EVOLUTION OF ABSTRACT VEGETAL ORNAMENTS IN ISLAMIC ARCHITECTURE

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Abstract
This research investigated the history of Islamic abstract vegetal ornaments and sketched their evolution to understand their creation process and innovations. We studied these ornaments regionally to identify regional variations and classified them based on tastes of patrons. Meanwhile, we analysed the formal aspects of these ornaments, including their dimension, proportion, dominant colour, material, and techniques. In addition, the study conducted detailed observations of their characteristics, such as margins, apex, thickness of stem scrolls and vents, to define their constructive elements, aesthetical properties, and design principles that reveal date, region, and styles. This research not only provides a comprehensive guide to the evolution of Islamic abstract vegetal ornaments for architectural conservation projects but also serves as a reference for the comparative and critical analysis of contemporary Islamic-inspired ornaments.

Keywords: Ornaments; Islamic ornaments; abstraction; Middle East art & architecture

INTRODUCTION
Above all monumental and structural elements, such as domes and minarets, the essential character of the Islamic architecture is the role of decoration (S. S. Blair & Bloom, 2003). All the other elements are determined by the elegance of their decorations. Vegetal or floral motifs have long been the foundation of Islamic decoration (Clévenot, 2000). However, Islamic architectural ornaments in general and abstract vegetal decorations in particular, which are symbols of the development and contribution of Islamic civilizations to art and architecture, have been degraded from an innovative arena of Muslim architects to the field of imitative art. The lack of research on the principles and architectural orders of these ornaments often leads to their inappropriate use, particularly in terms of date, style, and even formal aspects (main elements, proportions, colours, etc.) in the conservation, restoration, and building of new projects inspired by historic styles.

Research Methodology
This research is mainly based on descriptive and historical approaches, for which our first objective was to identify most popular vegetal ornaments (identification of research topic). The second objective was to collect these ornaments from most important surviving monuments (data collection). The scope of this research chronologically spans from the early stages of Islam’s birth to the late 18th Century and regionally covers areas from West Africa to the Indian subcontinent, thereby exploring the legacy of major Muslim dynasties and empires. Well-preserved ornaments from 150 Islamic-inspired monuments are gathered and classified based on time and region - evaluation and classification of date. Furthermore, formal aspects of ornaments including, constructive shapes, scales and proportions, line thickness and types of curves, density of pattern, material, colour and techniques are analysed to identify principles of Islamic abstract vegetal ornaments (data analysis). Our goal is to sketch the evolution of Islamic vegetal ornaments through the history and to describe variations in regional styles using the correlation of these principles with earlier classified periods and regional variables (data synthesis).
Main Elements of Islamic Abstract Vegetal Ornaments

From the earliest monuments with mosaics of naturalistic motifs, such as the Dome of the Rock and the Umayyad Mosque, to the early 18th Century glazed tiles of Madar-I Shah Mosque, several elements dominate the repertoire of Islamic vegetal ornaments. These main elements can be classified according to their botanical and morphological features. Narrowing these features down to the morphological aspects related to abstract ornaments is necessary because comprehensive botanical analyses are beyond the scope of this research (see Figure 1).

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<th>Natural leaves</th>
<th>Stem Scrolls</th>
<th>Palmate</th>
<th>Abstract Leaves</th>
<th>Buds</th>
<th>Flowers</th>
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**Leaves:** un-lobed or lobed forms of natural or abstract leaves

**Stem scroll:** an undulating or spiral stems connecting other element

**Palmate & Hastate:** a shape with single axial symmetry (Palmate has 5 or more lobes, Hastate has 3 lobes which can be associated to fleur-de-lis)

**Flowers:** either single axial symmetry shapes or round shapes with radial petals

**Buds:** both scaly and naked forms of flower and leaf

Figure 1. Predominant elements of Islamic floral ornament in Sheikh Lutfallah Mosque (Source: Mandana Fard, 2008).

Early stages; Umayyad Ornaments (660 – 750 CE)

Oldest surviving buildings in the Muslim world of architecture, including the Dome of Rock (691 CE), Al-Aqsa Mosque and Umayyad mosque (both 709 CE), are decorated with naturalistic floral and vegetal motifs, mainly derived from Sassanid and Byzantine arts (Flood, 2001). Plants that can be botanically identified in the Umayyad mosque of Damascus are palm and pear trees as well as acanthus and vine leaves (see Figure 2).

The salient characteristic of ornaments in this period is the golden background, which is similar to Byzantine ornaments. The gold colour also used for depiction of vegetal decorations, for which in such cases dark background is chosen to provide a sharp contrast. The same principles are used in later buildings such as Khirbat al-Mafjar (724 CE) in Palestine. Form Qasr-al-Hayr al-Gharbi (727 CE in Syria) onward, Byzantine mosaic technique expelled gradually, and carved stucco and stone became the prevalent technique. Meanwhile, stem scrolls became more popular, causing trees to be marginalized.
Another notable change is the use of relatively more stylized vegetal ornaments in mid-8th Century buildings. Al-Qasr Umawi in Amman (743 CE) with abstract acanthus leaves, rosettes, vine stems and grapes carved inside stone blind niches, spandrels and column capitals, is a good example of first artistic movement in the history of Islamic vegetal ornaments. Around two decades later in surviving ornaments of Al-Mshatta palace (743 CE), there is no sign of trees in ornaments, and scrolls became a main decorative motif. While in eastern territory of Umayyad reign, vine scrolls became more popular, acanthus remained the main motif in western extents, which were heavily under the influence of the Byzantine style. Mosaic also continued to serve as main decorative technique in western parts of Umayyad Empire. The great mosque of Cordoba with its lavishly decorated Mihrab (see Figure 2) and Maqsura (976 CE) is a great example of late surviving Umayyad buildings (Khoury, 1996).

