

ANATOMY OF AN ARABIC TYPE DESIGN

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ABSTRACT Arabic type design, like type design in general, should not be limited by rigid rules, other than those advocating open choice and user options. But as with all design fields, highlighting certain principles and guidelines is crucial to realizing a successful project. In an Arabic font design environment, such guidelines and principles should reveal deeper understanding of various script's visual and behavioral defining characteristics rather than mere traditional calligraphic or handwriting norms. A main goal of this study is to emphasize that designing Arabic fonts is much easier than portrayed, and designers of all backgrounds can be more involved designing rather than deciphering complexities. Classifying Arabic as complex may add challenge and thrill to a project, but can unfairly harm a flexible and powerful script. According to their connecting behavior in the traditional model, Arabic letters are two types: restricted or unrestricted. Based on this and other observations, the study provides a solid design model, free of the restraints of the chaotic four shapes per letter model widely used today. It does that through a systematic analysis of the Arabic script rather than its historic calligraphic flavors. A Mutamathil type style font, Mehdi, is used by this study for visual illustration. But the model provided is equally valid for the design and implementation of any other Arabic font including multiple glyphs per letter fonts. The choice of Mehdi is neither arbitrary nor biased given that its design also implements a complementary alternative input method, NAIM.

Designing an Arabic type requires adequate understanding and exposure to the original Arabic script visual characteristics and letterforms. Other derived scripts have added or subtracted letters and shapes but, more or less, they still share with Arabic its overall visual characteristics. One may point out that a derived script, like Kurdish, has different visual characteristics than Arabic due to different utilization of shapes. But the key point is that it is still using the same shapes. The absolute majority of derived scripts differentiate their new letters by adding various diacritic marks above or below original Arabic letter body forms, or use the same glyphs for different scriptural tasks. Except for a couple of cases (i.e. Urdu Ha u06C1) they have not added completely new body shapes unknown in the original script. Arabic is the minimum common denominator of most derived scripts and therefore it is recommended, but not required, to start an Arabic type project with it. This essay will analyze the Arabic script in detail but will point out—when applicable—how other derived scripts relate to it.

The design model outlined here does not adhere to the doctrine of the usual four glyphs per letter model in use today, but it is fully compatible with it. This study will present the new model through analysis and visual illustrations. First, it will examine the alphabet, then it will discuss its visual defining characteristics, and finally it will provide, with the aid of typographic charts, an anatomical view of shapes and sets along with specific design recommendations. Needless to say, creating Arabic fonts and fonts in general, require software tools and related technical expertise whose discussion goes beyond the scope of this work.

WHAT IS AN ARABIC ALPHABET?

To design a typeface for a specific script, one should be familiar with that script's definitive alphabet. Historically, letters and shapes of the Arabic alphabet were identified and grouped in several different ways based on vocal mouth source, geography, shape similarity or other criteria. The number of letters varied, some listed 29 letters while others listed only 28. Differences are primarily about whether to include soft 'Alif' (u0627), 'Lam Alif' ligature or 'Hamzah' (u0621).

In modern typography, the Unicode standards introduced yet another grouping of Arabic letters. A unique number was assigned to each member of the minimum letter shape set required to construct readable Arabic text, including soft vowel diacritic marks (or Harakat), regardless of whether a shape was a part of the common alphabet. The Unicode alphabet is based on Arabic writing not language and grammar. It encompasses 36 members, including in addition to the usual 28 - 29 common letters, four basic letters for 'Hamzah' ligature combinations, one for 'Alif Maddah' (u0622), one for 'Alif Maqsura' (u0649) and one for 'Iaa Marbutah' (u0629) (Unicode Consortium, 2005). Efficient keyboarding and minimum letter shapes utilization were apparently the main factors behind the Unicode classification. In a way, this is similar to grouping both lowercase and uppercase letters in the minimum set required to generate Latin text. The Arabic Unicode alphabet is more representative, at least typographically, than the commonly used alphabet and, therefore, this study will use it instead (*see figure 1*). Notice that the 'Lam-Alif' ligature and 'Hamzah' are full members in some alphabet groups while omitted in others. Also notice that the faded glyphs are alternative final form shapes recommended for all letters classified in this study based on connectivity as unrestricted letters, as will be explained later.

