ISLAMIC ARCHITECTURE AND DIGITAL DATABASES

RASHA ALI
The University of Paris IV – Sorbonne
ruchii@aucegypt.edu

Abstract. Epigraphy in Islamic architecture represented an indispensable element in its conceptual design and structure. Our research investigates this unique role, which epigraphy played in Islamic architecture as a tool singularizing this architecture and the sensuality it inspires inside a building while bestowing on it its particular identity. This how SADEPIG came to being: it is a virtual database regrouping all the information about the monumental epigraphy which date from the Sa'dian period in Morocco (1527-1660). The digital corpus of monumental Sa'dian inscriptions provides also buildings plans, virtual tour within the monument, construction details, information about the identity of patron and builders.

1. Islamic Architecture

"Islamic architecture", is a vast term which involves an immensely rich diversity of architectural traditions and ideologies; it's exactly where resided always the geniality of this architecture. Islamic architecture engaged and reformulated many building traditions, practices and applications, which it then re-used with a new concept in a new context. Hence, in spite of the multiplicity of Islamic architectural styles and technical aspects according to the region, yet no eye can miss it is Islamic.

One of the most significant aspects of the Arabic Muslim architecture is the recourse to the use of calligraphy as an important decorative element. The erudite combination between the Arabic scripts and floral arabesques as well as geometric interlacing opens the gates wide open to infinite possibilities of compositions, which enchain a dialogue between the light and shade while insisting on subtleties of colours and forms (Khatibi, 1994, p.191).

The outstanding flexibility of Arabic letters, the rhythmic movement of its compositions in addition to the harmony of its signs bestow grace

and vigour to the entire edifice.   Whether they would be capitals of columns, vaults, pillars, walls, or gates and windows, they are all endowed by epigraphic engravings; painted or sculpted they produce a seizing meditative effect (Khatibi, 1994, p.191).

2. Role of Epigraphy in Islamic Architecture

It is **"*Mightier than the Sword*"**[i], our Arabic script featuring in our buildings, whether externally or internally, involves both the beauty of proportions and artistic execution as well as transmitting a profound meaning.   That is to say that here the Islamic religion is introduced to provide both a sense of the beauty of the script and its spiritual context. Arabic calligraphy is an authentic Arabic Islamic art form and it associates the literary heritage of the Arabic language with the Islamic religion.   From where emanates its extraordinary beauty, richness and power? Calligraphy means "beautiful handwriting," and in Arabic tongue it also means "the geometry of the spirit."

The idiom which states that "*The pen is mightier than the sword*" expresses a worldly widespread recognition of the power of the written word.   Moreover, In Islamic culture, the particular importance accredited to writing found its roots in the fact that Arabic is both: the language of God's revelation to his Prophet Muhammad and subsequently the script in which it was written down. This is how the Arabic script has occupied a unique significance in Islam (Niewöhner, 2004, p. 574).   The script has become a defining ideological feature of the material culture of the region we can broadly call Dar al-Islam; a vast area that one time has stretched from Spain in the west to the Malay states and Borneo at the farthest east (Hattstein, 2004, p. 9).   The Arabic letters revealed a unified identity ideologically but diverse aesthetically, when we contemplate and read what's inscribed on various objects coming from the different corners of Dar al-Islam, we realize how the forms of Arabic letters change their shape according to epoch, region and material – whether it be a paper, a parchment, a coin, a tombstone, a metal bowl, a ceramic tile or a wooden frieze (see some examples in Table 1 below).

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[i] "Mightier than the sword: Arabic script beauty and meaning" was the title of a touring exhibition from the British Museum at The Ian Potter Museum of Art, Melbourne: 2003

TABLE 1. Examples of Islamic craft work embellished with Arabic calligraphy

Count Bobrinski cauldron, Herat 1163,Hermitage, St. Petersburg.	Marble decorative panel, Ghazni, 12ᵗʰ century.	Koranic Casket, Cairo early 14ᵗʰ century, Berlin Museum of Islamic Art.	Glazed pottery plate, Iran or Transoxania, 10ᵗʰ century, The Louvre Museum, Paris.

