

A Historical–Comparative Study of the Arabic Script Evolution from Nabataean Origins to Islamic Calligraphy

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Abstract - The Arabic language is one of the most powerful scripts in the history of humanity, a product of centuries of language, culture, and religion. It offers valuable insights into the evolution of writing systems not only in the ancient Near East but also in the Islamic world. The study adopted qualitative historical–comparative methodology to explore the history of Arabic script. Epigraphic Nabataean texts, early copies of the Qur'ān, and authoritative historical texts were used to study variation in letter morphology, orthographic conventions, and writing practices throughout the historical eras. Comparative analysis showed that the Arabic script gradually developed from the Aramaic writing tradition in the course of time, and then reached a more standardized orthographic system during the early Islamic era under the influence of the Nabataean script. The results also revealed that the preservation and transmission of the Qur'ān was a major factor in establishing uniform writing conventions, improving the forms of the letters, and popularising the use of the Arabic script in the growing Islamic civilization. Also, the Arabic calligraphy gave a new dimension to the script, making it a fine art tradition including the styles of Kufic, Naskh, and Thuluth. The interdisciplinary approach of the study (historical linguistics, epigraphy, paleography, manuscript studies, and Islamic cultural history) is the novelty of this study, as it allows for a comprehensive reconstruction of the development of the Arabic script. The study is a step towards a better understanding of the historical processes that led to the development of the Arabic writing system and provides a systematic framework for future research into the development and survival of ancient writing systems.

Keywords: Arabic Writing System, Arabic Script, Nabataean Script, Arabic Calligraphy, Historical Linguistics, Epigraphy, Qur'anic Manuscripts, Script Evolution

I. INTRODUCTION

Writing systems are among the most important accomplishments of human civilization that allow society to store information, organize political systems, document historical events, and pass on cultural and religious values over time (Reinfandt, 2020). The Arabic script is unique among major writing systems, due to its wide geographical spread, linguistic influence, and its deep religious importance (Posegay, 2024). It is currently adopted by over 400 million native speakers and has been borrowed by other languages, such as Persian, Urdu, Pashto, Kurdish, Sindhi, and once Ottoman Turkish. It is widely used, not only because of its linguistic versatility, but also because of its importance in the dissemination of Islamic civilization (Posegay, 2024; Ahmed, 2024; Garosi, 2022).

The study of the historical origins of the Arabic script has received a great deal of scholarly focus in the disciplines of historical linguistics, epigraphy, archaeology, and Islamic studies (Gruendler, 2019). It is usually argued that the Arabic alphabet was developed out of the Nabataean alphabet, which again descended from the Aramaic alphabet (Healey, 2023; Gruendler, 2019). The inscriptions from northern Arabia, Jordan, Syria, and the Arabian Peninsula have been found in such a way that the graphical development of the letter forms of the Nabataean language to the early Arabic alphabet can be traced (Healey, 2023). The Arabic alphabet did not develop suddenly, but has remained an ongoing process of

restructuring in accordance with the language, social interaction, and administration (Gruendler, 2019).

Islam emerged in the seventh century CE, marking an important milestone in the development of the Arabic script (Posegay, 2024). By the time Islam had transcended its initial geographic boundaries (the Arabian Peninsula), the Arabic language had become the language used for matters to do with religion, governance, learning, and science, as well as literature, in the Muslim world (Garosi, 2022). Transcription of the Qur'ān required a standardized script that could capture the divine text properly, and consequently, there were many changes made in the areas of orthography, notation, and manuscript production. Arabic script then became a regional means of communication that later became an internationally acceptable script, which is very stable linguistically (Garosi, 2022). Besides being a tool of communication, the Arabic script has gradually become one of the main art expressions in the history of the world, known as Arabic calligraphy (Healey, 2023). Such philosophical beliefs in religion that encouraged the minimalist style through the use of abstractions in religious expressions allowed artists to experiment with geometrical decoration and calligraphic design. Classical scripts (Kufic, Naskh, Thuluth) became crucial elements of manuscript writing, architecture, ceramics, textiles, coinage, and decorative arts and made Arabic writing not only a language but also a visual communication tool (Healey, 2023; Sathiyamani et al., 2025; Ismayil, 2024).

