ΩTimes and ΩHelvetica Fonts Under Development: Step One

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The Truth Is Out There
— Chris CARTER, *The X-Files* (1993)

Introduction

ΩTimes and ΩHelvetica will be public domain virtual Times- and Helvetica-like fonts based upon real PostScript fonts, which we call "Glyph Containers". They will contain all necessary characters for typesetting efficiently (that is, with TEX quality) in all languages and systems using the Latin, Greek, Cyrillic, Arabic, Hebrew and Tifinagh alphabets and their derivatives. All Unicode characters will be covered, although the set of glyphs of our Ω fonts will not be limited to these; after all, our goal is high quality typography, which requires more glyphs than would be required for mere information interchange.

Other alphabets will follow (the obvious first candidates are Coptic, Armenian and Georgian) as well as mathematical symbols, dingbats, etc.

Why PostScript instead of Metafont? METAFONT is the ultimate tool for font development. Extending Computer Modern fonts to the Unicode encoding is still one of our goals. We have started developing a set of fonts we call "Unicode Computer Modern" fonts, using techniques such as Virtual METAFONT (virtual fonts are created directly by METAFONT using the `gftotxt` utility for text output). Nevertheless we realized that the task of writing METAFONT code for some thousands of characters (including code for typewriter style) is a tremendous task, which will take several years.

So we decided to take a small break from METAFONTing, and to develop in a limited time period PostScript fonts that will cover a maximum number of languages and will give the TEX community a good reason to switch to Ω.

Why Times and Helvetica? First of all, because after Computer Modern they are the most widely used fonts in the TEX community. Many journals and publishers request that their texts be typeset in Times; Helvetica (especially the bold series) is often used as a titling font. Like Computer Modern, Times is a very neutral font that can be used in a wide range of documents, ranging from poetry to technical documentation...

It would surely be more fun to prepare a Bembo- or Stempel Garamond-like font for the serifs part and a Gill Sans- or Univers-like one for the sans-serifs part; but these can hardly be used in the scientific/technical area, and that's perhaps where TEX (and hence potentially Ω) is used the most.

When will the Ω fonts be finished? The development of ΩTimes and ΩHelvetica fonts is divided into four steps:

1. Drawing of PostScript outlines and packaging of Glyph Container fonts.
2. Development of virtual code, based on the real fonts of step one.
3. Kerning of virtual fonts.
4. Development of LaTEX code and Ω Translation Processes necessary for the use of these fonts.

For the time being (June, 1996) we have done the biggest part of step one, and this is what we present in this paper. We hope to have finished with steps two, three and four before the next teTEX CD-ROM in December 1996.

We want your support! Please keep in mind:

> The choice and shapes of glyphs presented in this paper are only a first attempt. We need *your* feedback to improve them, so that *you* can use them efficiently.

In the tables we present only Times family and medium series fonts (except in the case of Tifinagh, which is also presented in the Helvetica family). Up-to-date tables of the remaining fonts can be consulted on our Ω WWW server

`http://www.ens.fr/omega`

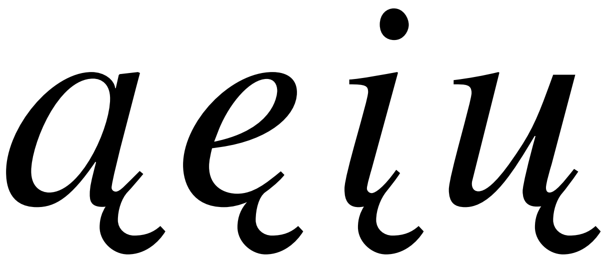

Figure 1: Italic style letters with ogonek (Polish and Lithuanian)

You can also retrieve the PostScript code from the same address, or from

`ftp://ftp.ens.fr/pub/tex/yannis/omega`

General remarks on the fonts

To prevent confusion, the word "font" in this section is meant in the sense of the PostScript Type 1 font structure; and not of TEX text or math fonts: the fonts we describe in this paper will *never* be used directly for typesetting. Their *raison d'être* is to provide glyphs for the virtual Unicode+Typography Ω fonts which we will develop in steps two–four. Hence, there is no need to look in the tables for a 'é': this character will be assembled by the virtual font, using the glyphs of letter 'e' and of the acute accent.

The same stands for the letter 'c' with cedilla: it can be assembled out of the two corresponding glyphs; however, this is *not* true for letters with ogonek: the shape of the ogonek changes while it gets attached to the letter; that is why you find letters with ogonek in the Glyph Containers and not letters with cedilla. In Fig. 1 the reader can see examples of letters in italic style, carrying an ogonek accent.

In Fig. 2 the reader can find the general structure of the fonts.[1] On the left, the 16-bit Unicode+Typography virtual font, on the right a certain number of Glyph Containers, that is 8-bit PostScript fonts.

The reader will notice that a certain number of glyphs are repeated in the different Glyph Containers. This is because we want to minimize the number of Glyph Containers used for a single-alphabet text. For example, accents for all fonts are stored in Glyph Container "Common"; theoretically, to produce an acute-accented Latin letter and an acute-accented Cyrillic letter, one would use three Glyph Containers: one for the accent, and one for each alphabet. To avoid this, we store all accents relevant to a given alphabet, in the alphabet's Glyph Container. The same method is used for shapes that are similar in the different alphabets: Latin, Greek and Cyrillic alphabets share the letter 'A', Latin, IPA and Cyrillic alphabets share the letter 'a'.[2]

The "Common" Glyph Container

The "Common" Glyph Container, shown in Table 1, contains glyphs that will be potentially used in conjunction with all alphabets. These are described in the following subsections.

Punctuation, digits, editorial marks Special care has been taken to distinguish between "typographical" punctuation and "typewriter/computer terminal-derived" one: compare the typographical double quotes "" and the straight 'ASCII' one ".

This table covers all Unicode punctuation marks from the ASCII and ISO 8859-1 tables as well as from the GENERAL PUNCTUATION table (`0x2010`–`0x2046`). We have not included a few punctuation marks specific to a single alphabet: Arabic asterisk, inverted comma and semicolon, Hebrew colon, Greek upper dot. These will be found in the corresponding Glyph Containers.

In Fig. 3 the reader can see how regular curly braces have been transformed into SQUARE BRACKETS WITH QUILL, by simply reflecting the central part of the brace.

Commonly adopted Latin alphabet derived symbols Symbols like © use Latin alphabet letters but are used in many non-Latin-alphabet based languages. Symbol № is an even stranger example: although the glyph 'N' does not exist in Cyrillic, this symbol is used mainly in Cyrillic-alphabet languages.

[1] In the figure, the reader will notice real font "Adobe Zapf Dingbats". In fact, the glyphs of this font have become Unicode characters (`0x2701`–`0x27be`) and we see no reason to redraw them since this font is widely available. Hence the virtual 16-bit font will also point to the standard Adobe Zapf Dingbats font.

[2] We will use a totally different approach when `dvips` and Adobe Acrobat will be able to use 16-bit PostScript fonts. Instead of having many 'small' PostScript fonts and one 'big' virtual font, we will use a single 'big' PostScript font, in Unicode+typography encoding. In that font, accented letters and repeated identical shapes will be obtained by the PostScript font technique of *composite characters*. This will allow Acrobat users to select and copy Unicode-encoded text directly from the document window.

Since the two techniques (16-bit + 8-bit real, vs. 16-bit composite real) will share the same TFM metrics for characters, it will be possible to convert DVI files from one format to the other, so that files obtained today by the first method will be "Acrobat-ready" later, whenever Acrobat switches to Unicode (hopefully soon!).