This script didn't stop inside its local borders, but migrated to Europe for example, where the Arabic script as a pattern reflected the fascination in Europe for exotic objects coming from the Middle-East, so we see for instance how the Arabic script transformed into pattern in Renaissance painting and in pottery imported from Islamic Spain. As far as in China and Indonesia there were objects made for Muslims at the Ming Court, featuring both Chinese and Arabic calligraphy and all sorts of artistic testimonials on the remarkable synthesis that took place in the exchange between the local and imported styles. The chef-d'oeuvres of calligraphy became prestigious collection materials; they are preciously preserved, collected and negotiated at "astronomical prices" (Niewöhner, 2004, p. 574).

In Islamic Architectural History, textual decoration played a distinctive role. In façade decoration as in interior design programmes, epigraphy had always its place reserved in a conscious hierarchical decorative program within the different parts of a certain building. For example, in a mosque of a "**T**" plan, the textual decorative scheme would be sumptuous in this area of intersection between the transverse nave and the central axial nave of the prayer hall. That's because this intersection hosted the most sacred part of the sanctuary which is the *miḥrāb* orienting the praying conglomeration towards the *qibla*; that's to say towards Mecca; the most sacred city of Islam. Consequently, specific Koranic verses were always chosen particularly for this place of the mosque to emphasize its function within. More specifically in the Moroccan and Andalusian medieval world, poetry was the summit of all

aspects of daily life. Hence we find it adorning all the palaces and houses; wooden ceilings, marble columns or fountains, stucco panels all tell us the story of the building and describe its beauty and architectural genie in poetic stanzas composed specifically for its several parts.

Reading the text is nothing but the first step on the way to establish the original context. The inscription has to be exposed to a "multipronged exegesis" in order to be able to reveal the circumstance when a certain quotation was cited. What must be taken in consideration is for instance: its location in the building, its role in the society, its place in contemporary cultural, popular, theological or even political arguments (Edwards, 1991, p.70). In Islamic architecture, indeed stone and brick delineate the building constructional structure, but it is the left to words to set up the ambience and sensational vibes. That's how words cloaked in friezes of "architext", became a constructive ingredient in the building that they embellish (Edwards, 1991, p.73).

The question is: can we set out a wider theoretical framework? Can a broad definition of Andalusian poetry and its *muwashahat* together with a demonstration of these poetic effects in architecture help in this aspect? The idea is to apply poetic ideas and their methods of thinking to architecture, asking what poetry in Islamic architecture is and how one can recognise the "poetic" in particular buildings or edifices.

3. Poetry and Islamic Architecture

Many western studies aimed to explicate poetry as a mode of thought and through the analysis of poetic thinking; they excelled in demonstrating the connections between poetry and architecture. Some studies managed to prove that the methods of poetry can illuminate architecture both theoretically and practically. The module explores the relations between these two corpuses of human knowledge and versions of sensual thought, poetry and architecture. Further studies applied techniques transferred from poetry to the understanding of architecture;–they stressed the usefulness of adopting various versions of rationality and irrationality for understanding design solutions.

Can we apply this to the understanding of medieval Islamic architecture? Two parallel threads of thinking are followed: on one hand, from the point of view of the poetry employed in this architecture, or rather composed and designed to ornament it, on the other hand, through tracing the relation between the poets and their poetry on the one hand and their influence on architects and their visions of design as well as the taste of the time on the other. To do this, the use of historical and cultural materials imaginatively in pursuing

such questions would be essential to construct a clear and forceful argument; and hence interpret prominently the cultural setting within which the architectural and the interior design took place.

