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Islamic Stuccos made Digital. Digitality and Studies of Islamic Art and Architecture

Autor/in:
Ana Marija Grbanovic

Kontakt:
ana-marija.grbanovic@stud.uni-bamberg.de

Institution:
Otto-Friedrich-Universität Bamberg

GND:
1155961668

ORCID:
0000-0001-7709-834X

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Ana Marija Grbanovic

Islamic Stuccos made Digital. Digitality and Studies of Islamic Art and Architecture

Abstracts

Dieser Artikel basiert auf Diskussionen des Workshops und auf meiner Forschungsarbeit, die auf der DFG-Konferenz der Universität Bayreuth mit dem Titel: »Wie Digitalität die Geisteswissenschaften verändert. Neue Forschungsgegenstände und Methoden« vom 23.–24. März 2017 präsentiert wurde. Ziel des Beitrags ist es, den Stand der Technik, Fragen, sowie Vor- und Nachteile des Einsatzes digitaler Technologien für die Erforschung islamischer Kunst und Architektur zu untersuchen. Dieser Artikel versucht nicht abschließend zu sein, sondern die Forschungsmethodik der Geschichte der islamischen Kunst und Architektur zu diskutieren. Dies ist angesichts des Fehlens solcher Diskussionen in dem gegebenen Bereich von hoher Bedeutung. Der Artikel basiert auf meiner laufenden Doktorarbeit zur Ästhetik der Ilkhanidische Architekturdekore in Zentral-Iran c. 1300 an der Otto-Friedrich-Universität Bamberg. Er diskutiert die Frage nach der Nutzung digitaler Technologie innerhalb der Forschung. Ein besonderer Schwerpunkt liegt auf der Untersuchung der Digitaltechnik für die Untersuchung von Stuckdekor und monumentalen, architektonischen Stuckinschriften (Bilder 1 und 2a, 2b) aus dem 13.–14. Jahrhundert in Zentral-Iran. Die Arbeit argumentiert, dass der Einsatz von digitaler Technologie von zentraler Bedeutung für die Förderung der Islamischen Kunst und für die Überwindung des traditionellen Ansatzes des stilistischen Vergleichs ist. Der Beitrag erklärt auch, warum Digitalität wichtige Primärquellen aus der Erforschung von Museumssammlungen, Objektbearbeitung oder Feldforschung von Denkmälern, auf denen Studien zur islamischen materiellen Kultur basieren, nicht vollständig ersetzen kann.

This paper is written based on workshop discussions and on my research paper presented at the University of Bayreuth's DFG funded conference, entitled: »Wie Digitalität die Geisteswissenschaften verändert. Neue Forschungsgegenstände und Methoden« March 23–24, 2017. The paper aims to investigate the state of the art, issues, advantages and drawbacks of the use of digital technology for the research of Islamic Art and Architecture. Rather than being conclusive, this paper aspires to discuss research methodology of the History of Islamic Art and Architecture. This is of importance given the lack of such discussions in the given field. The paper is based on my ongoing PhD research of Aesthetics of Ilkhanid Architectural Revetment in Central Iran c. 1300 at the Otto-Friedrich-Universität Bamberg. It discusses the question of the use of digital technology for the benefit of the research. Its particular focus is an inquiry of use of digital technology for the research of stucco revetments and monumental architectural stucco inscriptions (Figures 1 and 2, 3) from 13-14th centuries in Central Iran. The paper argues that the use of digital technology is of key importance for the advancement of Islamic Art studies and for researchers to overcome the traditional approach of stylistic comparison. The paper also explains why Digitality cannot entirely substitute key primary sources stemming from research of museum collections and objects handling or field research of monuments, on which studies of Islamic Material Culture are based.

1. Introduction

After briefly introducing the field of the research, the paper debates the history of Islamic Art and Architecture studies, as a scholarly discipline, in relation to its sister disciplines and the divide between them. Upon explaining the origins of this methodological backlog in the given field, the paper debates advantages and issues in the use of Photo Editing Software