What is novel in this study is that it provides an interdisciplinary integration of historical linguistics, epigraphy, manuscript studies, and Islamic cultural history towards a comprehensive understanding of the development of the Arabic script. This study does not merely belong to the realm of history; instead, it takes a holistic approach whereby it studies the Arabic writing system as a whole rather than individualistic aspects of language and art that have been addressed by previous studies. The outcomes of this research shall add a broader perspective to historical linguistics, epigraphy, Islamic studies, manuscript studies, and the history of writing systems concerning the historical developments that resulted in one of the most significant writing systems in the world.

Key Contributions of the Research

- The evolution of the Arabic script through time is comprehensively analyzed in light of the linguistic, epigraphic, historical, and cultural information available since its beginnings in Semitic cultures up to the early Islamic period.
- The impact of Islam and the need for the preservation of the holy book, the Qur'ān, in terms of the standardization of the Arabic script is shown.
- The evolution of the Arabic script into an art form is revealed through the rise of various calligraphy styles such as Kufic, Naskh, and Thuluth.

The remaining part of this essay shall follow the structure below. Section II discusses the relevant literature on the history of the Arabic writing system, its Semitic origin, and calligraphic developments within this system. The research methodology adopted for this investigation is detailed in Section III, where there is an explanation of the historical comparative method employed as well as sources and techniques for analysis. Experimental results of the analysis conducted on historical inscriptions, manuscripts, and epigraphic texts are discussed in Section IV. Discussion of findings is carried out in Section V, where there is an explanation of their relevance to the linguistic, historical, cultural, and religious development of the Arabic script.

II. LITERATURE REVIEW

A study conducted by Hallberg, (2022) used quantitative corpus-linguistic methods on a 72-million-word corpus of book-length Arabic texts to analyze how the use of diacritics (taṣkīl) varies across genres and levels of reader proficiency. The study looked at the contribution of vowel marks and pronunciation marks to the clarity and intelligibility of the text as well as the linguistic accuracy of the text. It was found out from the results of the study that the application of diacritical marks depends on the genre, target readership, and educational purpose. The study further found that the priority given to individual diacritics is largely consistent across genres, qualifying the common genre-based description of diacritic use. Here, the Qur'ān and educational texts have abundant diacritical marks.

Aller et al., (2022) studied techniques for recovering hidden textual information from ancient papyri and historical manuscripts by advanced non-destructive surface analytical methods. The study used complementary imaging and spectroscopic techniques that are being used to uncover writings that are faded, damaged, or hidden from normal observation. The proposed analytical approach allowed the researchers to read inscriptions that were not previously readable without necessitating the breaking or damaging of valuable archaeological artifacts. The study proved that the use of contemporary scientific imaging technologies has significant benefits for the conservation of manuscripts, as well as for historical analysis and text reconstruction.

Griffin, (2023a), Griffin, (2023b) introduced a two-part special issue on the intersection of digital libraries, epigraphy and paleography, examining how digital-library infrastructures can support the study, preservation and interpretation of ancient inscriptions and manuscripts. It was made clear in this special issue that digital infrastructure plays an important role in the preservation of vulnerable historical documents through the process of metadata standardization and image databases, as well as platforms for collaboration and research. It provided examples of how the digital humanities could assist in creating dialogue between historians, linguists, archaeologists, and manuscript scholars. The special issue highlights that digitization technologies are useful not only for preservation but also for comparing different writing systems.

Ghigo et al., (2020) applied a non-invasive, interdisciplinary protocol - combining near-infrared imaging and X-ray fluorescence spectroscopy - to characterize black Egyptian inks from Late Antiquity, analyzing 77 codicological units from a corpus of early manuscripts. Their study showed how the systematic collection of material data on ink composition can distinguish carbon-based from metal-containing inks and illuminate scribal practices and manuscript production, while also probing the methodological limits of characterizing the most ancient inks. Such archaeometric approaches to writing materials provide a material-science complement to the paleographic and historical study of manuscript traditions.