Abbasid, Tulunid, Buyid, Hudid, Almohad, Ayyubid (750 – 1258 CE)

Only a few buildings survived from the early Abbasid period in mid-8th Century, which none of them are remarkable in terms of flora decorations. In the early 9th Century, massive extensions added to the Great Mosque of Qairouan in Tunisia (Grube & Michell, 1995). In these early renovations of mosque, clear examples of Byzantine acanthus leaves, Egyptian lotus and rosettes are used in column capitals and wall decorations. Decorations used in this period are the continuance of the Umayyad architecture. But in later refurbishing, from 862 CE onward the current Mihrab, Minbar and minaret have been added. Decorative ornaments used in these elements are a mutation in Islamic floral ornaments, which its signs can be found from Samarra in Iraq to Masjid-I Noah Gumbad in Afghanistan. The marble panels of Qairouan’s Mihrab with carved floral motifs are imported from Iraq (Grube & Michell, 1995) which shows the influence of Samarra style in the mid-9th Century of Islamic world of architecture. Lavish living style of Abbasid rulers motivated Muslim architect and artisans to form a new level of decorative arts in their buildings that tended towards abstract floral motifs and distinguish themselves form principles of antiquity art. On the other hand, the heavy influence of eastern neighbouring dynasties such as Buyids and Seljuks caused the decline of floral motifs in their art and geometrical motifs became dominant ornaments in Abbasid architecture.
**Characteristics of Abbasid ornaments (Samarra Styles)**

In the mid-9th Century, Islamic floral ornaments experienced new styles and distinctive techniques, which are contemporary to introduction of geometric ornaments to Islamic architecture. These geometrical ornaments are generated on three main constructive bases of circle grids, polygon tilling and plane symmetry groups (Abdullahi & Embi, 2013). The excessive influence of geometry caused a revolutionary transformation in the naturalism of early Islamic vegetal ornaments. These new conventional designs are categorized under Samarra styles (Ali, 1999) and were so popular during 9th and 10th Centuries all over Islamic the Islamic world of architecture. The 9th Century carved stucco decorations in ruins of the old Samarra city are the products of above-mentioned transformations.

**Scrolling:** The immediate effect of geometry was on the stem scrolling. Pre-Islamic and early Islamic stem scrolls grow longitudinally (sinusoid curves) and volutes are springing from a main stem alternatively. However, in later styles, stems were in the form of a grid of circles, inscribed within a geometrical frame (square, hexagon, etc.). Other elements, including fruits, flowers and leaves are encircled by stem scrolls, which are sculptured over constructive circle grid (see Figure 2).

**Leaves:** Another notable change from early 9th Century onward is the form of leaves that became even more conventional and lost their natural order to another level. Sharp edges replaced by more round corners, leaf lobes become symmetrical around its main vein and finally leaves overall shape became limited to top and side view with certain curvatures.

**Framing:** Another change, which took place during this period, is the framing of surfaces. In earlier styles, patterns distribute naturally throughout required surfaces while in late Abbasid styles, vegetal motifs are constrained within polygons of geometrical patterns.

**Fatimid Ornament (909–1171)**

This is the Age of paradoxes. Fatimid’s artisans had a tendency to create natural figural motifs (Bloom, 2008) yet they were deeply drowned Abbasid abstract and geometrical motifs. Fatimids’ art is characterized by use of realism, while in architectural ornaments abstract floral and geometrical patterns are dominant. The Fatimids’ first impressive building in Cairo was Al-Azhar Mosque that was founded in 970 CE. The building was restored and expanded frequently throughout history, but window grilles and stucco panels in the spandrels of the main prayer hall along with carved stucco of Mihrab’s hood are either original or later Fatimids’ addition to the mosque (Behrens, 1989). Although abstract elements of Samarra style has been used in Al-Azhar, but especially in stem scrolls, a tiny naturalistic style is returned from early Islamic and pre-Islamic decorations. A difference that may notice between the Fatimids and Umayyads scroll is that in early Islamic styles, leaves or flowers grow out of main scroll whilst on Fatimid’s style leaves may grow out of other leaves and may form as a part of main scroll. In addition, leaves are broader, their curves are section of smaller radii and vine scrolls are stockier than early Islamic styles, which made dense and exuberant patterns in comparison to its earlier styles. These patterns are mostly axially symmetric which a vertical element (trees, palmate or bulbous chalice) bisects the surfaces and this was a common practice in Umayyad ornaments (see Figure 3)
Another characteristic of these ornaments is the excessive use of fan shaped leaves. Sometimes a secondary leaf grows out of the apex of bi-lobed leaves and in case of frieze and borders; leaves are growing continuously out of apex of each other to form scrolls. The same concepts have been used in Al-Hakim Mosque (1013 CE) of Cairo (see Figure 3). The original carved stone, brick and stucco works in blind arches and decorative bands are designed with vegetal motifs inspired by Al-Azhar ornaments. Later Fatimid’s surviving buildings such as Al-Juyushi, Al-Aqmar and Salih Tala’i Mosque are not significant in terms of floral ornaments. In these late Fatimid’s monuments, floral decoration is limited to tiny friezes and boarders. In terms of morphology, gradually stems and scrolls became thinner, tri-lobed and five-lobed leaves become more frequent in designs in comparison to early Fatimid’s ornaments.

