

ARCHTECTURE

# The story of the arch that never sleeps

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## ARCHITECTURE

# THE STORY OF THE ARCH THAT NEVER SLEEPS

### Abstract

Perhaps no other culture mastered the design and use of the arch more than the Muslims. Inheriting earlier arch forms from the Greeks and the Romans, Muslims developed a variety of new shapes including the horseshoe, multifoil, pointed and the ogee arch. The passion they had for this motif is connected to some mystical/ symbolic meanings and functional advantages. It is not surprising to find their architecture adopting it as a main structural and decorative feature. The arch soon conquered all cultures progressively becoming a global architectural motif. The present article explores the static significance of the arch, Muslims' understanding of it and its transfer to Europe.

### 1. Introduction

The use of the arch in architecture formed an essential part of early civilisations. The Egyptians and the Greeks used lintels, but the Romans and later Byzantines adopted the semi-circular arch. Structurally the thrust, in the simplest arch, is exerted by the weight of the masonry and any other superimposed loads above the arch as well as sideways (horizontally) by the cumulative wedge action of the voussoirs. Such action gives the arch an elasticity characteristic, which enables it to reach balance corresponding to the thrust. This condition is compared to that of a hanging load chain; "**the arch stands as the load chain hangs**". In the Muslim world such characteristic is better described in the proverb "**the arch never sleeps**". On the other hand, these characteristics reduced the thrust on a few points, which could be easily enforced. This relieved support to other areas, a fact, which permitted the construction of lighter walls and vaults saving considerable amount of material. In addition to the above, the arch provided an important decorative feature that was transmitted from architectural decoration to other forms of art especially furniture.

### 2. The Muslim adoption and mastery of the arch

Muslims mastered the use and design of the arch more than any other nation. Scot (1904) related their love for this motif to their love of the palm tree. They imitated the curve of its graceful branches in their constructions. Nonetheless, one cannot ignore the mystic meaning derived from the spherical nature of the universe and the divine symbolism of the dome from which the arch is derived. The Muslims' knowledge of geometry and laws of static must also have played a leading role in their choice of developing various types of arch. The arch was first employed for structural and functional purposes but progressively it was used for decorative purposes.

#### 2.1 The Horseshoe Arch

The first Muslim adaptation and modification of the design of the arch occurred in the invention of the horseshoe type. This was first employed in the Umayyads Great Mosque of Damascus (706-715, **figure 1**) (Briggs, 1924). There is a suggestion that the horseshoe form was derived from the symbolic use of

primitive ages where it represented a superstitious emblem for many societies (Jairazbhoy, 1973). The use of the horseshoe as a protector against the evil eye in North Africa is still maintained to the present day. They are often mounted onto front of doors of houses. Similar symbolic use is manifest in India and many parts of the world. Such suggestion should be dismissed as Islam categorically rejected any association or belief in superstition. A symbol of sainthood and holiness, the horseshoe arch provided a better advantage allowing more height than the classical (semi-circular) arch as well as better aesthetic and decorative use. Nevertheless, Muslims used this curve form to develop their famous ultra-semicircular arch around which the whole of Muslim architecture evolved<sup>1</sup>.

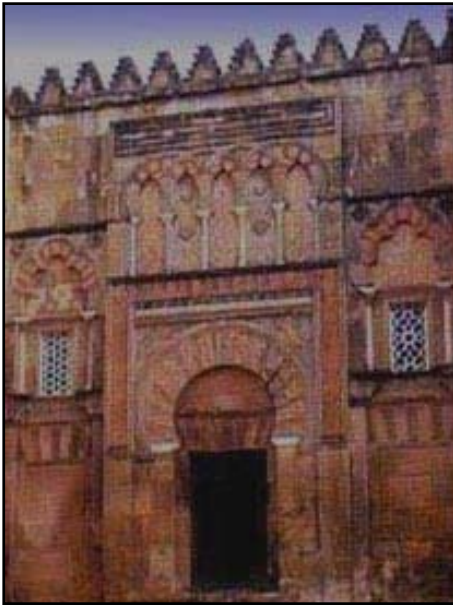


**Figure1. Horseshoe arches, Umayyad Mosque in Damascus.**

Meanwhile, the introduction of the horseshoe into Cordoba (Great Mosque 756-796, **figure 2**) set the path for its transmission to Europe through the northern Christian regions of Andalusia. This process started with the Mozarabs (Christian Spanish living in Andalusia) moving between Andalusia and Northern Christian parts of Spain. Among these were artists, scholars and builders and architects who brought with them Muslim methods of building, forms and motifs including the horseshoe arch (Trend, 1931).

