

Overlapping arches as a decorative and an architectural element in Islamic architecture

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Abstract:

Islamic Architecture is characterized by its richness in many elements that were used in both architectural and decorative aspects such as the arches that were not innovations of Muslim architect, but were found in the buildings of the ancient civilizations and were inherited after that in Islamic architecture. The Muslim architect developed the arches in his buildings and presented them in new shapes. Among the various shapes of arches that appeared in Islamic architecture a formation that is composed of the overlapping of these arches with each other. What increased the importance of this formation is that the Muslim architect adapted it to have an architectural role beside their decorative aspects. The purpose of this paper is to study the usage of overlapping arches as a decorative and architectural element in Islamic architecture. The study looked into the origins of this element by investigating its earliest examples in ancient civilizations to determine how it emerged in Islamic architecture. Furthermore, the study traced back the initial attempts in Islamic architecture to use this element in both decorative and architectural roles, along with an assumption that its usage as architectural element is entrenched in Islamic architecture, as well as the arguments that support this assumption. Further to that, the research clarified the numerous shapes of overlapping arches used as decorative motifs in Islamic architecture and backed these shapes with examples to illustrate each of them. In addition, the paper also identified the cases where overlapping arches performed an architectural role in Islamic architecture. Finally, the paper clarified how the use of overlapping arches both as a decorative and architectural element moved to European architecture as an influence of Islamic architecture.

Keywords:

Overlapping, Arches, Origin, Islamic architecture, Decorative element, architectural role, influences

المخلص:

تميزت العمارة الإسلامية بغناها بالعديد من العناصر التي استخدمت في الجوانب الزخرفية والمعمارية، ومن بين ذلك العقود التي لم تكن من ابتكارات المعمار المسلم ولكنها ظهرت قبل ذلك بعناصر الحضارات القديمة وورثتها منها بعد العمارة الإسلامية. وقد استطاع المعمار المسلم أن يقوم بتطوير هذه العقود بعناصره الإسلامية وقدمها بأشكال جديدة لم تكن موجودة من قبل. ومن بين الأشكال المختلفة التي ظهرت بها العقود في العناصر الإسلامية ذلك التكوين الذي يتكون من تداخل هذه العقود مع بعضها البعض. ومما يزيد من أهمية هذا التكوين بالعناصر الإسلامية هو أن المعمار المسلم استطاع أن يقوم بتطويعه ليكون له دورا معماريا إلى جانب دوره الزخرفي الذي كان له بعض الإرهاصات من قبل. ويهدف هذا البحث إلى

دراسة هذه ظاهرة العقود المتقاطعة أو المتداخلة واستخدامها كعنصر معماري وزخرفي في العمارة الإسلامية. وتبحث هذه الدراسة في تأصيل هذا العنصر وبيان نماذجه المبكرة في مجال العمارة بشكل عام منذ أقدم العصور، وكيف تطرقت هذه الإرهاصات المبكرة إلى العمارة الإسلامية. وتتبع الدراسة كذلك المحاولات الأولى للمعمار المسلم لتطويع هذا العنصر في عمائره الإسلامية واستخدامه للأغراض المعمارية والزخرفية. وفي الوقت ذاته، تتضمن الدراسة افتراضاً بأن المحاولة الأولى لتطويع هذه الظاهرة ليكون لها دوراً معمارياً إلى جانب دورها الزخرفي يرجع الفضل فيها للمعمار المسلم مع تدعيم ذلك بالأمثلة والقرائن الأثرية التي تدلل على صحة هذا الافتراض. وتتضمن هذه الدراسة حصراً للأشكال المختلفة التي ظهرت بها العقود المتداخلة في العمارة الإسلامية في النواحي الزخرفية مع تأصيل كل منها بتتبع النماذج المبكرة لكل منها مع تدعيم ذلك بالأمثلة، كما قامت بحصر الحالات المختلفة التي استخدمت فيها العقود المتداخلة كعنصر معماري في العمارة الإسلامية مع محاولة تأصيل كل حالة من هذه الحالات وبيان الإرهاصات الأولى لها لبيان الوصل بين النماذج المبكرة والمطورة في الفترات اللاحقة. وفي النهاية سلطت الدراسة الضوء على تأثير هذه الظاهرة على العمارة الأوربية وأشارت إلى نماذجها في كلا من النواحي الزخرفية والمعمارية.

الكلمات المفتاحية:

عقود، متداخلة، تأصيل، العمارة الإسلامية، عنصر زخرفي، عنصر معماري، تأثيرات

The research importance:

The paper aims to study the phenomena of overlapping arches in Islamic architecture for which, no specialized study was allocated. Therefore, the study shed the light on the role of this element in Islamic architecture in both decorative and architectural aspects. The paper also examines its origin and its earlier examples in architecture in general and in Islamic architecture in particular. Furthermore, the paper shows the influence of this element on European architecture in both decorative and architectural roles.

The research methods:

The paper raises several important points about overlapping arches, including their origin in architecture in general, their purposes, and their shapes in both decorative and architectural roles. The paper uses several methods to achieve its objectives that it traces back the earlier examples of these elements to clarify their origin. In addition, the paper uses the comparative analytical approach by examining the cases of these elements in the decorative and architectural uses. The same approach is used around the paper to extract the arguments that support the Islamic origin of these elements in some cases. Also, the paper relies on the descriptive approach by describing the various examples of these elements in both decorative and architectural cases.

Introduction:

Arches are one of the most important and most famous elements in Islamic architecture. However, they were not an innovation of the Muslim architect, but appeared in the architecture of the pre-Islamic period. Although ancient Egyptians reached a high degree of accuracy and perfection in their buildings, the arches were not known for surmounting the gates and windows

in their buildings which were limited to using the straight stone pieces for this position¹. The Greeks also agreed with the ancient Egyptians in this regard where their buildings were devoid of this element. Probably, the arches appeared for the first time in the architecture of the Roman who used them as a decorative and architectural element and created many types of them².

As for the Islamic architecture, the arches did not appear in the mosques of the early period as the ceilings were directly set on columns without arches, which applies, for example to the first construction of the prophet's mosque in Medina³, the Kairouan mosque⁴, and the mosque of Cordoba⁵. The arches appeared in Islamic architecture for the first time in the dome of the rock in Palestine 72 A.H/ 691 A. D⁶, and the great Umayyad Mosque in Damascus 86-96 A.H/ 705-715 A.D. and then they spread in all buildings around the Islamic world. The Muslims inherited the arches from the Roman architecture, developed them, innovated many types that characterized the Islamic architecture, and used them as a decorative and an architectural element in their buildings⁷.

The creativity of the Muslim architect was not limited to the variety of the arches, but his creativity extended to adapting them into complex formations that are produced by overlapping the arches with each other and using them in the architectural and decorative aspects. Hitherto, there is no specialized study for these intersecting and overlapping formations that are produced from the arches and used in various functions in Islamic architecture except for the researches that dealt with crossed-arches domes⁸. These included slight notes about the idea of the overlapping arches without indulging in detail. For the preceding, this paper is subjected to study the overlapping arches in Islamic architecture through following their origin in pre-Islamic civilizations and examining their earlier examples in Islamic architecture. The paper examines also the limitation of their spread in Islamic architecture, clarifies their uses, and highlights the decorative and architectural functions they performed. It also determined how these Islamic elements moved to European architecture with the same Islamic shapes.

Origin:

The origin of overlapping arches goes back to ancient Egyptian civilization, although the arches in general were not used in its formation. This is due to the similarity of some decorative elements that appeared in the buildings of the ancient Egyptian civilization with the overlapping arches, even though these decorative elements were not explicitly composed of arches in their formation. These decorative elements depended on some geometrical and floral designs and are used to decorate ceilings, walls, columns of the tombs and temples. Among these designs, the tangent and interlacing circles that appeared in the ceiling of one of the rooms of the palace of king Amenhotep III in Luxor⁹ (Figure 1, a). The ancient Egyptian used also some plant designs for decoration such as the papyrus leaves, which overlap with each other to decorate the bases and column's capitals in the temples and are similar in their general shape with the overlapping arches (Figure 1, b). Probably, these geometrical and plant shapes gave birth to the element of the overlapping arches in later periods.