for the purpose of studies of Islamic stuccos. This base allows for the discussion of the current situation regarding the use of Digitality to research Islamic Material Culture(s), the disparities between the disciplines and their origins. In its second part, the paper debates particular problems concerning the research on Islamic architectural revetments. It outlines issues, challenges and perspectives for the use of digital technology in this subject area. Particular examples are given, focusing on the research of Ilkhanid stucco polychromy and stucco inscriptions in Central Iran. The paper examines the relationship between the evidence provided by the primary sources and its use for the creation of digital reconstructions of polychromy and illustrations of architectural inscriptions. It also debates feasibility of employment of Photo Editing Software for the research, and the balance between the research scopes and the necessary amount of digital material. Further examples from the field of Islamic Art and Architecture are given to broaden the context of the discussion. The paper also debates the relationship between the research methodology for studies of Western Art and Architecture and Islamic Art and Architecture. It evaluates the field specific problems linked to the nature of field campaigns in the Near and Middle East and its implications for the use of Photo Editing Software. The paper proceeds to outline the current state of the art concerning the Digitality and its relationship to the discussed field, recent developments and the challenges for the future. In a nutshell, the paper argues that the use of digital technology is of key importance for the advancement in Islamic Art studies and for researchers to overcome the traditional approach of stylistic comparison. The paper also explains why Digitality cannot substitute entirely the key primary sources such as objects handling or field research of monuments, on which studies of Islamic Material Culture are based.

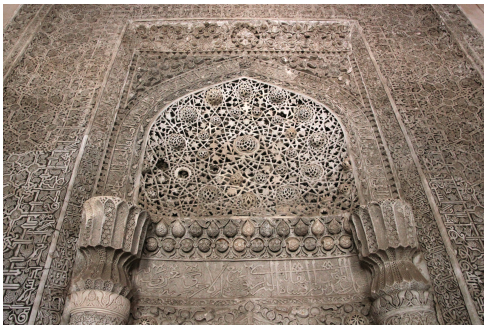

Fig. 1: Orumiyeh Friday mosque in North-Western Iran (Seljuk mosque and Ilkhanid stucco revetment). Detail of whitewashed stucco mihrab. (© Grbanovic 2014)

2. Background

Islamic Art and Architecture Studies and studies of Pre-Islamic Architectural Heritage of the Oriental lands became more visible fields of Art Historical research during the past years, especially in relation to war thorn areas destruction of monuments. Regardless of this important issue, studies of Islamic Art and Architecture are of great significance for the humanity, because they shed light and provide new knowledge about our common cultural, artistic and architectural heritage. The field of »Islamic Art and Architecture Studies«

considerably lags behind the field of »Studies of Western Art and Architecture.« This is manifest in its underdeveloped and old-fashioned theory of research and methodology. Instead of using modern technology and structured research methodology the vast majority of Historians of Islamic Art and Architecture still rely on *stylistic comparison* as the main method of enquiry. Handling of objects stored in museum collections and field research of monuments are key primary sources of the discipline. Field research often proves challenging for Western scholars, because they cannot always have access to the sites due to the armed conflicts in the countries of the Near and Middle East or political turmoil. On the other hand, not all countries present such problem, but Western scholars nonetheless often tend to dedicate a limited amount of their time to conduct field research in remote lands: either because of the limited research funding possibilities or due to logistic difficulties. This often leads to a confined or incomplete amount of documentation of monuments of Islamic Architecture, which is the key to the quality and success of the research. To compensate this, scholars tend to excessively rely on photographic archives of monuments. Indeed the body of photographic documentation of Islamic Architecture stored in the West comprises of black and white archival material dating to times between 1920s and 1980s. It is legitimate to state that the approach of Western Historians of Islamic Art is distinguished by often excessive scholarly reliance on photographical archives of structures and their revetments. They are either produced by researchers who travelled through the Islamic lands to survey Islamic monuments (for example K.A.C. Creswell, Arthur Upham Pope or Donald Wilber), or by foreign research and conservation missions archives; for example, the archive of Iranian mission to Iran aiming at preservation of Iranian monuments. Some researchers use photos of their own field campaigns, but these images can often become quickly outdated when monuments are altered during restoration or refurbishment campaigns. Old photographs of monuments are of key importance for the understanding of structural alteration through time, restoration interventions and urbanistic modifications. They are however of little aid at the understanding of current state of monuments and their modern alterations; also, they can neither provide detailed information on dimensions of monuments and their architectural revetments.
A similar problem arises for the research of Islamic Art Objects, which are dispersed in a countless number of collections. Consequently, a gap between studies of Islamic Art Objects in museum collections and studies of Architecture, despite the fact that objects of Islamic art cannot be fully comprehended without considering their original architectural context and vice versa. Moreover, a divide in research approach and focus between Western and home scholars, stems from possibilities of field campaign execution and nature of material gathered during field research. This is reflected in research findings and trends disparities. Increased possibility of global communication and circulation of publications[1] as generated by the development of Digitality is however slowly filling this gap. Nonetheless, the common challenge of language barriers and occasional political divides do slow this process down.