Sathiyamani et al., (2026) studied ancient papyrus protocols by detailed physicochemical examination of historical inks.

In this study, sophisticated analytical methods were used to examine the composition of inks, writing technologies, and the production of documents without harming the original documents. The results proved that the choice of ink correlated with document type and function - notably, papyrus protocols were consistently written in iron-gall ink while private documentary texts used carbon-based inks, providing a useful opportunity to analyze the ways of producing manuscripts and their spread. The study stressed the significance of applying archaeometry to interpreting the ancient documentary material along with historical linguistics and paleography. It helped enrich the knowledge of historical writing systems through an interdisciplinary approach and offered methodological assistance for further research of Arabic manuscripts and documents.

TABLE I SUMMARY OF RECENT LITERATURE ON ARABIC WRITING SYSTEMS, MANUSCRIPT ANALYSIS, AND DIGITAL PRESERVATION

Authors	Methodology	Dataset / Simulation Environment	Research Gap
(Hallberg, 2022)	Quantitative corpus-linguistic analysis of Arabic diacritical (taškīl) usage	Printed Arabic books, Qur'anic texts, and educational publications (72-million-word corpus)	Investigated modern orthographic practices but did not examine the historical development of Arabic script from its Semitic origins.
(Aller et al., 2022)	Non-destructive surface spectroscopic and imaging techniques (review)	Ancient papyri and archaeological manuscripts	Focused on recovering hidden texts but did not investigate the linguistic or historical evolution of Arabic writing.
(Griffin, 2023)	Editorial of a two-part special issue on digital libraries, epigraphy and paleography	Digital manuscript repositories and historical inscription databases	Emphasized digital preservation but provided limited discussion on the chronological evolution of Arabic script.
(Ghigo et al., 2020)	Archaeometric ink analysis (near-infrared imaging + XRF) of Late-Antique Egyptian manuscripts	77 codicological units (early Egyptian manuscripts/papyri)	Characterized writing inks but did not address the linguistic or paleographic evolution of Arabic script
(Sathiyamani et al., 2026)	Physicochemical ink analysis (non-invasive XRF) and archaeometric investigation	Ancient papyrus protocols and historical documents	Investigated scribal materials and writing practices but did not analyze the linguistic transformation of Arabic writing.

The summary of recent research on the field of Arabic manuscripts, handwriting recognition, epigraphy, paleography, and Digital preservation is summarized in table I. The literature reviewed has shown that great advancements have been made using multispectral imaging, digital images, archaeometry and computational techniques in manuscript analysis, documentation and preservation of cultural heritage (Nodar et al., 2022; Nehring et al., 2021; Mohamed et al., 2020; Sibilia et al., 2021; Marotta et al., 2025; Ghigo & Dominguez, 2023; Ghigo & Albarrán Martínez, 2021; Fani, 2025; Díaz Hidalgo et al., 2023). A few studies are also concerned with the issues of Arabic orthography, diacritical systems, and ancient writing materials in a multi-disciplinary approach. Most previous studies, however, focus on handwriting recognition, document restoration, manuscript authentication and/or digital preservation rather than giving an encyclopedic description of the Arabic writing system from a historical perspective. In addition, little has been done to bring together the linguistic evolution, the epigraphic evidence, the manuscript studies, the historical developments, and the religious influences in a coherent framework for analysis.

The present study thus fills this research void by providing an interdisciplinary historical study of the development, standardization and artistic development of the Arabic writing system from its Semitic origins to the early Islamic period.

III.METHODOLOGY

3.1 Research Design

The type of research in this study is qualitative research, which is historically/comparative research that aims to explore the origin, development, and standardization of the Arabic alphabetical system. The research is based on historical accounts and the interpretation of Arabic script, aiming at describing the various stages of its development from Semitic origins to the classical form. The historical approach makes it possible for the chronological evaluation of the evolution of the script, while the comparative approach makes it possible to detect differences and similarities in the structure of the Aramaic, Nabataean, and Arabic scripts. The research accounts for such disciplines as historical

linguistics, epigraphy, paleography, and study of Islamic culture, thus being a multidisciplinary study. The research covers the comparative analysis of the letter forms, conventions of writing, orthography of the Arabic script and cultural factors, thus providing information about factors which had a significant impact on the development of the Arabic script. The methodology involves all these different approaches, thus making it possible to evaluate contributions of language, religion, history, and art to the creation of the script.