Other Arabic alphabets were introduced based on typography and letters shape analysis. Well-known Iraqi type designer and calligrapher, Muhammad Sa'id al-Saggar, patented in 1972 a new type design method to construct Arabic glyphs from one or more common shape components he called 'roots.' Accordingly, he identified a set of 21

roots (see figure 2) that he named the Concentrated Arabic Alphabet (al-Abjadiyah al-Arabiyah al-Murakkazah), later referred to as Saggar's Alphabet (Abjaddiyat al-Saggar; al-Saggar, 1998). In 1973, a metal font based on his design was manufactured for a major Iraqi newspaper (al-Thawrah) and was used for many years to print headings. This font is probably the smallest Arabic font ever made. Adopting a similar design approach today, Dutch type designer Thomas Milo created remarkably light and sophisticated Arabic calligraphic fonts.

Typically, an alphabet serves several functions. The most important among them is facilitating language learning and writing. One can argue that the Unicode set of Arabic letters constitutes a unique Arabic Alphabet. It has even done a better job by additionally facilitating solid text searching and indexing capability. But it is difficult to call a set of shape roots an alphabet. Even as a purely technical method to reconstruct pre-drawn calligraphic shapes, this practice of chopping letters can harm Arabic typography on the long run. It would be a discouraging and difficult model for most type designers. It would require proprietary software platforms to process such random number of designated shapes. But the most damaging effect if this method is to be adapted universally would probably be loss of standardization, a crucial condition for a healthy typography environment.

Common Arabic Alphabet [Abjadiyah]

ا ب ج د ه و ز ح ط ط ي ك ك ل م ن ن س س ع ع ف ف
ص ص ق ق ر ش ش ت ت ث خ خ ذ ض ض ظ ظ غ غ

Arabic Alphabet by Vocalization

ع ع ح ه ه غ غ خ خ ق ق ك ك ج ج ش ش ض ض ص ص س س ز
ط ط ت ت د ظ ظ ذ ث ر ل ل ن ن ف ف ب ب م م ا و ي ع

Eastern Arabian Alphabet by Dotification

ء ك ك ل م م ه ه و ل ا ي د ذ ر ز س س ش ش ص ص ض ض
ط ط ظ ظ ع ع غ غ ف ف ق ق ج ج ح خ ب ب ت ت ث ن ن

Western Arabian Alphabet by Dotification

أ ب ب ت ت ث ج ج ح خ د ذ ر ز ط ط ظ ظ ك ك ل م م
ن ن ص ص ض ض ع ع غ غ ف ف ق ق س س ش ش ه ه و ل ا ي

Arabic Unicode Alphabet

ء آ أ ؤ إ ئ ا ب ب ة ت ت ث ج ج ح خ د ذ ر ز س س ش ش
ص ص ض ض ط ط ظ ظ ع ع غ غ ف ف ق ق ك ك ل م م ن ن ه ه و ي ي

Figure 1. Examples of Arabic alphabets

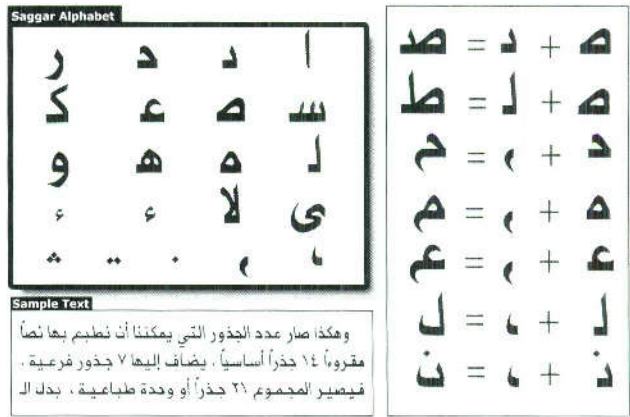


Figure 2. Concentrated Arabic Alphabet (Abjadidat al-Saggar)

