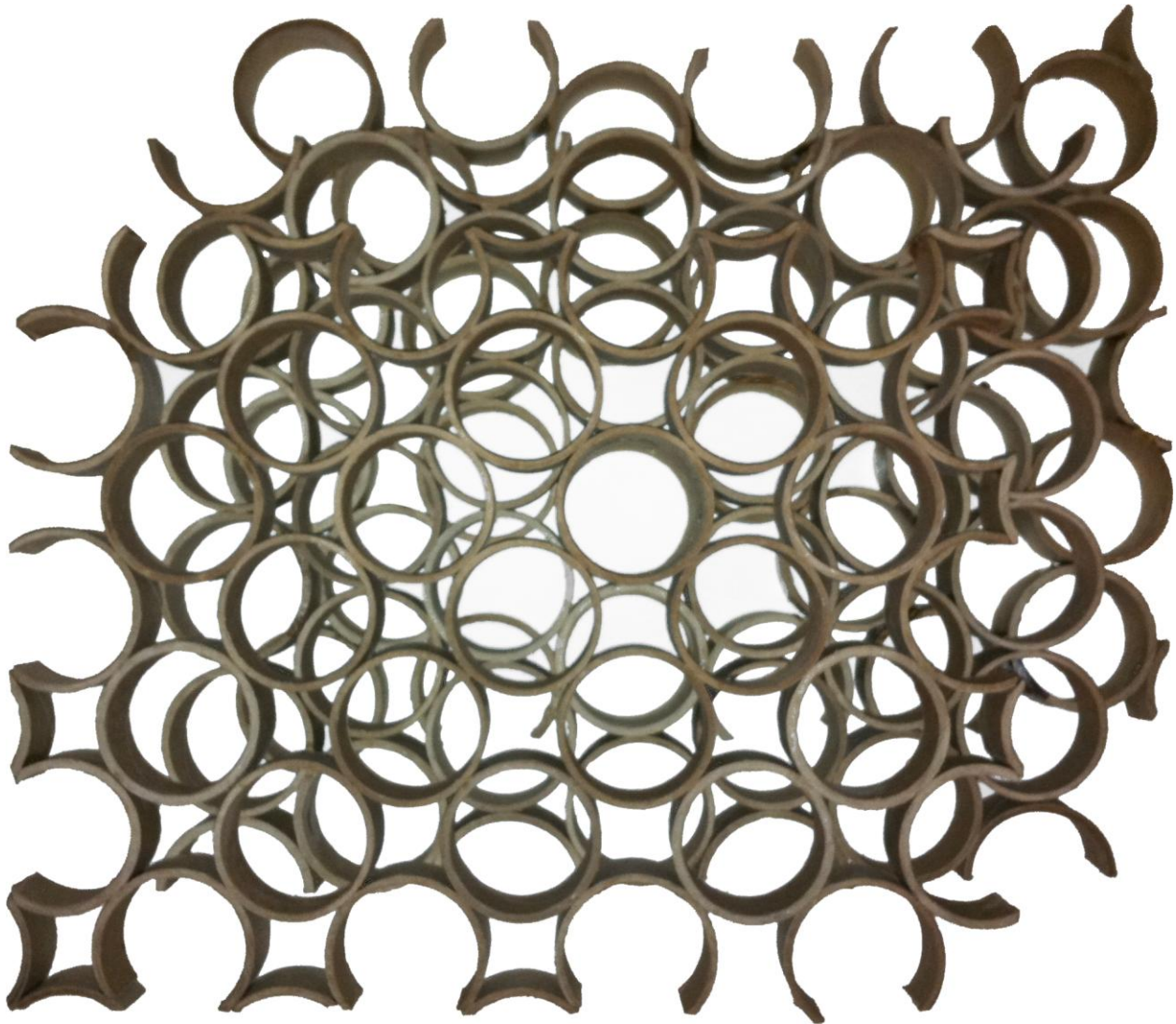


Figure 34. Circle Overlap: Moment of Unity

The fluid yet solid grid sets ground for infinite explorations. In both the structural design and overlay of the compositions, the circle remains the connecting factor organizing the arrangements. These explorations helped guide me towards composing a pattern that creates effect.

Islamic geometries fabricate art scenes which effect both perceptions of the art and the choices made by the artists producing it. Islamic artists applied their imagination to an underlying geometric framework to create outstanding works of geometric pattern. This

art illustrates an infinite variety as it permits and encourages contemplative reflection. Geometric works of art created in the Islamic world have been prized for centuries for their beauty, refinement, harmony, intricacy, and complexity. There is a strong need to understand how elements, categorizations and identification of this art is established and used for curatorial purposes as well as artistic development to accommodate the adoption of contemporary practices.

