

Arabic script and typography

A BRIEF HISTORICAL OVERVIEW

ARABIC WRITING is alphabetical; the direction of writing is from right to left; within a word, most letters form connected groups. One expects an alphabet to consist of a few dozen letters representing one unique sound each. The Arabic alphabet evolved somewhat away from this ideal: although most letters correspond to a sound, a few letters are ambivalent between two or more sounds. Some letters don't represent sound at all: they have only a grammatical function.

For modern office use there are 28 basic letters, eight of them only differentiated from other letters by diacritics, and six optional letters for representing vowels. Older spellings made less use of diacritics for differentiating; on the other hand, to facilitate Qur'an recitation, additional vowel signs occur, along with elaborate cantillation marks. To acknowledge slight variations of the received text, some Qur'an editions have additional diacritics, discretely adding or eliminating consonant letters.

As the Arabic script evolved into a connected script, it developed an elaborate system of assimilations and dissimilations between adjacent letters. Outside a small group of connoisseurs and calligraphers who study the principles established by the Ottoman letter artists, surprisingly little is understood of the efficiency and subtlety of this system,¹ and modern industrial type designs follow the approach found in elementary Western teaching materials.² There, beginners in Arabic script are given a maximally simplified scheme. While simplification is totally sound from a pedagogical perspective, it provides too narrow a basis for the development of professional typography.

DEVELOPMENT OF THE ARABIC SCRIPT

The Arabic script stems from the same source as the Latin, Greek, and Hebrew writing systems: Phoenician (figure 1).³ The underlying proto-alphabet had some two dozen characters; there were no vowels. The direct forebear of the Arabic alphabet is a late Aramaic alphabet from which it inherits the tendency to merge letter groups into larger units marked by a final swash instead of a space. As the script evolved, some

aspects inherited from the Aramaic alphabet became simplified, and new complexities and subtleties emerged.

This evolution can be classified in four developments:

1. *Shape erosion: shared graphemes.* A number of early Arabic alphabetic letters lost their original distinctiveness; as a result, only fourteen basic shapes remained to represent thirty consonants. Arabic writing of this type is reminiscent of stenography. Many shapes represented more than one letter and could only be understood in context. Given the oral origin of Arabic literature – reading was based on familiarity with the text – this reduced or skeleton script was in fact an economical way



Figure 1. Simplified diagram showing evolution of European and Arabic scripts from a common ancestor, Phoenician.

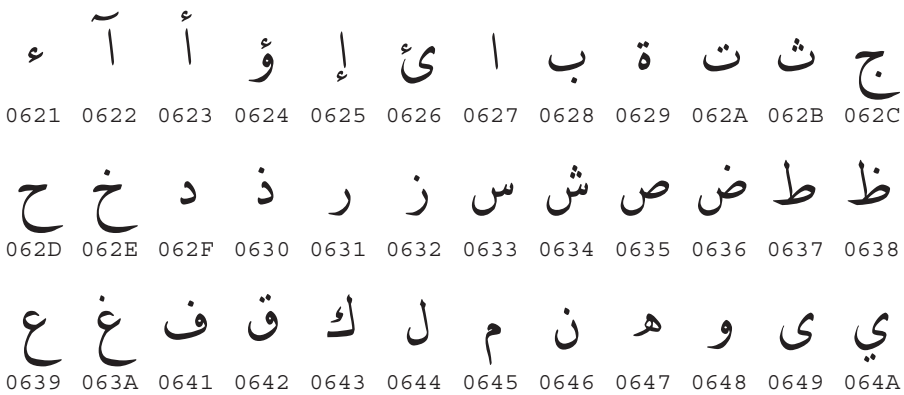


Figure 2a. A plain text encoding for Arabic, such as the Unicode encoding shown here, requires only a small set of codepoints.



Figure 2b. Each character code is rendered by up to four individual presentation forms. This is the minimum shaping required to produce recognisable Arabic text.

of writing. Drawn in dark brown or black ink with the broad side of a sharpened reed, it constitutes the smooth framework of a manuscript.

2. *Distinctive connections: multilevel characteristics.* Unlike its Syriac-Aramaic precursor, Arabic writing early on manifested two types of letter connections: horizontal (right to left) and vertical (top to bottom). This characteristic Arabic tendency emerged very early: with the partial exception of *hijâzi*, all styles of Arabic writing, from the austere hieratic writing (e.g. *kufic*) to the more capricious cursive styles (e.g. *naskh*), share this feature.



Figure 3a: Horizontal and vertical connection of two Arabic letters.



Figure 3b: Vertical connections are a feature in all major styles of the Arabic script, from the oldest *kufic* style as seen in this example from an early Islamic manuscript, left. On the right is the same text in the *naskh* style.