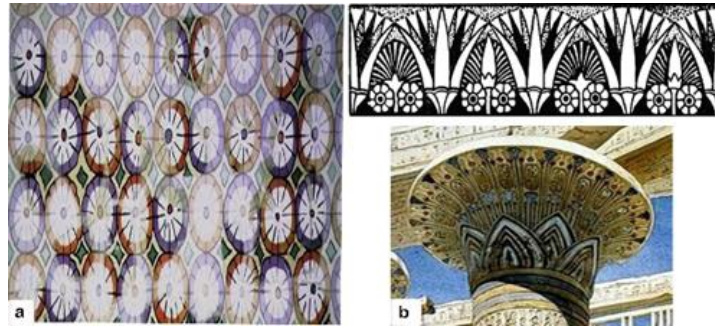


figure 1. decorations resemble overlapping arches in ancient egyptian buildings (a) amenhotep iii palace (b) papyrus flowers overlap with each other; mahmoud, 2020.

By examining the archaeological evidence and following up on the excavation works, it became clear that the decorative elements that depend on the overlapping shapes continued during the Sasanian and Roman period¹. Among these, some stone pieces extracted from the Roman excavation sites, preserved now in Syracuse Museum, and decorated with a decorative shape composed of an arcade of semi-circular arches overlapping with each other without columns¹. The same decoration executed with mosaic exists in a building which dates back to the Roman period in Villajoyosa city in Spain (Figure 2, a), the outer frame of this mosaic decorated with semi-circular arches overlapping with each other¹. Moreover, the excavation sites in the east that back to the Sasanian period yield many examples of these motifs that depend on overlapping arches, these decorations found in architectural ruins and earthenware jars, they composed of semi-circular and pointed arches overlapping with each other, and some of which composed of overlapping circles¹ (Figure 2,b).³

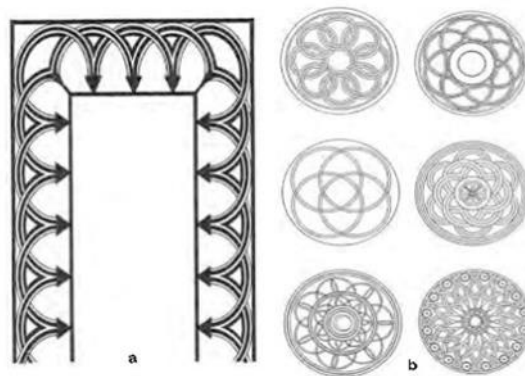


Figure 2. Roman and Sasanian decorative units of overlapping arches (a) Roman mosaic in Villajoyosa, Spain (b) Decorative units founded in architectural ruins and earthenware jars, Sasanian period; Fuentes, 2013.

Among the decorations of the pre-Islamic period that can be linked to the overlapping arches, the decorations of the Byzantine column's capital, which was known as basket capital¹, this type of column's capital decorated with interlaced shapes that are similar to the idea of the overlapping arches (Figure 3,a). Moreover, the excavation works provided us with another example of a Byzantine column's capital from Huerta, Syria, which includes carved decorations like overlapping arches¹ (Figure 3, b).⁵

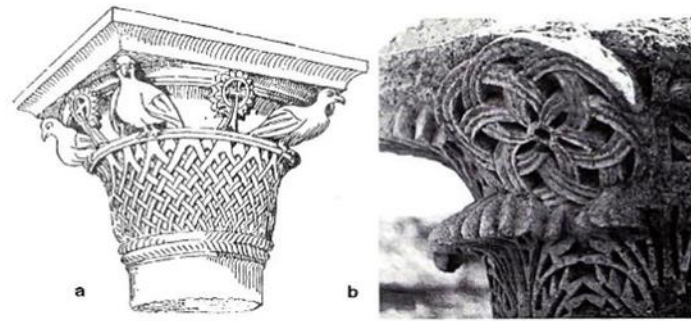


Figure 3. Overlapping arches motifs on column's capital (a) Byzantine column's capital, called basket capital style; Shafi, 1970. (b) Byzantine column's capital from Huerta, Syria; Odenthal, 1982.

From the preceding and in the light of the archaeological evidence, it can be said that the overlapping arches were used in the buildings of the pre-Islamic period for decorative purposes only, as we do not have any examples until today which could indicate that they were playing an architectural role.

It is known that Islamic civilization inherited many architectural and decorative elements from the civilizations of the pre-Islamic period. Among these inherited elements were the overlapping arches which firstly appeared in Islamic architecture in general in the façade of al-Hayr palace Qasr al-Hayr al-Gharbi 109 A.H/ 727 A. D¹. In this example, the overlapping arches were used as a decorative motif where the facades of the two towers that surrounded the palace gate were decorated with interlaced decorations composed of repeated units of overlapping lobed-arches¹ (Figure 4, a). Another early example exists in Mshatta palace 126 A.H/ 744 A.D, which includes a circle stone window occupied from its inside by pierced decorations composed of overlapping arches¹ (Figure 4, b). These two examples of al-Hayr and Mshatta palace are considered the earliest examples of this decoration in Islamic architecture in general. After that, many examples of overlapping arches spread in Islamic architecture as they were used as a decorative motif to decorate the facades, domes, gates, and minarets in the east and west as will be explained later.

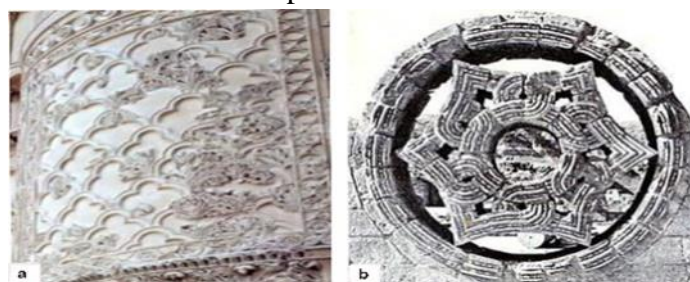


Figure 4. Decoration of overlapping arches, early Islamic period (a) Qasr al-Hayr al-Gharbi; Nassrah, 2018. (b) Mshatta palace; Kahil, 2008.

The Muslim architect was not satisfied by using the overlapping arches in the decorative aspects, as he inherited from the civilizations of the pre-Islamic period, but he adapted them to have an architectural role in his buildings. Accordingly, the idea was applied for the first time in Islamic architecture in al-Kharana palace in Jordan. It was dated by some orientalist in the first half of the 1st A.H/ 7th A.D century during the Sassanian period¹, but the later studies⁹

proved its construction date to the Umayyad state in the second half of 1st A.H/ 7th A.D century² .

Among the rooms of al-Kharana palace, there is one roofed by two crossed-arches (Figure 5), which overlap with each other in their center and the spaces resulting from their intersection were filled with a stuffing of brick² . The two crossed-arches¹ in this example may seem like a cross vault, which began to be used as an architectural element since pre-Islamic civilizations² , especially that some documents watha'iq during the Islamic period called it as cross-arch² . Nevertheless, we cannot consider cross-vault as a source of overlapping arches for the difference between their shape and formations. Moreover, the two elements have different functions as the cross vaults are limited to ceilings.



figure 5. two cross-arches roofed a room in al-kharana palace; al-kadi, 2016.

Despite the simplicity of the example al-Kharana palace, it is considered the first attempt in Islamic architecture to use two crossed-arches in roofing a square area, as the two crossed-arches formed the structure of the ceiling of the mentioned room and the stuffing between their crossed ribs just filled the spaces. Therefore, the architectural load of the room's roof depends on the two crossed-arches, which proves that it is a true attempt to use crossed-arches for an architectural function.