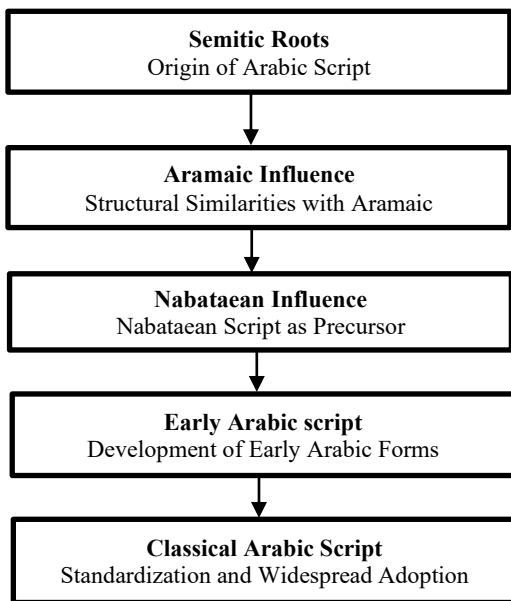


Fig. 1 Evolutionary Development of the Arabic Script from Semitic Roots to Classical Arabic

The Arabic script evolved gradually from the third to the sixth centuries CE, reaching greater standardization during the early Islamic period in the seventh century CE. This

evolutionary process is represented in fig. 1 below, in which the development of some Arabic languages and writings is presented. First comes the history of Semitic roots, which are the oldest roots of this script family. Then the history continues through the Aramaic influence on the development of the next scripts, paying particular attention to the structure and written forms of the script. The first script, which is a precursor of the Arabic script, is Nabataean, in which the letter forms and cursive qualities have become the recognizable Arabic forms. Next follows the history of the Early Arabic script and the development of the shapes of letters. The last stage in the evolution of this script is Classical Arabic script. In this stage, the orthographic principles and character forms were standardized, and the script spread to literary and administrative works and the recording of religious texts.

3.2 Data Collection and Sources

It should be noted that the investigation will be done on the secondary basis and will employ secondary historical sources, including inscriptions, epigraphical records, early Qur'anic manuscripts, ancient papyri, documentary materials showing different stages of Arabic writing. It should also be said that primary sources include scholarly books, journal articles, conference papers, and digital manuscript archives published by leading academic publishers. The emphasis will be made on the modern investigation on Arabic paleography, the conservation of manuscripts, historical linguistics, and epigraphy. Materials collected will be systematically classified depending on the time period, script type, linguistic peculiarities, and cultural context. This classification helps to date scripts relatively chronologically. Research employs archaeological, manuscript, and linguistic materials in order to build an appropriate documentary base for the history of Arabic writing.

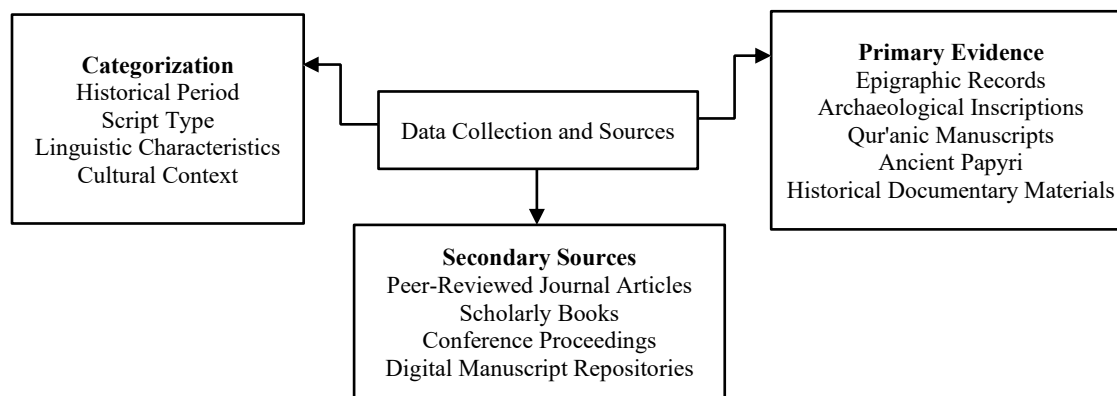


Fig. 2 Data Collection Framework and Source Classification for the Historical Analysis of Arabic Script Evolution