The spread of Islam took Arabic outside its area of origin.³ Arabic became an empire language and above all the language of religion. The efficient script with fourteen basic shapes, a useful writing system for native speakers of Arabic, was a burden to non-Arab Muslims. This circumstance led to the introduction of diacritics, i.e. small supplementary symbols in writing.

3. *Optional graphemes: vowel markers.* Vowels began to be written in the seventh century, i.e. the first century of the Islamic era, by means of dot-shaped signs surrounding the basic letter groups.⁵ In modern Arabic script this method is still in use, but the dots have been superseded by miniature versions of letters such as *alif* (indicated by a small stripe) and *wâw* (a small, open comma-shaped form).



Figure 4: Early Islamic manuscript in *kufic* style, left, showing the early development of vowel marking. The light grey dots and stripes (red in the original) are vowel markers, the two grey stripes indicating a long vowel marked in later text by a superscript *alif*; the dark stripes are consonant markers (see figure 5). On the right is the same text in the *naskh* style.

4. *More distinctive features: consonant markers.* From the ninth century on, another type of additional graphemes starts to appear in manuscripts.



Figure 5. In early, unmarked Arabic script, certain shapes could express multiple letters: the *archigrapheme* (the common graphical elements of two or more letters, minus the distinctive graphical elements). As a consequence, words could only be read in context. In some cases, like this example, even context might not resolve the ambiguity. The modern system of dots differentiates consonants of identical form.

To make the script more explicit, small stripes made by the imprint of the nib are introduced to distinguish otherwise identical bare letters. In modern Arabic script, the function of these stripes is taken over by dots above or below the bare letters – the tip of the nib is drawn exactly the length of the imprint, replacing the small stripes.

WHO ARE THE USERS OF ARABIC SCRIPT?

The spread of Islam incorporated a number of other cultures and their languages. In the areas bordering Arabia proper, Islamic culture with its Arabic language and script tended to take the place of the original culture and language. In the more remote areas, the traditional script was



Figure 6. The Arabic scripted world.

relinquished in favour of the Arabic alphabet as an expression of their cultural affiliation with Islam, but the original language was retained.

The resulting Arabic-scripted world therefore consists of both Arabic and non-Arabic speakers. It can be represented schematically on a map as three overlapping ellipses.

The innermost ellipse – the inner circle – is the original Arabia, where native speakers continue to use their historical language and script. Geographically it coincides with the Arabian Peninsula, also the heartland of Islam: the Ethnic Arabs.

The middle ellipse is made up of areas where Arabic replaced other languages and scripts. Geographically, this area covers Mesopotamia, the Levant, and North Africa:⁶ the Cultural Arabs. Together with Arabia proper, it constitutes the modern Arabic-speaking World.

The outer ellipse is made up of those Islamic nations that continue to use their historical language. As an expression of their integration in the Islamic civilization, these peoples replaced their original writing with an adaptation of Arabic script.⁷

Together, the Arabic-speaking world and the rest of the Arabic-scripted world form the Islamic world. For the non-Arabic portions of the Arabic-scripted world, Arabized computing is made complicated by the diversity of languages and the various extended Arabic alphabets.

Throughout history, a large number of languages were at one time or another written with the Arabic script, including such widely divergent ones as Spanish, Bosnian Serbo-Croatian, Hausa, Tamil, and even Zuid Afrikaans. Present-day languages using Arabic script include Persian (Iran), Pashto, Dari (Afghanistan), Urdu (India, Pakistan), Javanese (Indonesia), Kurdish (Iraq), and Uyghur (China).

Extension Devices

In order to enable the use of the Arabic alphabet for writing sounds in other languages, additional letters had to be created. The Arabic alphabet was expanded by deriving new letters from existing ones using a variety of devices. These devices derive directly from traditional aspects of Arabic writing; that is, they extend existing conventions to new purposes, rather than inventing new conventions.⁸

The gap. A gap, instead of a connection, creates the new, derived letter: e.g. the old *hâ'* (connected) becomes the new *æ* (disconnected). The basic shape of the new letter is the same as the corresponding Arabic form, but the assimilation pattern in text is different (figure 7a).

The dot. A diacritic is added in the form of additional dots: e.g. the *bâ'* (one dot below) becomes the new *peh* (three dots below). The bare letter form is the same, but additional dots indicate new letters (figure 7b).



Figure 7a. Not all Arabic letters connect. A gap is used in Arabic (grey, left) to distinguish the originally identical ascending forms of *lâm* and *alif*. In the orthographies of some non-Arabic languages such as Kurdish and Uyghur (right), a gap is used to create a new letter based on the Arabic *hâ'*. In Arabic (black, middle), this class of letter joins on both sides; in Kurdish it joins on the right only, and indicates the vowel *æ*.