Western Islamic Art Historians still excessively rely on *stylistic comparison* of often outdated photographs of monuments and their architectural revetment. For example, Their excessive reliance on photographical archives, the majority of which contain black and white photos of structures and their revetments, rules out discussion of one of the main features of Islamic

[1] Electronic open access publications are starting to replace hard copy publications circulated on a limited scale.

stuccos – their original pigmentation traces and their original polychromy. Lack of detailed documentation of stucco inscriptions also results in their limited comprehension. If a cutting edge within the discipline is to be reached, new methodologies, including the use of digital technology, should be incorporated in the research methodology of Islamic Art Historians. For the studies of Ilkhanid stucco revetments as well as for the vast majority of Islamic Art, the most common scholarly approach consists of *stylistic comparison*. This is partially caused by the scholarly will to determine a scientific criterion for differentiation and classification of Islamic Art and Architecture in periods, dynasties and geographic regions. It is based on the comparison and study of ornamental[2] elements, calligraphic style and type of relief and carving.[3] It often also involves qualitative judgement, which is determined by the viewers/ researchers context of education. This approach, when isolated and combined with art historians' will to answer questions regarding Islamic Art craftsmanship and patronage often leads to erroneous hypotheses regarding the stucco revetment. One of the main factors is often the lack or limitation of funding available for short time periods, which forces scholars to restrict their research to the most essential aspects excluding different or more costly approaches. Studies of Islamic Art and Architecture require an updated and interdisciplinary research methodology, which must go hand in hand with archaeology, archaeometry, studies of epigraphy and use of available digital software and tools.

Fig. 2: Example of Ilkhanid stucco revetment from the Pir-i Bakran mausoleum in Linjan, South of Isfahan. (© Grbanovic 2013)

[2] Grabar 1992.
[3] See for example: Grube 1981, p. 85–92; Shani 1989; Shani 1996.

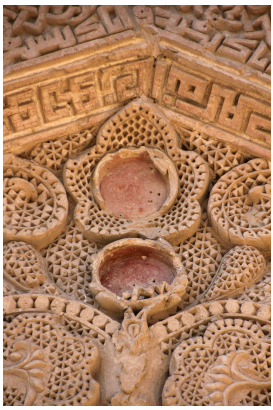

Fig. 3: Example of Ilkhanid stucco mihrab (with polychromy traces) of the Seljuk period Friday mosque of Haftshuyeh near Isfahan. (Grbanovic 2014)

3. Interdisciplinary Approach versus Research Disciplines Divides

The impact of Digitality on Islamic Art and Architecture studies is closely linked to the research methodology of the field, which stems from its history. The subject of the discipline, Islamic Art and Architecture, encompasses a vast geographical unit, ranging from Islamic Spain to China, and a long chronologic timespan of seventh to twentieth centuries. In comparison to studies of Medieval European Art and Architecture, History of Islamic Art and Architecture remains a relatively recent discipline, which started forming in the second half of the nineteenth century. Due to the complexity of the research subject, in terms of language competence (necessity to know Arabic, Persian, Ottoman Turkish, Turkish, or other languages), the need for archaeological excavations, the problem of dispersal of objects of Islamic Art in numerous collections and the large number of monuments, the division of the field of the research into numerous sub disciplines has begun at an early stage. Studies of Islamic Epigraphy (with the main focus on Arabic epigraphy) were established as a separate and independent field starting with Max van Berchem and the Corpus Inscriptionum Arabicarum project in second half of the nineteenth century.[4] The filed is closely linked to the studies of codicology.[5] The main aim of epigraphers is to document, record and translate Islamic inscriptions on architectural structures. Epigraphic studies remain a somehow detached research field, due to the necessity of a high degree of specialization for researchers, which requires a firm language command and rigorous research methodology for the study of inscriptions. Early Islamic Art Historians indeed rarely possessed this knowledge and often relied on work of other scholars. Knowledge of these languages has started to become the requirement for Islamic Art Historians in recent times. New digitalization projects of Islamic manuscripts in worldwide collections determined an increase in codicology studies, since they eased the access to the research material. Future possibilities of electronic reading software

[4] See: Fondation Max van Berchem: Introduction and Thesaurus d'Epigraphie Islamique.
[5] See for example: Déroche 2000.

for Arabic, Persian and Ottoman scripts is however necessary for the advancement of the field. Availability of Qur'anic and religious texts on-line and search machines for these, also greatly enhanced the research of Islamic inscriptions. All these digital tools are of aid at studies of Islamic Architecture, which can however only be applied on primary sources – examination of buildings and art objects however remains essential. Although some major institutions, such as the Metropolitan Museum of New York, the British Museum, the British Library, the Victoria and Albert museum and the Islamic Art Museum in Berlin made great amounts of photographs of objects stored in their collections available on-line,[6] this does not exclude the essential need to handle the objects in person in order to read the inscriptions, research their material constitution to be able to approach them scientifically.