Fig. 2 shows the data collection framework used for the historical study of the development of the Arabic script. The framework uses both primary and secondary sources to provide for full, reliable evidence. The primary sources are the epigraphic records, the archaeological inscriptions, the manuscripts of the Qur'ān, the ancient papyri, and the historical documentary materials, which provide direct historical evidence of the development of the script at various

times. Secondary sources include scholarly books, peer-reviewed journal articles, conference proceedings, and digital repositories of manuscripts that provide interpretations and supporting analyses drawn from primary sources. The gathered data are classified systematically for the historical period, script type, linguistic characteristics and cultural context, and a structured comparison of script evolution is possible. The multi-source and

multi-dimensional nature of the data collection method increases the likelihood of credible, consistent and detailed analysis of the historical data, as well as providing a fuller picture of the change of the Arabic writing system.

3.3 Data Analysis Procedure

The historical data gathered were analyzed in a qualitative content analysis and comparative historical interpretation framework. Next, an analysis of epigraphic inscriptions and early manuscript material was undertaken to establish structural features of the Nabataean, Aramaic and early Arabic scripts, such as letter forms, ligatures, orthographic rules, and writing styles. Finally, a comparative analysis was carried out to assess the graphic changes that took place in the shift from Nabataean to Arabic script. Another point of focus in the research was the influence of the early Islamic era and the compilation of the Qur'ān on the development of the standardization of the script, its orthography and diacritical markings. Finally, information related to the evolution of Arabic calligraphy and its artistic and cultural significance in the Islamic civilization was collected. This analysis is based on historical linguistics, paleography, manuscriptology and epigraphy and offers a holistic historical perspective, as well as a brief review of the current literature on the history of the Arabic script.

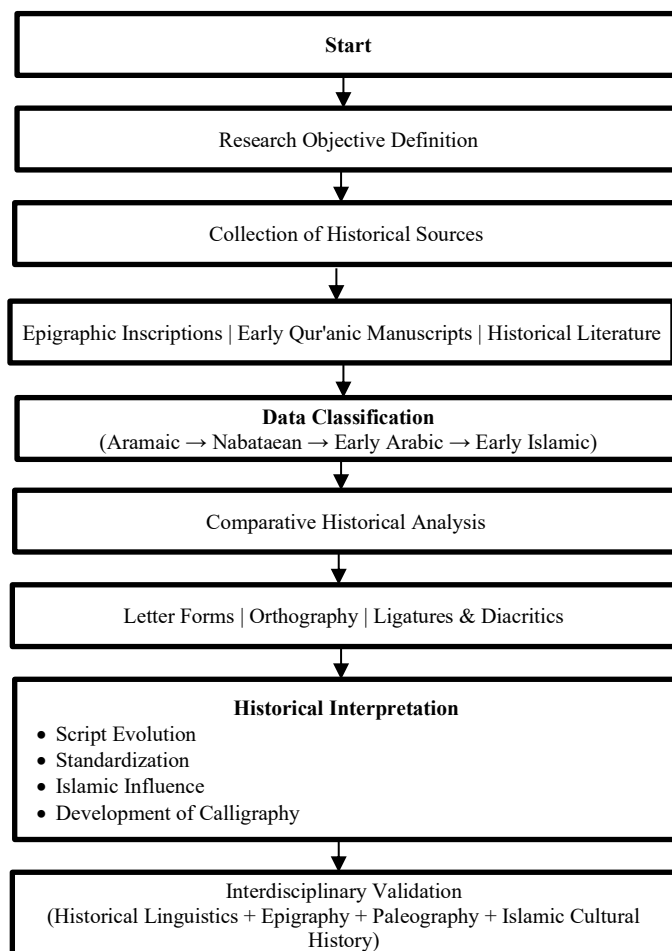


Fig. 3 Methodological Framework for the Historical and Comparative Analysis of Arabic Script Evolution