Buyids, Seljuk, Ghurid Ornaments (11-12th Century)

The nature of local building-materials and construction-techniques induced different type of ornaments to Anatolian Seljuks and Great Seljuks’ (Iran and central Asia) architecture (Hillenbrand, 1994). Brick has always been the predominant construction material in Iran and Central Asia and it suits perfectly for assembling geometrical patterns. Meanwhile, Anatolian Seljuks used carved stone as medium of their ornaments. In the oldest surviving Great Seljuk monuments such as Tomb Towers of Kharaqan (1093), Barsian Friday Mosque (1098) and until the early 12th Century, geometrical motifs dominate ornaments and façade decorations. By mid of 12th Century, the hegemony of geometrical patterns among Seljuk architects subsided slightly and vegetal motifs returned to their facades.

Floral ornaments of Great Seljuks and Ghurids’ monument of this period, such as Arch of Bust (1147), Sultan Sanjar Mausoleum in Merv (1157) and Jam minaret (1174) have much in common with their predecessors and specially Abbasid’s Samarra style. Of particular Seljuk floral ornaments’ characteristics is first the thickness of stems, which become very thin in comparison to both their predecessors and concurrent Fatimids style. The second distinguishing factor is the leaves dimension, which have been elongated and shows more mature aesthetically proportions. Early 12th Century Divrigi complex (1129) has both broad and long leaves on its carved stone entrance portals. By mid-12th Century, Anatolian Seljuks took a step further and defined new proportions that transformed broad leaves to long falcate shapes (see Table 1). Original carved wooden Minbar of Alaeddin mosque in Konya (1150) is one of early example of this new style. Additional tendril on the apex of leaves, which in botany is called as ‘Cirrhose Apex’ is the third feature that differentiates Seljuk’s ornaments from Abbasid and Fatimids design. Naturalistic Pinnate venation in leaves’ design is another popular feature among both Great and Anatolian Seljuk’s architects and artisans.
Table 1. Evolution of Main Elements of Islamic Floral Ornaments (Sources: Authors).

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Notes: Each image represents a specific floral ornamental element from the indicated period, illustrating the evolution and stylistic changes over time.
In early 13th Century, glazed brick and tile technique became popular among Seljuk architects. Tiles were mostly in blue spectrums while black or white were used to create depth and contrast. These techniques were mainly used to design geometrical motifs and vegetal ornaments were limited to boarders, friezes and cornices. Facades of Sirçali Madrasa (1242) and Büyük Karatay Madrasa (1252) are well survived example of late Seljuk glazed tiles with vegetal ornaments (see Figure 3).

**IL-Khanid Ornaments (mid-13th to mid-14th Century)**

By the rise of Il-khanid rulers (1256-1353), the land of Persia found an established and stable government following decades of chaos after Mongol invasion. By conversion of Il-khans to Islam in early 14th Century, Islamic art and architecture flourished once again and Il-khans Mongol patrons introduced many East Asian motifs and styles such as peony, Chinese Cloud/Yilan and lotus to Islam art (Komaroff, Carboni, & Art, 2002). One of the appreciable early 13th Century Il-khanid monument is Pire Bakran Shrine in Linjan of Iran. Caved stucco of eastern portal's spandrel is designed with a multi layered floral motifs, including large flowers and small leaves in the background. The flowers used in this spandrel might be related to Chinese peony, as using naturalistic flowers have been so rare from late Umayyad era. Other interesting characteristic is three-dimensional effects created by depth of carving and bulging finishes, which has also been used on other parts of building and particularly on highly elaborated Mihrab of the south wall. Such high relief, dense ornaments with squeezed large-scale leafage and bulging surface can also be found in Mihrab's crown of Bayazid Bastami Shrine (1313) and Uljaytu Mihrab in Friday mosque Isfahan (see Figure 4) that has been added to original mosque in 1310 (S. Blair & Bloom, 1995).

![Figure 4. Detail of Uljaitu Mihrab (Source: Mousavi, 2008) - Mihrab of Pire Bakran (Source: Authors) - late Il-Khanid molded tile (Source: In Heilbrunn Timeline of Art History. The Metropolitan Museum of Art, 2000).](image)

Stucco work remained dominant building decoration technique until decline of Il-Khanids in mid-14th Century, adorning their architectural masterpieces such as Varamin Friday – Congregational - Mosque (1322) and Sheikh Ahmad Jami complex, both in Iran. These ornaments hold very much in common with their concurrent Moorish style. Similar to Moorish ornaments, Il-khanid artisans combined a layer of thick continues curved lines with their ornaments that give a sense of climbing plants woven to screen panels or fence (see Figure 4). During late Il-khanids various tile revetments techniques including low-relief ceramic (both moulded and carved) tile, glazed brick and ceramic tesserae (mosaic tile), became popular. Flower spray with minimal palette of white, cobalt blue & ochre, forms general scheme of Il-Khanid tile works.
**Mamluk Architecture (1250-1517)**