Since ancient times there has been a deep interest in forms that are considered to incorporate within their intrinsic relationships – both mathematical and geometric – a universal truth. Resonances were seen to be present from the smallest to largest elements of the natural world and, in this, a unity was perceived. It was believed that these geometries were derived from, or described, the basic laws of the universe. It followed that, by studying or contemplating them, an understanding could be obtained of the origins of everything and, in this, a sacred truth. Geometry may sometimes appear chaotic and complicated but upon further exploration one can discover so much that brings understanding and clarity. These ideas and calculable structures connect to the theme of seeking knowledge of the Divine through the evidence of creation. This is also something that can be conveyed through the universally appreciated forms presented in geometry of varying kinds; helping to form a balance in spirituality and rationality. Islamic pattern and design is complete yet infinite, this is not a consideration brought about by religion, but one having to do with aesthetic appreciation, a phenomenon that resonates in many areas that govern the way in which we perceive the world about us.

### 3 RESULTS

The experiments and explorations revealed a way for me to define forms leading to a final pattern. The design is to satisfy an aesthetic level which serves as a piece for visual appreciation and a communication of ideas which if the viewer chooses can be explored from many angles, not just the Islamic. I chose to focus on surfacing the 'hidden grid' of the Islamic geometries because it structures the forms, and to make it a dominant part of the design creation taking form in both a two and a three dimensional pattern.

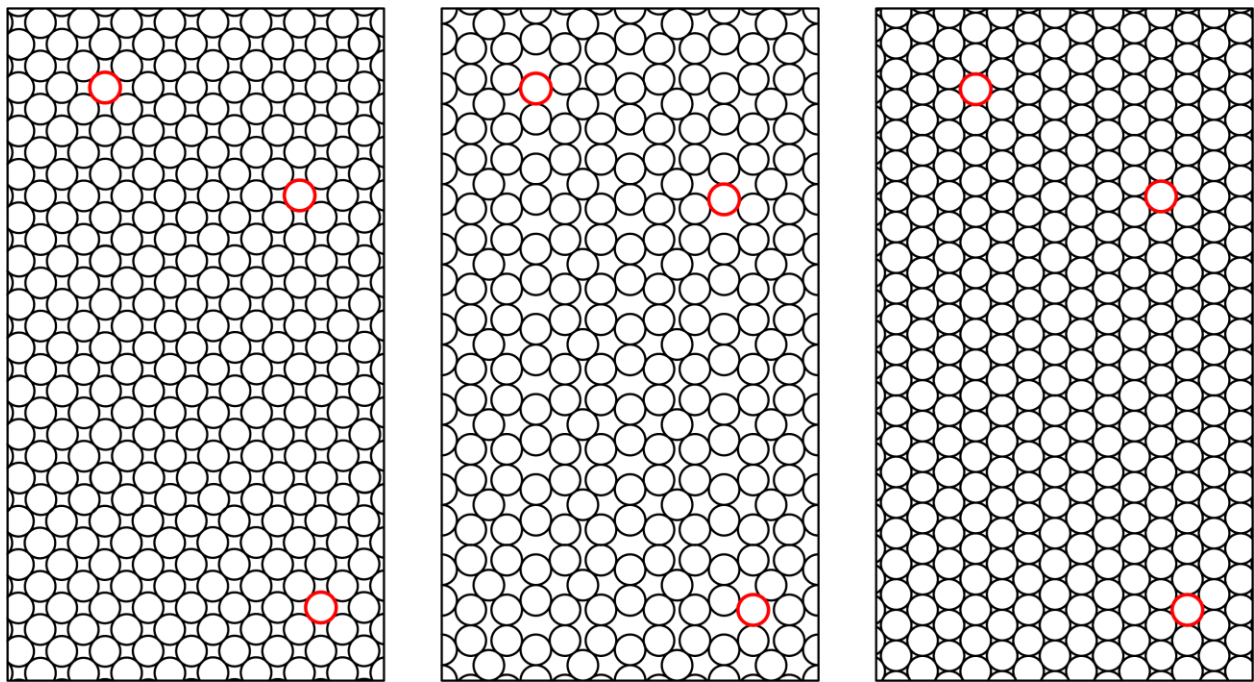


Figure 35. 4-5-6 Focal Point Overlap

### 3.1 2D Final Pattern Design

I overlay the circle grids aligning the highlighted circles in the 4-5-6 circle compositions, as they reveal a pattern that is defined by these reoccurring moments. The alignment of a single circle from each of the three circle compositions creates significant moments that connect the family groups by sharing a repetitive alignment of circles, a reoccurring moment that defines a pattern. Connected with accent points that sum the essential defining moments of a pattern, the circle geometries grow denser as they proceed further away from one defining moment, only to meet in an alignment again at another. The found pattern then is applied as an interior treatment – wall paper. An added layer of ‘map-pin’ grid is to be placed over the circle geometries spaced equally across the pattern design. The grid of pins takes on a 4-point geometric trace creating a layer of added reflection as well as a layer to support the wall paper design. This type of interior treatment will allow the pattern to multiply along the length of a wall bringing a contemporary touch of Islamic geometries creating an effect for the observer to view.