Fig. 3 presents the method used for researching the Arabic script and its development and usage in culture. The research begins with the recognition of the script, which includes the classification of inscriptions and manuscripts according to the period of time and the shape of the script. Then there is the analysis of epigraphic inscriptions to see what kind of structure these inscriptions have, such as letter shapes, styles of writing and inscriptional characteristics. After that, there is the comparison between different graphical transformations and the evolution of letters throughout the different historical periods. There are also some aspects such as the early Islamic period, standardization of the Arabic script, use of the diacritical marks and orthography improvement in the research. In the end, the research includes the analysis of Arabic calligraphy to find out the aesthetic value of this art. Thus, the everlasting influence of Arabic script and calligraphy on the Islamic civilization can be seen as well.

IV. EXPERIMENTAL RESULTS

4.1 Historical Source Analysis

The Arabic script has been studied using a qualitative historical–comparative approach to the examination of various classes of textual sources. Instead of quantifying the inscriptions or evaluating them by computation, this study analyzed epigraphic inscriptions, Nabataean inscriptions, early manuscripts of the Qur'ān, and authoritative historical sources in an orderly manner in order to trace the evolutionary phases of the Arabic writing system. All sources were studied with respect to their historical background, linguistic features, orthographic features, and cultural relevance. The combined use of these complementary sources allowed for a complete picture to be drawn of how the Arabic script developed from its Semitic heritage to its codification in the early Islamic era. Table II presents a summary of the primary historical sources used in this study and the contribution that each source has made to the study.

Table II gives a summary of the main historical sources used to research the development of the Arabic writing system and is intended to identify each source's contribution to comparative research. The earliest archaeological evidence of script development comes from epigraphic inscriptions, which illustrate the evolution of letter forms and conventions in writing. The history of the Arabic alphabet is accepted as being in the process of transition from Aramaic to Arabic; nabataean inscriptions provide significant structural similarities to make this claim. Early manuscripts of the Qur'ān are examples of the process of orthographic standardization that occurred during the early Islamic era, showing the development of standardization in the writing of the Qur'ān and the introduction of diacritical marks to ensure accurate transcription. These primary sources are supported by historical literature which offers linguistic, cultural and religious interpretations that will help to explain the larger historical picture of script evolution (Oliveira et al., 2025). The combination of these varied sources allows a complete

reconstruction of the Arabic writing system's developmental stages and helps to reinforce the historical interpretation.

TABLE II HISTORICAL SOURCES USED IN THE COMPARATIVE ANALYSIS

Historical Source	Period Covered	Primary Purpose	Contribution
Epigraphic Inscriptions	3rd–6th Centuries CE	Trace Early Script Development	Evidence of Letter-form Evolution
Nabataean Inscriptions	2nd Century BCE–4th Century CE	Transitional Writing System	Linguistic Continuity
Early Qur'anic Manuscripts	7th–8th Centuries CE	Orthographic Standardization	Script Consistency
Historical Literature	Various	Historical Interpretation	Cultural and Religious Context

4.2 Evolution of the Arabic Script Across Historical Periods

Comparative analysis deals with the contribution that the different historical sources make to the comprehension of the development of the Arabic writing system. The epigraphic inscriptions, the early Arabic manuscripts, the linguistic analysis and the historical records of Islam were studied and compared systematically to establish the changes in the script, the orthographic changes and the cultural influences of the successive historical periods. All of the parameters listed in Section 4.1 were predetermined for all of the sources. The results demonstrate that the inclusion of multiple categories of historic evidence to be interpreted is more comprehensive than when it is done with one category. The comparative results of the historic data studied are presented in table III, which details the historical periods of development.