Those architects whose reputations rest as firmly on their eloquent writings as on their designs and buildings can be traced through the evolution of the genre in Europe from the 15th to the 18th centuries; during this period many of the conventions that still guide architecture theorizing in the West were formulated. Many questions were asked about the relationships between writing and building, between theory and practice. Do the two creative forms illuminate, complement, or contradict one another?

Reading architecture as poetry, or poetry as architecture, leaves us in the particular position of reading poems that shall be taken as windows without limit. If we think of any poem, we shall dwell within that poem, persisting through space and time; moreover, we shall dwell at all times within, without giving up our standing outside. The same effect was meant to be achieved in two ways on the dweller through reading the poetic texts in the medieval Moroccan and Andalusian buildings; a non existing dimension was created through imagination, through metaphoric images and exaggerations in the poetic description of the standing edifice, in addition to the impact that was created within one's spirit imposed by the architectural designing language and tools.

Just as in architecture, poetry tends to organically regulate itself, as it ensures the balanced proportionality of all its components. Through exploring the vocabulary of Moroccan and Andalusian architecture and its ability to affect visual perceptions, our investigation is not merely confined to an analytical approach but invites the viewer of a Moroccan or an Andalusian monument to enjoy and indulge in the experience of poetic space and space of poetry.

Realizing the magnificent, unique role, epigraphy played in Islamic architecture as a tool singularizing this architecture and the sensuality it inspires inside a building while bestowing on it its particular identity within the earthly different types of architecture was what generated our work of research.

4. Islamic Architecture and Modern Technology

Technology is an indispensable necessity incorporated in every possible domain and aspect of our daily life now. Having a digital database gathering these architectural inscriptions would facilitate our knowledge process by having all necessary and precise information just by clicking a button on

computer screen. Not to mention the comparative means of research, hence visually accessible also on the screen.

Recently a lot of databases and special computer programs or software were developed and designed specifically to contribute to the modules of improvement of pedagogical tools of teaching and studying the Islamic art and architecture. Not to mention the crucial importance of documentation and information registration of Islamic monuments which have disappeared already or about to or even worse because they suffered from erroneous restorations which inhibit us for ever from contemplating the original status of a historical monument. So applying the modern technology to extensively advance and progress in our research of Islamic monumental epigraphy was a crucial necessity:

In the light of the progress of methodology of studying Arab epigraphy, the creation of our database for Moroccan Sa'dian and Andalusian Nasrid Monumental epigraphy was greatly inspired by an anterior great project held by a Tunisian team. This academic Tunisian team was the first to experience and experiment the Arabic computer program called *Epimac*.

Epimac: is a program figured out on the epigraphic plan by Mrs. Solange Ory, a professor at the French university of Provence, it was then interpreted in the computer language by 'Izz ad-Din Salah, a Tunisian doctor engineer of the Ecole Centrale de Nantes at Royan. This software was created to deal exhaustively with all the data which could possibly contain the Arabic inscriptions and put them under the disposition of the researchers of all disciplines. But it is too much hectically detailed because it contained a lot of dictionaries and language details and words roots which makes it nearer to calligraphic literary program rather than architectural epigraphic one. That's essentially, among others, what we carefully evaded in our SADEPIG which is much more architecturally oriented (Ory, 2001, p. 238).

5. SADEPIG

Nomenclature: The name chosen for this database derives simply from the mix of the first three letters of both words of "Sa'dian epigraphy".

General idea: When we first thought about the project, it was simply about designing a database to regroup all the information about the monumental epigraphy and written texts of buildings which date from the Sa'dian period in Morocco (1527-1660). Later the idea developed to invest in a user software, a simplified computer program, which would enable the researcher specialized in Islamic architecture or archaeology to browse easily between all the monumental epigraphy of all the

Moroccan architecture during the Sa'dian period in a first phase then those of Nasrid Andalusia in a second phase. Hence it's a sort of highly specialized program, a digital corpus of monumental Sa'dian inscriptions; every possible detail of this period buildings inscriptions is considered and included:

- The Arabic literary text of the inscription; Quranic, poetic or eulogist,
   - The French as well English translation of these texts,
   - The various analyses: Textual, Palaeographic and Artistic analysis,
   - Techniques of execution,
   - Supports used of different materials,
   - Photos,
   - Plans,
   - Sections
   - Maps
   - Virtual tour of the building and its inscriptions.