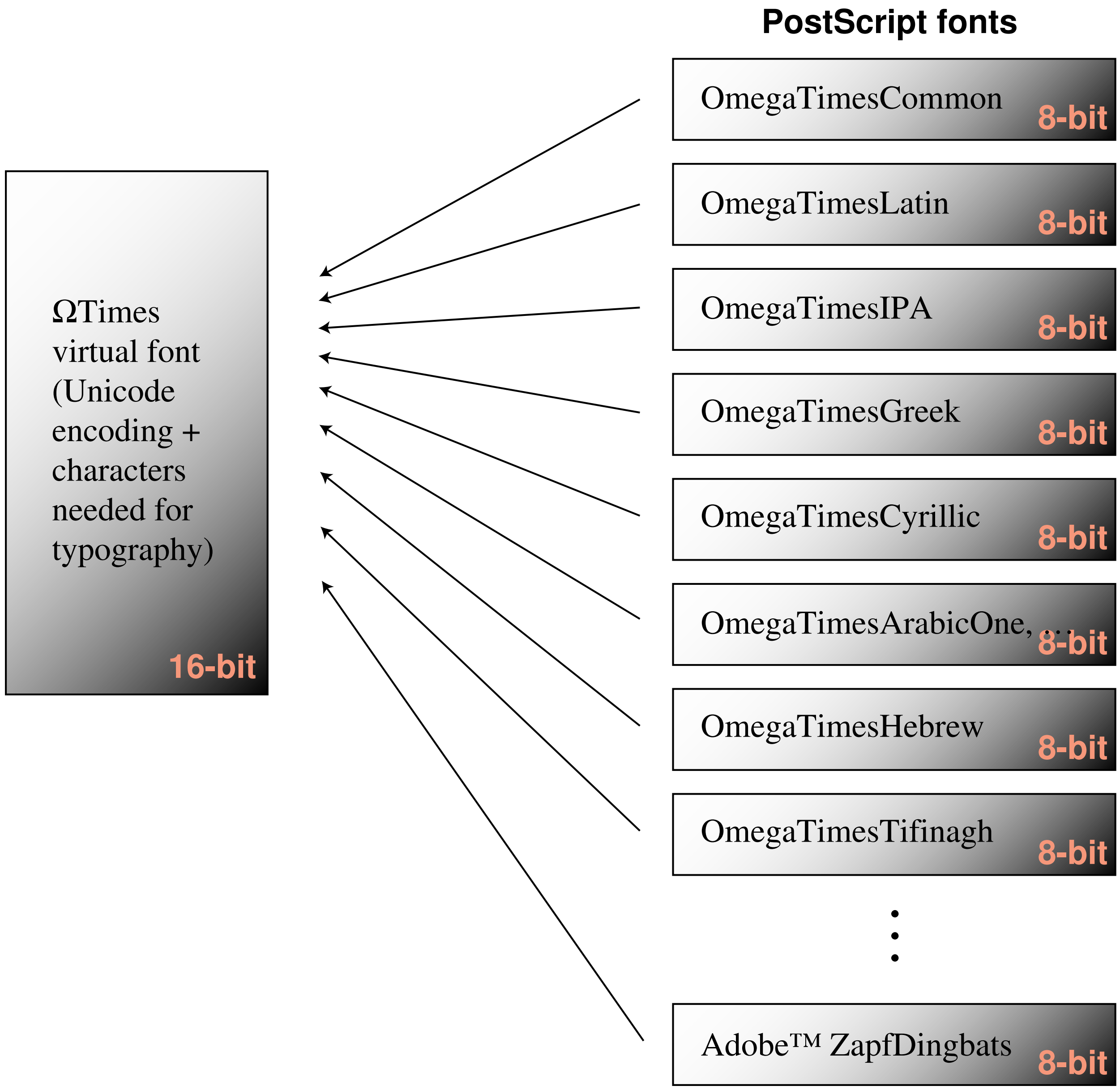

Figure 2: General structure of the ΩTimes fonts (idem for ΩHelvetica)

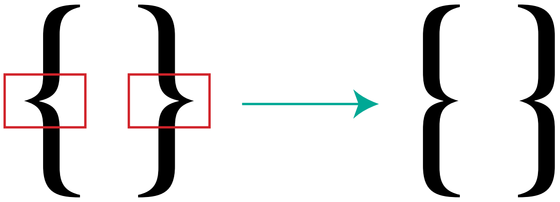

Figure 3: The LEFT and RIGHT SQUARE BRACKETS WITH QUILL were drawn by reflecting the central part of regular curly braces

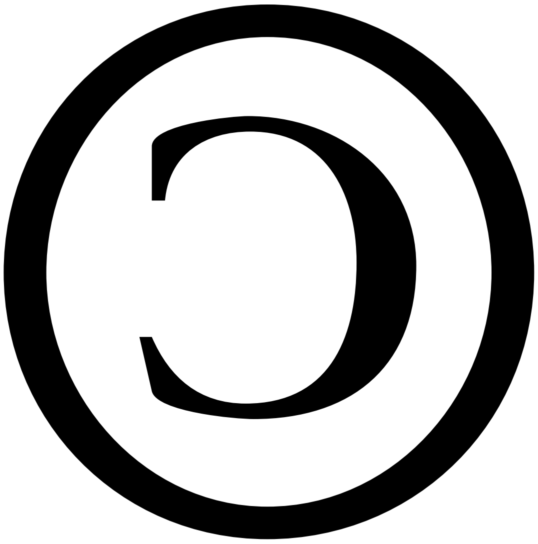

Figure 4: The GNU “copyleft” symbol

Figure 5: The ESTIMATED SYMBOL was drawn inside a perfect circle

In Fig. 4 the reader can see our small tribute to the GNU foundation: the “copyleft” symbol. We hope that this character will soon be included in the LETTERLIKE SYMBOLS section of Unicode.

— Q. Why not use the `\reflectbox` macro to reflect the “copyright” glyph into a “copyleft” one?

— A. Because we want to treat “copyleft” as a separate character in the virtual font, which may be searched inside a DVI or PDF file. In other cases, such as ᗺ, used in the AᗺBA logo and the cobar construction in Algebraic Topology, one can very well use PostScript-manipulation macros without damage.

Finally, in Fig. 5 the reader can see how the ESTIMATED SYMBOL fits inside a perfect circle (in red, for readers of a color version of this paper).

Currency symbols Among currencies having proprietary symbols, there are strong and weaker ones. The strong ones have made it into ISO 8859-1 (you-know-who made it even into ASCII itself, and is used by a well-known typesetting language to enter math mode. . .), the remaining ones have found their home in the CURRENCY SYMBOLS section of Unicode.

We have included them all (even the Thai currency symbol ฿, which looks suspiciously Latin) in the “Common” Glyph Container. Note that the symbol ₣ for French Franc is virtually unknown in France. . .

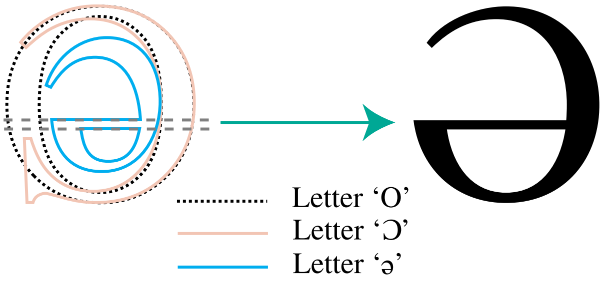

Figure 6: How shapes 'C', 'O' and 'e' were used for the design of the LATIN and CYRILLIC CAPITAL LETTER SHWA

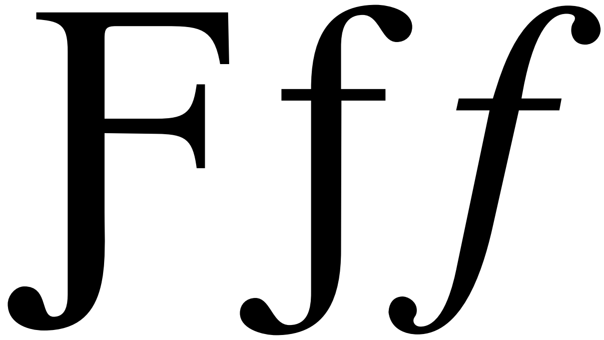

Figure 7: The African letter F WITH HOOK in Roman upper and lower case, as well as in italic lower case form

Figure 8: CAPITAL LETTER B WITH TOPBAR (which shares the same glyph as CYRILLIC CAPITAL LETTER BE) SMALL LETTER B WITH TOPBAR and CYRILLIC SMALL LETTER BE

Diacritics The zone `0xa0`–`0xe2` of the "Common" Glyph Container is dedicated to combining diacritics.

These diacritics are supposed to be useful for more than one alphabet; whenever a diacritic belongs specifically to one alphabet, it has been included only in the corresponding Glyph Container (this is the case for example of Vietnamese double accents, Greek spirit+accent combinations, and Slavonic accents). Thanks to the diacritics in the "Common" Glyph Container we will be able to construct all LATIN EXTENDED ADDITIONAL Unicode characters (`0x1e00`–`0x1ef9`) virtually, by combining them with letters from the "Latin" Glyph Container. This Unicode region covers Welsh, Vietnamese and transcriptions of Indic and other languages.