Studies of artistic techniques have always been a relatively isolated discipline, similar to European Art History, where this discipline also forms a separate field. The European disciplinary divide seems to have determined the partition between the Studies of Artistic Techniques of Islamic Art and studies of Islamic Art and Architecture History. Research of artistic techniques and studies of production of Islamic Art and Architectural Revetment have always been classified as a separate discipline, perhaps because such studies could undermine the seemingly lower status of Islamic Art as crafts rather than fine arts, in comparison to Western Art. This was not desired by Islamic Art Historians, who tried to elevate Islamic art and Architecture to the same level of importance as European Art and Architecture.[7] As for Persia, one of the major publications on this topic by Hans Wulff,[8] collects information on various historical arts and crafts. It is however mainly based on Wulff's observations of contemporary Iranian craftsmen and artists. Wulff's work reveals a methodological challenge, because it is difficult to understand whether the artistic techniques evolved through the time. Finds of these field observations should be revised based on archaeological findings and building on achaeometric research of Islamic Art and architectural revetment. As mentioned, Islamic Art Historians disregarded this field, and only recent research has begun detailed inquiries into production of architectural revetment. Contributions of Restorators, Aerchaeometrists, which shed light on the subject, eventually started to be considered by Islamic Architectural Historians, resulting in a formation of a new sub-discipline.[9] In this way, long standing speculations of early Islamic Art Historians are starting to receive revision. Future research should strongly depend on archaeomtric research of the material in order to avoid speculation.

Archeometry is an independent discipline with a long tradition. It is unfortunately perceived by the Art Historians as belonging to Archeological science, rather than one of essential aspects of Art Historian's research methodology. Art Historians therefore rarely make use of archeometric research and data, by instead relying on primary historical written sources. This attitude often gives origin to erroneous assumptions. Many Art Historic theories and speculations about Islamic Art and Architecture are incorrect because of the absence or non-consideration of Archaeomteric data on the subject. Existing archeometric research of Islamic

[6] For one of the latest digitalization projects of museum collections see: Staatliche Museen zu Berlin Preußischer Kulturbesitz, Museum für Islamische Kunst, Yousef Jameel Digitalization Project.
[7] Such attitude is well reflected in Grabar's works. See, for example: Grabar 1992.
[8] Wulff 1966.
[9] See the discussion in: Grbanovic 2017, passim.

stuccos is of key importance at understanding the context of Islamic artistic media and for the comprehension of its compositional characteristics and aesthetic qualities. Archeometric research can help us understand: material composition of Islamic art objects and architectural revetments. It also identifies pigments, binders and other substances used to produce art in determined geographical and chronological contexts and, consequently, it helps us understand better artistic techniques. Archaeometric information about pigments combined with our knowledge about their prices from primary written sources can give us an approximate idea about the provenance, preciousness or price of a certain object or architectural revetment. Knowledge about pigments composition also allows us to understand how polychrome aesthetics of Islamic Art and Architecture evolved and the nature of common artistic principles for stucco colouring used by the artists. This determines our understanding of craftsmanship of Islamic art, artistic principles and artists' notion used to produce the material culture of their time. As for the Ilkhanid period stucco decoration in Iran, the following disparity of scholarly hypotheses building on different sources, illustrates how important the proposed methodology is at increasing our knowledge about the researched subject. Available written sources suggest that, azurite, lapis lazuli, hematite, red lead, vermillion, malachite and gypsum were used for stucco colouring.[10] Existing archaometric data however indicates that azurite rather than lapis lazuli was used for blue colour.[11] Considering the difference in sources of these two pigments and the disparity between their presumed prices on Ilkhanid markets, this information suggests that cheaper and locally available material was used by the artists, rather than expensive mineral imported from remote areas of the Ilkhanid empire. The same archaometric research however confirms the statement of written sources that vermilion, red lead and ferrous oxides were commonly employed for red pigments, and that malachite was perhaps the most common green pigment, while carbon was used for black. Further archaeometric research is also necessary to better understand stucco artistic techniques and gilding techniques employed in the Ilkhanid Iran. Existing archaeometric data and primary sources allow for the comprehension of a larger context of significance of research of Ilkhanid stucco pigments. The earlier discussed archeomtric information about pigmentation composition, can however also serve the art historian to attempt to understand the original appearance of Islamic material culture and its aesthetics. This can also be achieved with the aid of hypothetical polychromy reconstructions produced by graphic experts or art historians themselves. Recent years have seen a technical development in computer software and digital photography, and a proliferation of use of graphic software for studies of Islamic Geometric Design, Epigraphy and Ornamental motives.[12] The fields of geometric and graphic design illustrate the possibility of use of these software and tools for the studies of Islamic Art in an exemplary way. This development opens a range of new perspectives in our field. A role model example is provided by the recent study of 15th century architectural revetment by Sandra Aube.[13] This approach however remains rarely employed in the field of Islamic Art History. This is either due to the research projects time limitations or lack of funding for the necessary niche training, software and equipment purchase and skills rarely mastered by Islamic Art Historians.