Together with a team of four computer engineers: a programmer, a graphics designer, a database designer, a user Interface designer, we designed our SADEPIG database after having seen and studied most of the previous distinguished databases designed before to be used in the field of Islamic and Arabic monumental epigraphy. Among which was for instance the program of *epimac* mentioned above and used during the course of a Ph.D. thesis of a student from Aix-Marseille University. Another project "under publication" soon which I had the chance of watching is that of the Monumental inscriptions of Cairo, a project sponsored by department of Islamic art and architecture of the American University of Cairo. Other databases like *epi* also applied in German universities and finally in Spain now "in process" is a database aiming to gather all the monumental inscriptions of the Alhambra of Granada under the supervision of the Spanish architect and Professor Antonio Almagro sponsored by the school of Arabic studies in Granada. Having carefully studied the advantages and disadvantages of each, we designed the basic research criteria of this database for the Sa'dian epigraphy, in spite of the fact that this period of the end of medieval age is much less known and less estimated by a lot of Islamic art historians.

The importance of this project is that it will bring to being a new dazzling information about the Sa'dian epigraphy, one that would clear a lot of misunderstanding concerning the comprehension of this difficult and rather complex period of Islamic art and architecture. Our aim is to present to researchers a program designed specifically to gather all possible information about the monumental inscriptions of medieval Islamic monuments in Morocco and Andalusia between the 14th and 17th centuries, which was developed in the course of my PhD studies and

research at the Sorbonne University in Paris. We look forward to facilitate the task for future junior and senior scholars of Islamic architecture, where they can consult and fetch a huge amount of information by exploring a single virtual database that furthermore provides buildings plans, virtual tour within the monument, construction details, information about the identity of patron and builders. In addition to this the program incorporates a textual reading to monumental inscriptions of every building, since the epigraphy is a specificity of Islamic architecture which bestows on it its particular identity within other architectures of our planet. Moreover the texts are also translated to English and French languages, whether Quarnic or poetic texts, they provide ideological significance to these buildings and give information about their functions. The database offers also answers to questions like who composed these texts and why and techniques of execution on different materials such as marble, stucco, wood or stone or mosaics.

6. Technical Overview

SADEPIG consists of two main parts:

Data Entry Program: The data entry program is used mainly for the entry of data. It is oriented towards speeding the process of data input and modification, and it relies on the user's knowledge and understanding of the data being input and the relations between its parts.

The data is divided into the four main categories that divide the Sa'dian architecture, and each category is divided into the corresponding subsections. These categories and subcategories are built into the program and cannot be changed, although with some work it can be modified into a more general categorization system.

The program database stores all the information related to the architecture at hand, including actual area maps and building/floor plans, with the ability to select where the specific monument resides in its corresponding map and where the specific inscription resides in the corresponding plan. This information is used in the second part of the program as means of visually browsing the database starting from a map of more than one building and down to a specific inscription.

This program's role comes at the beginning as all the research data is input either by the researcher or by a well-informed data entry person. After the data entry phase is over, the main focus is on the second, and more user-oriented, program.

User Program / Data Research Program: The user program was first planned as an integrated part of the data entry program, used by the researcher to retrieve the input data in a more user-oriented fashion. The idea was then extend to making a separate read-only program that can browse the database of architectural data provided by the original researcher and made available for other researchers of the field.

The program is mainly composed of different options for retrieving the stored data in an intelligent and easy way. Other than that, the program allows for different instances of data items to be opened at the same time, allowing the researcher to conduct a comparison between the information in the desired items.