Figure 7b: Many new letters are formed for non-Arabic languages by adding new patterns of dots (black) to the basic forms of Arabic letters (grey)



Figure 7c: In Arabic (grey, left) the letter *kâf* is distinguished from the similar – or, as in this *thulth* example, identical – shape of *lâm* by the inclusion of a small mark derived from a miniature form of the swash *kâf*. In Urdu (black), a miniature form of the Arabic *ţâ'* is used to distinguish the letter *tteh* from the Arabic *ţhâ'*.



Figure 7d: The Arabic letter *yâ'* (grey) has a variant calligraphic form. In Urdu (black), this variant is treated as a distinct letter, *e*, seen here in its word-final form.

The miniature. A diacritic is added in the form of a miniature letter: e.g. the two dots above the old *ţhâ'* are replaced by a miniature *ţâ'* ط to create the new *tteh*. The bare letter form remains the same, but the diacritic dots are replaced by a miniature letterform (figure 7c).

Variation. Arabic script developed a remarkable versatility. The relatively well-known obligatory contextual variation can be understood as a kind of graphic assimilation process. There is a creative tension between this assimilation and the graphical dissimilation of nominally identical letters in calligraphy, which produces free variants. In a number of cases these variants have become distinct letters in the orthographies of non-Arabic languages (figure 7d).

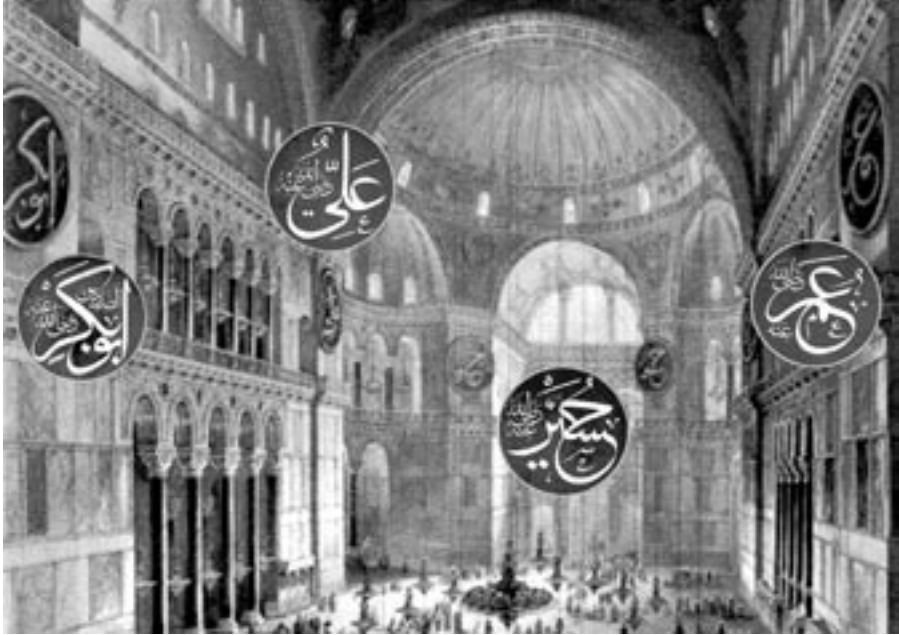


Figure 8. Interior view of the Aya Sofya mosque, Istanbul, from Caspare Fossati's *Die Hagia Sophia*. This image captures the paradox of the western visual artist's encounter with the calligraphic art of Islam: the building is rendered with precise accuracy, utilising all the techniques of linear and atmospheric perspective in the European tradition, but the image of Arabic calligraphy lacks any understanding of the actual forms. It is as if the artist lacks the necessary mental machinery to understand what he is seeing, and so is unable to depict it. The correct calligraphic forms are superimposed for contrast. (Conversely, this kind of realistic depiction of the building would likely have been impossible for an artist of the Middle-Eastern tradition, lacking an understanding of the visual culture of European art.)

TECHNICAL AND AESTHETIC CHALLENGES

Before the invention of photography, nineteenth century travelers were often accompanied by artists. Their meticulous drawings reveal an interesting blind spot in these observers' minds. The celebrated painter David Roberts RA does not depict a single letter of Arabic.⁹ Others seriously try to reproduce Arabic script, but with varying success. This drawing, for instance, of the interior of the Hagia Sophia Church, alias Aya Sofya Mosque (figure 8),¹⁰ includes some of the large calligraphic tableaux with the names of the caliphs (visible are the names of: Ali, Umar, Husain, Hasan, and Abu Bakr). The delicate beauty of the building is captured with an eye for subtle detail, but none of that subtlety remains in the depiction of the Arabic calligraphy. What does remain is the visual equivalent of Beethoven's *Für Elise* played on a cell-phone. This alarming lack of perception still pervades all attempts to deal with Arabic script.