ARABIC SCRIPT VISUAL CHARACTERISTICS

Traditional Arabic appears to conform to seven common characteristics: glyph connectivity, multiple shapes per letter, ligatures, variable x-height values, overall horizontality and extensive use of dots. When utilized, the required, but only occasionally used, soft vowel diacritics would constitute an additional visual characteristic. It is not absolutely mandatory to implement all of the above characteristics in every type design project. These are not rules of design or so-called script rules. An Arabic typeface design project should be as open as any other typography project. Each of these characteristics will be discussed in the following sections.

Connectivity, ligatures and multiple shapes

Establishing Arabic letters connectivity as a minimum script rule is without a doubt the most controversial topic in Arabic typography. Connectivity is not simply about connecting letters; it is about restrictions and consequential restrictions. As much as connectivity had played a major role in advancing the Arabic script historically, imposing connectivity as a required minimum typographic design rule would risk its future and survival.

Most likely, the drive for universal text connectivity in Arabic was the direct reason behind its adaptation of multiple shapes per letter, including ligatures formed by connecting two or more shapes. Historically, Arabic not only strived to connect letters within words but had also virtually connected words themselves by eliminating inter-word spacing. Consequently, alternative shapes were needed to handle both connectivity and its specific related condition: disconnection. Writing speed was possibly a major factor behind connectivity. But the creation of alternative position dependent shapes was most likely a requirement for an uninterrupted pen flow.

Being a major defining factor that influences other characteristics, connectivity is therefore important to analyze and examine further. To start, Arabic letters connectivity is not universal or linear. Letters are not always joined within words and when they do join, they are not always joined in the same manner. Arabic letters in a typical textual snapshot are either completely isolated or partially connected from one side in most

words. This nonlinear adaptation of both isolated and connected forms clearly indicates that Arabic was directly derived from a script with completely isolated letterforms, like south Arabian al-Misnad, which incidentally shares with Arabic all its letter sounds.

Analyzing their nonlinear connectivity, the Arabic letters can be grouped based on their ability to join or combine with adjacent letters in two categories: restricted and unrestricted. Unrestricted letters can appear isolated, joined with both preceding and following letters or joined with preceding letters only. Restricted letters are either partially or completely restricted. Partially restricted letters can appear either isolated or joined with preceding letters only, while fully restricted letters must always be isolated. Categorizing letters in the above manner is the first important observation of this study (see figure 4).

Examining traditional Arabic connectivity-triggered multiple shapes, one can make three additional observations.

- First: most medial shapes of restricted letters are not as crucial to legibility or visual aesthetics as handwriting speed.

- Second: final shapes are critically beneficial to legibility and readability only when unrestricted letters are used. They signal either end of words, since Arabic does not traditionally use spaces, or end of connected letters cluster preceding an always-isolated, fully restricted, letter, Hamzah. Placing a final shape before Hamzah seems to visually emphasize that its miniature shape must only appear isolated within words.

- Third: isolated shapes of unrestricted letters are in fact special visually-identical forms of their final shapes substituted when they follow any restricted letter or precede an always-isolated Hamzah.

According to the observations above, one can draw two important conclusions. First, utilizing carefully calculated space widths in modern Arabic fonts should eliminate the need for multiple shapes per letter. This is only partially true. Practically and due mostly to habit, Arabic text can benefit instantly by using final shapes for all restricted letters even when word spaces are included. Second, Arabic letters should be classified into two essential shape categories not four: normal and final shapes, where final shapes are only associated with unrestricted letters.

It is important to observe that the differentiating final shapes in this typographic model are called final because they are final letter shapes in words or final letter shapes of connected letter clusters within words when preceding an always isolated shape. Providing adequate spacing and designing final shapes with minor or exaggerated characteristically-blended extensions added to their normal shapes would be a most beneficial model typographically and even educationally.