By mid-13th Century, Seljuk techniques of designing vegetal decoration had already reached to Egypt and can be found in early Bahri Mamluks (1250–1382) monuments such as mausoleum Sultan Al-Zahir Baybars Mosque (1267) and Mustafa Pasha (1272) in Cairo (Yeomans, 2006). Although Mamluks were concurrent to Il-Khanids, they never reached to Il-Khanid’s level of delicacy. With the exception of decorations of Al-Nasir Muhammad Ibn Qalawun Madrasa (1303) which designed by Persians (D’Avennes, 2008), Seljuk design and proportions remains popular in Egypt and less density, low relief and excessive use of stipules distinguished them from concurrent Il-Khanid styles in Persia. These stipules are usually born on stems and blade of the leaves (dome’s drum of Hasan Sadaqah mausoleum, 1315, in Figure 5). Another distinguishing feature is the venation designs. While Il-Khanids used more naturalistic and particularly pinnate venation in their leafage designs, Mamluk followed their predecessor’s styles. Like the Fatimid style, inside their leaves are further decorated with offset curves of leaf’s blade, smaller leaves or much stockier veins in comparison to Il-Khanid style. Gradually the application of floral motifs became less and the only notable monument in terms of floral ornaments in late Bahri Mamluk architecture is Sultan Hassan Mosque (1363 CE) and Amir Sarghatmish Complex (1356 CE) both in Cairo. Although signs of mid-relief ornaments (which are the characteristics of Il-Khanid architecture) can be found in band of Quranic inscription in Kufic style around the Qibla wall of Sultan Hassan Mosque, but for the most part, the floral ornaments used in this mosque are inspired from Anatolian Seljuk style (Rogers, 1972).

**Timurids Ornaments (1370-1507)**

There is no clear break between late Il-Khanid and early Timurid art and architecture. In terms of ornaments and particularly floral motifs their predecessors already developed many of essential elements such as stem scrolling, abstract lobed leaves. Even tile revetment became popular in Persia during late Il-Khanids. Archaeological studies show that 13th Century II-Khanid’s
palace of Takht-e-Soleyman in north-western of Iran was decorated with interlocking geometrical tile panels. The surfaces of these tiles are mostly moulded with low relief of hunting and battle scenes, human figures and Persian poetry (Masuya, 2000). However, it was during Timurids that polychromic tiles became the main decorative feature of religious buildings in Iran and central Asia. In early Timurid monuments, such as Shad-I Mulk Aqa Mausoleum (1383) low relief moulded tile panels as well as other two main tile-working techniques including ‘ceramic tesserae (mosaic tile)’ and ‘painted glazed tiles (Cuerda Seca)’ were the main decorative feature of all monuments. However, what makes Shad-I Mulk Aqa Mausoleum and other early monuments distinguishable form later Timurid monuments are the extensive use of low and mid-relief ornaments made of moulded pottery tiles with sharp edges and dominant blue spectrum colors. Timurids continued to use Il-Khanid floral motifs and by later 14th Century, flowers and buds became fundamental elements of their vegetal ornaments. The early examples can be found in Shirin Beg Agha Mausoleum (1385), and Amir Zadeh Mausoleum (1386), in Samarqand of Uzbekistan.

Darb-i Imam Shrine (1453) in Isfahan as well as the Masjid-i Muzaffariyya or Blue Mosque of Tabriz (1464) represent the grace and refinement of late Timurids mosaic and tile work. The main distinguishing feature of late Timurid floral ornaments is the more frequent use of carnation flowers (see Table 1). Timurid ornaments deeply influenced contemporary neighbouring kingdom and empires such as Qara-Qoyunlu, Aq-Qoyunlu and Ottomans. Timurid art and architecture continued to evolve until early 16th Century and carried on by Safavids in Iran and Mughals in Indian subcontinent (Golombek & Wilber, 1988).

**Characteristics of Timurids Ornaments**

**Material and techniques:** Il-khanids style of mid and high relief ornaments using carved and moulded stucco or bricks were common in early Timurid style. However, gradually, flat tile work dominates their entire buildings. They used wide range of techniques including “ceramic tesserae (mosaic tile)” and “painted glazed tiles (cuerda seca)” with both under glazing and over glazing.

**Colour:** Transition from monochromic and polychromic designs of blue spectrum to colourful polychromic tiles (including turquoise, yellow, gold, ochre, red and green) is defining characteristic of Timurid style. This transition continued by popularity of over-glazing technique in late 15th Century, which resulted more exotic colors and contrast in late Timurid ornaments.

**Design:** Timurids artisans transformed Il-Khanid’s deeply carved, interlaced and complex multi-layered vegetal patterns to relatively less complex ornaments with flat finishing surface. In addition, more natural leaves and stem scrolls introduced during Timurids. These natural elements were usually used as filling elements or in background layer, while traditional abstract leafage remained as main elements in front layer having large scales and high contrast in comparison to naturalistic forms in background. On the other hand, hastate, dentate lobed (or deep serrate margins) leaves and elongated bi-lobed leaf forms became more popular in this period. Finally, the most distinguishable characteristic of Timurid ornaments from their predecessors is the extensive use of various types of buds and flowers. Most recognizable flowers are lotus, poppy, carnation and peony (see Figure 6).
There are no remarkable floral ornaments in early Ottoman buildings. Yeshil Mosque of Iznik (1391) is perhaps the earliest Ottoman mosque that floral motifs decorate tympanums, spandrels and boarders. These ornaments have clear connection with Seljuk motifs and carving techniques. Another noticeable building with floral motifs is Yeshil mosque of Bursa (1420) which has more detail in design and more refined finishing. Aside from carved stone decorations, Yeshil mosque is famous for its polychromic glazed tile works with dominant green and blue colour. The foliage designs, proportions, colour and glazing techniques, reminds the concurrent Timurid tile works. A script on its Mihrab shows that Naqash -Ali-Ibn-Ilyas who was master architect in Tabriz, is the designer of the tile works (Keskin, 2012), which shows the influence of Timurid art in Ottoman architecture during early 15th Century.