From the preceding, it can be asserted that this early example is the starting point for expanding the use of overlapping arches in architectural functions. The idea developed later to be applied in various architectural functions in Islamic architecture such as the arcades, transition zones, engaged voussoirs above entrances and mihrabs. However, the most famous architectural function that it has been used for was the domes that depend on this idea. This type of domes was known among the researchers by many names such as overlapping-arches domes, crossed-ribs domes, crossed-arches vaults.

The first known example of this type of domes are those exist in the mosque of Cordoba which is attributed to the works of al-Hakam II in 354 A.H/ 1055 A. D² . The technique of these domes depends on number of arches that are overlapping with each other away from their centers and away from the center of the dome to form with their overlapping a complete structure for the helmet. After that, the architect developed this technique to be able to dispense it with the construction of the dome's helmet and only fill the spaces resulting from the intersection of the arches with a decorative stuffing² (Figure 6).

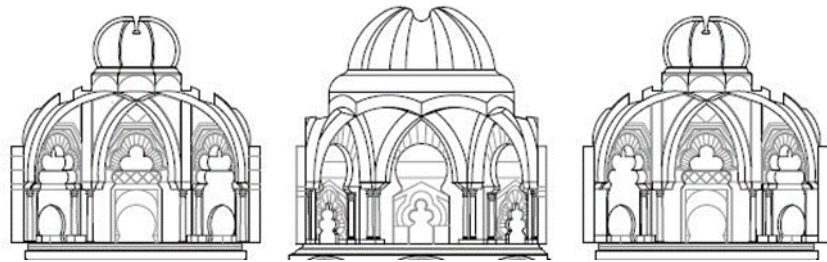


figure 6. cross-arch domes of cordoba mosque; fuentes, 2019.

It is possible to link the technique of crossed-arches domes in Cordoba mosque and the first attempt of using crossed arches for an architectural purpose in Al-Kharana Palace, as the similarity between the examples seems logical. This is evidenced by the fact that the two crossed arches of the example of the al-Kharana palace were used to form the structure of the room's roof which composes of a square area. By the same technique, the crossed arches used to form the structure of the helmets of the domes, which roofed also square areas in the Cordoba mosque's examples.

It can be said that the example of Cordoba mosque is more developed than the example of the al-Kharana Palace. This development represents in increasing the number of the overlapping arches to reach eight arches² instead of two arches⁶ only in the first example. Also, the intersection of the arches in the second example occurred away of their center and away of the center of the domes, which helped in forming a structure that compatible with the rotation of the helmets of the domes. Whereas the two arches in the first example overlap with each other in their center, which resulted in creating a flat roof after filling the space with stuffing above the rotation of the two arches.

Although, the example of the Cordoba mosque is more developed than the example of the al-Kharana palace, it can be attested that the idea of the two examples is the same, in which the overlapping arches were used in forming the structure of the roof. This is enhanced also by the examples that appeared later in Andalusia with the same simple shape of the example of the al-Kharana palace such as some examples of the domes of Bab al-Mardoum mosque in Toledo 390 A.H/ 999 A.D (Figure 7, f, g, h)². Other examples at the same mosque gathered between crossed-arches in the center and the overlapping arches around the dome's base (Figure 7, a, I), which assert the development theory. The simple shape of this technique appeared also in Andalusia in other examples such as the mihrab dome of al-Qanatir mosque Puerto de Santa Maria 4th A.H/ 10th A.D century² (Figure 8) and the central dome of al-Muslmin mosque in Toledo, which is known by Las Tornerias 5th A.H/ 11th A.D century². Hence, these simple examples indicate that this technique may be moved from the Levant region to Andalusia and then developed in the domes of Cordoba mosque.

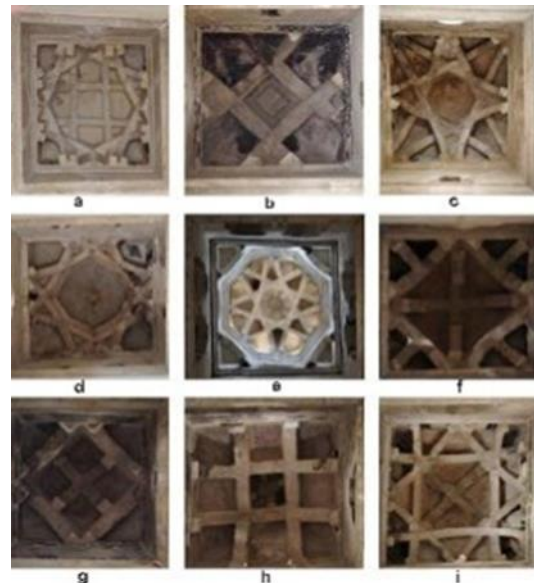


figure 7. cross-arches domes of bab al-mardoum mosque in toledo; fuentes, 2013.

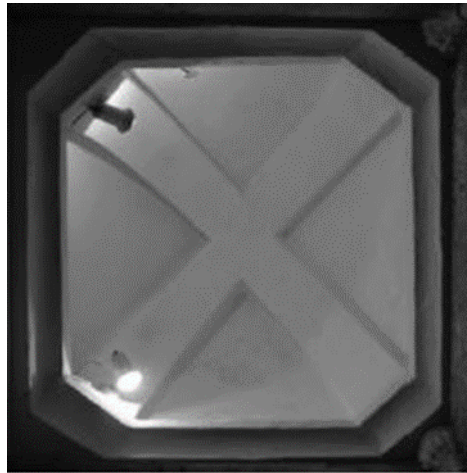


Figure 7. Two cross-arch domes, in al-Qanatir mosque in Spain; Akif, 2020.

This is also supported by the fact that the development of this idea did not stop in the domes of the mosque of Cordoba. The following examples which were influenced by these domes were more developed, such as the dome of the great mosque of Tlemcen 530 A.H/ 1137 A.D which composes of a structure that includes sixteen overlapping arches³. Therefore, the idea of these examples is the same and it is owned to the first attempt in the al-Kharana palace.

As for transferring of this idea directly from the al-Kharana palace in the Levant region to the great mosque of Cordoba in Andalusia, this regard seems to be logical, as both buildings were constructed under the patronage of the same state, which is the Umayyad state. It is known that the Umayyad state originally was founded in the Levant region. After its fall in 132 A.H/ 749 A.D under the attack of the Abbasid, one of its Amir managed to escape to Morocco and eventually succeeded in reviving the Umayyad state once more in Andalusia and established Cordoba; the first capital of the Umayyads there in 138 A.H/ 755 A.D. These events led to the movement of many architectural traditions directly from the Levant region to Andalusia.

Overlapping arches as a decorative element in Islamic architecture:

As aforementioned, this decorative element has had precursors since the buildings of the ancient Egyptian civilization and through Sasanian and Roman civilizations. Then, the Muslim architect inherited it, developed it, and used it during the Islamic period as a decorative element to decorate many parts of the buildings of this period. This element appeared on the facades, entrances, minarets, mihrabs, and arcades with various shapes that were created and can be summarized as follows:

Recurrent and superimposed units of overlapping arches:

This shape *-al-mushabbakat-* composes of recurrent units of overlapping arches that are repeated in a superimposed and intersected way until it occupies all space of decoration. The first known examples of this formation appeared in the facades of the two towers that surround the entrance of Qasr al-Hayr al-Gharbi 109 A.H/ 727 A. D³, which means that the Umayyad were the first to use this form as a decorative element in Islamic architecture. This explains also, the appearance of this element in the Umayyad architecture in Andalusia as the first attempt after the example of Qasr al-Hayr was in the great mosque of Cordoba above the superimposed arches that appeared in the mosque since the works of the Amir Abd al-Rahman Ibn Mo'awiyah 170 A.H/ 786 A.D³.