A cultural aspect

In the simple approach to Arabic script, all attention goes to the *assimilation* of the letters, that is, to their contextual formation. The four posi-

tions (initial, medial, final, and isolated) are presented as actual forms. However, the authentic outcome is also determined by *dissimilation*. For example, the sequence *bâ'-sîn-'ayn* س ع can easily be misread as *sîn-bâ'-'ayn* س ع, as the letter *sîn* uses three strokes similar to that of the letter *bâ'* – or rather, of the *bâ'*-class.¹¹ In such cases the letter *bâ'* gets either a dissimilar, raised stroke when it comes before the *sîn*, س ع, or a dissimilar stretched horizontal connection after *sîn*, س ع. This essential reading aid and design feature is missing in almost every current font system, and this is just one example of dissimilation. Font technology has still to discover the full extent of the traditional system.

The shaping of Arabic is governed by a set of rules that are both practical – in that they improve the legibility – and elegant, as they were laid down by people who rank among the world's greatest graphic artists. What sets the Arabic alphabet apart from all others is its development into an elaborate morphographical system. It is the outcome of a conscious effort by Arab and Persian scholars to turn the late Syriac-Aramaic script inherited by the Arabs into a finely balanced connected script, as an expression of Islamic culture. From the sixteenth century onwards, Ottoman calligraphers developed a number of the existing styles into uniquely disciplined art forms.

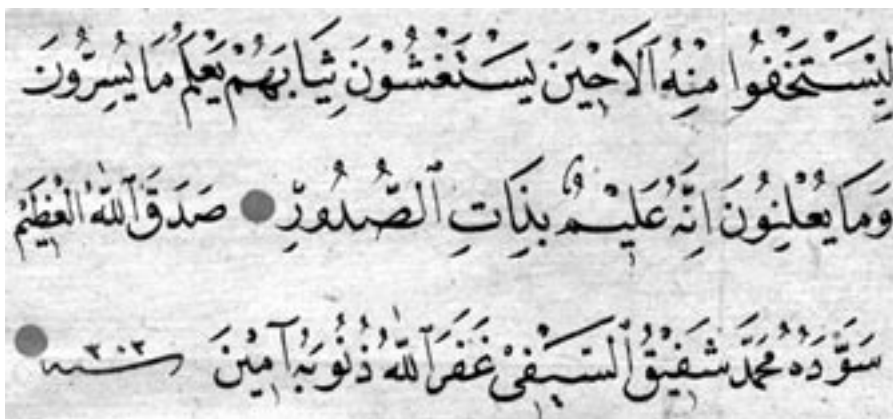


Figure 9. Qur'an fragment with colophon identifying it as the handwriting of Mehmed Şefik (Muhammad Shafiq) Efendi, an Ottoman calligrapher in the school of Mustafa İzzet Efendi, whose handwriting was to become the model of the finest nineteenth and twentieth century Arabic typography.

Simplification attempts

Typesetters have been wrestling with Arabic script for five centuries. Giving it a structure identical to that of Latin script would eliminate all problems, of course. The few known attempts to do this, however, were completely illegible and culturally alien, which may account for the lack of success of the designs of that nature.

Understanding the structure

Writing Arabic involves more than just lining up letters. The connected letters assimilate with each other. They are highly adaptable, which makes it impractical to describe each variant individually. In Arabic script the graphic unit of writing is the *syntagm*: a string of connected letters.

It is interesting to note that the concept of discrete or analytical letter permutations, as on typewriters and in modern fonts, did not exist amongst calligraphers. In traditional *mashq*, or writing exercises, contextual variants are never shown out of context; they are always shown as part of the syntagm.

Another important point is that all letters are subject to the intricate shaping rules that balance between assimilation of distinct letters and dissimilation of featureless letters.



Figure 10. A skeleton of six dissimilar forms is revealed, by the placement of dots, as a sequence of the letter *nun* repeated six times.

