The Structures of Arabic Writing Inscriptions: Insights from the Tombstones of the Fatimid Dynasty, Aswan - Egypt

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Abstract

In the past, plenty of materials and tools such as pens, ink, parchments, and rulers have been used for Arabic writing in Islamic manuscripts. Arabic writing became standardized, described based more on geometry during the Islamic civilization. This indicates the qualitative development and the importance of Arabic writing in the Islamic-Arabic book craft industry. Many suggest that different types of grid rulers have been used to structure the Arabic writings in Islamic manuscripts. In this context, this paper explores the structure of Arabic writing on stones. It is based on the hypothesis that Arabic writing structures in stones are similar to Arabic writing structures in the manuscripts.

This paper applies a geometrical analytical process to identify a structural tool used to structure the Arabic writing in a stone, similar to the geometrical analysis method that was used before in the Islamic manuscripts. It explores and discusses the outcomes of the analysis using an objective observation method.

It concludes that a grid ruler used to structure the Arabic writings in stone is analogous to the grid ruler used in the Islamic manuscripts. This paper is the first to discuss the structure of Arabic writing found on a stone in the Fatimid dynasty.

Keywords: Arabic writing, structure, geometry, inscriptions, grid, ruler, Fatimid dynasty.

Introduction: Arabic Writing Materials and Structure

Arabic writing during the Islamic civilization are found in the manuscripts such as Qur'anic manuscripts and architecture in mosques and many other places (Al Fahmawee & Omar, 2022), although they have evolved from the Nabataean scripts before Islam. The writing tools and materials had evolved alongside the spread of Islam in the Middle East. It was known that the writers who surrounded Prophet Muhammad (640-710) used different materials and tools like parchment and papyrus and tree leaves used for writing to memorize and to make a written Quran besides memorizing it orally (Von Denffer, 2015). Hijazi manuscripts are considered the earliest Quranic and Arabic manuscripts made from parchment and ink, which

were made around 610-750AD. Compared to the inscriptions that were graved on a stone, Arabic writing inscriptions such as the Um AL-Jammal inscription writing have been found before Islam.

Moreover, the tools and materials for producing the manuscripts such as pens and ink have evolved during the Umayyad and the Abbasid Caliphates. The quality of parchments (Neumeier, 2006) paper improved as well when Muslims during the Abbasid time learned from Chinese, the art of making paper (Mansour, 2018).

Because of this evolution, the style of writing has changed. In manuscripts, at Umayyads, the writing style was described as the Hijazi script, in which the stroke lines were thick and the line of Alf letter was slanted vertically, but in the Abbasid dynasty, the writings were described as kufi, in which the stroke of lines was thicker, and the Alf letter was more vertical and was shorter. A new era of Arabic writing has come into being during the Abbasids, thanks to ibn Muqla who described the proportions of Arabic writing structure, and it was named the proportioned script. It introduced a new type of Arabic writing such as Al-Nasik (Khokar & Nawaz, 2018). According to Francois Deroche (Déroche, 1992), who described a geometrical structure in an Islamic–Qur'anic manuscript, a ruler tool was used to help the scripters for writing which is *al Mastra*. This suggests that new tools had been added to the writing craft in the Islamic civilization as an important sign for the arrangement and structuring of Arabic writing in manuscripts.

Meanwhile, in the Arabic inscriptions before Islam, the writing style and the anatomy of Arabic letters have been influenced by the Nabataea inscriptions style. The inscriptions of the Arabic writing were unstructured and had been graved on a large unpolished rough stone like Um Al-Jimal inscriptions (Said & Al-Hamad, 2004). The writings have been unstructured but were graved on a polished stone like in Alnamarah inscription (Abulhab, 2011). The writing lines were slanted slightly horizontally, similar to the early Hijazi Manuscripts.

After the arrival of Islam in the Middle East, Arabic inscriptions improved significantly. During the Umayyads, the inscriptions were graved and written on polished stone walls using the mosaic style, like what was found in the Dome of the rock in Jerusalem and the palaces of Umayyad and the Abbasid Caliphates (Lindstedt, 2020). The inscriptions during the Abbasid caliphate, synchronous with the Fatimid dynasty have been found on the walls of mosques, tombstones, and palaces (Bloom, 2017). The writings have been structured and easy to read because the words were proportionally structured, and the spaces between the letters and words as well as the writing area had been recognized. All these improvements indicate that the new tools for structuring were used by the inscribers to structure the Arabic writings on the polished stones.

This paper aims to explore the structure of Arabic inceptions on the tombstone of the Fatimid dynasty. The study hypothesizes that a method to structure Arabic writings which were found in the tombstones as inscriptions is the same to structure Arabic writing which was found in Islamic manuscripts.