The "Latin" Glyph Container

The "Latin" Glyph Container, shown in Table 2, contains glyphs of letters for Latin alphabet languages. These are described in the following subsections.

Letters for Latin Alphabet Languages All glyphs necessary to typeset Western and Central European, Nordic, Baltic, African languages, Vietnamese and Zhuang.

Some African characters are derived from the International Phonetic Alphabet. It is a fascinating challenge to design upper case and italic style forms for these characters (for example, see in Fig. 6 the upper case version of letter ə letter which derives from the phonetic SHWA, and in Fig. 7 the straight upper case and straight lower case versions of an African letter that becomes a standard *f* in italic style).

Sometimes, although a Greek form (or a form derived from Greek) is used for the lower case, the upper case does not follow the Greek model: for example, the upper case of African letters ɛ and ɤ (the former is 100% Greek, while the latter looks more like a "phonetic gamma") are Ɛ and Ɣ.

Inversely, sometimes a Greek form is used for the upper case only: Σ is the upper case form of the integral-like ʃ, a character derived from the IPA, for which one can hardly imagine an obvious upper case form—taking a Greek letter for that purpose is the easiest solution.

It is quite interesting how the lower case of the Latin letter Б differs from the one of the Cyrillic letter sharing the same glyph (see Fig. 8).

Special attention has been paid to the notorious Dutch ligature 'ij', in italic Times lower case form and in Helvetica upper case form (see Fig. 9).

In the former case, we have connected the two letters, creating an intentional confusion with a 'y' letter with umlaut accent. In Fig. 9 the reader can compare these two constructions. On the other hand, the shape of the upper case sans serif 'IJ' is derived from the one of letter 'U': this is common Dutch titling practice.

Figure 9: Italic letter 'y' with umlaut accent followed by the Dutch ligature 'ij' in Times italic, Helvetica medium upper case and Helvetica bold upper case form

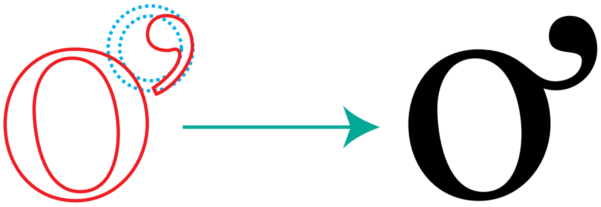

Figure 10: The Vietnamese SMALL LETTER O WITH HORN was designed using the glyphs of the ring accent, the apostrophe and letter 'o'

The characters Ꝁ and ꝁ are used in Breton. They are not (yet) included in Unicode, and have been brought to our attention by Jacques André.

Finally, in Fig. 10 the reader can see how the "horn" of Vietnamese letters has been designed, using graphical elements from the font: in this case, the ring accent and the apostrophe.

Ligatures Besides the "standard five" ligatures ff, fi, fl, ffi, ffl, we have included ligatures for the case where:

Figure 11: French ligatures 'st' and 'ct' in Times and Helvetica fonts

- the second or third letter is an 'i' with ogonek: fį, ffį, useful in Lithuanian;
- the second or third letter is a stroked 'l' : fł, ffł, useful in Polish;
- the second or third letter is a 'j': fj, ffj;
- instead of an 'i' one has an 'ij' ligature: fĳ, ffĳ, useful in Dutch;
- instead of 'f' one has a long 's': ſſ, ſi, ſl, ſſi, ſſl. We haven't (yet) included any 'f' + 'long s' combinations.

Finally we couldn't resist the temptation of making "French" ligatures ſt, ct, of course both in Times and Helvetica (!) font families. These ligatures are well-known because of their use (in the Garamond typeface) in the Pléiade book collection. One can argue about their reason of being in Times (and especially in Helvetica) style, which has absolutely no historical background... Consider them as an experiment, and trust us for not making them automatic in default text mode!

Diacritics Accents `0xf8`–`0xff` are used for Vietnamese only. Diacritics occupying positions `0xe8`–`0xf6` are shared with the "Common" Glyph Container.

The "IPA" Glyph Container

The "IPA" Glyph Container, shown in Table 3, contains a collection of glyphs needed for the International Phonetic Alphabet. They have been found in different sources: Unicode encoding, literature on phonetics (in particular we covered the complete table of characters of the French classic *Initiation à la phonétique*, by J.-M.-C. Thomas, L. Bouquiaux and F. Cloarec-Heiss, PUF, 1976). Only a small part of these characters is contained in the Unicode encoding. We would be **grateful** for any feedback from scholars on additional characters or corrections of the existing ones.

Since IPA is so... international, we have assumed that one can encounter phonetic insertions in text written in any language. Hence, we have included all glyphs needed, including lower case Latin alphabet letters, and small capitals—the latter being included only whenever these are significantly different from their lower case counterparts: including for example small caps 's', 'x', 'z' would be useless since they are indistinguishable from lower case 's', 'x', 'z'.

This point deserves some explanation: one should not confuse *small capitals used for text* and *IPA small capitals*. The former are a stylistic enhancement of text; they appear only in words entirely in small capitals style; their height is *not* equal

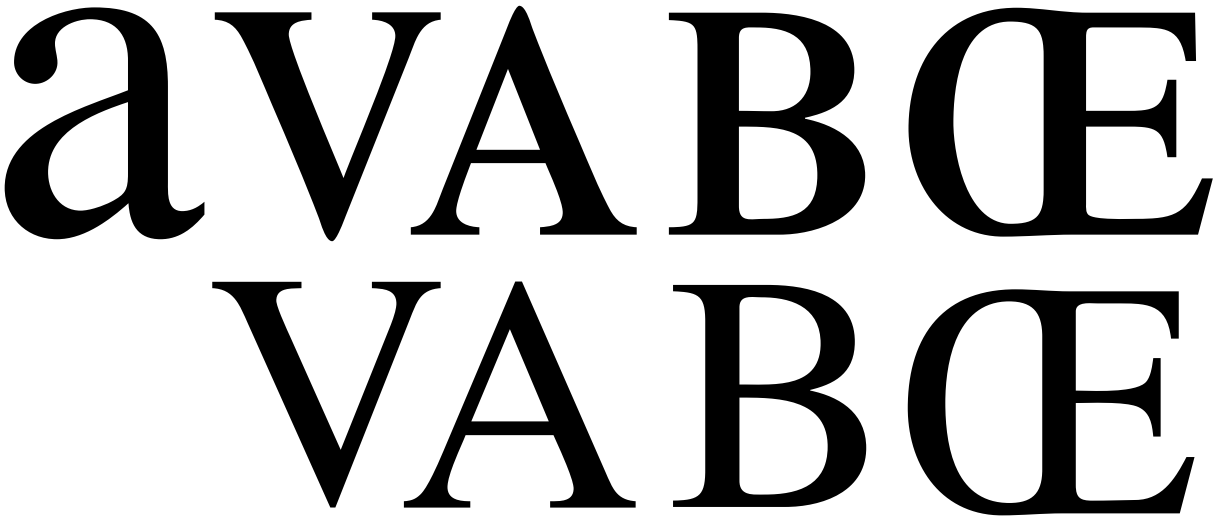

Figure 12: On the first line lower case letters ‘a’ and ‘v’ and specially designed IPA small capitals, on the second line upper case letters reduced 68%

Figure 13: Three closely related glyphs: German ‘sz’, IPA ‘beta’ (not a Unicode character), Greek lower case ‘beta’

to the x-height of the font, generally they are slightly higher. The latter are phonetic characters used together with authentic lower case letters: they *must* have exactly the same height.

In Fig. 12 the reader can see some small caps we have designed for the ΩTimes IPA Glyph Container. It may not be obvious from the figure, but stroke widths of the small caps are exactly the same as the ones of lower case letters (see lower case letter ‘a’ to compare as well as glyph ‘v’ which is used to represent both a lower case and a small caps ‘v’). On the second line of the figure, one can see the same letters obtained as ‘fake’ small capitals.