TABLE III HISTORICAL DEVELOPMENT OF THE ARABIC WRITING SYSTEM

Historical Period	Major Characteristics	Historical Significance
Aramaic	Alphabetic foundation	Origin of Semitic writing traditions
Nabataean	Connected cursive letter forms	Transitional stage toward Arabic
Early Arabic	Distinct Arabic letter morphology	Formation of recognizable Arabic script
Early Islamic	Standardized orthography and diacritics	Preservation of the Qur'ān and administrative writing

The major phases of the historical development of the Arabic writing system are summarized in table III, from Semitic to standardised Arabic in the early Islamic period. The Aramaic stage laid the groundwork for the basic alphabetic system that would impact several Semitic writing systems. The Nabataean phase added more interwoven and cursive letter shapes, which were the closest forerunners of the Arabic script. The script developed during the Early Arabic period

distinctive morphological features that made it distinct from the previous scripts and make it more appropriate for written communication. The Early Islamic period was a great turning point in the evolution of scriptures as it introduced standardisation of orthographic conventions, refinement of letter forms and imbued diacritical marks to ensure accuracy of Qur'anic texts. The historical phases show that the Arabic script has developed gradually, by continuous adaptation of the language, cultural interaction, and religious influence and not in a sudden change.

4.3 Comparative Interpretation of Historical Evidence

A historical analysis of the development of the Arabic script was provided by a comparison of the evidence from each of the successive developmental phases starting with the Aramaic script and moving through the Nabataean, the Early Arabic and the Early Islamic stages. This comparative historical study has been conducted to find out the changes in letter morphology, conventions of writing, orthographic practices, and the cultural and religious factors that influenced the development of the scripts over time. The study reconstructed the process of the development of the Arabic writing system by examining inscriptions, manuscripts and records of every period and the most prominent events that helped to standardise and popularise the Arabic script. The main attributes and the historical meaning of each evidence source are summarized in table IV.

TABLE IV CONTRIBUTIONS OF DIFFERENT HISTORICAL EVIDENCE SOURCES

Evidence Source	Historical Insight
Epigraphic inscriptions	Evolution of letter forms
Nabataean inscriptions	Transition from Aramaic to Arabic
Qur'anic manuscripts	Orthographic standardization
Historical literature	Cultural, linguistic and religious interpretation
Arabic calligraphy	Artistic development of script

Table IV shows the complementarity of the various types of historical evidence in the study of the development of the Arabic writing system. Epigraphic inscriptions can be used to directly demonstrate the development of letter shapes, and to record the earliest stages of script development. The transition from Aramaic to Arabic script is attested by Nabataean inscriptions, which show that there were gradual changes over a period of several centuries. Religious texts were preserved and standard conventions of orthography were implemented in the early manuscripts of the Qur'ān, providing evidence of Islam's formative era. Historical texts provide valuable linguistic, historical and cultural insights into the social and religious context of the development of the script, and Arabic calligraphy illustrates the evolution of the script from a utilitarian means of communication to a fine art. These complementary evidence sources are interpreted together; the whole picture is thus revealed, and this interdisciplinary approach is used in this study.

V. DISCUSSION

The results of this research are a detailed historical understanding of the development of the Arabic writing system based on epigraphic inscriptions, Nabataean inscriptions, early Qur'ān manuscripts and historical sources. This research, which is historical–comparative in nature, and focuses on the interdisciplinary study of the Arabic script, differs from previous studies, which considered primarily individual aspects such as manuscript conservation, Arabic calligraphy or digital analysis of historical text. The comparative analysis shows that the Arabic script did not suddenly appear as a result of a language change, but rather it has been developed over time, as a result of the adaptation of the language. The similarity between the Aramaic and the Nabataean scripts, and the Archaeological inscriptional evidence strongly suggests that the Nabataean script was the main ancestor of the Arabic script. These results are in line with previous studies in historical linguistics and epigraphy and offer a more comprehensive interpretation with the synthesis of several categories of historical evidence.