During later decades and until mid-16th Century, Ottoman architects such as ‘Sinan-I Atik’ paid less attention to ornaments and floral motifs in particular. Apart Frome some sporadic painted decorations, not significant floral ornaments are used in buildings of this period, such as Fatih mosque (1470) and Bayezid II Complex (1506) both in Istanbul. Mimar Sinan has also continued his predecessors’ tradition in his first royal commissioned project. He designed both exterior and interior of Sehzade mosque (1549, in Istanbul) with minimal but elegant ornaments. Apart from two tympanums of courtyard’s arched openings, and parts of carved minibar, there are no noticeable floral ornaments within the mosque. Mimar Sinan himself designed external façade of Sehzade Mehmet mausoleum with coloured stone works with a ribbed dome surface. However, entire interior surfaces are covered with ceramic tiles. These tiles are designed with floral motifs in yellow, green and blue colors. A Persian poem above the entrance suggest that these tiles are designed by Persian artisans who may first brought to Anatolia by Sultan Selim-I after conquest of Tabriz in 1514 (Freely, 2011). Although Persian tile design and techniques had a great presence in Ottoman architecture, but tiles of Sehzade mausoleum are among the last imitations of Persian tile works in Ottoman Empire. By the fall of the Timurids in mid-16th Century, their tile work techniques have already been localized in Anatolia, and Ottoman architects stared to redefine Timurids art to match Turkish taste and architectural style. This revolutionary (Necipoğlu, 1990) artistic movement in Ottoman tile-work history, was concurrent to construction of Suleymaniye Complex (1559) in Istanbul. One of the earliest places that tulip and hyacinth flowers appeared as an essential element of Iznik tiles is Rustam Pasha Mosque in Istanbul (1563). Another feature of tile works in Rustam Pasha is extensive use of scarlet colour in tulip and other flowers, Saz leaves and even stems. Similar motifs and techniques have been used in the most admired Mimar Sinan’s project; Selimiye Complex in Edirne (1574) and Sokollu Mehmed Pasa Mosque (1578) (see Figure 7).
Ottoman architects used similar floral motifs and techniques throughout the next century in buildings such as Ahmed Çesmesi 1729 and Al-Shurbaghi Mosque in Egypt 1758. However, from late 16th Century, Ottoman classical architecture gradually lost the ground to emerging western baroque architecture. By mid-18th Century, baroque ornaments became dominant even in religious buildings such as Laleli Madrasa 1764 in Istanbul.

**Characteristics of Ottoman’s Ornaments**

Early Ottoman floral patterns are either designed by Persian artists or developed under their supervision. Hence, although experts may recognize the difference of colour tones as a result of using locally available materials and pigments, but it is difficult to differentiate between late Timurids and early Ottoman floral motifs in terms of design elements and proportions. In the 16th Century, gradually the art and technique of glazed tile work localized in numerous workshops developed in Anatolia and Iznik in particular. The result was the merge of Turkish taste of color and penchant for naturalism with Persian design and technique.

**Colour:** Introduction of a new colour scheme might be the first noticeable result. Ottoman artists replaced Timurids traditional dark background colors including cobalt blue, purple and green, by mainly white and lighter blue colors. Other distinguishing factor is the strong presence of green and scarlet in colouring leaves and flowers. Black colour also became popular in Iznik tile works, especially in borders’ background and drawing of leaves and flowers margin.

**Flowers:** Ottomans not only brought a new level of naturalism and detail in design of flowers in Islamic ornaments, but they also introduced Tulip and hyacinth to pre-developed floral motifs such as lotus, lily, peony, chrysanthemum and carnation.

**Leave:** Although Islamic abstract leafage remained an essential element in surface paintings and carved decorations, but late in Ottoman tile revetment these motifs are limited to either filling element or borders. On the other hand, long dentate tulip leaves so called as Saz, which has similarities with acanthus leaf took the main role in Iznik glazed tiles during late 16th Century.

**Stem scrolling:** in contrast to other elements, stems lost much of its natural orders in late Ottoman ornaments. Stems are uncontentious, very tiny and not proportioned to other elements. Meanwhile, in design of spiral scrolls, Ottoman architects used more tangled forms, such as the carved stone works on the spandrels of the main entrance portal of Yeshil Mosque of Bursa.

**Tessellation design:** late Ottomans were in favour of simple patterns, including few, but extremely detailed repeating elements. These simple patterns were suitable for mass production, responding to the growing demand of tiles for the huge Ottoman monument.
**Safavid, Suri, Shaybanid (1501 - 1726)**

During Safavids, economic and political links with Mughal Empire in the east and European countries strengthened. These links opened new doors to Persian art and architecture with colourful ornaments (Canby, 2002). The mausoleum of Harun Vilayat (1513) is one of earliest shrines commissioned by Safavids. In comparison to Timurid ornaments, more Turquoise blue, relatively smaller abstract leafage and more Yilan bands can be noticed in tile works. Another noticeable difference is the dome’s exterior design. While Timurids domes were either ribbed or covered with simple or plain blue tiles, Safavid architects covered their domes with similar motifs used in façade decoration. Strong presences of yellow, gold and ochre are another characteristic of mid-16th Century Safavid monuments like Sheikh Safi’s mausoleum (1544).

From early 17th Century mosaic technique replaced by under-glazed painted ceramic tiles (Clévenot, 2000). So that apart from two meters continues marble dadoes, almost entire surfaces of the grand Shah Mosque (1638) and the most exquisite piece of Safavid architecture, Shaykh Lutfallah mosque (1618) are covered with under-glazed painted tiles (see Figure 8).