Figure 3 illustrates some of the observations above. The first line shows six words composed of unrestricted letters only. These linearly connected words are arranged in three pairs where identical letters having normal and final shapes are shaded. The second line displays six more words including both restricted (shaded) and unrestricted letters. Clearly, connectivity is nonlinear in the examples of this line. Notice the last word in the second line. The shaded Hamzah, as an always isolated restricted letter, necessitated a preceding final shape for the letter Baa to signal end of connected cluster. The third line lists seven words each including one restricted letter (shaded) at the end. The last line includes seven words each composed of restricted letters only. Notice that letters are completely isolated within words of both lines. Also notice that statistically, Arabic has far more words similar to those of the last three lines than the first linearly connected one.

بيتي بيت صبحي صبح علمي علم
 يلوذ ويريد خريف وميض عاقبة عبء
 دوري ذرف وداع اوراق درب ذوات
 زرزور وزارة وردة وداد دورة رادار رذاذ

Figure 3. Nonlinear connectivity of Arabic letters.

The analysis provided in this section and illustrated by figure 3 clearly indicates that neither connectivity nor its consequential multiple shapes are Arabic script rules. They should be indicated and dealt with instead as specific stylistic needs appropriate for specific design cases. Arabic types with isolated non-varying shapes are as Arabic as traditional types. The font used in figure 3 actually employs completely isolated letters, a variant of it uses single shapes, yet both are readable.

In an Arabic font project, designers can manipulate letter separation widths, provide unified letter shapes with few or no alternative position-dependent glyphs, but still produce legible Arabic typefaces. Designing Arabic types without the connectivity restriction in mind may even allow designers more freedom to express the Arabic letters on various media. It frees their hands and minds by removing a persistent obstacle.

Horizontal toothy appearance

Confusing toothy spikes compounded with a horizontal appearance is a hallmark of an Arabic text look and feel. Most Arabic letter shapes are wide. The bulk of their structural information is distributed on or parallel to the x-axis. Higher statistical occurrences within words of 'toothy' wide letters (i.e., Baa, Taa, Thaa, Seen, Sheen, Sad, Dhad) add to this visual appearance even further. As with multiple shapes per letter, the main culprit behind this toothy appearance is also connectivity. Arabic shapes when isolated, even in initial word positions are highly distinguishable. But letter connectivity produces toothy spikes naturally, especially when utilizing miniature medial shapes possibly to insure handwriting speed.

Still, one should point out that Arabic's toothy look is more a hallmark of modern Arabic typography than its historical calligraphic schools. Genuine Naskh, or Naskh Ta'leeq styles do not appear toothy at all since their associated shapes do not collapse linearly along the x-axis. The main shapes contributing to a toothy appearance are not only the key shapes behind the problem but are also the key shapes for its solution. If designed appropriately, they can be the ideal shapes to set the entire tone of a typeface, vertically or horizontally. For example, in an Arabic detachable shapes type design, as with the Mutamathil type style, 'Baa' (u0628) is the first shape designed. It sets the entire font harmony and integrity. All other shapes should dance to its tone and rhythm. They should proportionally relate to its width, height and tooth shape.

What x-height value?

Without a doubt, designing a typeface with one fixed x-height value would be easier typographically than designing one with random values. But the crucial typographic benefit of setting an x-height value is not its uniqueness but rather its predictability. Designing a type with multiple x-height values is as easy or difficult as designing one with a unique x-height value. It is true that Arabic body shapes are not confined to three uniform fixed y-axis values, but they do not ascend and descend randomly. In a harmonious design, they should adhere to multiple y-axis values determined by their relation with each other.