Review of Literature

The study of inscriptions is an important part of Islamic architecture, as it gives insight into the various aspects of Islamic civilization and culture. Geometric analysis of Islamic architecture has been an important part of understanding the cultural and historical context of the Islamic world, that requires a deep knowledge of the history and philosophy Islamic culture, which can uncover unique insights into the intricate designs found in Islamic architecture.

The early geometrical exploration of Islamic architecture was by Creswell (1924) who explored the structure of the dome of the rock, which he extensively studied and documented with detail and care. Additionally, many initial elements of Islamic architecture have been explored through geometrical analysis like the studies of plans of historical sights: for example, the mosque (Goudarzi et al., 2020) palaces (Mojtahedzadeh, & Namavar, 2019).

In Islamic architecture, the analysis of geometric forms have been used particularly in small architecture elements such as the Minbars (Singer, 2008), arches (Rahman, 2015) and Muqarnas (Imani, 2017). The same geometry could be applied also to any decorative elements

for example applying patterns to walls or frieze beside arabesques (Mahmoudi, Rezvani & Vahdat, 2020). However, still many architecture elements and different decoration types have been limited and less studied through geometry compared to what is mentioned above like tombstones and for the decorative Arabic inscriptions.

The Arabic inscriptions found on tombstones have been studied mainly to learn more about the context and life of the deceased, including what religion they followed and when they died (Bauden, 2010). Tombstones have been made often with artistic care for wealthy or influential Muslims. Despite the importance of geometry to Islamic culture, Arabic inscriptions in tombstones have been less concerned with geometrical analysis. As far the known, there is no study that explores the structure or the anatomy of Arabic writing in tombstones. However, compared to Islamic manuscripts, the Arabic writing structure has been studied widely by applying different geometric analysis methods to reveal more about the techniques and the tools that have been used in writings.

Recently, the explorations of Arabic writing structures have been studied in Islamic manuscripts. Different methods have been used in these studies. The researchers usually use the geometrical analysis method which has helped the researchers to describe and to conclude that Arabic writing has been structured in Islamic manuscripts. For example, Polosin (1995) has explored the geometry of the page layouts in Quranic manuscripts. Moreover, a geometric analysis method has been used by George (2003;2007). He has found a repeated structure of grids in 1079 folios in early Quranic manuscripts, which include a proportioned rectangle that hold the script area structured on a grid. In this grid, the Arabic writings as well as the page layout and the margins of the pages are set in the writing lines. Additionally, George found an application of a grid of modular units where text and illumination decoration are shared. Besides the Quranic manuscript studies, proportioned rectangles have been used in Islamic illustrations that hold the main shape or the main scene of the illustrations. They have been used repeatedly in different manuscripts according to Jahameh (2002).

Later, Jarar (2012), has studied the Moroccan manuscripts, using the geometric analysis method. He has found a link between the structure of the page layout and the Arabic writing. He has also found that the Arabic writing anatomies have been set on a group of circulars set. Jahameh (2018) has found similar results. She has employed the geometric analysis process method on a selected structure of 151 folios from Islamic manuscripts in all Islamic Dynasties. She has found the Arabic writings and other graphic elements such as illustrations and ornamentations as well as the page layouts in Islamic manuscripts, which have been set on the same square grid or a hexagon grid. She hypothesized that a grid as a ruler has been used for structuring to help the writers in Islamic manuscripts to structure all the graphic elements at the same page in Islamic manuscripts (Fig. 1).

Fig. 1: Grid ruler used in making books at the book craft.
Source: Necipoglu, 1995

The studies of Arabic writing structures are limited to Islamic manuscripts. Furthermore, the Arabic writing structures as inscriptions have been less recognized in these studies. However, Geroge (2021 has found that Al Majour Quran is similar to the inscription writing at the Aqsa Mosque. This has raised a question of a systemic method for writing which includes tools that help the inscribers to grave Arabic writing on a polished stone-like Islamic manuscript.

Research Methodology

As mentioned, this paper aims to explore the structure of Arabic inscriptions on the tombstones. The study hypothesizes that the method to structure Arabic writings found in the tombstones as inscriptions is the same used to structure Arabic writings found in Islamic manuscripts. Although materials are different because the tombstone is made from a solid base that needs specific tools to leave a deep mark for writing, the manuscript is a gathering of folios and needed a pen with ink. Yet, structuring Arabic writing in two or more different materials is similar because of the use of the same structural tool: the grid ruler.

This study uses two methods n a study of Islamic graphic design titled "towards a new concept of grid system applications" (Jahameh, 2018).