[10] Allan 1973, p. 111–120; Mustawfī 1973, S. 192–199.
[11] For more detailed discussion of the issue see: Grbanovic 2017, passim.
[12] For some excellent examples of use of digital technology for studies of Islamic Art, Architecture and Epigraphy, see: Ghader 2009; Rajaei et al. 2009. See also: Square Kufic in Architecture.
[13] Aube 2017.

Fig. 4: Detail of the Oljeitu mihrab (1310) at the Friday mosque of Isfahan. The digital photo shows the amount of remaining stucco polychromy on the mihrab. (© Grbanovic 2014)

4. Digitality and Islamic Stuccos

The above discussion of field divisions connected to studies of Islamic Art and Architecture studies and its methodological rigidity, serves for a more detailed discussion of the relationship between *Digitality* and Islamic Material Culture Studies in this section. It is dedicated to a more detailed discussion of possibilities and challenges connected to the use of digital photography and software for the research of Islamic Art and Architecture. It focuses on the issues concerning studies of Ilkhanid[14] stucco revetments in Central Iran found in architectural structures erected during the golden period of the Ilkhanid Empire, in a short time span (1295–1315), marked by rules of Ghazan Khan and Oljeitu. This discussion is however also of relevance to the other fields, geographic and chronologic frames of the discipline. During the Ilkhanid period, the welfare of the Empire allowed for the architectural proliferation to reach its zenith.[15] This vertex of architectural productivity is best exemplified by three World Heritage Sites of UNESCO from the Ilkhanid period: the Mongol palace of Takht-e Suleyman (c. 1270), the Oljeitu's mausoleum at Sultaniyya (1305–1313) and the Oljeitu's mihrab (1310) at the Friday mosque of Esfahan.[16] The study in question focuses on less studied contemporary structures in Central Iran, in the surroundings of the city of Esfahan. These structures are of minor dimensions, compared to the imperial architecture. They lack sufficient study and they are mainly in a poor state of preservation. They however contain an enormous amount of architectural revetment. Ilkhanid architectural revetment most commonly exists in thee artistic media: tiles, stucco and wall paintings. The majority of tile revetments from these monuments was however removed from its original architectural context and exported from Iran to become parts of museum collections worldwide.[17] The remaining stuccos and wall paintings are rich in information, which can also provide answers about various aspects of Ilkhanid architectural revetment, based on existing research. The main goal of this research is to answer the research question summarized as: *What are the Form, Function and Meaning*

[14] For general information about Ilkhanid Art and Architecture, see, for example: Archnet: Ana Marija Grbanovic: Ilkhanid Art and Architecture, passim.
[15] Morgan 1986, 158–74, p. 225.
[16] See for example: Blair 2014, p. 112–171.
[17] See for example: Paone 1980.

of Ilkhanid Architectural Decoration? The *formal/aesthetical aspects* of architectural revetment concern its original appearance, ornamental and epigraphic vocabulary and artistic principles they were produced with. *Function* raises the question of function of architectural revetment within architectural context, in relation to the architectural elements and viewer's experience of space. *Meaning* explores the message that architectural revetments convey with their aesthetic appearance, the symbols they contain and, above all, the content of inscriptions they bare. For the sake of brevity, the below discussion focuses on two main aspects of this research, both strongly connected to the need for use of digital technology: studies of stucco polychromy and studies of stucco inscriptions. In this way it should be possible to illustrate why and how the use digital tools is necessary in order to contribute towards a better understanding of the research subject.