The facades of the arcades inside the mosque are decorated with rectangular areas occupied by intersected decorations of recurring units of overlapping lobed-arches that depend on the columns. These decorations are quite similar to the earlier example of Qasr al-Hayr, which confirms the close relationship between the two examples despite temporal and geographical difference between them. The decorations of the great mosque of Cordoba were the beginning of the spread of these decorations in Islamic architecture in Andalusia and Morocco. This is applied particularly to Andalusian and Moroccan minarets that it is rare to find a minaret that is not decorated by these repeating elements of overlapping arches.

Best examples of minarets that are decorated by this type of decoration, the minaret of the great mosque of Seville, Giralda, which is attributed to the Almohad dynasty by the order of Abu Yousef Ya'qub al-Mansour in 580 A.H/ 1184 A. D³. The main shaft of this minaret is basically decorated with intersected decorations which is composed of overlapping arches, its facades include vertical rectangular areas occupied by repeated elements of overlapping arches (Figure 9, a). Likewise, the second shaft which was included in the original minaret was decorated by the same type of decoration³, but this shaft was replaced now by the current steeple during the later additions.

This type of decoration was not limited to the minarets in Andalusia but was also used as a

decorative motif in other architectural units. It appeared in the main façade of the mosque of Bab Mardum, which is known by Cristo de la luz 390 A.H/ 999 A. D³ that the blinded arcade⁵ in this facade is surmounted by a rectangular area that is occupied by intersected decorations. It was also used as a main decorative motif in al-Hambra palace in Granada that the façades of the arcades that overlook the palace halls were basically decorated by intersected decorations performed in stucco. These decorations composed of repeated units of overlapping arches.

Moreover, the recurring overlapping arches were a custom decorative motif on the minaret of Morocco³. It appeared in the minaret of the great mosque of Tlemcen 530 A.H/ 1136 A. D³ (Figure 9, b), the minaret of al-Koutoubia mosque in Marrakech 542 A.H/ 1147 A. D³ and the minaret of Hassan mosque in Rabat 593 A.H/ 1197 A.D. Also, among the examples of this decoration in Moroccan minaret, the minaret of al-Mansoura mosque in Tlemcen 703 A.H/ 1303 A.D³, the minaret of Abi al-Hassan al-Marini 742 A.H/ 1341 A.D⁴, and the minaret of al-Hamraa mosque in Fes 752-755 A.H/ 1351-1354 A.D⁴. It's evident that this decoration spread in the majority of the Moroccan minarets and did not limit to them, but also appeared in other architectural units such as the facades, the entrances, and windows. Among these, the arcades that overlook the open courtyard of Albo-inaniyah madrasa in Fes 751-756 A.H/ 1350- 1355 A. D⁴.

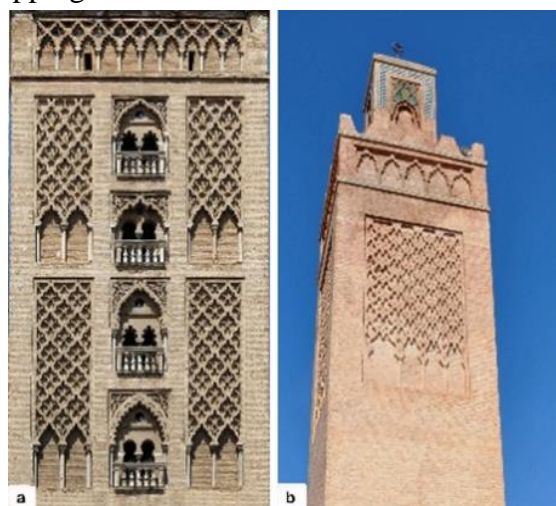


figure 8. decorations of overlapping arches on the minarets. (a) great mosque of seville; auguste de montéquin, 1990. (b) tlemcen mosque, almagro, 2015.

Although this decorative formation originated in the Levant region and then moved with the Umayyad dynasty to Andalusia and from there to Morocco, it did not resonate in Islamic architecture in other countries except for some rare examples in Cairo that were probably influenced by the Andalusian style. Among these, the clock tower in al-Manial palace in Cairo, which is composed of interlaced decoration which resembles those decorations of the Andalusian and Moroccan minarets (Figure 10, a).

The interlaced decorations which are composed of overlapping arches appeared also in rare examples in Anatolia such as the great mosque in Sivas 626 A.H/ 1228 A.D⁴ that the straight lintel which surmounted the main entrance is decorated by interlaced shapes like overlapping arches (Figure, 10, b).

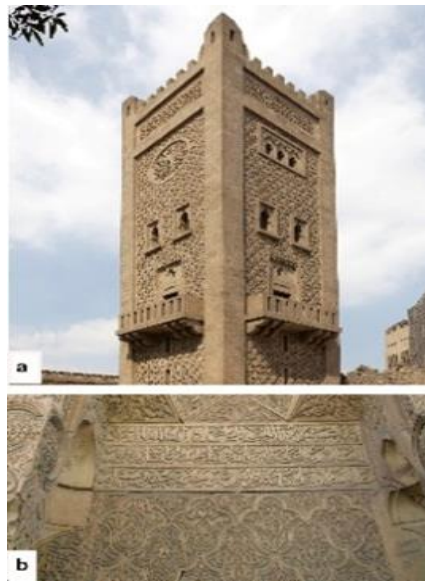


Figure 9. Decorations of overlapping arches (a) Clock tower of Manial palace, Cairo; Author. (b) Great mosque of Sivas; Pancaroğlu, 2009.

Overlapping arches depend on columns:

Among the various decorative shapes of overlapping arches, a decorative shape that composes of an arcade of overlapping arches depend on columns, which is considered one of the most famous decorative elements in Islamic architecture in Andalusia and Morocco. This element was used as a decorative motif in the minarets, facades, and entrances. The first known example of this decoration exists in San-Esteban gate in the great mosque of Cordoba, which was renewed by Amir Mohamed ibn Abd al-Rahman in 241 A.H/ 855 A. D⁴. The façade of this gate includes the most famous example of this decoration, which composes of horseshoe arches that overlap with each other and depend on four columns (Figure 11, a).

Similarly, the arcade of overlapping arches that depend on columns was used as a decorative element above the main entrances of the architectural buildings in many later examples in Andalusia and Morocco. Among these, the main facade of Bab Mardum mosque in Toledo 390 A.H/ 999 A. D⁴, the mentioned façade includes three entrances surmounted by a blinded arcade composes of five horseshoe arches in addition to semi-arch on both two sides that overlap with each other (Figure 11, b). This element appeared also above the entrance of al-Ja'faria mosque 437- 473 A.H/ 1045- 1080 A. D⁴, which includes six overlap-arches in addition to semi-arch

on both two sides depend on six columns and repeated inside the mosque above the mihrab (Figure 11, c). Moreover, the blinded arcade with overlapping arches was used as a decorative element above the main entrances in Morocco such as the entrance of al-Noussak zawayah in Sale 757 A.H/ 1356 A. D⁴.



Figure 10. Blinded arcade of overlapping arches (a) San-Estiban gate, Cordoba Mosque; Khoury, 1996. (b) Bab Mardoum mosque, Toledo; King, 1972. (c) Ja'faria mosque, Zaragoza; Bloom, 2020.

As for the minarets, the first attempt for using this element probably began in the original minaret of the great mosque of Cordoba, which constructed by the Umayyad caliph Abd al-Rahman al-Nasir in 340 A.H/ 951 A. D⁴. The main shaft of this minaret was decorated at its top by a decorative blinded arcade composed of nine arches depending on columns, but the arches here were not overlapping but were adjacent. The same blinded arcade was used to decorate the later examples of the minarets in Andalusia and Morocco, but the formation of the arches was developed to be intersected. The best example can be seen in the minaret of the great mosque of Seville, Geralda, 580 A.H/ 1184 A.D, that the blinded arcade which composes of overlapping arches that depend on columns repeats at the top of the main shaft and the second shaft of the original minaret before the later additions⁴ (Figure 12, a). The same decoration appeared in many examples of Moroccan minarets such as the minaret of al-Koutoubia mosque in Marrakech 542 A.H/ 1147 A.D, which includes an arcade composed of three overlapping arches which depend on columns at the top of each side of its main shaft⁵ (Figure 12, b). Furthermore, the blinded arcade of overlapping arches that depend on columns was used as a decorative element in the domes. The best example can be seen in al-Moravid dome in Marrakech 455 A.H/ 1063 A.D, its outer surface was decorated with overlapping arches depending on columns⁵.