![Figure 8. Mausoleum of Harun Vilayat (Source: Bruce Allardice, 2008) - Sheikh Safi al-din Shrine (Source: Marco Di Leo, 2014) – A Portal in Shah Mosque (Source: Dan, Twiga Swala 2011).](image)

Tiles are painted with floral motifs and calligraphy in mostly dark blue and turquoise background. In tiles with dark blue background, patterns are outlined with white and yellow colors. On the other hand tiles with turquoise, yellow and white backgrounds, are outlined with black colour. Surprisingly, there is not much geometrical motifs used in Shah Mosque. Similar to other monuments in mid-Safavid period Yilan bands, Saz leaves, more realistic flower and leaves are the main differentiating characteristics. By the end of 16th Century Painted plaster became an essential feature of Safavids’ royal palaces (Stierlin, 2002) and non-religious buildings such as Fin garden of Kashan (1590), Chehel Sotun (1647) and Hasht Behesht (1670). In contrast to religious buildings, figural paintings in context of historical scenes decorates Safavids royal palaces and pavilions. Although some familiar Islamic floral repertoire has been repeated in these paintings, but their realism combined with figural and animal motifs classifies them under non-religious art, and is out with scope of this this research.

**Characteristics of Safavids’ Ornaments**

Safavid architects never lost the sight of their precious Timurids architectural heritage. Although Safavids brought Persian arts and painting in particular to a new level, but in Islamic vegetal motifs, their decoration are refinement of Timurids ornaments.
**Colour:** Safavids used more vivid colors and their enthusiasm to paintings and miniature extends their colour repertoire of architectural ornaments. However, cobalt blue, turquoise, white, black, yellow, gold, and fawn/ochre and green spectrum are the prominent colors of their vegetal ornaments. While the extensive use of yellow is a characteristic of Safavid ornaments, they used far less red spectrums in comparison to concurrent Ottoman artists.

**Techniques:** During Safavids, painted under-glazed tiles along with plaster painting were dominant techniques while mosaic tile technique marginalized due to huge demand massive Safavid monuments and their restoration projects. Although the outcome of mosaic technique was both delicate and intricate, but the process was so slow and expensive.

**Leaves:** There is not much difference between early Safavid and Timurid leafage designs. However, the painted under-glazed tile technique helped Safavid architects to design smaller and more detailed leaves with very fine dentate margins. Another noticeable feature is the use of Saz leaves, which first developed by Tabriz artisans in mid-16th Century and became an essential element of Ottoman Iznik tiles. Although the motif developed by the Persians, but it never became a main design element as it was in Iznik style.

**Flower:** Another distinguishable feature is the profusion of flowers in floral patterns. Safavid architects used the same Timurids repertoire, but flowers are larger, relatively more naturalistic and much more detailed.

**Stem scrolling:** another consequence of painted glazed tiles is Safavids’ slimmer, multi-colour and outlined stem scrolling verses stockier and mono coloured stems in Timurids Style.

**Chinese Influence:** apart from emphasizing on flowers that might be related to East Asian art, the main Chinese motif can be observed in Safavid art are Cloud/Yilan bands. After the Mongol invasion, Cloud / Yilan bands introduced to Persian art, but it was during the Safavids, that these motifs became popular in architectural ornaments. This might be due to popularity of Chinese porcelains (Victoria, 2002) in early Safavid period.

**Composition and Configuration:** Safavid ornaments have two different configurations of floral patterns. The first type follows their predecessor’s style of prominent stem-scrolling and abstract lobed leafage. In second configuration which its roots back to late Timurids period, the arrangements of prominent flowers and Saz leaves defines the structure of pattern and other elements such as very thin stems and small leaves have only filling role. These two configurations might be used side by side or even combined in single pattern. But even in combined designs, they are mostly used as two distinguishable layers of stocky abstract foliage woven to flower sprays, Tile works of Sheikh Lutfallah Mosque in Figure 1 is a good example where prominent abstract leafage configuration decorates the medallion and prominent flower configuration fills the surrounding surface.

**Mughal (1526-1858)**

Early Mughal ornaments were a continuation Timurid style (Asher, 1992) with similar motifs and techniques including both carved stucco and polychromic tiles. Nila Gumbad (the blue dome) in Delhi is one of earliest Mughal tombs located on the east side of Humayun tomb. The form of building, proportion and ornaments resembles the late Timurid architecture. Typical Timurid floral ornaments such as bifid and lobbed leaves along with lotus flowers can be found in carved decoration of tomb’s ceiling. Jamali Kamali Mosque and Tomb (1536) in Delhi is another early Mughal building with richly carved stucco works of vegetal motifs. Despite high density and complexity of patterns used in this building, individual elements are not refined and proportionate to traditional Islamic floral ornament. These types of ornaments were common in mostly non-Imperial buildings of Mughal architecture. Red Fort of Agra (1565-73) was Emperor Akbar’s first major projects (Burton-Page & Mitchell, 2008). It was built at the outset of merging Perso-Islamic architecture with local styles and techniques in late 16th Century. A result of subjecting to local influence was the replacement of stucco and tile works with local strong tradition of stone
carvings (see Figure 9). Highly Skilled local craftsmen brought Islamic vegetal ornaments to a whole new level of perfection. Elements are well proportioned, curves are balanced and harmonious and nearly perfect symmetry applied to develop flowers and buds.

Figure 9. Carved sandstone in Jahangiri Mahal (Source: freewisdom.org, 2007) - Safavid style ornament in Fatehpur Sikri - Spandrels of Taj Mahal: lily & windflower (Source: Poco, 2009).