The most straight-forward way for locating a certain item is to provide the index and retrieve a specifically-desired item. A more general way is to search for a value in a specific field, such as "Inscription Names" or "Monument Names" or "Patron Names", and a list of matching results would be produced. If a keyword search is required, a global search option is available that searches all the available fields and returns the results grouped by the respective result category; e.g.: Monuments, Inscriptions, Patrons, etc…

Another major feature of the program is the ability to browse through the database in a top-down manner. The user can start with the preferred criterion, be it Patrons, Monuments, Country/City, Category/Type, etc… and work all the way down through the items below this criterion. For example, a user might choose to list all the Monuments in a particular City, then list all the Inscriptions associated with a chosen Monument, and view the full details of a selected inscription and its monument. This provides means of exploring the program database for a user who is interested in knowing the amount of data stored in the database and under each criterion, and preview this data as desired.

One main highlight of the program, which had to be supported by the data entry program to provide the correct data, is the visual part. Given the visual area maps and building plans provided by the researcher at the time of data entry, the user has the ability to browse the database *visually*. The program provides a list of area maps (that were originally input using the data entry program) from which the user can select the desired area. The user can then click on a certain part of the map, provided that this part is associated with a specific Monument, to view the monument that resides at this area. The user is then presented with the stored information about this monument, along with a list of the visual plans that were stored in association to this monument. It is then possible to choose a certain plan and click on certain areas of this plan where one or more inscriptions are located and this inscription or a list of inscriptions is displayed. As such, whenever any item that has visual

data associated with it is opened, this visual image is shown alongside its data to allow the user to more visualize the whole architecture and, if desired, use this visual browsing system instead of the traditional one. This gives greater user interaction and a virtual feel of the architecture at hand.

7. The Program Application

1- When we click on the program's shortcut to open it, after the start up logo and the splash screen of program data (Figure1), the first screen we see is the interface with a tool bar offering us the control buttons leading us to choose between the four categories of Sa'dian architecture (Chrt.1, Figure 2):
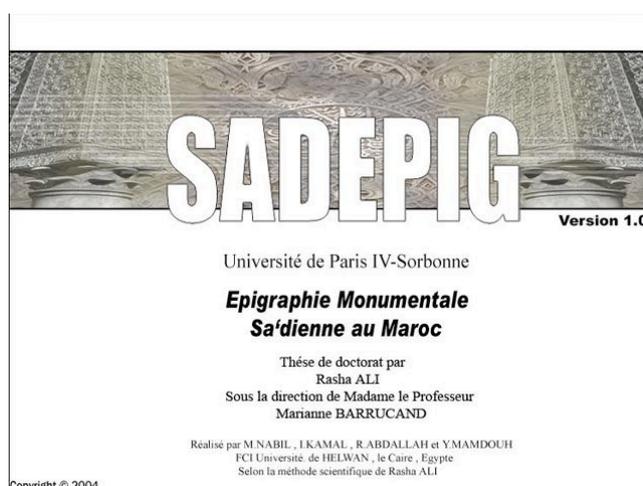

Figure 1. Screenshot of splash screen.
SADEPIG - 1st version 2004.

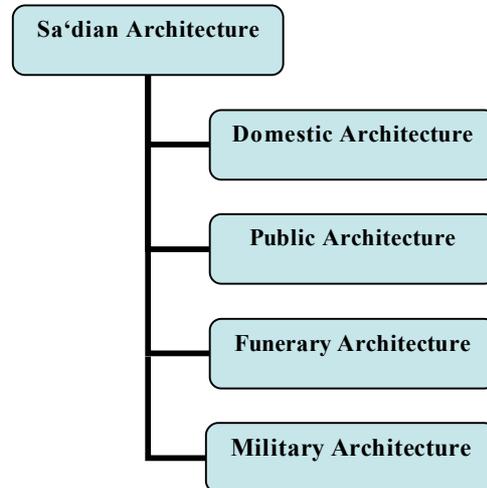CHART I. Saʿdian Architecture Category Choice.