These methods are:

First, the geometrical analysis method is used to apply the Islamic manuscripts to ascertain if the grid was used as a structural tool in the manuscripts or not. The importance of the geometric analysis is setting the grid based on the object size itself. The purpose of this analysis is to see if the grid system is used on the tombstone beside the manuscripts. It will also allow the exploration of the geometrical structure of Arabic writing.

Second, the objective observation method is to examine the result of geometric analysis and to ascertain if the visual applications were set in the grid or not.

The Geometric Analysis Method

Jahameh (2018) has introduced three systemic ways to set the grid system based on the detection of the rectangle type. First, a hexagon grid system based on the proportional roots of root 3 and root 5 and the golden section is used. Second, a square grid system based on the proportional rectangle of root 2 and root 4 rectangle, and the square is used. Finally, setting a grid for an unproportioned rectangle or an unseen proportion rectangle is by drawing a line above and below the case study. Then the same geometric analysis is applied for stages for the hexagon grid and the square grid, and then through the objective observation method, we explore if there is any relation between the case study and the suggested grid.

The geometric analysis method is based on stages to set the grid. First by detecting the type of proportional rectangle or detecting the surrounding lines of the case study, then the unit scale for the grid is set–which is a circle, then, by fading out multiple times from this unit till we reach a logic scale size for a circular unit to set a circular grid. This unit size is related to a logic scale of the physical grid tool. To set a straight grid line, we connect any crossed line that is found in the circular grid. Then we remove the circular grid and keep the grid lines. Additionally in this paper, we consider any rectangle that has the same duplicated proportion rectangles in the same area of the case study.

As explained by Jahameh (2018), Fig. 2 shows the steps to set up the square grid based on the proportional root two rectangle, which was used in the above thesis and is used for this paper too (Fig. 2). In the stage one, inside the root 2 rectangle, we draw a circle at the center of the rectangle. The circumference of the circle must touch the two longer sides of the rectangle. In the stage two, the main circle was divided equally into four areas. In each area, on its circumference, a circle was placed in the center of each area. Each area is equal in size to the main circle. All these circles present the main unit set to reach the main unit circle size, by fading in this unit inside each other till we reach a logic unit scale like in the stage 3.

In the stage 3, the smallest unit circle set is created from the main unit circles set. In stage 4, the size of one of these circles becomes the basic unit of the circular grid. Stage 5 is a square circle grid based on the same main unit scale as in the stage 4.

Finally, stage 6 shows the lines that connect any crossed lines at the circular grid, and stage 7 shows the square grid lines without the circular grid.

The Objective Observations Method for Geometric Analysis

By using the geometrical analysis, this paper explores the Arabic writing inscriptions on the tombstone structured on the grid. By setting the value of true and false of the detections, to know if the grid was used as a tool to structure the writings on the tombstone. The objective observations are aimed at ascertaining if there are relations between the visual applications of the case study and the grid system.

- The space between the writing lines was set based on the grid. That can reveal if the grid is used to set the writing lines.
- If the letters are structured on a grid, which includes curved lines of the letters and straight lines of letters, this can show how far the grid is used for shaping the letters.
- Detect the sentence *Bism Allah al Rahman al Rahim* (بسم الله الرحمن الرحيم), because al *bismillah* is considered the main phase in Arabic religious writing, we believe that the writer would pay serious attention to structure the sentence well on the grid.