5. Stucco Polychromy Research

The limited possibilities of accessing architectural sites and conducting archeometric examinations of stucco revetments, render it challenging to propose new scientific information about Islamic stuccos. This determines the nature of scientific research as more demanding in contrast to the available infrastructure and scientific information for the studies of Western Art and Architecture. It would be however erroneous to directly apply the well-developed research methodology of scholars in Europe[18] for the study of Islamic stuccos and the production of their hypothetical polychromy reconstructions. While fourth generation polycromy reconstructions[19] can be used to gain a better understanding of the aesthetics of Ancient Roman and Greek polychromy, such reconstructions cannot be produced for the Islamic stucco revetment, due to the lacking infrastructure and consequent absence of reliable scientific information about the material. Although the digital research methodology developed in Europe, above all in Germany, should be taken as a role model, it requires adjustments to the given context. Its haphazard application presents numerous risks which can affect the scientific validity of the conducted research. Firstly, there is a danger of over interpretation caused by the lack of scientific data on the material characteristics of Islamic stucco revetment (chemical composition of stucco, pigments, adhesives and gilding technique). Secondly, one must rely on the quality of photographical material available and know its technical properties. Thirdly, unless the material was examined with archaeometric analyses, there exists no guarantee stating that the remaining evidence was not altered through the centuries: a high level of caution is thus necessary. Fourthly, the researcher has to be acquainted with the characteristics of the remaining evidence and understand how the digital camera translates this evidence into digital information, which is used also to produce polychromy reconstructions suggesting the original appearance of stucco revetment. These reconstructions are of key importance in the study of Islamic Art and Architecture because they allow researchers to discuss stuccos' artistic characteristics, painting and gilding principles and decorative hierarchy – aspects which would otherwise remain obscure. Research projects such as those in Rome (Ara Pacis), Cividale (Tempietto Longobardo) and in Germany (exhibition: Gods in Color; Bunte Götter –

[18] For examples of excellent research on polychromy, conducted in Europe, see: Brinkmann / Wünsche 2007; Brinkmann et al. 2010.
[19] Brinkmann et al. 2010, p. 188–217.

Die Farbigkeit antiker Skulptur) demonstrate the significance of this material for curatorial and didactic activities.[20]

Based on the aforementioned limitations, I propose here some points that are relevant to the possibility of alternative solutions for the studies of Islamic stuccos. Building on the documentation of monuments, archives and written sources, Islamic Art Historians can discuss the craftsmanship, inscriptions, ornamental vocabulary and polychromy of stucco craftsmanship and its aesthetics. The use of existing archaeomtric information about the material subject to research, which Art Historians can potentially extrapolate with computer software into a new form of information, allows for a better understanding of the artistic decorative principles, decorative hierarchy and patronage of stucco revetments. Only all these approaches and sources combined, enable the Art Historian to scientifically discuss the aesthetics of architectural stucco revetment. My investigation of relation between technology of documenting the architectural revetment, existing publications and their quality suggests, that the nature of the development of digital photography technology had an important impact on Western scholars' knowledge and understanding of Islamic stucco revetments. In short, because polychromy of stuccos could be rarely recorded, it attracted little attention in the West. Furthermore, due to the limited possibilities of archeometric examinations of stucco, the information about the composition of stucco polychromy was not available until the recent decades. The comparison of available photographic documentation of the well-known Oljeitu mihrab (1310) illustrates this point. Photos published by Arthur Upham Pope and Max van Berchem in the first decades of the 20 century are entirely black and white.[21] The first colour photos with visible rests of mihrab's extensive polychromy traces were released in the West with Bernard O'Kane in 1990s.[22] However, almost contemporary photos published by Sheila Blair and Robert Hillenbrand hardly give justice to the mihrab's polychromy perhaps due to the limitation of the publications format.[23] The Oljeitu mihrab, however retains extensive amounts of stucco polychromy (Fig. 4). These examples illustrate the difference in quality of stucco revetment recording in relation to development of photographic technology. Western scholars and viewers of photos of Iranian stuccos, who have not travelled to Iran thus saw them as ›white‹ although they were not white. Scholars who travelled to Iran could not record the stucco polychromy well and it must have thus been difficult for them to discuss the matter in details in their research. Furthermore, the trending research methodology in those times seems to have determined the research focus on fundamental questions such as: identification of inscriptions, their understanding, questions of craftsmen and commissioners and above all ornamental vocabulary of Ilkhanids, rather than technical aspects of stucco and stucco polychromy composition. Another issue relating to the communication of existence of stucco polychromy stems from the high prices of photographic technology and publishing of colour and high resolution photos. This is still a persistent problem in the discipline as these examples show. Furthermore, the photo editing software necessary for the elaboration of photographic material and production of stucco polychromy reconstructions just became available at the end of the 1980s. Stucco Polychromy, as a research subject, thus seems to have been overlooked

[20] Foresta 2011; Chinellato 2008; Chinellato 2004; Chinellato 2010; Brinkmann et al. 2010.
[21] Pope 1977, p. 396; van Berchem 1909, p. 368.
[22] Alamy Stock Photo: mihrab of Oljeitu, Friday mosque of Isfahan, Iran.
[23] Blair 2006, p. 254; Hillenbrand 1994, plate 22.

due to the limited means of it being recorded in remote architectural sites in Iran, in addition to the lack of digital photography technology and knowledge of photo editing software.