One can certainly create valid Arabic fonts by giving its shapes a fixed x-value. But this is not a necessary step to solve a problem since there is no real problem to start with. Ascender and descender values of 'Alif,' 'Dal' (u062F), 'Baa' and 'Ayn' can certainly be adequate reference points to work with in any Arabic typeface design project (see figure 3). Still, many argue that an Arabic typeface is more harmonious with Latin typefaces only when it shares its unique x-height value. If this is true then assigning multiple x-values to Latin can do the trick too.

Dots and vowel diacritic marks

Are those many Arabic dots really a problem? An honest answer is no. Adding dots in Arabic was and still is a remarkable evolutionary step. They not only make letters clearly distinguishable from each other but they have preserved Arabic script simplicity, a fact that should especially be appreciated by modern digital typography. Imagine if the masters of Arabic scripts had created 'Vs' for all those Arabic 'Us.' How many additional shapes one would need to remember and deal with? Adding dots was so powerful and useful a step that its practice was even expanded by the many nations adopting Arabic script. For those who may have difficulty counting the dots, various Arabic calligraphy schools represented dots by equivalent shapes not much different visually than the Latin diacritic shapes used today. A type designer can certainly eliminate all dots by combining them into visually equivalent marks.

Excessive dots and diacritic marks may seem to compound an Arabic random x-height appearance, but this is not the case since dots are placed relative to shapes' bodies. Dot sizes should be adequately proportional to letter body size and identical throughout the entire font.

Finally, soft vowel diacritic marks (Harakat) are required in Arabic despite the fact that they are only used occasionally. Like dots, they are placed relative to shapes' bodies even though this, we believe, is not a good design approach. Except for those placed on 'Alif' and 'Hamzah,' all soft vowel marks should be positioned above and below letters at two uniform, adequately distant, locations to preserve shapes' integrities and emphasize vowel diacritics from dots and other mark diacritics.

Typographic blueprint for an Arabic type design

After examining the underlying Arabic alphabet, its shape variations and letter connectivity behaviors and other related philosophical design issues, a list of useful type design considerations is presented. A brief discussion and analysis of letters and shapes follows, aided by the three typographic charts displayed in Figures 4, 5 and 6. Any Arabic script can be constructed utilizing a specific set of the letter skeletons displayed in Figures 4 and 6. Actual glyphs are created by adding various dots and diacritic marks to these skeleton shapes. The glyph set of Figure 5 illustrates with relational details one such script letter set for the case of Arabic. Figure 6 repeats the relational details of Figure 5 for all body shapes required to construct any other Arabic script.

Initial design considerations

1. Decide whether shapes will be connected, virtually connected or completely isolated. Connectivity is a design issue not a script rule. Isolated or connected shapes should

preserve their visual characteristics regardless.

2. Letters should have one normal shape assigned to a unique Unicode value. Additional optional final shapes may be added to all unrestricted letters. In a typical software environment, a normal shape would then be the default shape. Generally speaking, normal shapes in this design model resemble initial forms while final shapes resemble isolated forms in the traditional four glyphs model. Additional medial, initial or ligature shapes may be necessary depending on the nature of a design project. In an Open Type environment, designers should utilize the rich logical features provided to force isolated shapes first, add multiple glyphs per letter, ligatures or other desired behavior.

3. Design fonts for Arabic script first. It is the common denominator of most Arabic scripts. Glyphs added by other derived scripts are variants of Arabic glyphs that only differ from them by additions of dots or other diacritic marks, or by glyph behavior and utilization.

4. Baa is the best letter to start with followed by Alif. These two shapes define the font's harmony and style.

5. When designing extended Arabic fonts with one glyph per letter, one must handle carefully cases of restricted letters having different final shapes, and also similar normal ones, like 'Qaf' (u0642) and 'Faa' (u0641). The number of dots is not enough to differentiate them in a text since some scripts use both 'Qaf' with two dots and one dot. Designing single glyphs for such letters should include a hint of their final shape characteristics.

6. Design dimensions of certain glyphs should be calculated early on to handle all dots and other diacritic combinations not utilized by the Arabic script. For example, glyphs with one dot in Arabic can take four dots in an extended Arabic environment.