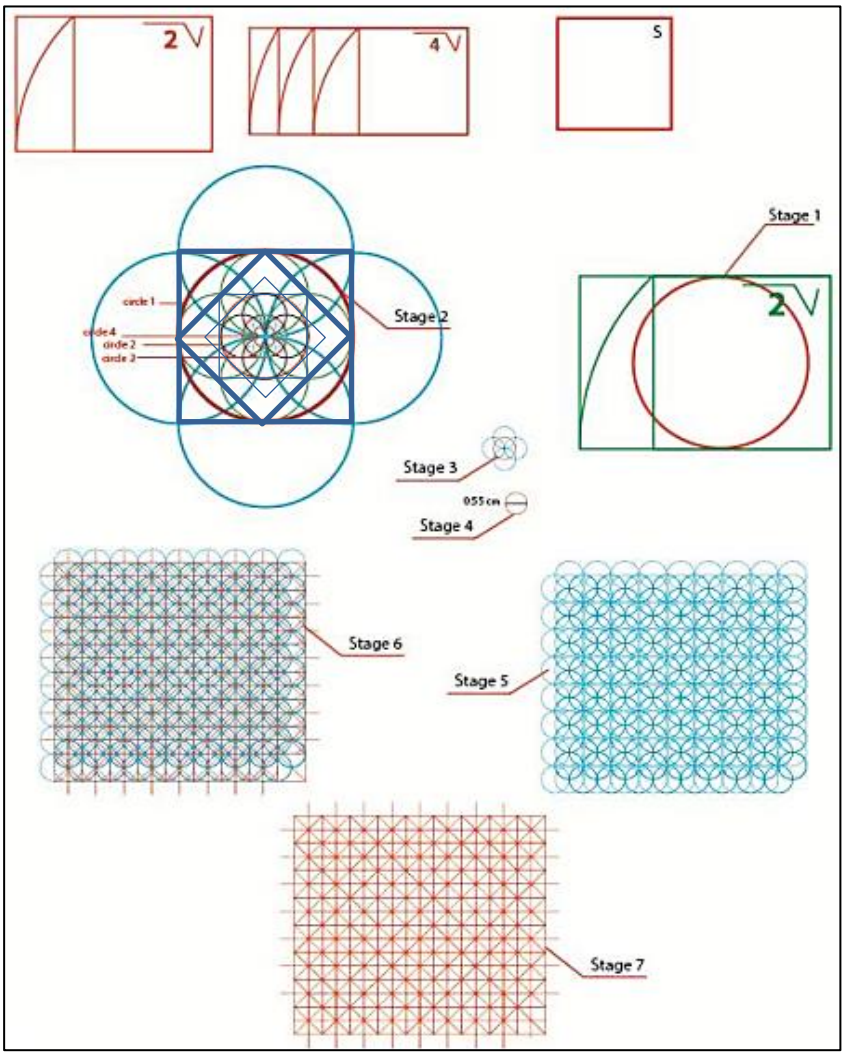

Fig. 2: Stages to set the square grid based on the root 2.
Source: Jahameh, Vol 1, P 60, 2018

The Case Study

The selected case study aims to explore the possibility of using the same grid system found in the Islamic manuscript as a tool of structure. It seeks to explore the grid system application in the new material: stone, besides studying the application of Arabic writing structure at a tombstone.

To achieve this aim, the case studies are selected based on specific criteria. These include:

1. The case study should be a figure of a tombstone with high resolutions usually offered by a museum.
2. The Arabic writing should be well-structured on the stone.
3. The tombstone should be chronologically identified.

Based on these criteria, a tombstone from the Fatimid dynasty is selected. This is available from the British Museum, and the museum number is 1868,1102.432. The tombstone was in Aswan in Egypt and was made in 1159 (1613297708-Fatimid Tombstone). It was made from polished limestone. Its dimension are as follows: Length: 51.50 cm and Width: 21.75 cm (Tombstone, the British Museum)

Islamic arts and architecture during the Fatimid Caliphate had transformed and developed all forms of Islamic art and architecture including Arabic calligraphy (Bierman, 1998). The craft of buildings and the crafts of making books had developed. Many developments of Arabic writing types are found in manuscripts (Neumeier, 2006), such as Kufic calligraphy had branched in to different types, such as the Mashriqi Kufic calligraphy. The Arabic writing inscriptions have also been found regularly in the buildings and the tombstone design during Fatimid dynasty (Arif, 1960).

Findings and the Analysis

The analysis aims to see if the grid system is applied to the tombstone beside the manuscripts. The analysis allows us to explore the geometrical structure of Arabic writing, based on the selected methodology.

The geometrical analysis process.

Stage 1: Detect the proportion rectangle at the tombstone, in the Fatmied tombstone
The result: Fig.1 found two rectangles for one type of rectangle which is root 2. The image was also set on the actual dimension size of the tombstone as was described by the British Museum, to reach an actual unit scale for the grid (Fig. 3).

Stage 2: We detected the proportion rectangle that led us to the type of the grid which is a square grid and will help us to detect the unit scale of the square grid system. Based on dividing the circle into 4 sections, one can introduce a square in a blue line as it is seen in the stage 2. Then we fade into the same circles inside the main circle, and we fade in multiple times until we reach a logic unit scale to set up the grid. An this stage, the unit scale size which is 1.04 cm is derived. (Fig 4)

Stage 3: Based on the unit scale and the size of the circle, a square circular grid can be set (Fig. 5).

Stage 4: The red lines connect any crossed lines in the circular grid (Fig. 6).

Stage 5: Shows the square grid (the connected line) without the circular grid (Fig 7).