Another result of local style influences was the application of naturalistic forms along with traditional abstract Islamic floral motifs. Moguls' penchant for nature introduced a variety of trees, shrubs and flowers to Islamic floral ornaments. Flowering trees, pomegranate trees, Platanus trees and vines shrubs are examples, which widely used in decoration of buildings in Fatehpur Skiri buildings (1585). Apart from new naturalistic forms and traditional Timurid vegetal motifs, the very early example of Safavid floral style, decorates the apex of south entrance portal of Fatehpur Sikri (see Figure 9).

One of the most significant early example of white marble inlay is the facades of tomb of Akbar the Great (1614) in Sikandra. The Mausoleum is covered with red sandstone and elaborated with inlay white marble and black slate. The inlay floral motifs are deeply inspired from Safavid flowers and buds repertoire. The bold Yilan bands on spandrels of main arched entrance, which was popular in early 17th Century Safavid ornaments, along with stucco works and paintings of interior surfaces, suggest the strong presence of Persian architects and artists in Mughal court. I'timad al-Daula mausoleum (1628) in Agra is the Mughal's first entirely marble inlay decorated building. Abstract vegetal ornaments of I'timad al-Daula mausoleum are particularly borrowed from Shaykh Lutfallah mosque (1603) in Isfahan. Although early 17th Century Mughal floral elements are identical with Safavid motifs, as result of onerous nature of Parchin-Kari inlay (i.e. Pietra dura) technique, Mughal ornaments of this period are simpler in forms and less detailed. Margins of leaves and petals are even, patterns are less colorful and more repetitive, and their unit-cells contain less elements. Another distinguishing feature is missing principle of differentiating layers of natural and abstract motifs. In both Timurid and Safavid floral style, usually a bold layer of abstract lobed foliage is interlaced with naturalistic layer of stems and leaves. However, in Mughal style, these two layers merged and both abstract and natural leaves grow out of same stem. Similar designs, but with more details, particularly on leaves and petals’ margins decorate Musamman Burj (1640) in Agra fort that shows the progress of mastering Mughal artisans in Pietra dura.

From forth decade of 17th Century onward, as a result of both progressing localization of architecture and expansion of trade with western powers (Kleiner, 2009) Mughal ornament cast off its dominant Perso-Islamic style. New floral elements (such as various types of lilies,
chrysanthemum and windflowers) along with low-relief (Bas Reliefs) technique became prevalent in Mughal architecture. Ornaments became less dense with slim stem scrolling an incredibly detailed leaves and flowers, particularly in reliefs. Probably the most exquisite and refined Mughal ornaments belongs to Taj-Mahal mausoleum (1648). Apart from conventional Islamic stem scrolls often used in arch spandrels and margins, depiction of entire flower plants became an essential element in Mughal floral ornament. Plants and flowers growing on the soil heap (Janick & Kamenetsky, 2010) or flowers arranged in vase, were also in vogue particularly for decorating dados with relief techniques.

Islamic leafage repertoire combined with Mughal flora, in both polychromic glazed tiles and Safavid technique of plaster painting, remained fashionable, especially in the western parts of the Mughal territory until their decline in the late 18th Century. Polychromic tiles and paintings on walls and ceilings of Jahangir Tomb (1637), Wazir Khan Mosque (1635) and Dai Anga Tomb (1650) in Lahore are well survived examples.

CONCLUSION

Vegetal ornaments in early surviving Islamic monuments are continuation of antiquity art that follows the natural order of growth. Architects and artisans of this period were more botanically accurate in depiction of natural motifs and most plants in their ornaments can be recognized.

**First artistic movement (The Age of Celebration of Geometry):** By introduction of geometrical patterns to Islamic architecture in 9th Century, botanical characteristics of plants were almost disappeared. Earliest Islamic abstract vegetal forms, including flabellate (fans shaped) and lobed leaves are also introduced in this period. In these newly fashionable ornaments continues scrolls and leaves’ connection to stems have not defined anymore and elements are derived from geometrical shapes and patterns.

**Second artistic movement (The Age of Perfection):** Morphological comparison of 9th to 10th Century Islamic ornaments with 11th Century Seljuk floral motifs, clearly shows us the evolution of floral ornaments and development of Muslim artisans’ skill. By the end of 12th Century, nicely proportioned long organic forms as well as detailed features such as pinnate vents & cirrhose apex has already emerged in Islamic floral repertoire.

**Third artistic movement (The Age of Islamic Sculpture):** Commercial and political ties of Il-khanid with Yuan Dynasty (Robinson, 2007) encouraged the influence eastern art in Middle East and Islamic art. Return of flowers into Islamic art long after the Umayyad era can be related to this development. Flowers like; chrysanthemum, lotus and peonies are among plants having auspicious connotations in Chinese art, introduced during Il-khanids. Another distinguishing feature of Il-khanid ornaments is three-dimensional effects created by deep carved/molding techniques with bulging surfaces. During this period, high relief sculpture techniques introduced to Islamic art and architecture. These ornaments are usually multi-layered, profuse, highly complex and usually combined with calligraphy, and geometrical motifs. However, colourful, cheap, fast and mass-producible tile techniques, overwhelmed Islamic sculpture art, whilst it reached to its climax in the early 14th Century.

**Fourth artistic movement (The Age of Colour and Flower):** Timurid architecture grew out of well-established Il-khanid architecture. Nevertheless, what defines Timurid style is all celebration of colors and flowers, which both became essential element of Islamic architectural ornaments from late 14th Century onward. Through the next two centuries, by the rise of painting art as well as painted glazed tile technique in both Safavid and Ottoman prosperous courts, Muslim artisans reached to a new level of sophistication in design of abstract vegetal ornaments and employed colourful palette in their designs.