Figure 2. Screenshot of interface screen with tool bar of category choice.
SADEPIG - 1st version 2004.

2- Once we click on any of these four categories, we open another window featuring the subsidiary categories enveloping the different types of buildings within the one category for example clicking on "domestic architecture" we choose between the palaces or the houses buttons. Or else if we click on the "public architecture" option, we have buttons marked with: mosques, *madrasa*s, *zawiyya*s, fountains and *maristan*s…etc (Figure 3).
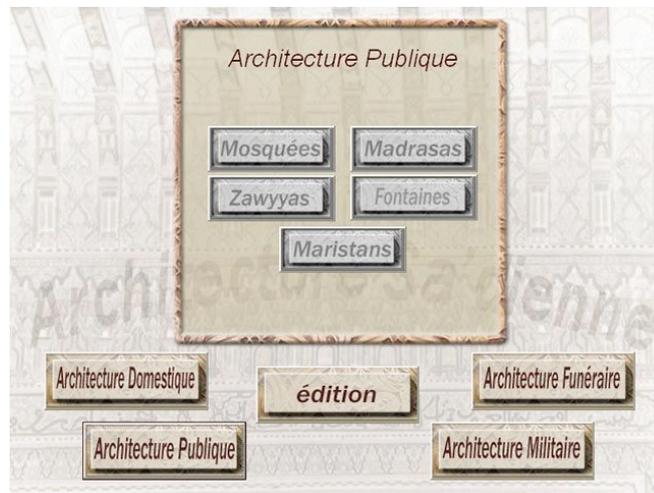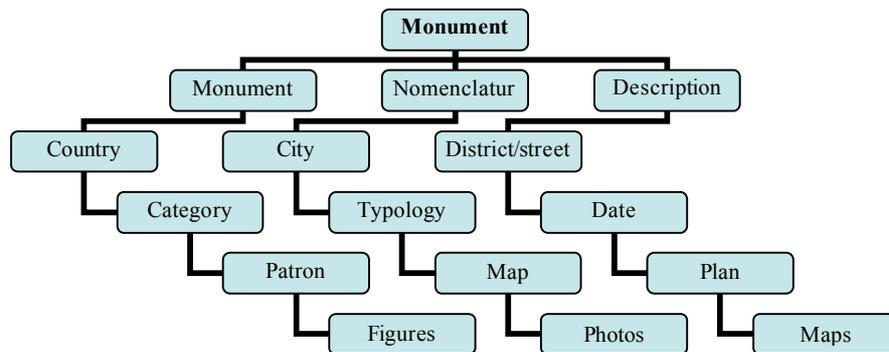
Figure 3. Screenshot of screen of subsidiary categories.
SADEPIG - 1st version 2004.

3- Once a building has been chosen within the subsidiary categories, we have another screen with several list boxes providing the following data (Chrt.2, Figure 4):

CHART 2. Monument Data.

* Finally a button marked ***inscriptions***

Figure 4. Screenshot of screen of Monument data.
SADEPIG - 1st version 2004.