The analysis also emphasizes the crucial role played by the early Islamic period in the standardization and propagation of the Arabic script. The early manuscripts of the Qur'ān show the emergence of more stable conventions of orthography, the more precise letter shapes, and the beginnings of the diacritical marks, all of which serve to preserve and transmit the Qur'anic text with accuracy. These developments rendered the Arabic script to become a standardized writing system that would facilitate religious, administrative, educational and literary functions in the growing Islamic civilization. The results suggest the importance of religious needs, including the protection of the Qur'ān, in fostering script uniformity and rapid standardization in use of the script. So, the Arabic script became a regional script and one of the most influential and lasting scripts in the world.

The study also underscores the importance of using a variety of historical sources to gain a more complete picture of the evolution of scripts. Epigraphic inscriptions evidence changes in letter formation and in letter conventions in a direct archaeological way, while Nabataean inscriptions show the transitional period between the use of Semitic letter conventions and use of the Arabic alphabet. The documents of the early Qur'anic manuscripts provide information on how the scripture underwent orthographic refinement and how it was preserved, while historical writings offer insight into the linguistic, cultural, and religious contexts that shaped the process. The Arabic calligraphy is another example of the way the script has evolved from a practical method of communication into a rich art form, with several different styles including Kufic, Naskh, and Thuluth. The synergy of these sources of evidence reinforces this historical interpretation and illustrates the usefulness of a combined historical-linguistic, epigraphic, paleographic, manuscript and Islamic cultural-historical approach.

There are some drawbacks to be noted, however, in spite of these contributions. The study is primarily on published

historical records, archaeological reports, manuscripts and secondary scholarly literature, not on newly discovered inscriptions or unpublished documents. Not all historical inscriptions are available in all geographical areas and historical eras, and the preservation of inscriptions may also be incomplete, a fact that can impact the development of a chronology. In addition, some historians are more inclined to believe some evidence and less to believe other evidence, partly due to differences in the archaeological findings, partly due to the dating of manuscripts, and partly due to differences in the linguistic interpretations of the texts. These can be improved upon in future studies through including new inscriptions, more early Qur'anic manuscripts, improvements in the science of epigraphy, multispectral imaging of manuscripts, and the use of computational paleographic analysis. The latter would be an ancillary benefit to the historical reconstruction of Arabic script evolution, as well as the preservation and wider dissemination of one of the world's most important writing systems, all in the context of interdisciplinary investigations.

VI. CONCLUSION AND FUTURE WORK

In this study, a thorough historical–comparative study of the development of the Arabic writing system was carried out, using the various types of epigraphic inscriptions, the Nabataean inscriptions, early Qur'anic manuscripts, and historical literature. The results showed that the Arabic script has gradually developed from the Semitic script to the Nabataean script, and then to achieve more orthographic standardization in the early Islamic period. The study of the comparative analysis of several sources of the past revealed that there were successive changes in letter morphology, in writing convention and in orthographic practices, due to the interaction of cultural, religious and linguistic factors. In addition, the study emphasised the importance of the preservation of the Qur'ān in establishing the standardisation of the script and the development of Arabic calligraphy as not only a writing system but also an important art form. The study combines historical linguistics, epigraphy, paleography, manuscript studies and Islamic cultural history to create a comprehensive understanding that enriches the knowledge of the historical development and global impact of the Arabic script.

Future studies would benefit from building on the current historical research, including the inclusion of newly discovered archaeological inscriptions, other early manuscripts of the Qur'ān, and unpublished documentary materials from international manuscript collections for an enhanced chronology of the development of Arabic script. The use of state-of-the-art technologies like multispectral imaging, digital epigraphy, computational paleography, artificial intelligence for manuscript analysis and 3D documentation of archaeological objects could further contribute to the preservation, interpretation and authentication of historical writing systems. Finally, comparative studies of other Semitic scripts, such as Aramaic, Syriac, and Hebrew, would give better understandings of the spread of scripts from one region to

another, of the linguistic transformation of script, and of cultural relationships between regions of the ancient Near East. Such interdisciplinary studies will contribute to a more comprehensive understanding of the historical evolution of writing systems while supporting the preservation of the world's documentary and cultural heritage.

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