7. Dots are crucial to Arabic glyphs. They should be generously emphasized. Dots do not necessarily need to be distinguishable from each other in a cluster but their overall combined shape must be clear in order to identify various letters. Dots should be positioned relative to individual body shapes.

8. Even though Arabic had few right 'slanted' styles in its earlier days, visually generating slanted variations based on script ordering direction makes more sense. Right to left ordered Arabic italic styles should be slanted to the left to achieve harmony.

9. The so-called 'Arabic numerals' used globally today are also heavily used in the Muslim and Arab worlds and are rapidly replacing Indic-Arabic numerals. In an Arabic font, these numerals should look harmonious to Arabic shapes. It is not enough to rely on their default Latin designs.

10. Ligatures formed by transforming two or more adjacent shapes into one, are not required in Arabic. The 'Hamzah' combinations, which can be thought of as ligatures, are part of the Unicode Arabic alphabet now. The 'Lam-Alif' ligature and its diacritic variations can be handled as two adjacent letters. But it is highly recommended to include it for readability improvement.

11. 'Tatweel' (or 'Kashidah') (u0640) is a swash like extension appended to letters anywhere within words. It is a useful glyph in Arabic fonts used primarily to adjust widths of cursive words. In an isolated shape design Kashidah should be a zero width

Additionally, three vertical rectangular boundaries are drawn around certain glyphs to indicate that these member glyphs should have identical normal shapes but different final ones (boxed groups 1 and 2) or identical body shape parts (boxed group 3). In a one glyph per letter design, special care must be given to glyphs in boxed group 2 and 4 to distinguish them when used together within words. Boxed group 4 includes glyph of the letter Alif with its 'Hamzah' variants and 'Lam' preceded ligatures. The Lam Alif ligatures are recommended but not required. Notice that glyphs of boxed group 3 set font's maximum ascender value while glyphs of highlighted group 6 set maximum descender value.

The inset figure illustrates required, but occasionally used, Arabic soft vowel diacritic marks, or Harakat. They are shown here larger than their actual sizes when positioned above the glyphs of Figure 5. Notice that their positions relative to font's maximum and minimum vertical values is appropriate for all glyphs except for the glyphs of boxed group 4 where they need be positioned manually relative to Hamzah diacritic marks.

Figures 4 and 6 show the entire body or skeleton shapes needed to design a font that can handle Arabic and any additional script derived from Arabic. Figure 6 is almost identical to Figure 5 except for the inclusion, within circles, of extended Arabic additional shapes. Actual glyphs for various scripts are formed by combining the shapes of this figure with several dots or other diacritic marks possibilities. When creating Arabic fonts, designers should consult the latest Unicode standards code chart for full listings of such possibilities. Highlighted and boxed glyph groups in this figure correspond directly to those of Figure 5. Notice the additional vowel diacritic marks added to handle additional scripts.

CONCLUSION

Designing Arabic fonts is not really complex nor is the underlying Arabic script itself. As a matter of fact, less independent shape designs are required for most Arabic font projects than for Latin. While this study establishes connectivity as the main culprit behind most Arabic typographic complexities, it does not advocate its abandonment. Instead, it promotes deeper understanding of it in order to establish an open design environment where both cursive and non cursive styles can coexist. It is imperative that glyph design should not always be tied to connectivity. Creativity should not be wasted on forcing shapes to connect at any expense. Arabic and derived scripts are flexible and powerful enough to encompass wide design variation. The key new typographic concepts of this analytical essay are, first, in term of connectivity: letters are either restricted or unrestricted and, second, in term of shapes, all letters have one normal shape, but unrestricted letters can be assigned an additional final shape. By systematically analyzing shapes and behaviors, this study offers a solid Arabic typographic model. The offered design principles are useful for both traditional and non-traditional Arabic font designs. The philosophical analysis presented should at least soften the loud drums of design censorship still performing individually and within corporations after centuries of typography.

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