The result was the appearance, in northern Spanish regions, of a large number of religious edifices in a Moorish style with horseshoe arches. For instance, St Miguel de Escalada, near Leon, was built by monks arriving from Cordoba in 913. Among the features it had were the melon shaped domes and the horseshoe arches (Dodds, 1994).

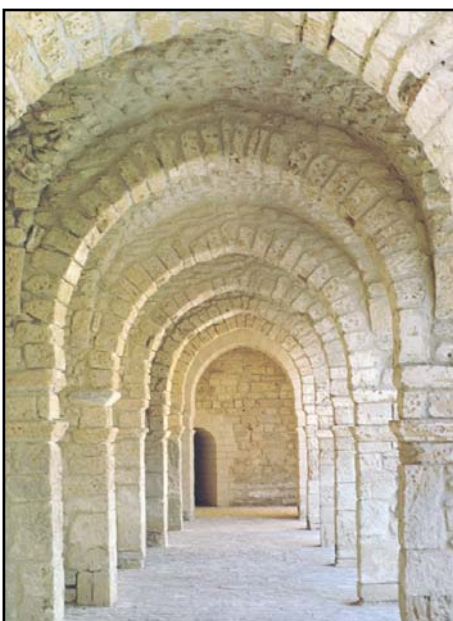
The horseshoe arch had also been illustrated by Mozarabs in their illuminated manuscripts such as the one of Beatus of Lebara. Historic sources indicate that the illuminator of this manuscript, named Magins, worked at the monastery of St Miguel de Escalada. The church of St Cebrian de Mazote, also founded by Mozarab Cordoban monks in 921, reveals similar planning, structural and decorative elements of that of St Miguel de Escalada with a basilica plan, horseshoe arches, tripartite choir and horseshoe shaped apses (Dodds, 1994).



**Figure 2. The horseshoe and the cinqfoil arches on main façade, Cordoba Mosque.**

## 2.2 The Transverse Arch

Further development came in the 8<sup>th</sup> century when Muslims used, for the first time, the transverse arch in the Palace of Ukhaidir (720-800) setting precedent for its universal use. After the adoption of the pier as a replacement of the classical column, Europe embraced this arch in the 11<sup>th</sup> century. Here, the arch was thrown from each pier of the arcade to the wall of the aisle (**figure 3**). There is no clear evidence on how and when this arch was transmitted to Europe where it is considered to be the first step revolutionising the way churches were built. The use of the transverse arch over the nave not only provided greater safety and durability but also gave the final shape of the nave especially in terms of height and roof. This feature represents a fundamental structural step in the process of development of Gothic. It led to the adoption of ribbed vaulting which progressively enabled the vaulting of the nave and evolving the compound.



**Figure 3. Arcade of transverse arches in Mahdia Mosque (Tunisia, 11<sup>th</sup> century).**

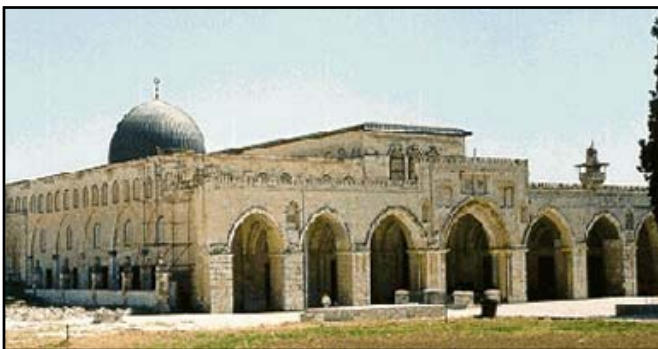
### 2.3 The Pointed Arch

In relation to the pointed arch, Rivoira (1914) thought that the pointed arch occurred in India carved out of a solid block of some seventh century temples taking the views of Havell (1913) who related the pointed arch to the niches of early Buddhist temples. Indian artists are known to have worked for Harun-ar-Rashid in Baghdad and Indian merchandise were sent to Cairo and Syria.