**Formalism:** this research analysed formal aspect of Islamic abstract vegetal ornaments and showed both common principles in major Muslim empires as well as variations in Styles. For instance, early Islamic leaves had acute apex and gradually, acuminate apex became popular
during the Fatimids era, while Cirrhose apex introduced by the Seljuks in the 11th Century. Another interesting fact is that not all but a few types of leaf margins were used in Islamic ornaments. Entire margin were popular among all styles, particularly North Africa and Arabian Peninsula, crenate were popular in early Islamic period till 12th Century, doubly serrate were a characteristic of ottoman ornament and serrate margin were popular in Persia and central Asia during Timurids and Safavids architecture (see Figure 10).

Figure 10. From Left: Acute, Acuminate and Cirrhose Apex – Bilobed leaves with Acute, Acuminate and Cirrhose apex – popular leaf margins in Islamic ornament (Source: McSush, 2008).

Dimensions and proportions of elements are important factors to identify origin and styles. This study shows that early Islamic abstract motifs were derived from the curves of smaller radii (possibly from grid circles) and obtuse shaped. It was during Seljuks in 11th and 12th Century that these elements grown to perfect proportions. Falcate and elongated bi-lobed leaf are legacy of this period, however, immerging and development of painting and miniature in late 14th Century, allowed Muslim artists to introduce new proportions and highly detailed designs (see Figure 11).

Figure 11. From Left: Obtuse, falcate and acicular leaves - Typical 10th Century Fatimid bi-lobed leaf, 12th Century Seljuk leaf and 14th Century Timurid leaf – leaf dimension (Source: Authors).

This research showed that Muslim architects and artisans followed common principles in design of Islamic abstract vegetal ornaments. These principles have been evolved throughout the history of Islamic architecture and their signs can be found in almost entire Muslim states. However, analysis of formal aspects such as main elements, dimensions, proportion, dominant color, material and techniques (see Table 2) and further detailed observation, such as type and thickness of stem scrolls and vents will reveal the date, origin and styles. These comprehensive analyses are not only essential for archaeological studies and architectural conservation, but also fundamental for new historical-inspired designs to ensure identifiable architectural style with flawless vernacular characters, chronological orders and formal aspects.
Table 2. Popular material, techniques and dominant colours (Source: Authors).

<table>
<thead>
<tr>
<th>Style</th>
<th>Material</th>
<th>Color</th>
<th>Techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td>Umayyad</td>
<td>Stone, Brick, Glass Paste</td>
<td>Polychromatic: Dominant Gold &amp; Black</td>
<td>Both Byzantine Glass Paste Tesserae, Mosaic &amp; Sassanid Carving Techniques</td>
</tr>
<tr>
<td>Abbasids</td>
<td>Stone, Stucco</td>
<td>Monochromatic: Natural Stone &amp; Pale / Clay</td>
<td>Low-Relief &amp; Sunk-Relief Carving</td>
</tr>
<tr>
<td>Fatimids</td>
<td>Stone, Stucco</td>
<td>Monochromatic: Natural Stone &amp; Pale / Clay</td>
<td>Low-Relief &amp; Sunk-Relief Carving</td>
</tr>
<tr>
<td>Seljuks</td>
<td>Stone, Stucco, Brick</td>
<td>Monochromatic: Natural Stone &amp; Pale / Clay</td>
<td>Low-Relief Stone Carving In Anatolia, Low-Relief Brick &amp; Stucco Carving In Persia &amp; Central Asia</td>
</tr>
<tr>
<td>Il-Khanids</td>
<td>Stucco, Glazed Brick, Ceramic Tile</td>
<td>Monochromatic In Stucco Carvings &amp; Minimal Palette Of White, Cobalt Blue &amp; Ochre In Tiles</td>
<td>Mid-Relief &amp; High-Relief Stucco Carving</td>
</tr>
<tr>
<td>Mamluks</td>
<td>Stone, Stucco</td>
<td>Monochromatic: Natural Stone &amp; Pale / Clay</td>
<td>Low-Relief &amp; Mid-Relief Carving</td>
</tr>
<tr>
<td>Timurids</td>
<td>Ceramic Tile</td>
<td>Polychromatic: Dominant Blue, Turquoise, Ochre &amp; Jade</td>
<td>Low-Relief Tile &amp; Glazed Brick (Early Timurid) Ceramic Tesserae (Mosaic Tile) (Both Under &amp; Over Glazed) Techniques</td>
</tr>
<tr>
<td>Ottomans</td>
<td>Stone Ceramic Tile</td>
<td>Polychromatic: Dominant White, Blue, Scarlet &amp; Green</td>
<td>Stone Carving Painted Glazed Tile (Mostly Under Glazed In Late Ottoman Period) Plaster Painting</td>
</tr>
<tr>
<td>Safavids</td>
<td>Ceramic Tile Plaster</td>
<td>Polychromatic: Dominant Blue, Turquoise, Gold, Jade &amp; Black</td>
<td>Ceramic Tesserae (Mosaic Tile) (Early Safavid) Painted Glazed Tile (Under Glazed) Plaster Painting</td>
</tr>
<tr>
<td>Mughals</td>
<td>Stucco Ceramic Tile</td>
<td>Monochromatic: In Stone Carvings &amp; Palette Of Whites, Black, Gray, Red &amp; Gold In Inlay</td>
<td>Low-Relief Stucco Carving (Early Mughal) Red Sandstone Carving Red Sandstone Inlay Marble Inlay &amp; Plaster Painting (Late Mughal)</td>
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References


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