Western studies of architectural polychromy began towards the end of the 19 century, when Art Historians became interested in the remains of polychromy on Classical Greek Statutes and Architecture with polychromy traces. Nowadays researchers produce the so called fourth generation polychromy reconstructions.[24] These polychromy reconstructions are based on an extensive amount of archeometric information extracted from the objects and then reproduced with original materials. The new UV-VIS technology seems to even allow scholars to determine the original shades and saturation of the polychromy. While these reconstructions have not passed as uncontroversial, they nonetheless suggest that there is a possibility of archeometry and art history to collide and propose new knowledge about very well-known artistic and architectural heritage. The main drawback of such projects is their cost and necessary time. It does not seem that such investigation techniques will soon be applied on Islamic stucco revetment studies. It is nonetheless possible to attempt to produce feasible polychromy reconstructions of hypothetically original appearance of Islamic stuccos with the existing means. Digital photographs of architectural revetment can be employed to observe the remaining polychromy traces. Photo editing software can aid at better spotting some small fragments of polychromy with the use of filters and magnification. Based on the gathered information tentative digital polychromy reconstructions can be produced with Photo Editing Software. These reconstructions are however purely tentative and they present several problems. How do we know what was the original saturation of the colours, without a detailed archeometric analysis? Did the colours decompose and oxidise through time and they thus changed their aesthetic characteristics? These issues can only be resolved with the aid of archeomtric technology and microscopic research. Having said this, although these reconstructions are highly speculative, they can nonetheless be of use to Islamic Art Historians. Details of the polychromy reconstructions illustrate clearly how the artist used the colours, and based on this reconstruction Art Historian can discuss artist's colouring principles and aesthetics of Islamic stucco revetment. Furthermore, such polyhcromy reconstructions could be of use for spreading the information about the original appearance of the stucco revetment to the wider audience; for example, museum visitors, students of Art History and the scientific community. They thus assume an important didactic function. In the Cividale museum, in North Italy, the 8 century Ratchis altar is displayed and the polychromy reconstruction is projected on to it in order to show to the visitors how the altar looked like originally and how the artists coloured it (Figs. 5–6).[25] A similar projection of polychromy reconstruction has also been executed and put on display for the Ara Pacis Augustae in Rome.[26] While the Cividale reconstruction has been produced based on archeometric analyses of pigmentation traces, the one in Rome was executed in a more speculative manner, drawing on primary written sources about Roman polychromy practices. These two examples illustrate the larger context of importance of studies of architectural revetment polychromy, the information they provide and possible didactic functions of tentative polychromy reconstructions.

[24] See, for example: Brinkmann / Wünsche 2007.
[25] Chinellato 2008; Chinellato 2004; Chinellato 2010.
[26] Foresta 2011.

Fig. 5: Ratchis altar with remaining polychromy traces, stored in the Cividale archaeological museum. (© Grbanovic 2016)

Fig. 6: Projection of hypothetical original polychromy reconstruction on the Ratchis altar for didactic purposes. The projection is animated and based on archaeometric research of the altar. (© Grbanovic 2016)

6. Arabic Epigraphy

Studies of Arabic or Persian architectural inscriptions have been one of the major scholarly challenges through the history of the discipline. One needs to possess a solid language command and knowledge of calligraphic scripts for their thorough research. Arabic Epigraphy established itself as an independent field during the past decades, but it nonetheless almost entirely excludes the use of digital tools. This section attempts to suggest possible benefits of use of photo editing software for the study of Arabic and Persian Epigraphy as part of Islamic Art Historians' approach. It also discusses the feasibility of this study approach, its benefits and the extent to which it should be applied and considered as authoritative evidence. The use of software does not only allow one to reproduce a certain inscription, it also enables its further elaboration, incomparable to manual copying of inscriptions – the common practice of Art Historians. Its employment allows researchers to discuss architectural revetment from new perspectives. Digital reproductions of inscriptions and architectural ornamentation enable a detailed discussion of their design and their artistic composition. They facilitate comparative research of a large quantity of material, because they can be reproduced and modified in numerous ways. Studies of inscriptions' letter shapes and their comparative research enable discernment of craftsman workshops' characteristic and their activities.