TYPESETTING AUTHENTIC ARABIC

The obvious differences between authentic *naskh* writing and mechanical *naskh* reproduction can be attributed to a technical problem: it is very difficult to handle syntagms in typography. Each syntagm within a word forms a unit that relates to the baseline as a whole; e.g. it stands on a secondary baseline (in *naskh* at an angle of approximately 5 degrees, in *ruq'ah* slightly steeper). Between the words there are no orthographic spaces – final forms mark the word endings at the cutting point of the two baselines. In conventional typesetting of Arabic, no such difference between main and secondary baseline is possible. The slanted base line of the letter groups is made horizontal, creating the need to enhance the final forms of words with typographical spaces, bringing it in line with Latin script. The nineteenth century Ottoman punchcutters who worked to emulate the elegance of Arabic script understood the synthetic nature of script. Far from using individual, analytic letterforms, they designed an elaborate system of syntagm components to mould any occurring sequence of letters into a syntagm. One would be tempted to call these letter-compound segments ligatures, but there is a difference. Ligatures are usually optional, i.e. discretionary letter combinations in an otherwise analytical writing system. For these typesetters, syntagm components were the basic building bricks, sometimes covering more than one letter, but often representing only part of a letter – or a letter and a half. Dots and vowels were added separately.

Successful designs

At the end of the nineteenth century, there were very good Ottoman type designs to cope with the dual, multilevel baseline of most Islamic scripts. These typefaces could consist of well over a thousand individual elements of metal type and were highly complex. Because of this, they required specialized technical virtuosity based on thorough knowledge of the underlying calligraphic script. In the last quarter of the nineteenth century and the first half of the twentieth century, this typography produced impressive results.

European attempts

These Ottoman developments took place in the second half of the nineteenth century. In Europe, typesetting with Arabic characters has been undertaken since the early sixteenth century. The early Arabic types have a Western North-African appearance. Maybe European punchcutters had access to the Andalusian spoils of the Spanish Reconquista, and were consequently misled in their calligraphic styling; in any case, their designs were totally out of touch with Islamic taste and with Middle Eastern taste in particular. If these early attempts had any effect on the development of Islamic printing at all, it was negative. In the period that Middle Eastern calligraphy was reaching its zenith, European Arabic typography produced absolute monstrosities. For more than two centuries the Ottoman authorities opposed the large scale introduction of typesetting and printing of Islamic script; the low quality of the designs was a factor in delaying the acceptance of typography in the Islamic world.

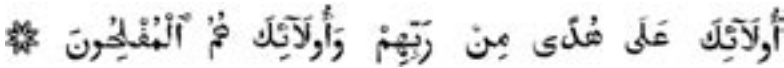


Figure 11a. Typical European font used to typeset the *Coranus Arabice recensiois Flügeliana*, Leipzig Germany 1867, shows widely spaced primitive forms without relation to any known calligraphic style.

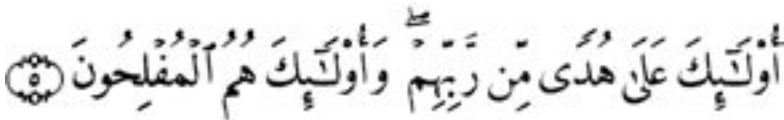


Figure 11b. The same text as printed in the first and only typeset Qur'an authorized by the Azhar University, the so-called *Fuad Qur'an* (1924), printed in Cairo by combining Ottoman calligraphic expertise with German technology.

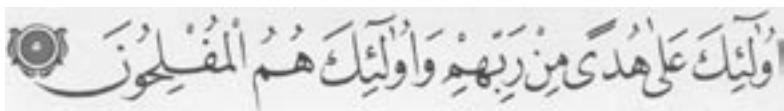


Figure 11c. The same text again, from an eighteenth century Ottoman manuscript by the hand of Mehmed Emin Rüşdü Efendi. The main mission of Ottoman typography, the source of Middle Eastern Arab typography, was to maintain the integrity of this *naskh*, or book calligraphy, in type.

Breakthrough in Istanbul

The first, short-lived effort to print books with Arabic letters was made in Istanbul by İbrahim Müteferrika, a Hungarian renegade, in 1727. In the last decade of the eighteenth century, typesetting in the Ottoman Empire was taken up again and on a larger scale, culminating in the designs of Ohanis Mühendisioğlu¹² in the second half of the nineteenth century. These laid the basis for all modern *naskh* typefaces. It took a scholar to handle the set of over 1500 movable types to construct each syntagm correctly. With the increased use of typography, one can observe that the discrepancy between hand-written and typeset *naskh* increases, due to mistakes, incomplete fonts or ignorance of the design.