We had a lot of fun designing these characters. In some cases, they just had to look a little different from their Greek counterparts: for example, in

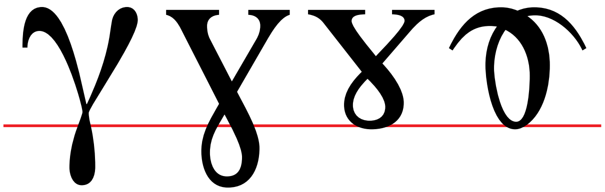

Figure 14: Different types of ‘gamma’: the first one from the Greek alphabet, the others from the IPA

Fig. 13 the reader can see how the ‘phonetic beta’ has been inspired by the German ‘sz’, and not by the ‘real’ Greek beta; in Fig. 14 we present a collection of gamma-like glyphs, as well as the ‘real’ Greek letter gamma.

In some cases we were not very sure about the origin of some IPA characters and did several attempts: for example, in Fig. 15 one can see two symbols with superficial resemblance: an inverted ‘f’ and a dotless stroked ‘j’. Which one is used in phonetics? The choice is left to the user.

Finally there was one case where we had to solve a *real* design problem: the one of the ‘l with retroflex hook’ and ‘ezh’ ligature (not a Unicode character). In most real-life examples we had the opportunity to see, the letter ‘ezh’ was sadly squeezed so that its tail remains higher than the retroflex hook of the ‘l’; we find it bad typographical practice to squeeze the ‘ezh’ and propose three solutions (only one of which of course will survive in the final Glyph Container). In Fig. 16 the reader can see: (a) the tail of ‘ezh’

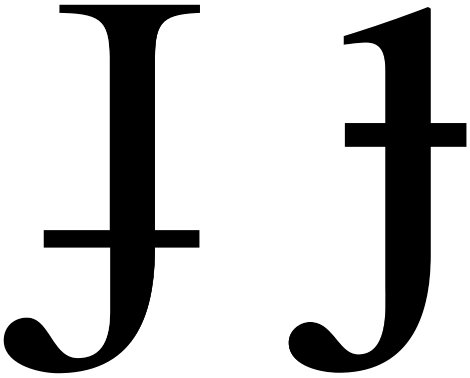

Figure 15: Two IPA symbols of different origin: inverted letter 'f' and dotless 'j' with stroke

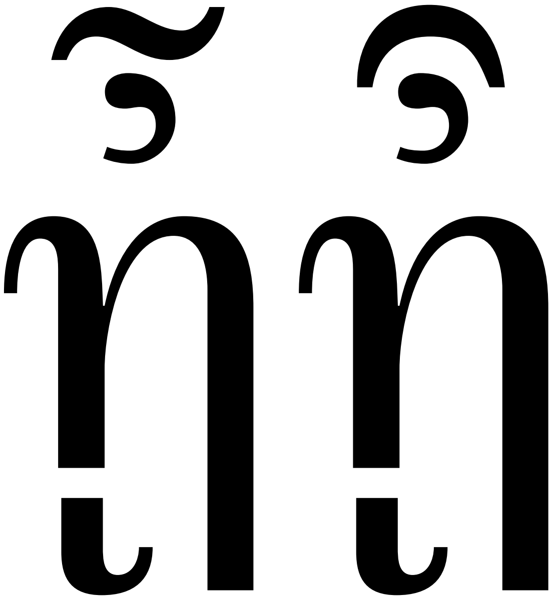

Figure 17: Two forms of Greek circumflex accent: the first used in modern Greek typesetting, the second one used in a number of scholarly typefaces

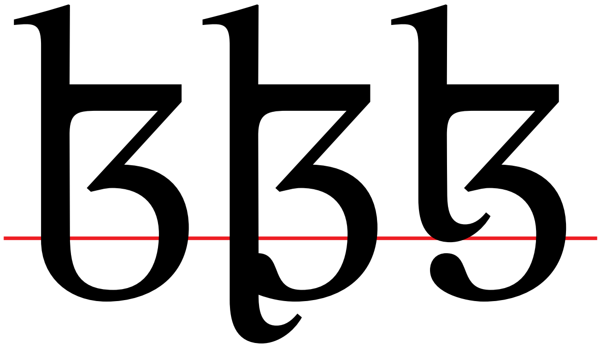

Figure 16: Which one is the best 'l with retroflex hook+ezh' ligature? (Three proposals)

merged with the retroflex hook of the 'l', (b) the retroflex hook of the 'l' continuing deep enough for it to be seen under the tail of 'ezh', (c) the retroflex hook rising higher so that it fits between the tail of 'ezh' and the baseline. In cases (a) and (c) the risk may be that the 'l with retroflex hook' be taken for an 'ordinary l' (compare ɮ, ɮ and ɮ); in case (b) we are going too deep under the baseline...

Anyhow, we expect your feedback to resolve this issue.

The "Greek" Glyph Container

The "Greek" Glyph Container, shown in Table 4, contains glyphs needed for the Greek language, ancient and modern. The problem with most commercial Greek fonts is that they are either made for modern Greek use, or for ancient Greek use by non-Greek scholars. There is a third possibility: fonts made for ancient Greek use by Greek scholars.

In this Glyph Container we have tried to satisfy all three categories of users. Of course, this font can be used both for monotonic and polytonic text (there is a straight monotonic accent, while the acute one can be used as well). But we have gone even farther, by including two versions of the circumflex accent, shown in Fig. 17: the tilde-like one,

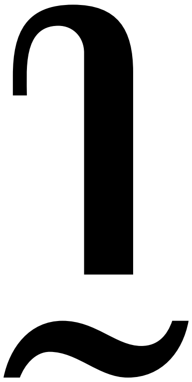

Figure 18: The inverted 'iota with circumflex' (not a Unicode character) used in 19th century modern Greek printing

Figure 20: The different variant forms of Greek letters: beta, theta, phi, rho, kappa

used in Greece, and the cap-like one used in scholarly Western editions.[3]

Faithful to the first TUGboat paper of one of the authors (Y.H., together with Klaus Thull, back in 1989), we have included the inverted iota with circumflex accent, found in certain 19th century editions of modern Greek (see Fig. 18).

Version 1.0 of the Unicode standard contained upper case versions of Greek numerals, just as Roman numerals were provided in upper and lower case; in ISO 10646 these characters were removed, apparently by decision of the Greek delegation. We find this action absurd (there are many examples of upper case numerals in literature) and have of course included the relevant glyphs in the Glyph Container. In fact we have included all known variants of Greek numerals: stigma, digamma, qoppa and sampi (see Fig. 19, next page), and the upper and lower numeral signs.

Greek letters are also very common in mathematics and physics. Some variant forms are used for different purposes in these fields (rho with curved or straight tail, open/closed phi, open/closed theta, curly or straight kappa). To these we add a variant form used in regular text: the initial and medial beta (β vs. ϐ). All variant forms of lower case letters are shown in Fig. 20.

There is also a variant form of letter sigma: the so called "lunate" sigma. This character is used in some scholarly editions to avoid the distinction between ordinary medial and final sigmas. In Fig. 21 we compare it with Latin letter 'c': the lower case of lunate sigma has no bulb and the upper one, no serif

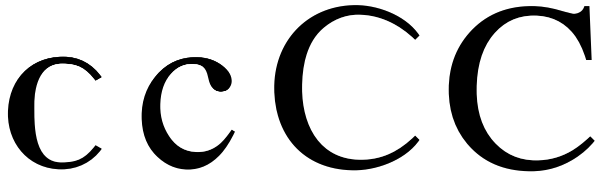

Figure 21: The glyphs of Greek lunate sigma and Latin letter 'c' (in upper and lower case)

(and hence the Greek and Latin letters are identical in the Helvetica family).

The reader may ask why on positions `0x80`–`0x8d` and `0xa0`–`0xad` of the Glyph Container table we have accented letters, while on positions `0x90`–`0x9d` there are only accents and no letters. The answer is very simple: accents on Greek letters sometimes change shape according to the width of the letter. Greek vowels can be roughly divided into three width classes: narrow ones (the iota), wide ones (the omega) and medium ones (all the remaining). On row `8` and `a` we have placed accents for narrow and wide letters respectively; on row `9` we have placed the ordinary accents. And since rows `8` and `a` have been made for unique vowels, we have prefered to include complete accent+letter combinations (letters being aliases, of course) so that the virtual font doesn't need to make the construction.

The same reason justifies positions `0x5e` and `0x5f`: the dieresis (dialytika, in Greek) does not have the same width whether it is placed on a iota or an upsilon.