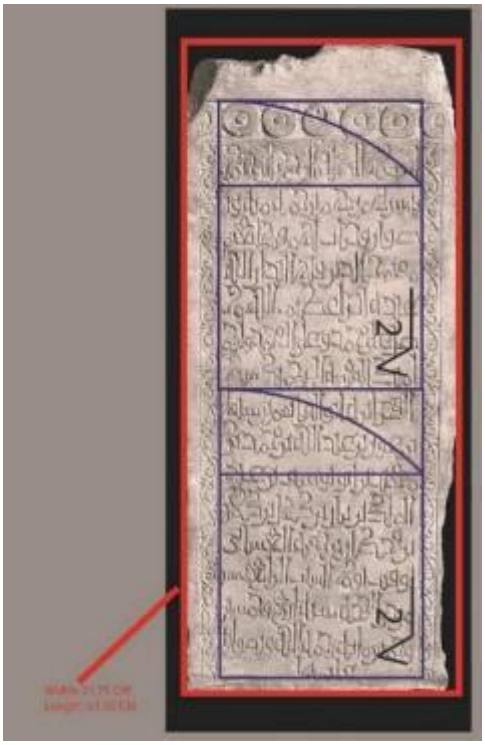

Fig. 3: Two proportioned rectangles are used on the main layout of the tombstone, Source: Authors

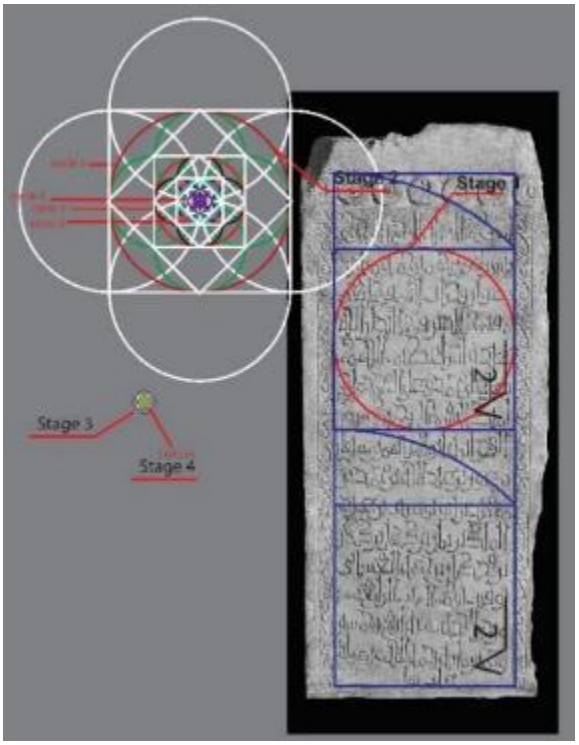

Fig. 4: Dividing the circles to reach the main unit scale, on the tombstone, Source: Authors

Fig .5: Circular grid, Source: Authors

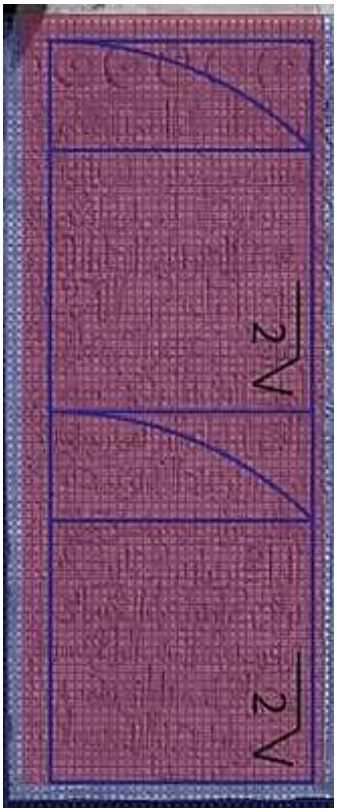

Fig .6: Circular grid with connected lines, Source: Authors

Fig 7: A Square grid line without a circular grid, Source: Authors.

Fig 8: The space between writing lines, Source: Authors

Objective Observation Detection on the Fatimid Tombstones

The space between the writing lines was set based on the grid is true, because all the writing lines are set exactly on the grid. Many of them were set horizontally straight like in the writing line 1 and 2, 3, 4, 5 & 6. However, the writing lines 7 and 8, 9, 10, 11, 12, 13, 14 and 15 were horizontally slanted by one square and half like writing line 11, and one square was slanted like the writing line 7. Only the half square for example writing line 12. The space between writing lines was equally like in the first 6 writing lines and the space between each of them is 5.5 squares (Fig. 8).

The curved and straight lines of letters are structured on the grid are true, because the function of the grid was to regulate and adjust the anatomy of the letter lines. As shown in the Fig. 9, through the points which are the crossed lines of the grid that were used mainly to control the curved lines to set the beginning and the end and the depth of letter-curving lines like *AIN* letters and *WAW*, *RA'A* letters are highlighted in white rectangles. The straight lines which are highlighted in blue rectangles were set based on the grid and many letters like *ALF* and *LAM*

were set exactly structured on the grid by keeping the same length and size on the grid. Moreover, the space between each letter is recognized and set based on the grid (Fig. 9).