4- Clicking on ***inscriptions*** we open another screen featuring (Chrt.3, Figure 5):
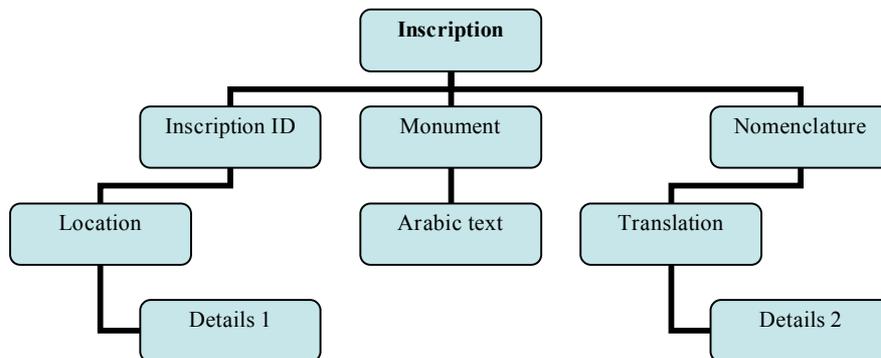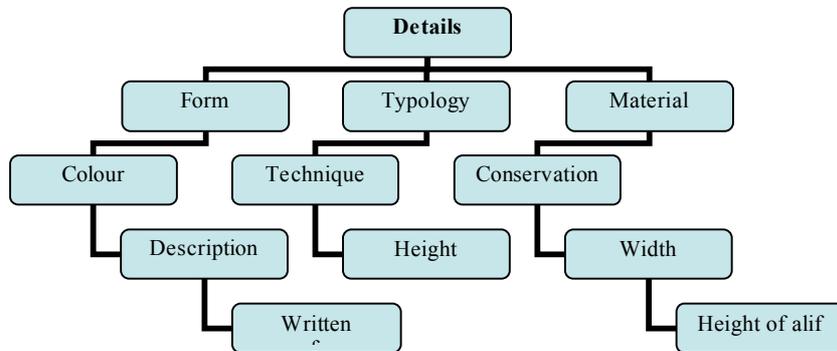
CHART 3. Inscription Data.

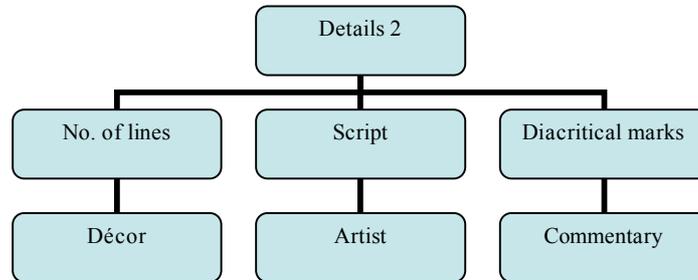*Figure 5*. Screenshot of screen of Inscriptions data.
SADEPIG - 1st version 2004.

5- Then clicking on *details* we open a fifth screen providing further data (Chrt.4):

CHART 4. Inscription Details 1.
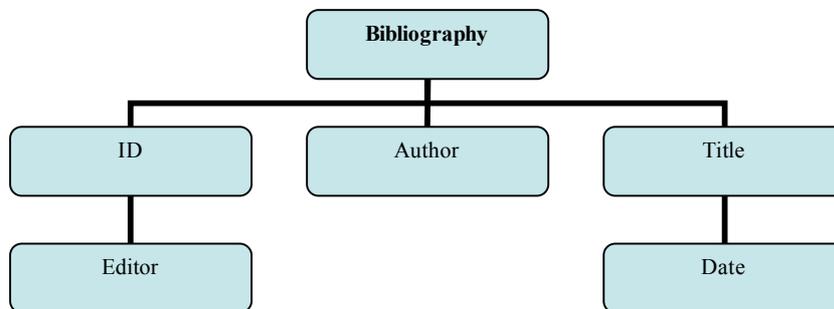

6- Then clicking on *details 2* we have (Chrt.5):

CHART 5. Inscription Details 2.

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                          ┌──────────────┐
                          │  Details 2   │
                          └──────┬───────┘
          ┌──────────────────────┼──────────────────────┐
   ┌──────┴──────┐        ┌──────┴──────┐        ┌───────┴────────┐
   │ No. of lines│        │   Script    │        │ Diacritical marks│
   └──────┬──────┘        └──────┬──────┘        └───────┬────────┘
   ┌──────┴──────┐        ┌──────┴──────┐        ┌───────┴────────┐
   │    Décor    │        │   Artist    │        │  Commentary    │
   └─────────────┘        └─────────────┘        └────────────────┘
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   * Finally a button marked ***Bibliography***

7- Clicking on a button in screen of details 2 called ***Bibliography*** we have (Chrt.6):

CHART 6. Bibliographic Details.