Finally, in the table there are also the specifically Greek guillemets (round ones), the upper dot, and the two forms of "subscript" iota: for lower case

[3] This brings us to a nice typographical joke: the Greek "circumflex" accent is either "tilde"-like or "cap"-like, but never actually… "circumflex"-like!

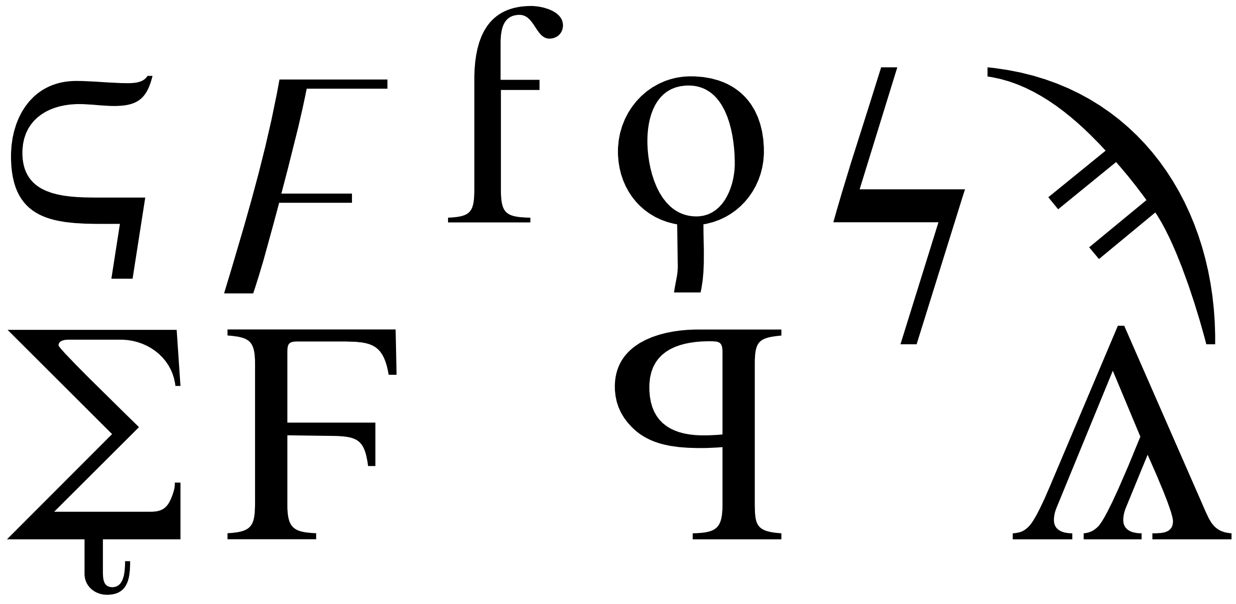

Figure 19: Collection of glyphs used for Greek numerals; on the first line: lower case stigma, digamma (2 variants), qoppa (2 variants), sampi; on the second line: upper case stigma, digamma, qoppa, sampi

letters (ypogegrammeni) and for upper case ones (prosgegrammeni).

The "Cyrillic" Glyph Container

The "Cyrillic" Glyph Container, shown in Table 5, contains glyphs needed for all languages using the Cyrillic alphabet, whether European or Asian. Characters for pre-Lenin Russian (fita, izhitsa, yat) have also been included, as well as "modernized" versions of Slavonic characters. As in the case of the Latin 'st', 'ct' ligatures, one may argue the necessity of modernizing Slavonic script, especially when it comes to draw the Helvetica version. It happens that these characters have been included in Unicode (like the Coptic ones), and this is already reason enough to draw the font; it is up to the user to actually adopt the "modern" font, or use beautiful traditional Slavonic typefaces.

What was fascinating when designing Slavonic letters, was their relation to Greek ones. In Fig. 22 we compare Slavonic and Greek Xi and Psi: at a first glance, Slavonic Xi has a resemblance to Greek lower case xi, it is quite surprising that the Slavonic xi is reflected with respect to the Greek one. Upper case Psi letters are identical, and lower case Slavonic psi has a heavier stem (with serif, while Greek lower case letters *never* have serifs). Uppercase Slavonic Omega ѡ is a magnified lower case omega (where we have placed a serif on the central stem). For the lower part of the Slavonic Yus Ѫ we have used an in-

Figure 22: Comparing Slavonic letters Xi and Psi with the corresponding Greek ones

verted Psi: this is a small designer's secret allowing better integration of the letter in the Times (resp. Helvetica) font family.

Another design initiative of ours was to use graphic elements from the Serbian letter Ђ ђ, for the Asian Cyrillic Ԕ ԕ, Ԥ ԥ, Ԗ ԗ. We expect user feedback to validate or deny this choice.

The "Arabic" Glyph Container

The "Arabic" Glyph Container, shown in Tables 6–8 contains the glyphs that are necessary to typeset in any language using the Arabic alphabet.[4] The design of these Ω Arabic fonts has actually not much in common the Times and Helvetica families: in fact we have used popular modern designs, which can be used both for technical and literary text, and which allow easy readability in small sizes. Fat and thin stroke width, ascender height and descender depth have all been calculated with respect to the corresponding parameters of the Latin/Greek/Cyrillic fonts.

In Fig. 23 the reader can see the metrical relationship between the Latin, Arabic and Hebrew fonts: we want these characters to fit to each other, so that multilingual texts using the three scripts will produce typographically acceptable results.

Concerning diacritics we have included all vowels, and combinations with shadda and hamza, as well as some special cases: madda, wesla, vertical fatha, vertical fatha + shadda, and other diacritics used in Arabic spellings of African languages, Kurdish, Baluchi, Kashmiri, Uigur and Kazakh.[5]

Esthetic Ligatures We have included a very small number of esthetic ligatures (less than 150): ba-like letters followed by a final noon-like, initial fa-like letters followed by a ya-like, an initial lam-meem ligature, and the llah ligature with and without vertical fatha + shadda. We are not convinced that heavy ligaturing of these fonts, in the manner of traditional Naskhi fonts, would be esthetically judicious. Nevertheless we are open to any suggestion on possible ligatures that might be added.

The "Tifinagh" Glyph Container

The "Tifinagh" Glyph Container, shown in Tables 9 and 10, contains the glyphs needed for typesetting Tamazight (alias Berber) language. A complete description of the Berber TeX system developed by one of the authors (Y.H.) can be found in *Un système TeX berbère*, Actes de la table ronde internationale « Phonologie et notation usuelle dans le domaine berbère », Institut National des Langues et Civilisations Orientales, Paris, 1993, and in the forthcoming *Cahier GUTenberg* on Semitic scripts.

The glyphs shown on the tables deserve a number of explanations. Tifinagh script has always been written in a non-serif style. On table 9 we show an "Helvetica" version of the script, in the sense that everything has been done to bring these glyphs closer to the Latin/Cyrillic/Greek Helvetica types. This approach is quite safe, and—in all modesty—the result should not surprise any speaker of Berber.

On the other hand, table 10 shows a 100% experimental font! The main idea was to say: "How would Tifinagh letters look like today, if they had followed the same evolution as Latin ones?" See Fig. 24 for a closer comparison of some Tifinagh letters in Helvetica and Times style. Admittedly, the result seems weird, and a lot of corrections have to be made before these drawings actually can be called Tifinagh glyphs... Nevertheless, the Berber language is getting more and more typeset, often together with other scripts, so that the problem of homogeneization with Western typographical traditions cannot be avoided; the style of the Times typeface is certainly one of the first challenges.

The "Hebrew" Glyph Container

The "Hebrew" Glyph Container, shown in Table 11 contains the glyphs needed for Hebrew, Yiddish (both in the Russian or American YIVO spelling) and Ladino. The font design is based on a—very popular in Israel—modern Hebrew typeface. Once again we have adapted the stroke widths and character dimensions to those of Latin/Greek/Cyrillic glyphs. In Fig. 23, the reader can compare the size and weight of Hebrew letters with the ones of Latin and Arabic ones.[6]

We have *not* included Masoretic signs in the font, because we believe that the Bible should be typeset in traditional "square" fonts. Nevertheless, we have included letters with dagesh which appear only in a few isolated positions in the Bible, as well as the inverted nun. We have also included two different forms of the lamed-aleph ligature (with and without left stroke), used in older texts.