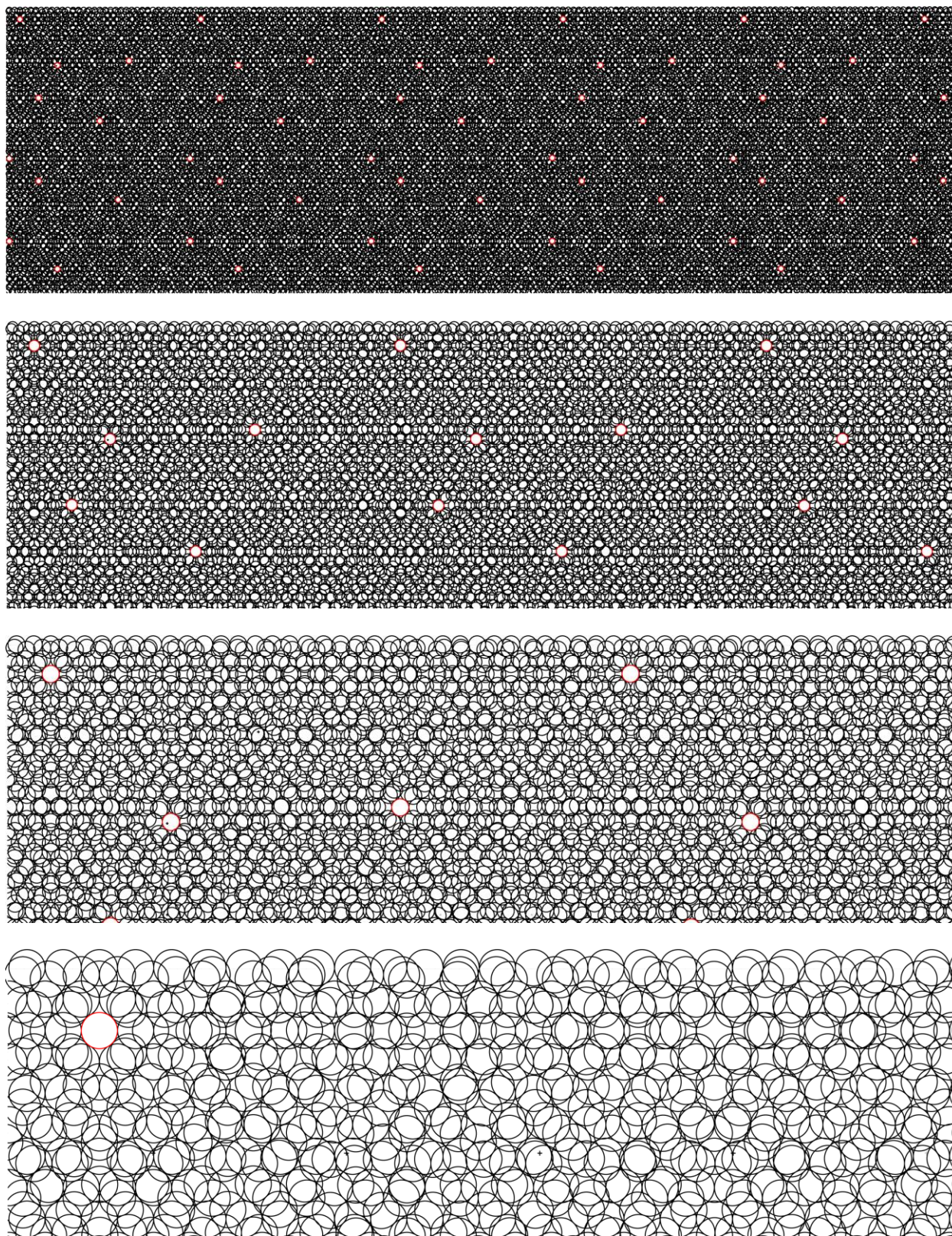


Figure 36. 4-5-6 Combined Pattern Drawing



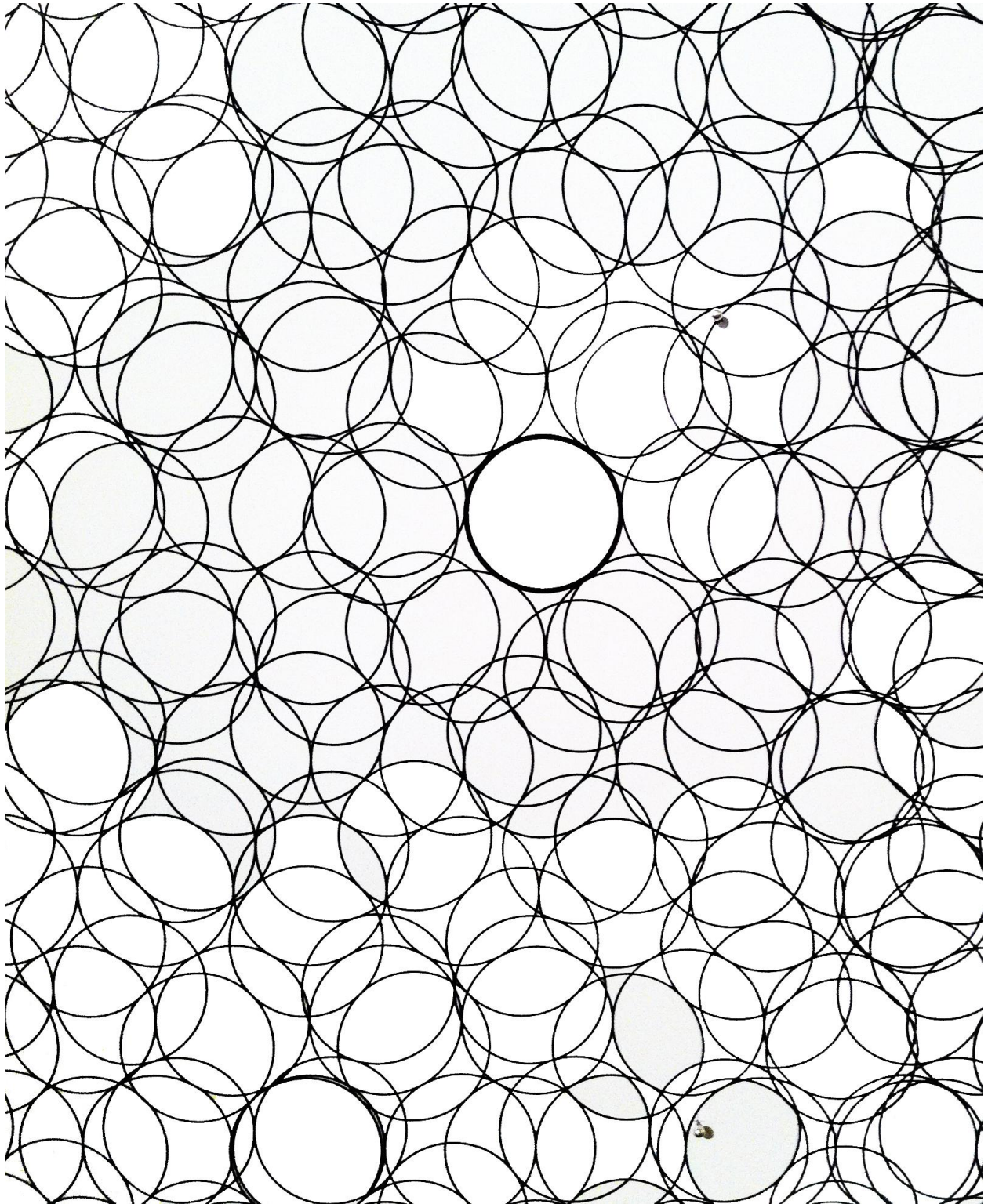


Figure 37. Final 2D Design: Wall Paper

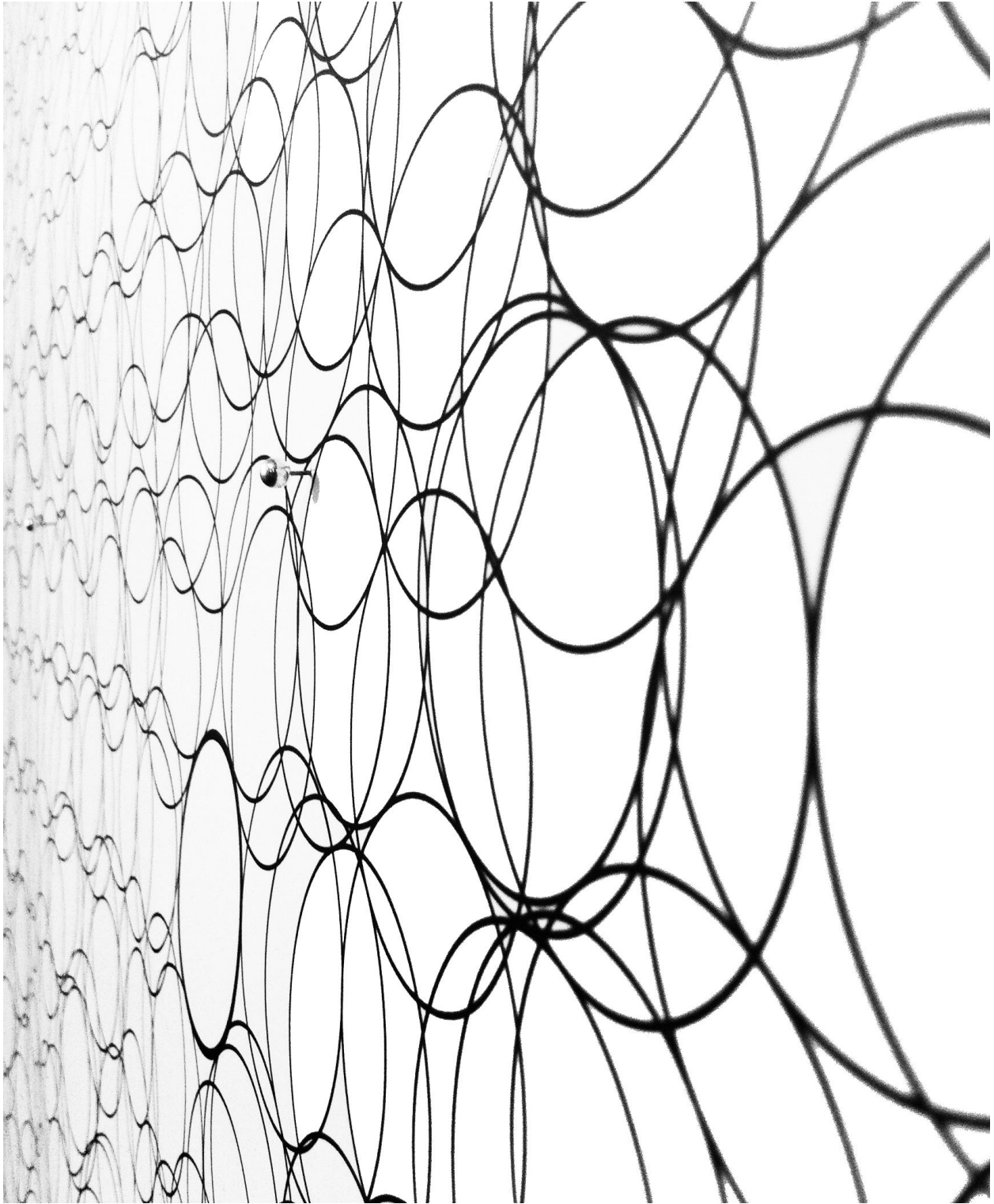


Figure 38. Final 2D Design: Wall Paper Perspective



### 3.2 3D Final Pattern Design

Featuring the 3 origins of the Islamic geometries, the final pattern extends from the two dimensional final design as it transforms into a three dimensional pattern. From the moment of aligned circle overlap in the combined 4-5-6 point geometries, the three dimensional formation gradually 'builds-up' as the pattern expands the further away from the defining moment the geometries share. The three dimensional codes apply as the three dimensionality effect takes place gradually from the moment of circle overlay alignment. The calculated structure takes form as the line geometries multiply creating an organized pattern of Islamic geometries that encompasses both the origin of pattern formation and the line geometries it holds.

Application of the new found codes to creating a three dimensional Islamic geometric pattern entail the circles to pivot as if peeling or lifting from the two dimensional grid to a three dimensional design. With each circle touching its adjacent at the equally divided connection point on the perimeter, the organized form takes shape. The family groups unfold in a composition governed with principles, aiming to connect as an interior treatment that captures one in its three dimensional design and in the effect in leaves with the play of light, casting shadows of mixed interesting arrangements.