Outside Morocco and Andalusia, this decorative element rarely appeared in Islamic architecture except for some limited examples such as the minaret of al-Mansour Qalawun complex in Cairo 683-684 A.H/ 1284-1285 A.D, where the cylindrical shaft of this minaret is decorated by an arcade composed of overlapping arches and columns which wrap around the body of the shaft

(Figure 12, c). This decoration was performed according to the decoration of the Andalusian and Moroccan minarets, which is compatible with the various influences of the west on this building⁵ .

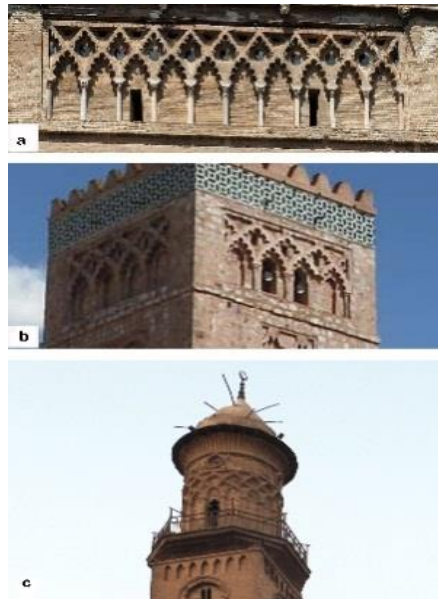


Figure 11. Overlapping arches depending on columns decorate the minaret (a) Great Mosque of Seville; Bloom, 2020. (b) Koutoubia mosque, Marrakesh; Maldonado, 2011. (c) Qalawun complex, Cairo; Author.

Overlapping arches without columns:

This decoration composes of number of arches that overlap with each other without columns. It was used in Islamic architecture in general in east and west to decorate the façade of the buildings and forming the outer frame of the arches of the entrances, windows, recesses, and mihrabs. The Muslim architect was excellent in carving these arches with this intersecting shape with different colors to the extent that the architectural elements which include this decoration look like masterpieces.

Sometimes, the overlapping arches without columns were used for forming the outer frame of the decorative medallions that decorate the façade of the buildings or flanking the oculus that surmounts the mihrabs. The first known example appeared in Mshatta palace in Jordan 126 A.H/ 744 A.D, which includes a stone circle window occupied by pierced decorations composed of overlapping arches⁵ (Figure 4, b). This decoration shape transferred after that to Egypt and Syria, it was executed in various material such as stucco, stone, and marble. Moreover, the technique of this decoration was more developed than that example of the Mshatta palace that the overlapping arches became more precise and incised or inlaid with multi-colors.

It appeared after the example of the Mshatta palace as a decorative motif in the soffits of the arches in the south-west portico of Ibn Tulun mosque in Cairo 263-265 A.H/ 877-879 A. D⁵ , it shows adjacent medallion executed in Stucco and occupied the arch's soffits (Figure 13). Later, it appeared in the same city during the Fatimid period at the façade of the Aqmar mosque 519 A.H/ 1125 A.D⁵ , the façade includes in its right and left sides of the entrance two-circle medallions, their outer frame performed by overlapping arches carved in stone (Figure 14,a).

The medallions of overlapping arches continued in Cairo during the Mamluk period as they appeared in Mihmindar mosque 725 A.H/ 1324 A.D which includes an oculus surmounting its main entrance, the oculus is surrounded by a decorative medallion composed of overlapping

arches executed by colored stone⁵. These medallions appeared also in al-Sultan Hasan madrasa 757-764 A.H/ 1356-1363 A.D, the medallions appeared in various places of the madrasa such as the medallion that surrounds the oculus in the northern façade and also the medallion that surrounds the oculus above the mihrab of the dome which can be seen in the southeast façade. The medallions of these examples are quite similar in their technique and composed of overlapping arches executed in colored stone⁵ (Figure 14, b). The medallion of overlapping arches appeared also as a decorative motif inside the mihrab of Qijmas al-Ishaqi mosque in Cairo 885 A.H/ 1480 A. D⁵, where the niche includes the signature of the engraver, which is sieged by a decorative medallion composed of overlapping arches (Figure 14, c).



Figure 12. Stucco medallions of overlapping arches in the soffits of the arches in Ibn Tulun mosque, Cairo; Creswell, 1979.

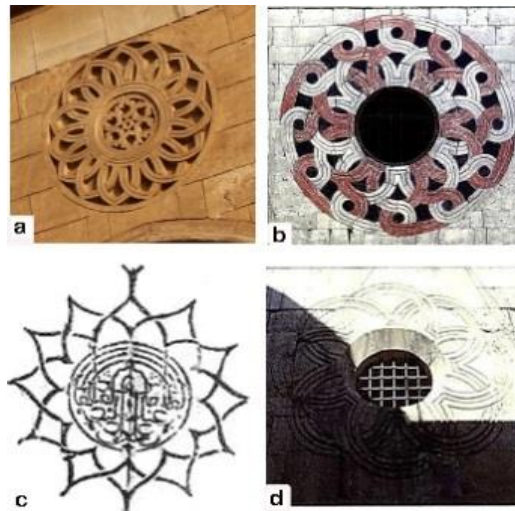


Figure 13. Decorative medallion of overlapping arches (a) al-Aqmar mosque, Cairo; Author. (b) Sultan Hassan madrasa, Cairo; Kahil, 2008. (c) Qijmas al-Ishaqi mosque, Cairo; Author. (d) Baybars mausoleum, Damascus; Kahil, 2008.

These medallions appeared also in Syrian architecture, the first known example can be seen in the mausoleum of Baybars in Damascus 676 A.H/ 1277 A.D⁵ which includes an oculus above its mihrab, the oculus is surrounded by a medallion composed of overlapping arches incised in stone (Figure 14,d). Another example can be seen in the same place in al-Tekritiyah turbah in Damascus 698 A.H/ 1298 A. D⁶, which completely matches the previous example. These Syrian examples came later than the Egyptian examples in Cairo, which suggest that they appeared in Syria by the influence of Egyptian architecture. Although, the first known example of these medallions appeared in Mshatta palace in the Levant region. Nevertheless, it is difficult to link between the Mshatta example and the examples of Damascus because of the simplicity of Mshatta example, which composed of pierced decorations in a shape of overlapping arches inside the oculus. Whereas the examples of Damascus are more developed than this example

and surrounding the outer frame of the oculus in shape identical to the Egyptians models, which assert the Egyptian influences in this regard.

The most famous uses of the overlapping arches without columns are the formation of the arches that surmount the entrances, mihrabs, and sometimes recesses. The overlapping arches in these models form the external façade of the voussoirs of the arch and appear as an interlaced shape. Moreover, the overlapping arches in these models were made as an external covering on the façade of the arch and formed with multi-colors of stone, marble, and stucco. In some cases, this decoration was not just an external covering, but the voussoirs of the arch were completely formed in a shape of overlapping arches, so that it plays an architectural role in the formation of the arch beside the decorative role.