[4] We have also included undotted versions of letters ba, fa, qaf, for typesetting of old manuscripts.

[5] We have *not* included diacritics used for the Qur'ān, as we believe that these should be printed using very specific traditional typefaces; nevertheless the diacritics provided are sufficient for excerpts from the Qur'ān.

[6] It should be noted that the height of Hebrew letters is exactly equal to the half distance between that of upper case and lower case Latin letters.

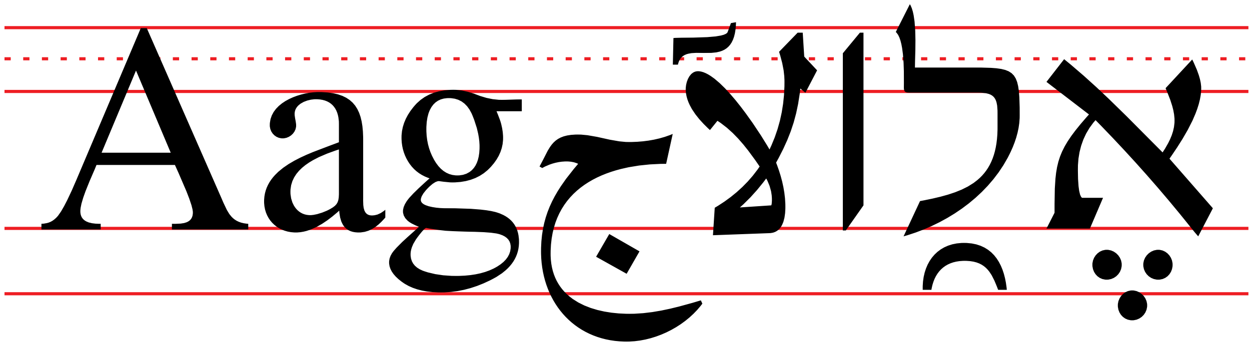

Figure 23: Capital height, x-height, baseline and descender depth of Latin, Arabic and Hebrew letters

Figure 24: On line 1: Tifinagh letters in Helvetica style, with shapes identical to Greek and Latin ones; on line 2: idem. but shapes become stranger; on lines 3 and 4: the same letters, in Times style, using "evolutional logic"

	"x0	"x1	"x2	"x3	"x4	"x5	"x6	"x7
"2x		!	"	#	$	%	&	'
	(	)	*	+	,	-	.	/
"3x	0	1	2	3	4	5	6	7
	8	9	:	;	<	=	>	?
"4x	@	©	🄯	®	℗	¢	£	¤
	§	¶	¦	º	ª	¬	†	‡
"5x	‰	‱	′	‵	‸	⁁	⁂	▪
	⟦	⟧	℮	[	\	]	^	_
"6x	{	}	※	‿	⁀	␣	¡	¿
	‘	’	‛	‚	“	”	‟	„
"7x	«	»	‹	›	–	—	◦	•
	‣	\	№	{	|	}	~	
"8x	¥	₠	₡	₢	₣	₤	₥	₦
	₱	₩	Ⱡ	℔	℞	℟	℣	฿
"9x	Ⅎ	‽						
"Ax	̀	́	̂	̃	̄	̅	̆	̇
	̈	̉	̊	̋	̌	̍	̎	̏
"Bx	̐	̑	̒	̓	̔	̕	̖	̗
	̘	̙	̚	̛	̜	̝	̞	̟
"Cx	̠	̡	̢	̣	̤	̥	̦	̧
	̨	̩	̪	̫	̬	̭	̮	̯
"Dx	̰	̱	̲	̳	̴	̵	̶	̷
	̸	̹	̺	̻	̼	̽	̾	̿
"Ex	͡	͠						
	"x8	"x9	"xA	"xB	"xC	"xD	"xE	"xF

Table 1: Tentative `OmegaTimesCommon` Glyph Container Table (June 10, 1996).

	"x0	"x1	"x2	"x3	"x4	"x5	"x6	"x7
"2x		Æ	Đ	Ø	Þ	Ą	ß	Ę
	Ħ	Į	ı	Ĳ	Ł	Ŋ	Œ	Ŧ
"3x		æ	ð	ø	þ	ą	đ	ę
	ħ	į	ȷ	ĳ	ł	ŋ	œ	ŧ
"4x	Ų	A	B	C	D	E	F	G
	H	I	J	K	L	M	N	O
"5x	P	Q	R	S	T	U	V	W
	X	Y	Z	ĸ	Ơ	Ư	Ꝁ	
"6x	ų	a	b	c	d	e	f	g
	h	i	j	k	l	m	n	o
"7x	p	q	r	s	t	u	v	w
	x	y	z	ſ	ơ	ư	ꝁ	
"8x	Ɓ	Ƃ	Ƅ	Ɔ	Ƈ	Ɗ	Ƌ	Ʃ
	Ǝ	Ə	Ɛ	Ƒ	Ɠ	Ɣ	ƕ	Ɨ
"9x	Ƙ	ƚ	Ɯ	Ɲ	ƞ	Ɵ	Ƣ	Ƥ
	Ƨ	Ʃ	ƪ	Ƭ	Ʈ	Ʊ	Ʋ	Ƴ
"Ax	ƀ	ƃ	ƅ	ɔ	ƈ	ɗ	ƌ	ƍ
	ɜ	ə	ɛ	ƒ	ɠ	ɣ	ɩ	ɨ
"Bx	ƙ	ƛ	ɯ	ɲ	Ʀ	ɵ	ƣ	ƥ
	ƨ	ʃ	ƫ	ƭ	ʈ	ʊ	ʋ	ƴ
"Cx	Ƶ	Ʒ	Ƹ	ƺ	Ƽ	ƾ	ǂ	Ǥ
	[illegible]				ff	fi	fl	ffi
"Dx	ffl	fį	ffį	fł	ffł	fj	ffj	fij
	ffij	ſſ	ſi	ſl	ſſi	ſſl	ſt	ct
"Ex	ƶ	ʒ	ƹ	ƻ	ƽ	ƿ	¸	ǥ
	`	´	ˆ	˜	¯	˘	˙	¨
"Fx	ˀ	˚	˝	ˇ	̏	̑	̣	’
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	"x8	"x9	"xA	"xB	"xC	"xD	"xE	"xF

Table 2: Tentative `OmegaTimesLatin` Glyph Container Table (June 10, 1996).

	"x0	"x1	"x2	"x3	"x4	"x5	"x6	"x7
"2x	ɑ	ɒ	ɐ	ɑ˞	ɓ	ƅ	ƀ	ƀ
	ɓ̸	β	ɔ	ɔ˞	ƈ	ç	¢	ɕ
"3x	ɖ	ᶑ	đ	ɗ	ʤ	δ	ʣ	ʥ
	đ	ɖ	ɗ̸	ð	ə	ɘ	ɚ	ę
"4x	ɛ	A	B	ɜ	D	E	F	G
	H	I	J	K	L	M	N	Œ
"5x	P	Q	R	ɝ	T	U	ɛ˞	ʃ
	ʄ	Y	ɸ	φ	ɸ	φ	ɸ	ɟ
"6x	ƒ	a	b	c	d	e	f	g
	h	i	j	k	l	m	n	o
"7x	p	q	r	s	t	u	v	w
	x	y	z	ɡ	ɣ	γ	ɤ	
"8x	ɷ	ɷɷ	ɠ	ǥ	ʛ	ħ	ɦ	ɥ
	ɧ	ʮ	ɦ̡	ɦ	ƕ	ɨ	ɩ	ᵻ
"9x	ɟ	ȷ	ʝ	ȷ	ʞ	ĸ	ƙ	ł
	ɭ	ʎ	ɮ	l	ƚ	ɮ	ʎ̸	ɮ̸
"Ax	ɺ	ɬ	ɭ̡	ł	ƛ	λ	ɱ	ɯ
	ɰ	ɦ	ɳ	ɲ	ŋ	ɲ̊	ɳ̊	ɳ̊
"Bx	ŋ̡	ŋ	ɲ	ơ	ϱ	ϙ	ƥ	ƥ
	ƥ	ƥ	ᵽ	ʠ	ɋ	ɽ	ɹ	ʁ
"Cx	ɽ	ɻ	ɻ	ɾ	ɭ	ɻ	ɾ	ʂ
	ʃ	ɭ	ɿ	ʆ	ꞩ	σ	ʈ	ƫ
"Dx	ŧ	ɵ	ʦ	ʧ	ɟ	ʨ	θ	ʉ
	Ω	ʉ̸	ʉ	ʊ	ʌ	ʌ	ʍ	ɷ
"Ex	ω	χ	x̡	ʐ	ʒ	ƶ	ʒ	ʑ
	ʒ	ƺ	ʔ	ʕ	ƽ	ʡ	ʖ	⊙
"Fx	ɞ	ɷ	Ω	ʡ	ʢ	ƻ	ꝏ	ɮ
	ɮ							
	"x8	"x9	"xA	"xB	"xC	"xD	"xE	"xF

Table 3: Tentative `OmegaTimesIPA` Glyph Container Table (June 10, 1996).