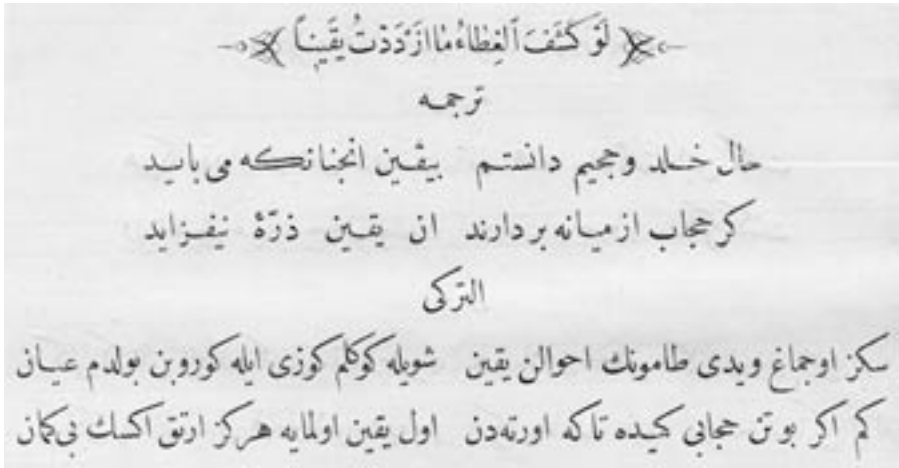


Figure 12. Typography by Ohanis Mühendisioğlu in the *Yeni Hurufat*, 1870.

The Mother of Arabic Typography

Ottoman *naskh* (spelled *nesih* in modern Turkish) definitely guided all Middle Eastern efforts in typography. In the 1860s the Armenian typographer Ohanis Mühendisioğlu, an Ottoman-Turkish citizen, finally succeeded in reproducing this script in a way that met the demanding standards of the Islamic calligraphic tradition.¹³ His sublime approach to typography was clearly based on a sophisticated understanding of Arabic script and calligraphy. Figure 12 shows brilliant typesetting by Mühendisioğlu in the *Yeni Hurufat*¹⁴ in the three main languages of the Ottoman Islamic world: Arabic, Persian, and Turkish.

In the context of Ottoman culture, it was unthinkable that a lowly typographer would attempt to produce his own version of Arabic script. Mühendisioğlu (1810–1891) modelled his typography on the handwriting of *Kazi Asker* (Supreme Judge) Mustafa İzzet Efendi (1801–1876), who ranked among the viziers or ministers of the Ottoman state. İzzet Efendi, i.e. Lord İzzet, was a man of great authority. He was a composer of Ottoman classical music and the leading calligrapher of his times. Among the



Figure 13. *Meşk mürakka'i* or writing exercise by İzzet Efendi elaborating the shapes and connections of the letters 'ayn (large, in the *sülüs (thulth)* style) and *kâf* (small, in the *nesih (naskh)* style). This kind of exercise is the artistic equivalent of the *étude* in the Western musical tradition.

many calligraphic and musical compositions of his hand are the large tableaux inside the historical Aya Sofya Mosque in the very heart of Istanbul, capital of the Ottoman Empire. This lofty man certainly was not the type to be involved in anything so plebeian as type design, and it can be ruled out that the craftsman and the calligrapher ever met.

This adaptation by Mühendisöğlü of İzzet Efendi's calligraphy is the starting point of all later Arabic *naskh* typefaces. The font was graphically extremely sophisticated, as it was designed to follow all the *allographic* rules of *naskh* in the tradition of the copyists, the professional book producers before the advent of typography. The essential feature is that it deals with both dot and vowel attachments as separate horizontal layers above and below the main script. In other words, the design was *archigraphemic*.¹⁵ However, the seeds of decay are already present in the 40-page *Yeni Hurufat* booklet. The initial pages immaculately implement every rule with the correct glyph. As the page numbers go up, so the number of calligraphic typos increases: the zenith of Arabic typography stands at the beginning of the erosion, rather than the evolution, of *naskh* script.¹⁶ This is an extremely good design, but it should have had a computer program to support it!

Arabic ligatures

An interesting concept in the type industry is the Arabic *ligature*. In Latin typography the ligature is an aesthetic device to improve the rendering of a few troublesome letter combinations. Such replacement letter groups belong in fonts, whence a rendering system can use them to replace let-

ter groups. In Arabic, however, connecting letters is not the exception but the rule. Theoretically each letter can have a different appearance in *any* combination, something that can only be crudely imitated with ligatures. The use of ligatures tends to be determined by the nature of the typeface design and the technical limitations of the font technology. Many contemporary fonts contain a multitude of ligatures in order to approximate the desired appearance of authentic Arabic text, but it needs to be understood that this is a technical solution to a technical problem, and not an inherent feature of the Arabic script. It is not hard to conceive of different technologies for typesetting Arabic that would achieve equivalent or superior results without using any ligatures at all.



Figure 14a. Skeleton script showing individual archigraphemes.