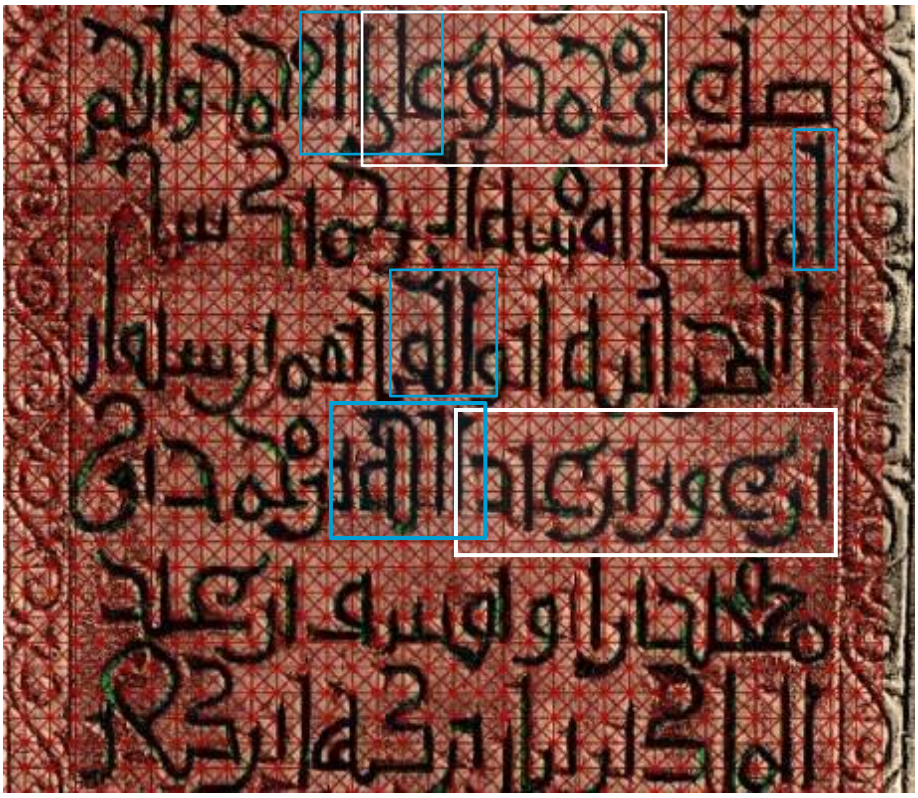

Fig. 9: The straight and curved lines are set on the grid.
Source: Authors.

The sentence Bism Allah al Rahman al Rahim (بسم الله الرحمن الرحيم), was detected. Al *bismillah* is considered the main sentence in the Islamic religion. We considered that the writer would pay serious attention to it to be well on the grid. This is true because each letter and word is detected exactly on the grid as seen in the Fig. 10.

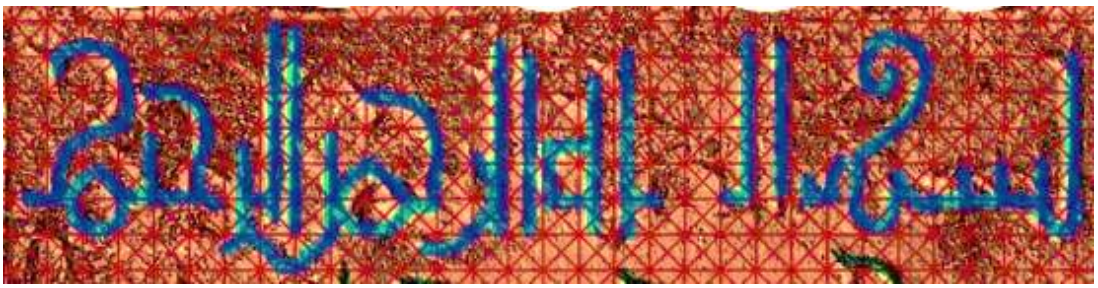

Fig. 10: The sentence Bism Allah al Rahman Al Rahim is structured on the grid.
Source: Authors.

Discussion

The Geometrical Proportions of the Inscriptions

Many philosophers in the Islamic civilization have written about geometry. For example, Al Buzjany authored the geometry needed by craftsmen in the 9th century (Eissa, 2022). At the early step of the geometrical analysis, we found the use of a two geometric proportional root 2 for the layout. Proportion rectangles are recognized in Islamic architecture (Hamma, 2017). Finding the proportion of rectangles in the tombstone indicates a deep understanding of using geometry in the tombstones. It was also used as the main structure of

the layout and holds all the writing inside the rectangle. That means the geometry was recognized by the inscription's craftsman of the building as well as in the book crafts in Islamic civilizations as a layout application, and addendum to the findings in architecture.