The Indian origin of the pointed arch and its passage to Syria and Egypt through Sassanid Iran has been already dismissed by Hill (1993), who rightly believed in the Muslim origin of the invention of the pointed arch. The first appearance of the pointed arch in the Muslim World was traced to the Al-Aqsa Mosque<sup>2</sup> (780, **figure 4**), but the Palace of Ukhaidir remains the first building where the pointed arch was used constructively and systematically.

The main advantages of the pointed arch was that it concentrated the thrust of the vault on narrow vertical line that could be supported by the flying buttresses, a major feature of European Gothic architecture. The pointed arch enabled the reduction of the lateral thrust on foundations. In Gothic, it enabled architects to lighten the walls and buttresses which had to be massive to support earlier semicircular arches<sup>3</sup>. Additionally, it resolved the difficulty of achieving level crowns in the arches of the vault allowing the vault to become suitable for any ground plan.

To tackle the question of height, Muslims had employed a variety of techniques, in addition to the pointed arch. The method used in Kairawan Mosque<sup>4</sup> (836) is revealing. Here, in order to gain a crown level of height, masons have raised the arcade of narrow areas above the arcade of other areas as shown in **figure 5**. In the Great Mosque of Cordoba, a more impressive method consisting of intersecting arches as well as building a second arcade on top of a first lower level arcade was introduced (**figure 6 & 7**). These clearly show the genius as well as the rational thinking in addressing various architectural problems.



**Figure 4. The Al-Aqsa Mosque inspired Crusaders to imitate the Muslim pointed arch in Europe.**



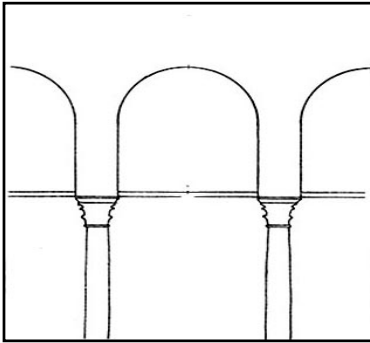


Figure 5. Raised arcades, Kairawan Method.



Figure 6. Raised Semi-circular arches, Cordoba Mosque.

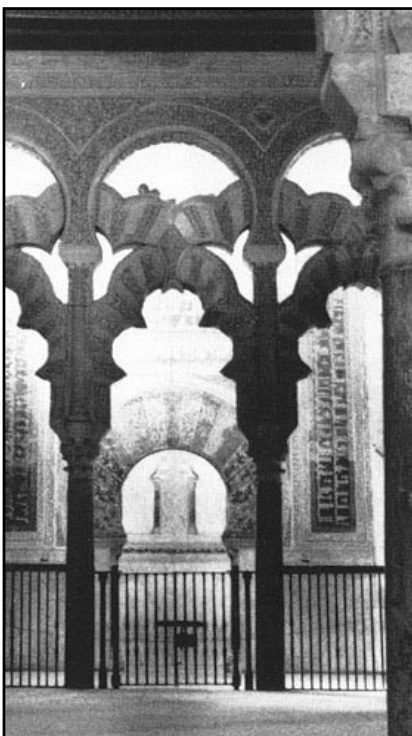
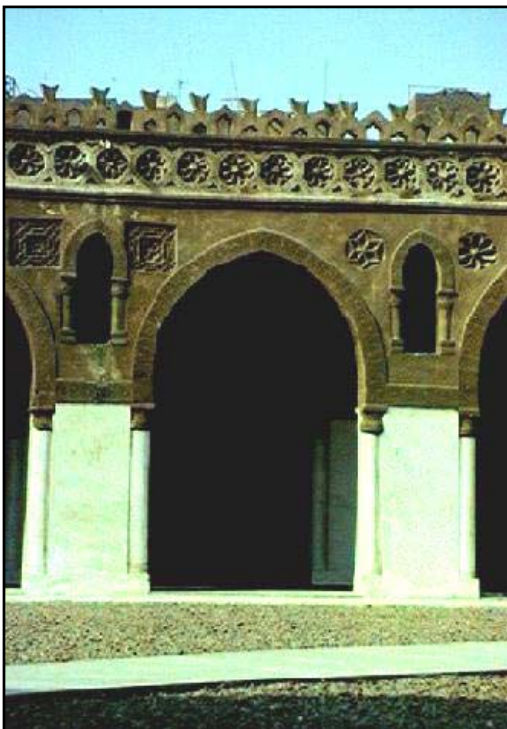