Figure 14b. The addition of dots establishes the identity of ambiguous graphemes.



Figure 14c. Consonant enhancers identify reduplicated consonant graphemes.



Figure 14d. Vowels are identified, or their absence is marked.



Figure 14e. Punctuation or cantillation (precise verbalisation) is indicated.



Figure 14f. The erroneous placement of illegal dots in copying is blocked.



Figure 14g. Ornamental elements are added to aesthetically fill holes in the text.

Horizontally layered structure

Arabic script is best constructed following the historically-evolved pattern: in several horizontal layers surrounding the skeleton layer, each one adding an additional aspect of the script in a strict order. The best-known layers are those of dot patterns and of vowels. In addition there is a separate layer for the *shadda* or consonant enhancer. The full layered system (figure 14) is especially important in Qur'anic text, where it guides correct pronunciation and copying and also prevents likely errors.

Calligraphic alternation

Islamic script is more than just a connective alphabet with contextual variation. Many letters can be variously rendered with calligraphic alternatives, each of them having an equivalent range of contextual permutations. This phenomenon is much more powerful than the nearest equivalent in Latin calligraphy. Calligraphic permutation opens the perspective of fine-tuning justification in typesetting with a mechanism borrowed from calligraphic manuscripts.

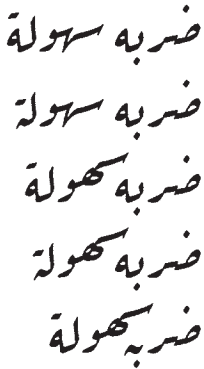


Figure 15. Five different settings of the two same words in the *ruq'ah* style, showing how alternate calligraphic permutations can be used to justify text across varying column widths. Other permutations are possible.



Unicode & Arabic

The Unicode character-encoding standard enables cultural diversity in computer text processing. In terms of encoding, the logic of Arabic is no different from any other alphabetic script, hence the *real* challenge of the computer age is not the encoding of Arabic but its visual representation: the development of digital typography that leaves the graphical structure of the script intact.

The Unicode standard is designed for logical representation only: the entry, storage and manipulation of raw text. In practice, it is sometimes mistakenly used as a glyph list for font designers. Such mixing of levels, of logical and visual representation, is potentially disastrous for the emerging Arabic typographic technology. A fixed list of Arabic letter shapes puts unrealistic constraints on the artistic reproduction of Arabic text in digital form. The future must embrace flexible, generative mechanisms of representation, working above the level of Unicode text.

Notes

1. Even a well-researched work like *Arabic Typography, a comprehensive sourcebook* by Huda Smitshuijzen AbiFarès (London, 2001) is written without the notion of rules governing the joining of letters. Its ‘anatomy of letterforms’ does not venture beyond summing up the absolute minimum of letter variations (§ 3.2, p.99). Like practically all works in this field, this publication touches on the calligraphic standardization of individual letters by Ibn Muqlah (Baghdâd, 885–940 AD), but without mentioning the fact that proportions of isolated letters hardly have any relevance for a dynamic script like Arabic. As for the more sophisticated connected letter groups – the product of the design process set in motion by the same Ibn Muqlah – they are mentioned cursorily in § 4.2.3.3, ‘the shapes of characters’. As usual, they are presented to the reader as ‘ligatures’ and ‘artistic expressions’ without so much as a hint at traditional morphographic rules.
2. A positive exception is T.F. Mitchell, *Writing Arabic, a Practical Introduction to Ruq‘ah Script*, Oxford 1953. It is the only book in English that attempts to give a systematic description of Arabic script. Unfortunately this excellent book fails to point out that the structure it describes is in fact the general structure of Arabic script. *Ruq‘ah* happens to be the authentic simplified Arabic and as such is a good stepping-stone for beginners.
3. The author wishes to thank Mamoun Sakkal for providing this illustration from his website at www.sakkal.com/ArtArabicCalligraphy.html
4. ‘By about twenty years after the death of the Prophet, his successor, the Caliph, had gained control over the Arabian Peninsula. In addition, all the Roman provinces from the Syro-Palestinian coast to the mountains of Kurdistan as well as the core of the Persian Empire had come under his dominion. In another twenty years all of North Africa had been subdued and Spain was to follow suit. As for the government of this large empire, the Arabs at first retained the Persian and Byzantine state machinery integrally. They did not interfere with the internal civil and religious administration of the conquered peoples. At this point in time, the seventh century AD, i.e. the first century of the Hijra, it is an anachronism to think of the spread of Islam as a mass conversion.’ *The Arabs in History*, B. Lewis (OUP 1966), pp.49–63, ‘The age of the conquests’.
5. One can assume that the enhanced orthography was above all meant to facilitate memorizing the Qur’an in a properly recited form. Such diacritics therefore may be considered mainly pedagogical. In order to avoid the impression that the received text was altered, they were written by means of red dots. In some manuscripts one also observes brown points in the same role.
6. In the Levant (Syria, Lebanon, Palestine) and Mesopotamia (Iraq) various Aramaic languages were replaced by Arabic. In some parts these languages continue to be used by Christian communities. Egyptian only survives in the Coptic Christian community for sacral use. In the remainder of North Africa the Berber languages still maintain themselves in many places.
7. Until the beginning of the twentieth century this was the case with no exception. The main exceptions were created in the past one hundred years. The Turkish Republic abolished the writing of Turkish with Arabic script in favour of Latin; the Soviet Union forced a number of Islamic peoples to convert to Communism and the associated use of Cyrillic script: ‘Alphabet follows religion’ (Diringer, *The Alphabet, a key to the history of mankind*. London, 1968.). This phenomenon