	"x0	"x1	"x2	"x3	"x4	"x5	"x6	"x7
"3x	ϒ	ϐ	ϑ	φ	ϱ	ϰ	ϲ	ϖ
	ι̰	ϙ		·	«	»	ͺ	ɪ
"4x		Α	Β	Ϲ	Δ	Ε	Φ	Γ
	Η	Ι	Θ	Κ	Λ	Μ	Ν	Ο
"5x	Π	Χ	Ρ	Σ	Τ	ϒ	F	Ω
	Ξ	Ψ	Ζ	Ϛ	Ϟ	Ϡ	Ϊ	Ϋ
"6x		α	β	ς	δ	ε	φ	γ
	η	ι	θ	κ	λ	μ	ν	ο
"7x	π	χ	ρ	σ	τ	υ	ϝ	ω
	ξ	ψ	ζ	ς	ϟ	ϡ	f	
"8x	ἱ	ἰ	ὶ	ί	ῖ	ι̑	ἳ	ἵ
	ἷ	ἱ̑	ἲ	ἴ	ἶ	ἰ̑	ʼ	ˏ
"9x	῾	᾿	`	´	~	̑	῝	῞
	῟	̔̑	῍	῎	῏	̓̑	ˈ	
"Ax	ὡ	ὠ	ὼ	ώ	ῶ	ω̑	ὣ	ὥ
	ὧ	ὡ̑	ὢ	ὤ	ὦ	ὠ̑		
"Bx	ϊ	ῒ	ΐ	ῗ	ϊ̑	ϋ	ῢ	ΰ
	ῧ	ϋ̑	ῥ	ῤ	ϱ̔	ϱ̓		
	"x8	"x9	"xA	"xB	"xC	"xD	"xE	"xF

Table 4: Tentative `OmegaTimesGreek` Glyph Container Table (June 10, 1996).

	"x0	"x1	"x2	"x3	"x4	"x5	"x6	"x7
"2x		Ђ	Є	Ѕ	І	Ј	Љ	Њ
	Ћ	Щ	Џ	Ѡ	Ѥ	Ѧ	Ѩ	Ѫ
"3x	ı	ђ	є	ѕ	і	ј	љ	њ
	ћ	щ	џ	ѡ	ѥ	ѧ	ѩ	ѫ
"4x	Я	А	Б	Ц	Д	Е	Ф	Г
	Ю	И	Ж	К	Л	М	Н	О
"5x	П	Ч	Р	С	Т	У	В	Ш
	Х	Ы	З	Ъ	Ѣ	Ь	Э	
"6x	я	а	б	ц	д	е	ф	г
	ю	и	ж	к	л	м	н	о
"7x	ҧ	ч	р	с	т	у	в	ш
	х	ы	з	ъ	ѣ	ь	э	
"8x	Ғ	Ѭ	Ѯ	Ѱ	Ѳ	Ѵ	Ф	Ѽ
	Ѿ	Ҫ	Ґ	Ғ	Ҕ	Җ	Қ	Ҝ
"9x	⸗	ѭ	ѯ	ѱ	ѳ	ѵ	ф	ѽ
	ѿ	ҫ	ґ	ғ	ҕ	җ	қ	ҝ
"Ax	Ҟ	Ҡ	Ң	Ҥ	Ҧ	Ҩ	Ҭ	Ү
	Ұ	Ҳ	Ҵ	Ҷ	Ҹ	Һ	Ҽ	Ӄ
"Bx	ҟ	ҡ	ң	ҥ	ҧ	ҩ	ҭ	ү
	ұ	ҳ	ҵ	ҷ	ҹ	һ	ҽ	ӄ
"Cx	Ӈ	Ӌ	Ӕ	Ә	Ӡ	Ө	Ҙ	Ҿ
	Ç							
"Dx	ӈ	ӌ	ӕ	ә	ӡ	ө	ҙ	ҿ
	ç							
"Ex	´	¨	`	˘	˝	–	⌐	~
	ʽ	ʼ	ᵕ					
	"x8	"x9	"xA	"xB	"xC	"xD	"xE	"xF

Table 5: Tentative `OmegaTimesCyrillic` Glyph Container Table (June 10, 1996).

	"x0	"x1	"x2	"x3	"x4	"x5	"x6	"x7
"2x	*	،	؛	؟	-	٪	؉	؊
"3x	٠	١	٢	٣	٤	٥	٦	٧
	٨	٩					ﷲ	ﷲ
"4x	ـِ		ـُ	ـْ	ـً	ـٍ	ـٌ	ـٰ
	ـَّ	ـِّ	ـُّ	ـّ	ـًّ	ـٍّ	ـٌّ	ـّٰ
"5x	ءَ	ءِ	ءُ	ء	ءً	ءٍ	ءٌ	ـعـ
	ـٓ	^	ˇ	ـٔ	ـٕ	ـٖ		
"6x	ء	آ	ﺂ	أ	ﺄ	ؤ	ؤ̂	إ̌
	ﺈ	ئ	ﺋ	ﺌ	ﺊ	ا	ﺎ	ب
"7x	ﺑ	ﺒ	ﺐ	ة	ﺔ	ت	ﺗ	ﺘ
	ﺖ	ث	ﺛ	ﺜ	ﺚ	ج	ﺟ	
"8x	ﺠ	ﺞ	ح	ﺣ	ﺤ	ﺢ	خ	ﺧ
	ﺨ	ﺦ	د	ﺪ	ذ	ﺬ	ر	ﺮ
"9x	ز	ﺰ	س	ﺳ	ﺴ	ﺲ	ش	ﺷ
	ﺸ	ﺶ	ص	ﺻ	ﺼ	ﺺ	ض	ﺿ
"Ax	ﻀ	ﺾ	ط	ﻃ	ﻄ	ﻂ	ظ	ﻇ
	ﻈ	ﻆ	ع	ﻋ	ﻌ	ﻊ	غ	ﻏ
"Bx	ﻐ	ﻎ	ف	ﻓ	ﻔ	ﻒ	ق	ﻗ
	ﻘ	ﻖ	ك	ﻛ	ﻜ	ﻚ	ل	ﻟ
"Cx	ﻠ	ﻞ	ﻵ	ﻶ	ﻷ	ﻸ	ﻹ	ﻺ
	ﻻ	ﻼ	م	ﻣ	ﻤ	ﻢ	ن	ﻧ
"Dx	ﻨ	ﻦ	ه	ﻫ	ﻬ	ﻪ	ﻪ	و
	ﻮ	ى	ﻳ	ﻴ	ﻰ	ي	ﻲ	ﻟ
"Ex	ٮ	ـٮـ	ـٮـ	ٮ	ں	ں	ڡ	ڡـ
	ـڡـ	ڡ	ٯ	ٯ	ڤ	ڤـ	ـڤـ	ڤ
"Fx	ٹ	ٹـ	ـٹـ	ٹ	ٽ	ٽـ	ـٽـ	ٽ
	پ	پـ	ـپـ	پ	ٺ	ٺـ	ـٺـ	ٺ
	"x8	"x9	"xA	"xB	"xC	"xD	"xE	"xF

Table 6: Tentative `OmegaTimesArabicOne` Glyph Container Table (June 10, 1996).