Moreover, it was known that the builders in the Islamic civilization had the skills like dealing with measuring and proportioning that were needed to structure the writings in the building (Necipoğlu, 1996). Finding the use of proportions at the tombstone is a confirmation of utilizing these principles by the craftsmen during the Islamic civilization. It is considered as a deep awareness and the importance of using the geometry of the writing crafts for the arrangement and for structuring the visual elements. In this study, writing is the element that was arranged inside the proportioned rectangles.

The Application of Arabic Writing on the Grid

The grid system has the main function for Arabic writing which makes the letters and words readable. Based on the objective observations, the grid was used to set the writing readable compared to many inscriptions that were not structured or on the grid or ruled. As a result of this, it was difficult to read (Fig 11). To structure the writing, the scale and the size of words and letters and the writing lines have been recognized obviously on the grid. The writing lines have been set on the grid although many of them have been horizontally slanted. The slanted writing lines have also been founded in the Islamic manuscripts (Fig. 12).

The structure of letters and the structure of words like what was found in the sentence "Bismillah al Rahman al Rahim" indicate how far the grid had a role to structure the writings similar to the result of the previous study which has found the exact application of Arabic writing on the grid as seen in the Fig. 10. The writer needed the grid to straighten the lines and to adjust them perfectly on the grid that will lead the importance of the space between letters and words to set the writing perfectly on the grid.

The Anatomy of Kufic Writing

According to Al-noon (1972) who described the Kufic calligraphy with specific anatomy scale and size, the scale of the Alf Letter is 10 units as seen in the Fig. 13. The same description was found in this case study of Alf letters. The length of the Alf letter is half of five squares as set vertically, but if we divided the squares, we will reach the same result of Al noon result, as seen in the Fig. 14. Although the scale of the Alf letter was different in the scale approximately, the letters and words were structured exactly on the grid. For example, the letter Alf, at the word of Allah at writing line number 1, the length of *Alif* is 4.5, meanwhile in AL Rahman it is 5 units. In Al Rahim, the length of Alif is 5.5. Thus, we have a different scale of Alf, but all of them are recognized on the grid, similar to letters of curved letters such as the *Raji* and waw. None of them have been structured exactly on the grid although the scale is similar to the depth of the curve which is different from each letter.

This raises questions about the description of Kufic calligraphy from the historical object sources, based on what we found in a similar scale of letters. However, the study found the exact application of the writing on the grid. This introduces a new classification of Kufic writing. We especially found the same scale of 4.5 units application repeated at the Alf letter on all the written words of Allah in this case study. That means the awareness of using the grid and the awareness of the letter's scale that was structured on the grid. It is argued that this means that the grid is used to shape the anatomy of letters.

Fig 11: Unstructured Arabic manuscript a stone. (El-Hawary, 1930)

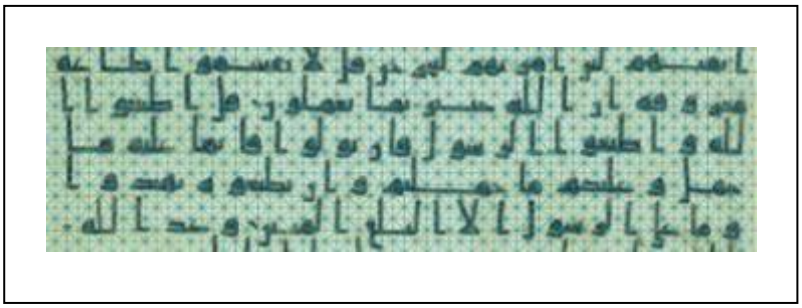

Fig 12: Slanted writing lines in the Islamic (Jahameh,2018, Vol 2, P 24)

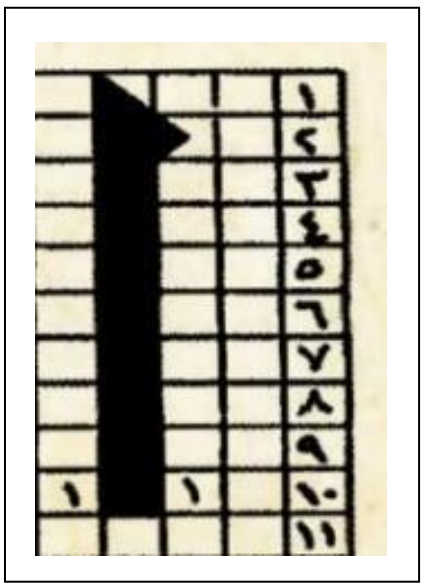

Fig.13: Al-noon the geometrical description of Alif on the left side, Source: Authors. (Al-noon, 1972, P2)