The following example of Ikhanid stucco inscription executed in carved stucco from the Pir-i Bakran mausoleum near Isfahan illustrates a possible way of use of photo editing software and tools for the research of Architectural Inscriptions (Figs. 7–8). Digital software has been used in order to produce a precise copy of this inscription, and its two respective scripts. The function of this digital image is the following it allows us to reproduce the script and isolate the inscription from its ornamental background; in this way one can better appreciate its design and discuss its aesthetic characteristics. It is possible to understand how the inscription was designed; whether it was a professional scribe, calligrapher or some other person who designed it. Moreover, the digital image can be reproduced in various sizes, colours and dimensions for didactic purposes and for publication. Ultimately, it is much easier to discuss the inscription and its aesthetic characteristics are clarified through its digital manipulation. This can be brought another step further: one can digitally dismantle the inscription and study the shapes of letters and their variations in order to understand epigraphic characteristics of the inscription. Similar attempts to enhance studies of architectural inscriptions have already taken place. Digital software can be used to enhance visibility of architectural inscription in its architectural context.[27] This is especially useful for didactic purposes. As for reproduction of Square Kufic inscriptions, a separate digital software can be used. Reproductions of these inscriptions are of great use for studies of their design and the way the designers organized the text spatially. Digital reproductions are again clearer, because the script is isolated from its context, allow for their reproduction, and can also be used for didactic purposes. Last but not least, digital reproductions of inscriptions on wall paintings are useful for the research and studies of architectural revetment and decoration design.

Fig. 7: Historic inscription at the Pir-i Bakran mausoleum and its digital copy. (© Grbanovic 2014)

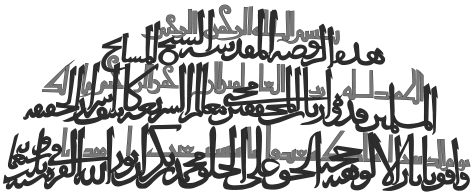

Fig. 8: Historic inscription at the Pir-i Bakran mausoleum and its digital copy for studies of Islamic epigrahpy and calligraphic design. (© Grbanovic 2014)

7. Conclusion

[27] See, for example: Rajaei et al. 2009.

This paper attempted to discuss the relationship between *Digitality* and Studies of Islamic Art and Architecture and especially Islamic stucco revetment. Some examples were given in order to illustrate the many-fold aspects of potential of the use of *Digitality* for the studies and research of Islamic Art and Architecture. Impact of *Digitality* on the field, which developed through time and went hand in hand with the development of the respective field, was highlighted. While some of the above outlined assumptions might sound obvious to a specialized reader versed in *Digitality*, they however result in importance for the Islamic Art Historians, given the aforementioned backlog in the digitalization of the discipline and the lack of its discussion. It is nonetheless important to stress here, that only some aspects of the discipline and its methodology are or will eventually be impacted and changed by *Digitality*. Islamic Art objects and monuments should remain the key primary sources for the research in the field. *Digitality* should however be one of the aspects of the interdisciplinary approach to the subject, which still results excessively jeopardized by the traditional methodology of *stylistic comparison*. The use of digital technology for the research of Islamic Art and Architecture is a must and one of the keys to the cutting edge discoveries in the future of the discipline.

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Captions for Figures

Abb. 1: Orumiyeh Friday mosque in North-Western Iran (Seljuk mosque and Ilkhanid stucco revetment). Detail of whitewashed stucco mihrab. (© Grbanovic 2014)

Abb. 2: Example of Ilkhanid stucco revetment from the Pir-i Bakran mausoleum in Linjan, South of Isfahan. (© Grbanovic 2013)

Abb. 3: Example of Ilkhanid stucco mihrab (with polychromy traces) of the Seljuk period Friday mosque of Haftshuyeh near Isfahan. (Grbanovic 2014)

Abb. 4: Detail of the Oljeitu mihrab (1310) at the Friday mosque of Isfahan. The digital photo shows the amount of remaining stucco polychromy on the mihrab. (© Grbanovic 2014)

Abb. 5: Ratchis altar with remaining polychromy traces, stored in the Cividale archaeological museum. (© Grbanovic 2016)

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Abb. 7: Historic inscription at the Pir-i Bakran mausoleum and its digital copy. (© Grbanovic 2014)

Abb. 8: Historic inscription at the Pir-i Bakran mausoleum and its digital copy for studies of Islamic epigrahpy and calligraphic design. (© Grbanovic 2014)