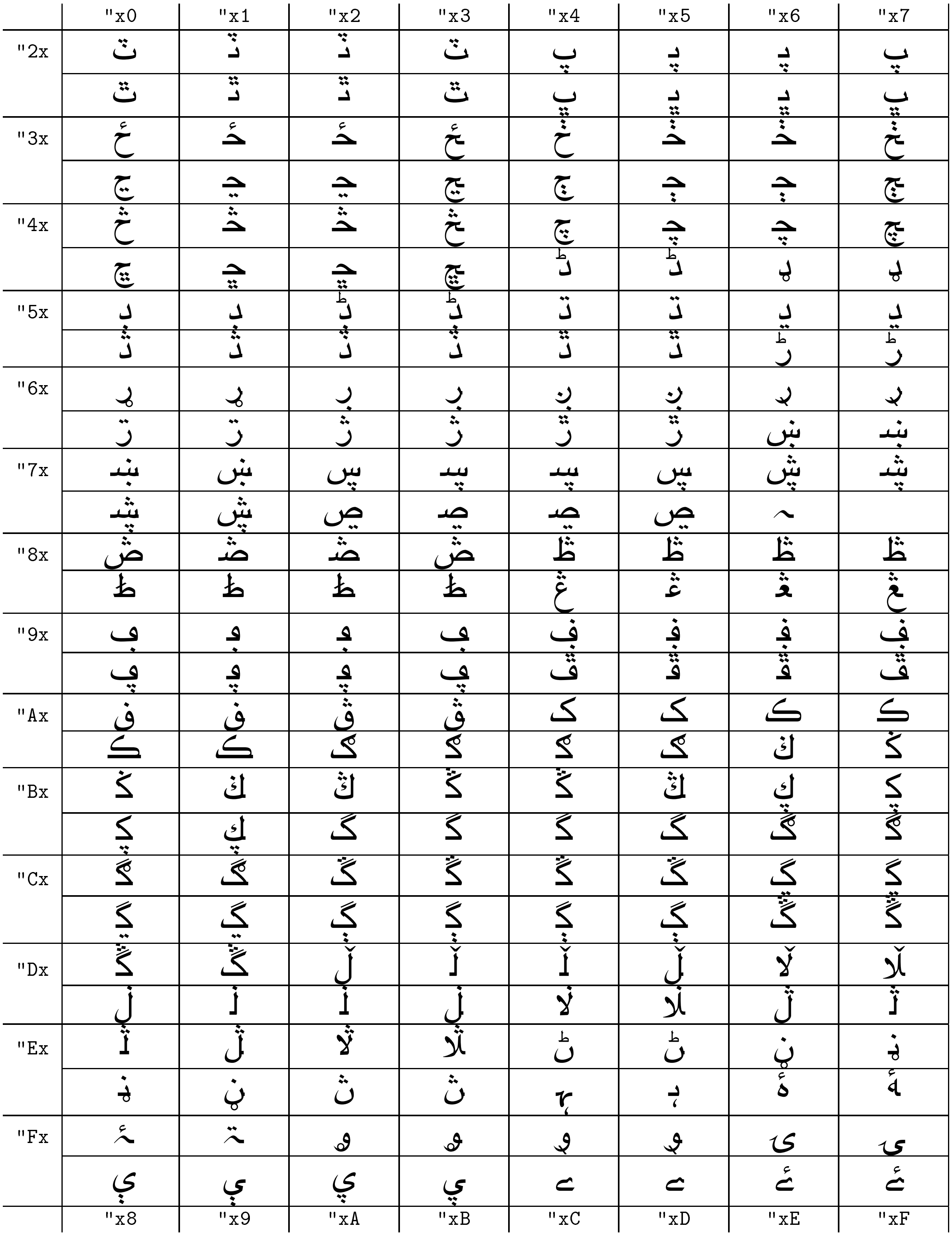

Table 7: Tentative `OmegaTimesArabicTwo` Glyph Container Table (June 10, 1996).

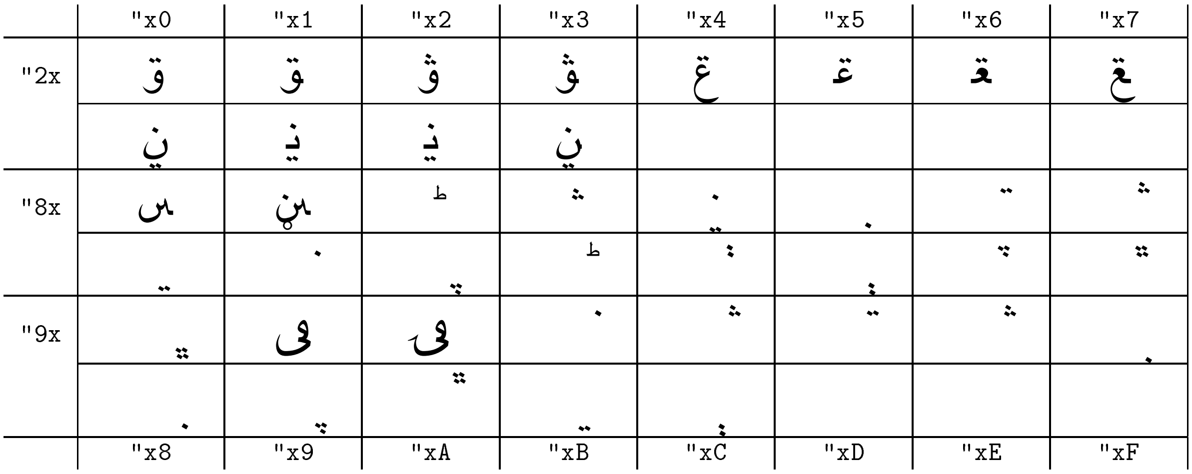

Table 8: Tentative `OmegaTimesArabicThree` Glyph Container Table (June 10, 1996).

Table 9: Tentative `OmegaHelveticaTifinagh` Glyph Container Table (June 10, 1996).

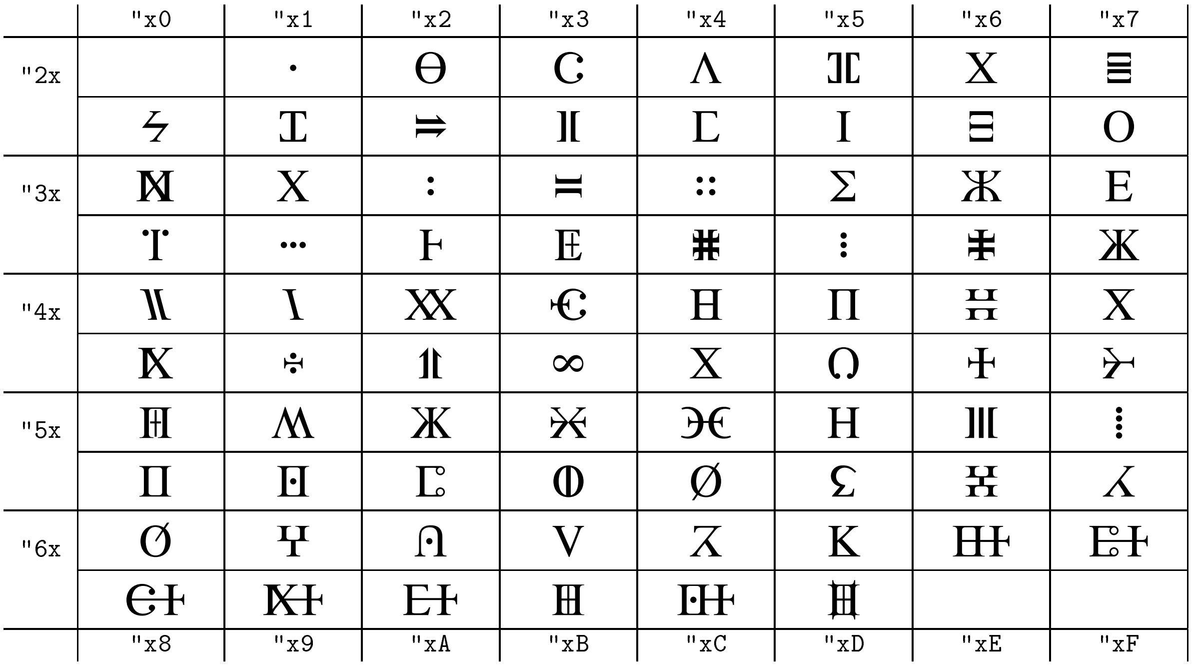

Table 10: Tentative `OmegaTimesTifinagh` Glyph Container Table (June 10, 1996).

Table 11: Tentative `OmegaTimesHebrew` Glyph Container Table (June 10, 1996).