This technique spread in the architecture of many countries of the Islamic world, but the first known examples are attributed to the city of Aleppo in Syria, which assumes that this technique is an innovation that was attributed to Aleppo and from this city spread to other countries. The first known example of this technique appeared during the Ayyubid period in the mihrab of al-Shazbakhtiyya madrasa in Aleppo 589 A.H/ 1193 A.D (Figure 15, a), the mihrab of al-Sultaniyyah madrasa 620 A.H/ 1223 A.D, and the mihrab of al-Firdus madrasa 633 A.H/ 1236 A.D. The same technique continued in the same city during the Mamluk period in the mihrab of Minkali Bugha mosque 768 A.H/ 1367 A. D⁶ . It also continued during the Ottoman period in the mihrab of al-Bahramiyyah mosque 991 A.H/ 1583 A. D⁶ and the entrance of the sanctuary of the great Umayyad Mosque, which was renewed in 1039 A.H/ 1629 A. D⁶ .

The same technique appeared in many examples in Damascus since the Mamluk period such as the mihrab of the mausoleum of Baybars 676 A.H/ 1277 A.D⁶ , the mihrab of al-Afridiyyah madrasa 749 A.H/ 1348 A.D, the entrance of Araq al-Silihdar turbah 750 A.H/ 1349 A.D, and the mihrab of al-Jaqmaqiyyah Khanqah 769 A.H/ 1367 A.D (Figure 15, b). Around the same period, the technique appeared in many examples in al-Quds in Palestine such as the mihrab of al-Silsila dome during the renewal works of al-Sultan Baybars in 661-671 A.H/ 1263- 1273 A.D, the mihrab of Emir Tinkiz 729 A.H/ 1328 A.D, and the mihrab of al-Haram mosque in al-Khalil 732 A.H/ 1331 A.D⁶ .

This technique appeared also in Cairo in many examples since the Mamluk period, such as the main entrance of the ribat of Azdumur al-Salihi 672 A.H/ 1273 A.D⁶ , the main entrance of al-Zahir Baybars palace 7th A.H/ 13th A.D century⁶ (Figure 15,c), and the gate of Darb-allabban beside the citadel 8th A.H/ 14th A.D century. Moreover, the overlapping arches formed the outer covering of the arch of the entrance of al-Aqbughawiyah madrasa 740 A.H/ 1339 A.D⁶ . In addition, the arches of the recesses that is situated in the southern façade of al-Sultan Hassan madrasa 757 A.H/ 1356 A.D, and the mihrab of the mausoleum of the mother of al-Sultan Sha'ban madrasa 770 A.H/ 1368 A. D⁶ .

It seems that this technique moved to Anatolia by the influence of Syrian architecture, where it appeared in many examples since the 7th A.H/ 13th A.D century, such as the entrance of Alaa al-din mosque in Konia 616 A.H/ 1219 A.D⁷ and the entrance of Kafatay madrasa in Konia 649 A.H/ 1251 A.D⁷ (Figure, 15,d).

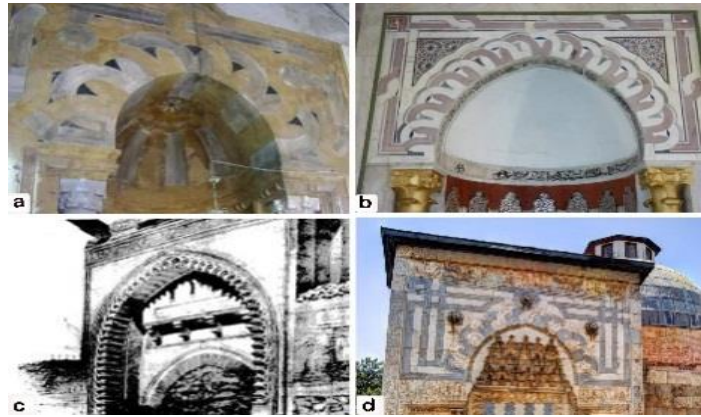


Figure 14. Overlapping arches decorate the arches of the mihrabs and entrances (a) Shazbakhtiyah madrasa, Aleppo; Author. (b) Jaqmaqiyah Khanqah, Damascus; Author. (c) Baybars palace, Cairo; Mahir, 1979. (d) Karatay madrasa, Konia, Hegazi, 2012.

The overlapping arches without columns also appeared like a row of intersecting arches to decorate the areas above the entrances, windows, and other spaces. Among these, the stucco decorations inside the mausoleum of Sayyida Atika and al-Ja'fari in Cairo 514-519 A.H/ 1120-1125 A.D. It appeared also in the stucco decorations around the inscription at the top of the main shaft of the minaret of al-Nasir Mohamed madrasa in Cairo 735 A.H/ 1303 A.D. Among these also, the decoration that appeared above the straight lintel of the entrance of a house discovered during the excavation works in Balad city Eski Mosul in Iraq dated back to Atabek period 521-660 A.H/ 1127 A.H/ 1261 A.D⁷, the decoration shows a row of overlapping arches carved in marble. They also appeared above the western gate of the new city of Fes 675 A.H/ 1276 A.D where the arch of this gate is surmounted by a decoration made by colored brick in a shape of a row of triple arches intersected with each other.

The overlapping arches as an architectural element in Islamic architecture:

According to the archaeological evidence, it can be said that the use of overlapping arches as an architectural element was relatively rare compared to their decorative aspects. Hence, the architectural role of this element did not appear in Islamic architecture in general except for limited cases that can be seen in the following:

Crossed-arch domes:

The overlapping arches are considered an essential component of these type of domes, which composed of number of arches that overlap with each other away from the center of the dome. Crossed-arch domes are considered an Islamic innovation, where they appeared for the first time in the great mosque of Cordoba and attributed to the renewal works of al-Hakam al-Mustansir in 354 A.H/ 965 A. D⁷ (Figure 16, a). Although these domes were the earliest examples in Islamic architecture in general, nevertheless many theories were assumed on their origin. These various theories may be were discussed because these domes were achieved with a high perfection to be sufficient to assume that they were not the first example of this type⁷. Among the theories that were supposed about the origin of these domes, theories have attributed this technique to the Persian origin⁷ but in fact the first known example in Persia appeared in the great mosque of Isfahan, which was later than the domes of Cordoba mosque. Therefore, it is illogical to attribute the origin of this technique to Persia. There was also another theory

which supposed that this technique was developed from the ribbed dome of Qairawan mosque⁷, which was attributed to the renewal works of Ziyadat-Allah Ibn al-Aghlab in 221 A.H/ 836 A.D. But in fact, if we consider that the ribbed dome was the origin of crossed-arch dome, then it is more logical to attribute the origin of this technique to the Levant that the dome of Hammam al-Sarh is a ribbed dome and is earlier than the dome of the mosque of al-Qairawan⁷.

Anyway, this study previously referred to the example of the al-Kharana palace as a first attempt in Islamic architecture to use the overlapping arches in an architectural role. At the same time, the study supposed the example as an origin to crossed-arch domes in the Cordoba mosque for the similarity of the technique in both of them. This is enhanced also by the examples- previously mentioned- which appeared in Andalusia with the same simple shape of the attempt of the al-Kharana palace. In addition, other examples that gathered between this simple shape of the crossed arches and overlapping arches around the base of the dome, which refer to that the idea moved from the Levant with its simple shape and then developed in the domes of Cordoba mosque.

After the domes of Cordoba mosque, crossed-arch domes widely spread in Andalusia and became a custom technique. They also moved to Moroccan architecture and appeared for the first time in the mihrab dome of Tlemcen mosque 530 A.H/ 1137 A.D (Figure 16, b), which became more developed, and the architectural role of its overlapping arches became clearer that the architect increased the number of the arches that formed the structure of the dome⁷.