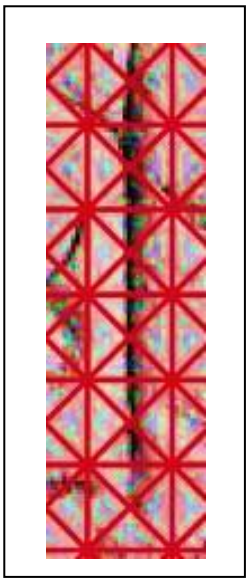

Fig.14: The Alif letter is structured in**,** 5 squares units taken from the tombstone, Source: Authors.

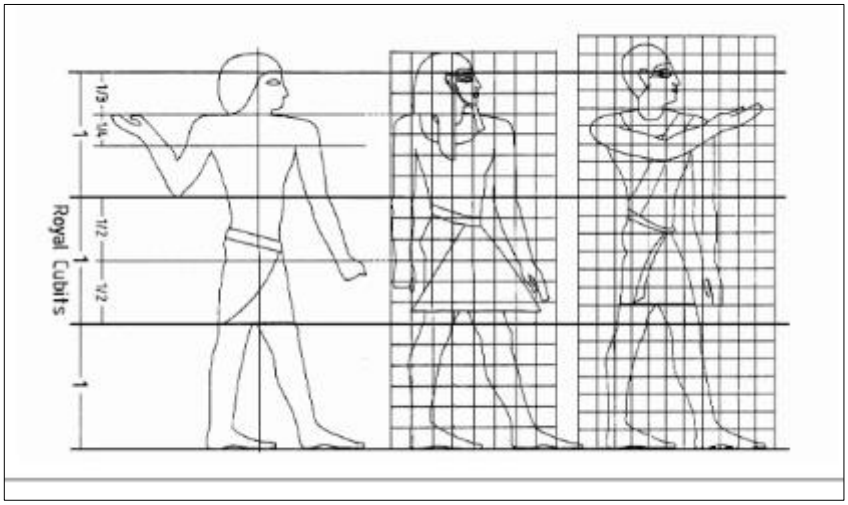

Fig .15: The use of the grid in Pharaoh's civilization as inscriptions on a stone
Legon, 1996:70

The Hypothesis:

This research hypothesizes that the grid system has been a tool of design to structure the inscriptions on the tombstone

As we mentioned above, the grid was studied and explored as a tool for writing illuminated manuscripts, and rulers were used to recognize it as a tool to structure the writings in Islamic manuscripts besides the illustrations and ornamentations. Although geometrical tools like compasses are used in building crafts, as far as the study unravels, there has been no description of using the grid as a physical geometrical tool or as a description of an illustrated drawn grid that was used in the inscriptions or for building in Islamic architecture, especially during the Fatimid dynasty, although the grid has been used in the previous era of Pharos civilization to structure the illustrations on a wall of stone, as seen in the Fig. 15.

However, finding the use of a grid in two different materials confirms that the grid is considered a tool in the Islamic civilization crafts. Moreover, the findings indicate that the grid will lead to the possible use of the grid on other materials such as glass, coins and metals. There is a possibility of the use of a different type of a grid; like the hexagon grid which is found in the Islamic manuscripts beside the square rectangle.

The grid system in the Islamic manuscript was set on one proportional rectangle. This study has set the grid based on detecting two proportional rectangles of root two that were found on the same layout at the tombstone. That means any detection of a proportional rectangle and more at the same area as the layout of any case study will enable the geometrical analysis method to set the grid.

Conclusion

The study introduces a new method and new result in Arabic writing inscriptions on a stone. It has also revealed a structured tool that helped to structure and arrange Arabic writing on the tombstone. The different crafts in Islamic civilization used to share similar materials and tools for the structuring the graphic elements such as Arabic writing. In this case study, a stone that shared the same structured tool used in the Islamic manuscript was identified as a grid ruler. This ruler was used in both materials to structure and arrange the Arabic writings which include the writing line, and structuring letters and words on the grid. What we know about the main function of the ruler tool in the Islamic civilization is setting the main layout of the design and the writing lines, but what we don't know is that the grid as a ruler could determine the anatomy of Arabic writings in the tombstone, which suggests a new style of Kufic calligraphy.

This paper concludes that the main role of the grid is to structure the Arabic writing to be easily readable. Grid as a tool has revealed the use of proportion rectangles on the tombstone. It is the same application that was found in the Islamic buildings and the Islamic manuscripts.

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