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                          ┌──────────────┐
                          │ Bibliography │
                          └──────┬───────┘
          ┌──────────────────────┼──────────────────────┐
   ┌──────┴──────┐        ┌──────┴──────┐        ┌───────┴────────┐
   │     ID      │        │   Author    │        │     Title      │
   └──────┬──────┘        └─────────────┘        └───────┬────────┘
   ┌──────┴──────┐                               ┌───────┴────────┐
   │   Editor    │                               │     Date       │
   └─────────────┘                               └────────────────┘
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8- Clicking on button of ***photos*** in same details 2 screen, we open another window (Chrt.7, Figure 6):
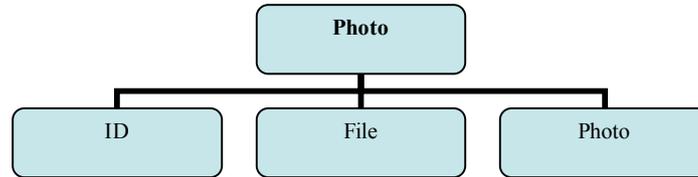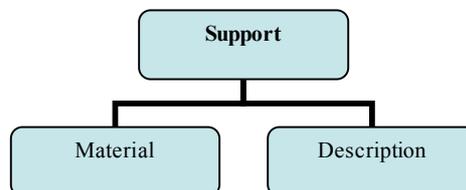
CHART 7. Photos.

Figure 6. Screenshot of screen of Photos.
SADEPIG - 1st version 2004.

9- Finally on same screen of details 2 we have button called ***support*** opening a window:

CHART 8. Structural Support of Inscription.

8. Conclusion

More than any thing the epigraphy in Muslim buildings signified their triumph, existence and distinguished identity. Nothing was ever left to hazard, writing never simply represented only décor in Islamic architecture, but rather an indispensable element in concept, design and structure. Texts, Quranic or poetic were carefully chosen or composed specifically for certain buildings with careful measurements to fit to walls and facades, they were aftermath confined to the workmanship who realized them beautifully and skilfully according the different support which will receive them, whether it be stone, marble, wood, stucco or mosaic.

The script applied in monumental epigraphy was never the same used on paper or parchment or manuscripts. Furthermore, not any text was placed anywhere, the program destined for a *mihrab* was never that of a window or a door or a ceiling or a dome. The program designed for a house was far from that designed for a mosque or tomb or a *madrasa* or a hospital. This was the culmination expression of architecture in Islamic civilization, if it is a royal building commissioned by a sultan, the text composition was confined to *wazir al-qalam al-aʻla* "the great vizir of supreme pen", beneath whom was a whole secretarial organization of a very refined and sophisticated level called *diwan al-insha'*, from where this is transferred to the *ʻarif* or architect of the time and his atelier of artists and *mʻalilm*s.

In order to progress in such a specialised study we had to turn in 2004 to the tools of our modern age. Certainly nowadays the computer incarnates our daily language and close companion par excellence. Our aim is to contribute to a technological march in the field of Islamic architecture and archaeology already started since at least a couple of decades. Our SADEPIG database is not the first and won't be the last. Our contribution targeted a virtual venue. We were not contented with the existent databases mainly occupied with the text and linguistic dictionaries in addition to other materialistic inscriptions details. That's what has driven us to develop our own with a focus more oriented on the architectural value of an epigraphy within a building. So we included plans and sections of buildings, maps to locate them within the quarters and their cities. Moreover in a later development in 2005, we added a virtual tour that would guide the consultant of this database within the building with emphasis on the placement of various inscriptions within an edifice or another. Our prospect is to continue ameliorating SADEPIG and equipping it with video and sound before it passes to be under the disposition of scholars and researchers of Islamic art, architecture and archaeology.

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