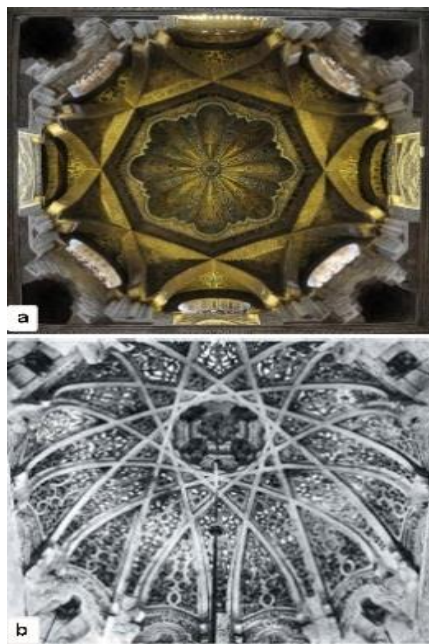


Figure 15. Western examples of cross-arch domes (a) Cordoba mosque (b) Tlemcen mosque; al-Kadi, 2016.

Strangely, the crossed-arch domes moved from the western Islamic architecture in Andalusia and Morocco to the eastern Islamic architecture in Iran and central Asia. At the same time, there are no parallel examples in the middle region of Egypt and Levant, which is something that need to be explained. The technique of these domes began to appear in Iran after approximately one century of the domes of Cordoba mosque, the first known examples appeared in the great mosque of Isfahan during the renovations of Seljuk period in 478 A.H/ 1086 A. D⁷ (Figure 17, a). Among the Iranian examples of this technique also the mausoleum of Sultan Ahmed Sijar

in Merv 551 A.H/ 1157 A. D⁸, which includes a dome that was formed by a number of overlapping arches⁸ (Figure 17, b). The domes of overlapping arches widely spread in central Asia such as the dome of the mosque annexed to Mir Arab madrasa in Bukhara 942 A.H/ 1533 A.D and the dome of Abd al-Aziz Khan in Bukhara 10th A.H/ 16th A.D century⁸ (Figure 17, c).

Regarding the overlapping arches of these domes, they were made with various raw materials. Some examples of Andalusia and Morocco were performed with stone such as the example of Cordoba mosque while they were performed by baked brick in other examples such as the overlapping arches of the dome of Seville palace 6th A.H/ 12th A.D century⁸ and the overlapping arches of the dome of Tlemcen mosque 530 A.H/ 1136 A.D. Nevertheless, the overlapping arches in the majority of the eastern examples were performed with backed brick such as the example of Isfahan mosque. As for their architectural role, they performed an essential architectural role in the majority of these examples as they replaced the transition zones and formed the structure of the domes⁸.

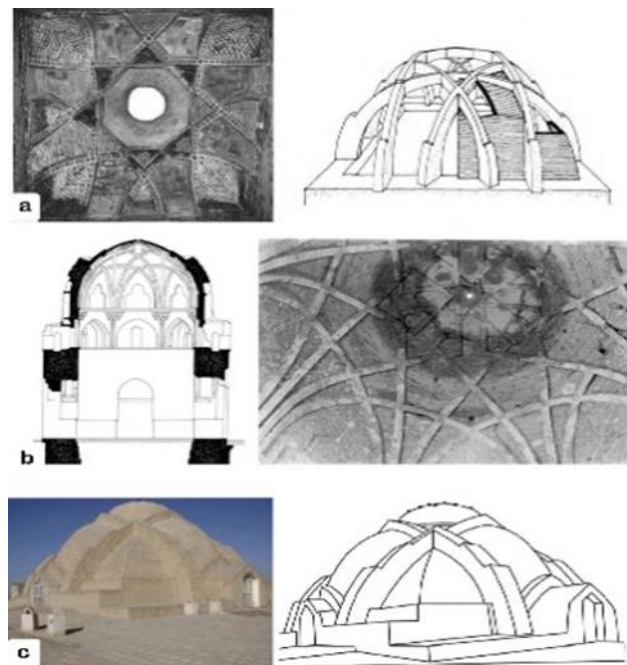


Figure 16. Eastern examples of cross-arch domes (a) Isfahan Mosque; Fuentes & Huerta, 2010. (b) Ahmed Sinjar mausoleum, Merv; Fuentes, 2013. (c) Abd al-Aziz Khan madrasa, Bukhara; Ragab et al., 2020.

Arcades of overlapping arches:

The overlapping arches were used in forming the arcades in rare examples in Islamic architecture, which may be limited to Andalusia and did not appear outside this region. In this type of arcades, instead of being composed of a row of adjacent arches, they composed of a number of arches that overlap with each other. The most famous example of this type of arcades, is the arcades that surround the mihrab square in the great mosque of Cordoba, which were added to the mosque during the renovation works of al-Hakam al-Mustansir in 354 A.H/ 965 A.D (Figure 18, a). These arcades are considered the first attempt to use overlapping arches in forming the arcades as an architectural element in Islamic architecture and are considered a clear example of employing them in architectural roles⁸.

The architectural arcades that are composed of overlapping arches were repeated in some examples after the attempt of Cordoba mosque. Among these, the arcades of al-Ja'faria palace in Zaragoza 437- 473 A.H/ 1045- 1080 A.D, which includes many architectural arcades composed of lobed and foliated arches which overlap with each other⁸ (Figure 18, b).⁶

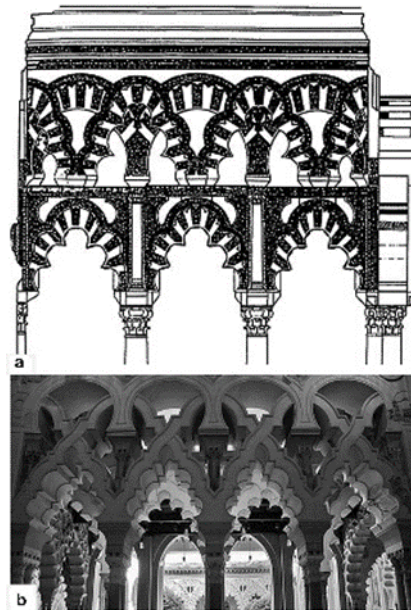


Figure 17. Arcades of overlapping arches (a) Cordoba Mosque (b) Ja'faria palace, Zaragoza; Maldonado, 2011.

The technique of the arcades of overlapping arches in Andalusia depends on a custom system in which the arches are overlapped with each other are of the same shape, which means that all overlapping arches of the arcade itself are horseshoe or pointed-horseshoe or lobed arches. However, a break with this technique appeared in the arcades which surround the mihrab area in Cordoba Mosque, where the arcades are composed of horseshoe arches overlap with different shapes of lobed arches. This was produced for the first time and hardly spread outside this mosque⁸.⁷

Engaged voussoirs:

As known, the engaged voussoirs play an architectural role in the formation of the arches. We have previously mentioned that overlapping arches were used as a decorative element on the facades of the engaged voussoirs that surmount the entrance, mihrabs, and recesses. Besides, many examples have been mentioned to illustrate these cases in various countries of the Islamic world. Moreover, it has been referred that the overlapping arches in these decorative cases were formed as an external covering on the facades of arches. Nevertheless, some examples of engaged voussoirs that formed the arches were made with stone or marble blocks that were formalized on overlapping arched shapes, which means that the overlapping arches were not just an external decoration, but they completely formed the voussoirs. Accordingly, the overlapping arched shapes played an architectural role in the formation of the arches in these cases. Among the examples which prove the preceding, the main entrance of Azdumur al-Salhi mausoleum in Cairo 7th A.D/ 13th A.D century⁸, the arch that surmount⁸ the entrance of this mausoleum is composed of a number of engaged voussoirs that were completely formalized on

a shape of overlapping arches. At the same time, we cannot limit the position of these cases to the architectural role that the overlapping shapes were formed with multi-colored stone or marble, which indicates that they played a decorative purpose beside their architectural role (Figure 19).



Figure 18. Engaged voussoirs of overlapping arches, Azdumur al-Salhi mausoleum, Cairo; Author.