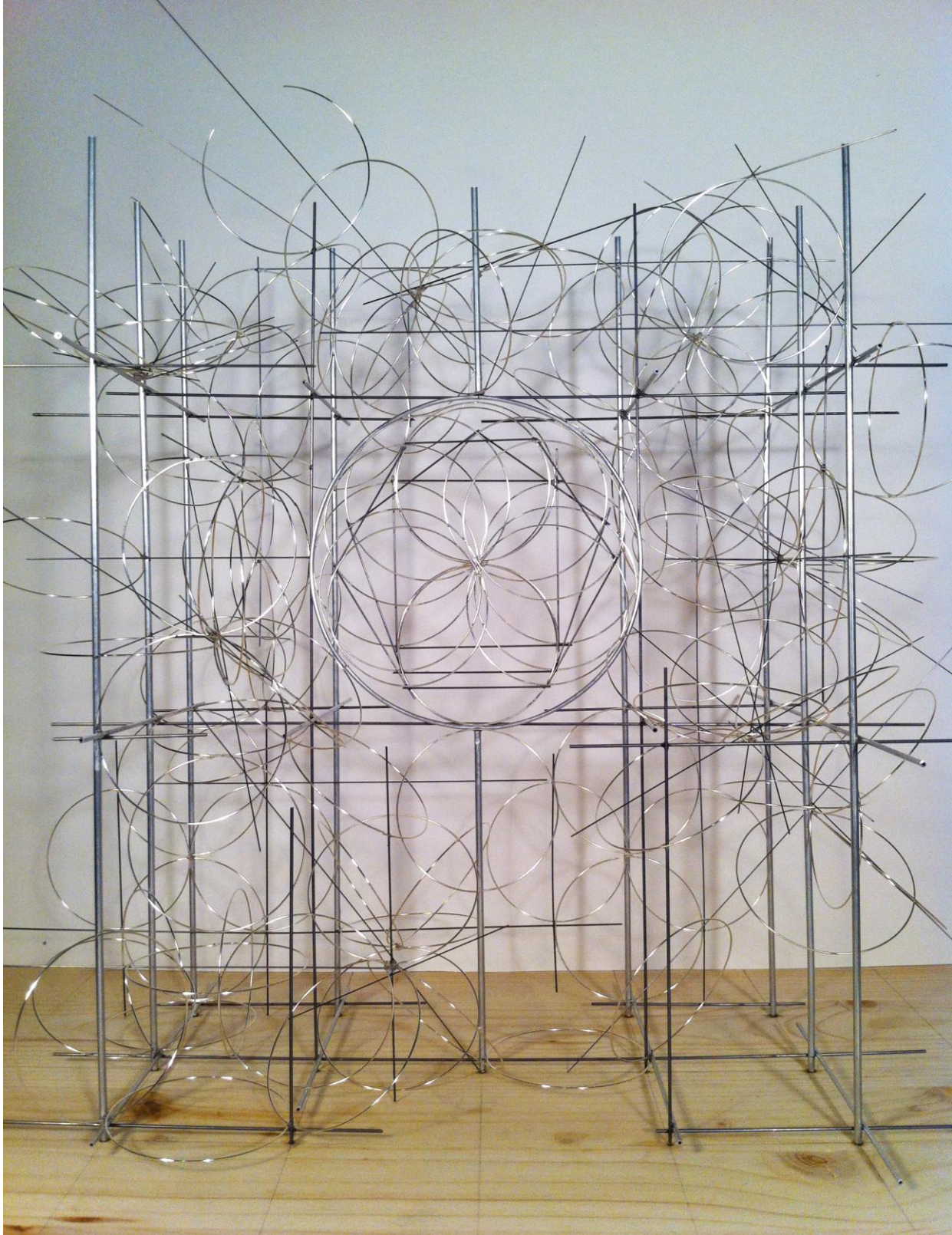


Figure 39. Final 3D Design: Front View



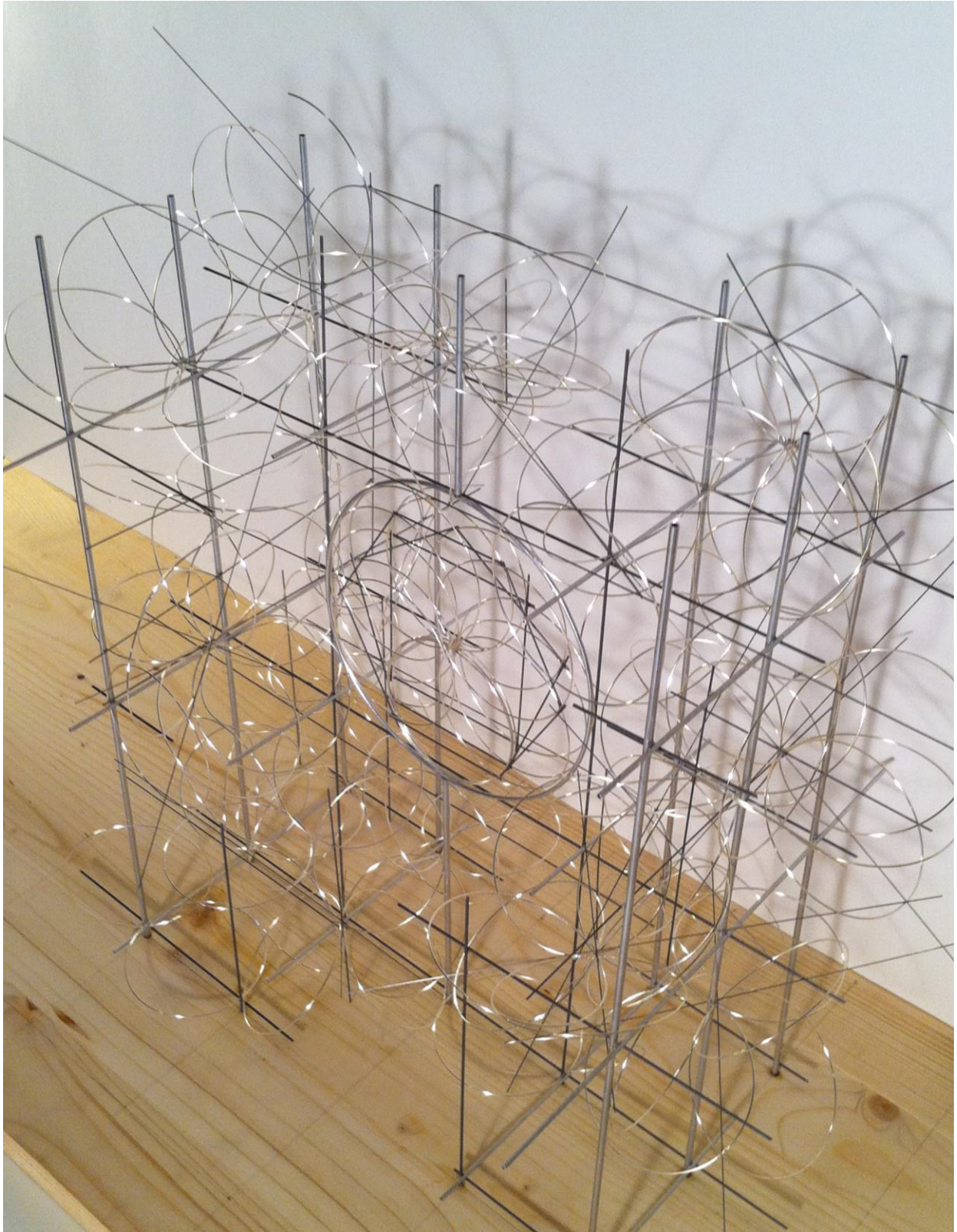


Figure 40. Final 3D Design: Perspective View

In the geometries of Islamic art, symmetry is thought to be beautiful and intricate with a character illustrative of completion, a unity to be sought in its simplicity, complexity, and multiplicity with an infinite number of patterns that can be developed from their grid. Islamic Design – A Genius for Geometry by Daud Sutton addresses the subject of infinity as represented in Islamic patterns:

“Conceptually a repeating pattern can continue forever, but in practical applications Islamic patterns are generally cropped to form rectangular sections with corners in the centre of key pieces, often stars. Framing a pattern this way maintains a geometric elegance at the same time is clearly implying that it could repeat indefinitely, as it were, under its borders – the perfect visual solution to calling to mind the idea of infinity, and hence the Infinite, without any pretence of being able to truly capture such an enigmatic concept visually.” (Sutton, 2007)

Moreover, it is a common feature that containing frames tend to appear arbitrary, implying the continuity of pattern beyond the frame that the brain sees, comprehends and mentally extends as part of its normal working. This is in sharp contradistinction to Western art, where the frame generally comes first and the work is formed within it, often having a direct relationship with the frame. This framing also usually gives a single central piece which ensures a numerical quality traditionally said to invoke, and favor with, ‘Divine Unity’. With decorative freedom and structural balance, the subconscious search for unity takes place. Reading patterns, the eye is likely to move first to the center of the design as this is the point from which the geometry is driven. In most cases this will mean the center of a circle or, the point derived from a circle. The latter implicitly also associated with the circle, and with the grids formed, usually being based on equal distant ‘connection’ points

along the circumference of a circle allowing the geometries to multiply and unfold extending to infinity. With unity, logic, and order as design elements, the construction is of natural geometries