- can also be observed in the Christian world: Roman Christendom meant Latin Script; Greek Christendom meant Greek (and later Cyrillic) script.
8. In the development of the proto-Arabic script, the opposition of connected and disconnected forms to distinguish different but morphographically similar letters is an old device that precedes the use of letter points for this purpose. Later non-Arabic alphabets continue these traditional methods. Like in the family of *bâ'*, *tâ'*, *thâ'*, *nûn*, and *yâ'*: before the *bâ'* family got its dots, it was, as a whole, distinguished from the members of the *dal*, *dhal*, *râ'*, *zayn* family – also still without dots – by the gap. This gap also forms the distinctive feature that helps to differentiate *lâm* from *alif*:  vs. .
 9. See, for instance, David Roberts RA, *The Holy Land, 123 coloured facsimile lithographs & The Journal from his Visit to the Holy Land*, Terra Sancta Arts Ltd, Israel, 1982 (first edition 1842).
 10. Caspare Fossati, *Die Hagia Sophia, nach dem tafelwerk von 1852*, Harenberg Kommunikation, Dortmund 1980. For comparison similar, authentic tableaux are superimposed; these are taken from Nabil F. Safwat, *The Art of the Pen, Calligraphy of the 14th to 20th centuries*, Volume V of the Nasser D. Khalili Collection of Islamic Art, The Nour Foundation/Oxford University Press 1996.
 11. These examples represent the skeleton representation of the words *sab'* 'seven' and *tis'* 'eight', which were indistinguishable in old manuscripts, leading to ambiguous datings. (Personal communication from Dr Gerd-Rüdiger Puin, University of Saarbrücken, Germany).
 12. Mühendisoglu is the Turkish version of his name, with the literal meaning of *son of the land surveyor* (or *civil engineer*). His name is also encountered in Ottoman-Persian (Mühendiszade) and Armenian forms (Mühendisyan).
 13. An *arzuhal* or petition to the Sultan of the Ottoman Empire dated 1283 AH (1865 AD) came into my possession in 1983. In it Mühendisoglu announces that for the first time a valid *naskh* typeface has been designed. He describes how he used the handwriting of the late *şeyhü l-hattâtin* (leading calligrapher) Mustafa İzzet Efendi to accomplish this historical achievement. Uğur Derman, the leading specialist on Ottoman calligraphy, reports corroborating evidence to the Turkish Librarians' Association (Türk Kütüphaneciler Derneği Basım ve Yayıncılığımızın 250. yılı Bilimsel Toplantısı. 10–11 Aralık 1979, Ankara; Bildiriler, Ankara, 1980, vii, 174 pp.: M. Uğur Derman, *Yazı sanatının eski matbaacılığımıza akisleri*. pp. 97–118). In this essay he also mentions the advanced *ta'liq* typefaces designed by Mühendisoglu as early in the 1840's. In spring 2001, I discovered two of only three books ever printed in Mühendisoglu's *ta'liq*.
 14. According to the colophon it was printed in Istanbul 1869–70 AD. In spring 2001, I made the sensational chance discovery of this rare book printed in the exact same *nesih* typeface as the petition of 1865 described in footnote 11.
 15. This term, and others in this essay, are more fully explained in: 'Authentic Arabic: a case study. Right-to-left font structure, font design and typography' by Thomas Milo, in *Manuscripta Orientalia*. Vol. 8 No. 1, March 2002. (Saint Petersburg, Russia.) pp. 49–61.
 16. *Naskh*, *thulth*, (*naskh-i*)*ta'liq* and *ruq'ah* scripts are governed by well-organised and logical morphographical rules, the knowledge of which is rare among type designers and typographers today.