The influence of the overlapping arches in European architecture:

There were close relations between Muslim Arabs and European countries throughout history. Among the reasons that caused these relationships, the commercial treatments which helped in moving the cultural traditions and the arts of the Islamic countries in the east to Western Europe⁸. Besides, the European⁹ pilgrims who used to pass through Eastern Islamic countries on their way to al-Quds, where they moved the products and the architectural traditions of the east to their countries⁹. In addition to the crusader wars which represented a major impact of Islamic influences in Western Europe in the field of the architecture and applied arts. Hence, these impacts led to moving the architectural traditions of the Islamic world to the west to the extent that many elements of Islamic architecture were applied in the west with its same shape that remind its Islamic origin. Furthermore, northern Spain is considered the first European regions that were affected by Islamic architecture in general during the Romanesque, Gothic, and Renaissance periods, because of the Christians who lived in Andalusia during Islamic rule and then migrated to northern Spain, bringing with them the tradition of Islamic architecture of Andalusia⁹.

Among the decorative and architectural elements that moved from the Islamic East to Western Europe, the overlapping arches, which appeared in European architecture with all uses and shapes which were known in Islamic architecture particularly in Andalusia as these elements spread in Andalusia more than other Islamic countries. Overlapping arches appeared in European architecture with their decorative purposes and architectural roles as seen in Islamic architecture and their examples almost harmonized with those found in Islamic architecture whether in their general shape or their technique.

Among the decorative elements of overlapping arches that appeared in European architecture by effect of Islamic architecture, particularly in Andalusia the recurring units of overlapping arches that widely appeared in Andalusian minarets. The same decoration appeared with the same shape in many examples of European architecture such as the decorations of the tower of Tarazona Cathedral in Zaragoza, Spain 557 A.H/ 1162 A.D century⁹ (Figure 20, a). In addition,

the decorations of the tower of San Pablo church in Zaragoza 13th A.D century (Figure 20, b), and the decorations above the main portal of Batalha monastery which is known as the monastery of Santa Maria da vitória in Portugal 786 A.H/ 1385 A.D.



Figure 19. Decorations of overlapping arches in cathedral's towers (a) Tarazona cathedral, Zaragoza. (b) San Pablo church, Zaragoza; Fuentes, 2013.

Besides, the Blinded arcade that is composed of overlapping arches was a decorative element on the facades of Islamic architecture such as the decoration above San Esteban gate of Cordoba Mosque and the blinded arcades of Bab al-Mardoum mosque in Toledo. The same decorative element widely spread on the façades of European architecture during Middle Ages and Renaissance periods with the same shape and same arches that was previously used in Islamic architecture. Among these examples, the tower of San Bedru church in Teruel (Figure 21, a), the tower of Teruel Cathedral Spain in the 12th century, which are decorated by blinded arcades composed of semi-circular arches overlap with each other. Among these examples also, the blinded arcade which decorates the façade of Saint Pablo church in Zaragoza 13th A.D century, and the blinded arcade which decorates the tower of the same church⁹ (Figure 21, b). The overlapping arches used as a decorative element outside Spain in Gothic architecture such as the main façade of Prague cathedral the 14th century A.D, which includes a terrace extending along the façade and decorated with pierced decorations with foliated arches overlapping with each other.

Regarding the architectural role of overlapping arches in European architecture, they appeared during the Romanesque, Gothic, and Renaissance periods. Among the architectural roles of overlapping arches in these buildings, their role in crossed-arch domes and vaults that widely spread in European architecture as an effect of Islamic architecture. Crossed-arch domes and crossed-arch vaults can be seen in various examples with their Islamic origin shape such as the ceiling of the narthex of St. Evasio in Casale Moferrato in the 12th century, this example is a very singular case as the narthex is roofed with four overlapping arches cover an enormous space of over 15 m⁹ (Figure 22, a). Therefore⁴, this example can be considered more developed than Islamic examples.



Figure 20. Blinded arcades of overlapping arches (a) San Bedru church, Teruel. (b) San Bablo church, Zaragoza; Guzman, 2003.

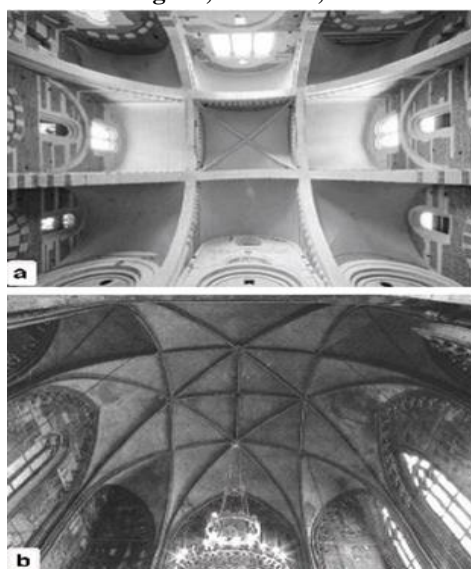


Figure 21. Cross-arch domes in European cathedral (a) Narthex of St. Evasio, Italy. (b) Prague cathedral, Prague; Fuentes & Huerta, 2015.

Many examples of crossed-arch domes and crossed-arch vaults appeared in Gothic architecture in European countries such as Prague Cathedral in the 14th century A.D (Figure 22, b), and the crossed-arches vault of the south tower of St. Stephen's Cathedral in Vienna 14th A.D century, which typically follows the Islamic pattern of crossed-arches domes of Cordoba⁹ .

Moreover, overlapping arches were used as an architectural element in European architecture in forming arcades as seen in the great mosque of Cordoba and al-Ja'faria palace in Zaragoza. These cases can be seen in many examples of European architecture such as arcades, which can be seen among the ruins of the monastery of San Juan de Duero in Soria, Spain⁹ (Figure 23, a). This case is a clear reflection of the arcades which are composed of overlapping arches and depend on columns. Besides, it is clear that they were derived from the arcades around the maqsura of Cordoba mosque. This element can be seen in the same shape of Islamic architecture in Notre Dame Cathedral in Paris in the 14th century A.D (Figure 23,b), which includes an arcade extending along its main façade, depends on columns, composed of foliated overlapping arches⁹ , and resemblant of the arcades of al-Ja'faria palace in Zaragoza.



Figure 22. Arcades of overlapping arches in European architecture (a) Monastery of San Juan de Duero in Soria, Spain; Garsía, 2015. (b) Notre Dame cathedral, Paris; Bruzelius; 1987.

Conclusion:

This is a detailed study on overlapping arches that were used as decorative and architectural element in Islamic architecture. Firstly, the paper examined the origin of overlapping arches and traced back the first examples in the architecture in general. After that, it attested that the origin of this element goes back to ancient Egyptian, Roman, and Sasanian civilizations where it was used as a decorative element by using plant motifs and geometrical patterns. The paper asserted that the first attempt of using overlapping arches in architectural role in Islamic architecture was in the Levant and from this attempt; they were employed in more developed architectural functions in later periods. The paper determined all shapes of overlapping arches that were used as decorative elements in Islamic architecture and supported each of them by surviving examples to support the idea. The paper referred that the first example of the interlaced decoration –al-mushabbakat- attributed to the Umayyad architecture in the Levant, where it appeared in Qasr al-Hayr al-gharbi and then moved with the Umayyad to become widely spread in Islamic architecture in the west of Islamic world. The paper referred also that the first example of using overlapping arches in forming the decorative medallions attributed also to Umayyad architecture in Mshatta palace. Then they appeared and developed in Egyptian architecture during the Fatimid and Mamluk period and later appeared in Syrian Architecture during the Mamluk period by the effect of Egyptian architecture. The paper attested that using overlapping arches in decorating the arches of entrances and mihrabs began in Aleppo city and from it, this decorative formation moved to Syrian cities, Egypt, and Anatolia. Furthermore, the paper determined the cases of the architectural roles of overlapping arches in Islamic architecture. Moreover, it presented an assumption that crossed-arch domes of Cordoba Mosque may be derived from the two crossed arches of al-Kharana palace, and the arguments of this assumption were presented. Finally, it clarified the influence of overlapping arches of Islamic architecture on European architecture in both decorative and architectural aspects.

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