#### 4 CONCLUSION

Extending the art of Islamic geometries to a three dimensional field is a step that can lead to many paths. One that can open possibilities to introduce these designs connecting them within society. The Arab world introduced the visual strength of geometric structure in the use of pattern. A number of interesting details are embedded in its architectural vocabulary observed in their visual forms. Patterns covering monuments reflect a solemn identity of the people and civilization; fabricating a façade as the structures become landmarks. Landmarks that exemplify the identity, the shape and tone of a society, collectively representing the image a culture holds through its art. Certain features have become fixed and eternal helping us remain true to our identity. While architecture create language for and of a society, interior design create a language for and of its user. Interior design is the process of shaping the experience of interior spaces. Shaping a built environment that is functional to enhance the quality of life and culture of the occupants. Interior Design has the ability to mold how one reacts and interacts within the space. Color, texture, lighting, materiality and space planning all can alter the mood to the desired core leaving behind an effect that may last, leaving a mark in the world of design.

Islamic art has strong aesthetic appeal that transcends time and space as well as language and culture. The focus on the geometries leads to an exploration of past Islamic design that magnifies the contemporary thought utilizing the circle, in effort to have this

design influence and merge into contemporary interiors. Studying the hidden grid of the four, five, and six-point circle compositions reveals the root to the geometries, as I search for a deeper understanding to the essence of their formations— aesthetically, mathematically, and symbolically. Generating their individual and collective forms, one of the great achievements of Islamic design is the manner in which the geometries or underlying patterns are subservient and not immediately apparent. The hidden structure is the basic geometry on which the different shapes are established and set out in relationship to each other. To investigate pattern conceptualization and construction, the juxtaposition of exposing both lines and circles that create Islamic geometries reveal what structures their numerous forms in pattern. With the new applied calculations to their three dimensional transformation to its growing design process, the pattern starts to expand and take form in new ways. Similarly to traditional form, the structure is calculated yet fluid in its selected and found rhythms, flowing as it evolves from a two dimensional form to its new applied codes of three dimensional implications. To the unfamiliar, the geometries might not strike one as Islamic due to its 'contemporary' touch, but when contemplated further, the underlying structure of geometries can be identified as those that appear in traditional Islamic patterns. Most common geometric compositions which form the basis for the many of the patterns to be found in Islamic decorations are respectfully the constructions of six and four-point geometries, and five-point geometries for curved surfaces. With this new formula to a three dimensional pattern, the construction of these geometries is limitless. Selecting the simplistic elements that give its Islamic character, my explorative study of Islamic geometric design magnifies the connecting features of the grid that tie the three basic groups and to show how the design multiplies and grows for a new pattern to emerge.

With the organized arrangement of elements, application to process formation of the three dimensional new derived codes should act as a catalyst, layering, multiplying, and elevating such calculated compositions allowing the design to take its form. These structures underlay much if not all Islamic patterns formations as the studies combine to a beautiful self explorative progression of a 'growing pattern' that classify its stages as it develops. Connected by accent points, the pattern carries a rhythm of precise moments in which the three groups meet in alignment with each other.

In repetitive geometric pattern we appear to lose that sense of weight and, in most patterned work we experience weightlessness in the overall design. This is a quality which lends itself to contemplation and is very much in tune with an Islamic view of the world. By their very nature, Islamic patterns do not have a direction implicit in their geometry but tend to be formed with no apparent ending. With arrangements used to create various grids, an infinite pattern variety of abstract thought provoking compositions of Islamic design can be drawn. The experiments and explorations that I have done will push the envelope in not only Islamic design but interior as well. I hope for my design strategy and idea to open more possibilities for how I could view this new form.

Having a solid foundation to interpreting the original tenants in Islamic design patterning and further exploration may yield to further three dimensional patterning. This process is a way of allowing history to physically build upon itself to the new. It is not only a departure from the essence but a return. In the design process, I experienced math, art, and symbolic act of returning to Islamic heritage through art. The layering of pattern is creating an order; organized arrangements of human perspective of perfection – glorifying and respecting Gods creation.



Deeper understanding of the religion, culture, symbolism and geometry is required to fully indulge this art form. The art produced could be critiqued from the viewpoint of culture and the legacy that the culture leaves, in this way attributing value to these works of art, as art that contributes to “cultural memory”. Neither a style nor a movement but rather a value system that arises from a specific culture, a specific time and place, yet despite this, it speaks to all viewers. To recapitulate this work to me holds messages about community, about generational history, about familial and cultural memory. From this viewpoint, then, the art is very culturally-specific but universal in its message to all viewers.

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