Figure 7. Attaining Height Method 3: Trifoil and semi-circular arches, Cordoba Mosque.

### 3. Transmission of the Pointed Arch

Historic sources indicate that Sicily played the role of intermediary for the transmission of many Muslim motifs including the pointed arch. Professor Conant (1954) established the Sicilian connection through Amalfitan merchants who had trade links with Egypt where the pointed arch of Ibn Tulun (figure 8) must have been the source. White (1971) Endorsed this theory<sup>5</sup> suggesting that it was transmitted to Amalfi in 1000 through commercial and trade ties with Egypt. It was first used in the porch of the Abbey of Monte Cassino in 1071. This challenges the idea widely adopted in Europe that the pointed arch, on which Gothic architecture is based, was an invention of European architects in their efforts to overcome the static problems in Romanesque vaulting. It is worth noting that while works were being carried out, Monte Cassino became the retiring place for the Tunisian Christian scholar, Constantine the African. A physician and a distinguished scholar in mathematics, science and theology, with large experience of Muslim building techniques and forms in Muslim Fatimid North Africa, Constantine would have undoubtedly commented or advised in the building process. Furthermore, according to Meyerhof (1931), Constantine had an assistant Arab monk nicknamed "the Saracen" who helped him in translating Arabic books. Such connections give credibility to this theory.



**Figure 8. Ibn Tulun Mosque was another source for the transfer of the pointed arch to Europe.**

In 1083, St Hugh the Abbot of Cluny (South France) visited Monte Cassino, five years before the work on the third Church of Cluny started (1088-1095). Conant (1954) revealed that the new church of Cluny used some 150 pointed arches in the aisles. Other Muslim features included the use of catenary vaulting, polyfoil cusps framing the triforium arches, and the rectangular frame enclosing the arch of the gate (1109-1115), known as Ijmiz, (destroyed in 1810). In 1130, Abbot Suger visited Cluny and between 1135 and 1144 he and his engineers built St Denis, the first Gothic building.

The adoption of Cluny and Monte Cassino, the two most influential churches in Europe, of the pointed arch and other Muslim forms encouraged the rest of Christian Europe to adopt it leading to its rapid spread across much of France, especially in the south, later in Germany in mid 12th century (Heer (1962, p.332), and eventually to the rest of Europe.

#### 4. Conclusion

This brief story is an example of many Muslim elements, which found their way to Europe where they provided solutions to many practical and intellectual problems. The Muslim arch was described as to **never sleep** due to its structural-decorative functions as well as its universal adaptability. A survey of world architecture would show its wide spread use whether in the form of a semi-circular, horseshoe, pointed, ogee, or cusped and multifoil arch. The arch demonstrates the positive contribution of Muslim architects to human civilisation.

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#### Notes:

- 1 The Romans were the first to use it but Muslims improved its form.
- 2 Al-Aqsa was built by Omar (2nd Caliph in 632).
- 3 The semi circular vaulting caused some static problems in covering such large and irregular areas.
- 4 Originally built between 670-675.
- 5 She traced the pointed arch to India in the second century AD. According to her, it was transmitted to Persia and then to Syria and Egypt.

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