

The XCharter Font Package

Michael Sharpe

August 9, 2017

I Package Features

The *XCharter* fonts are extensions of the Bitstream Charter fonts, adding oldstyle figures (proportionally spaced only), superior figures and small caps in all styles. The original Charter fonts were created by famed font designer Matthew Carter in the late 1980's to enhance legibility of the output from printers of that era (laser, dot matrix, thermal and inkjet) with resolutions that would now be considered low—not far from modern screen resolutions. Their low contrasts, high x-heights and use of piecewise linear outlines where possible may make them interesting again as fonts that will render well on small devices and perhaps projected slides. (It's worth noting that the same designer provided Georgia for Microsoft. It is widely considered to be one of the clearest serified fonts for viewing on screen, and bears a number of similarities to Charter, though the latter is heavier.)

As of version 1.09 (2017-06-25) there is a new collection of Cyrillic glyphs in *XCharter*, copied from Andrey Panov's *Khartiya*, an extension of the free Charter fonts, with small caps included. Some new figure styles were also copied from *Khartiya*—inferiors, numerators and denominators. Along with these additions, there are now slanted versions for those who wish to have both slanted and italic text available to meet distinct semantic purposes. Note that figures and uppercase slanted and italic are almost identical (except for slanted *Q* and italic *Q*) but lower-case forms are distinct.

Support files are provided for T1, TS1, LY1, T2A and OT2 encodings, the latter being to support the Cyrillic component of *XCharter*. The package has a number of options:

- `scaled=.98`, for example, scales all text to 98% of specified size;
- `lining` (or just `lf`) makes lining figures (0123456789) the default for text—this is set automatically and does not need to be entered explicitly;
- `oldstyle` (or `osf`) sets the figure style in text mode to oldstyle (0123456789) with numeral one like a shortened 1, but math mode will always use lining figures;
- `oldstyleI` (or `osfI`) sets the figure style in text mode to oldstyle (0123456789) with numeral one like a shortened I, but math mode will always use lining figures;
- `sup` sets the style for superscript figures (eg, footnote markers) to *XCharter*'s superior figures rather than using the default text inserts in mathematical superscripts. This option has no effect if a KOMA class is in force.
- `scosf` makes oldstyle figures the default in small cap text, no matter what the global figure setting may be.

SPECIAL MACROS:

- `\useosf` (usable only in the preamble) may be used for changing the text figure style to osf though math mode will use lining figures.
- `\useosfI` (usable only in the preamble) may be used for changing the text figure style to osfI though math mode will use lining figures.
- `\textsu` prints its argument in superior figures, eg `\textsu{12}` results in ¹². The effect is the same with `{\sustyle 12}`.
- `\textin` prints its argument in inferior figures, eg `\textin{12}` results in ₁₂. The effect is the same with `{\instyle 12}`.
- `\textlf` prints its argument in lining figures, eg `\textlf{12}` results in 12. The effect is the same with `{\lfstyle 12}`.
- `{\osfstyle 23}` prints 23 using whatever oldstyle option is in force.
- `\textosf` prints its argument in oldstyle figures using, in effect, the osf option—e.g., `\textosf{12}` results in 12.
- `\textosfI` prints its argument in oldstyle figures using, in effect, the osfI option—e.g., `\textosfI{12}` results in 12.
- Numerators and denominators are normally used only for constructing fractions, but may if needed be called using `\textnumerator` and `\textdenominator`. They are about 7% smaller than superiors and inferiors. The `\textfrac` macro allows you to write, e.g., `\textfrac{31}{32}` to get ³¹/₃₂. You may use `\textde` and `\textnu` as abbreviations, though the latter will not be available if `babel` is loaded with greek option.

Three math packages seem to provide reasonable companions for XCharter. The first example uses Charter italics as math italics, but doesn't provide arbitrary scaling and doesn't sufficiently distinguish math italic *v* from mathematical Greek ν . Moreover, it is not easy to redefine `\mathcal` to get a better math calligraphic alphabet—eg, the `mathalfa` package fails. The second uses `libertine` italics and Greek in math mode, which is a good match to Charter in style and weight after scaling up, is arbitrarily scalable, has distinct math italic *v* and mathematical Greek ν , and is completely compatible with `mathalfa`. The third is a new revision of `newtxmath` with option `charter` (or, equivalently, `xcharter`), which substitutes Charter italics as math italics and uses a back-slanted version of its slanted Greek symbols. This version is scalable and has a math italic *v* (plus a matching *w*) distinct from ν .

EXAMPLE 1:

```
\usepackage[charter,expert]{mathdesign}
\usepackage[scaled=.96,osf]{XCharter}% matches the size used in math
\linespread{1.04}
```

EXAMPLE 2:

```
\usepackage[scaled=.98,sups,osf]{XCharter}% lining figures in math, osf in text
\usepackage[scaled=1.04,varqu,varl]{inconsolata}% inconsolata typewriter
\usepackage[type1]{cabin}% sans serif
\usepackage[libertine,vvarbb,scaled=1.07]{newtxmath}
```

```
\usepackage[cal=boondoxo]{mathalfa}
\linespread{1.04}
```

EXAMPLE 3:

```
\usepackage[scaled=.98,sups,osf]{XCharter}% lining figures in math, osf in text
\usepackage[scaled=1.04,varqu,varl]{inconsolata}% inconsolata typewriter
\usepackage[type1]{cabin}% sans serif
\usepackage[charter,vvarbb,scaled=1.07]{newtxmath}
\usepackage[cal=boondoxo]{mathalfa}
\linespread{1.04}
```

EXAMPLE 4:

```
\usepackage[<specify babel languages>]{babel}% load before XCharter
\usepackage[scaled=.98,sups,osf]{XCharter}% osf in text, lining figures in math
\usepackage[scaled=1.04,varqu,varl]{inconsolata}% inconsolata typewriter
\usepackage[type1]{cabin}% sans serif
\usepackage[charter,vvarbb,scaled=1.07]{newtxmath}
\usepackage[cal=boondoxo]{mathalfa}
\linespread{1.04}
```

Here is a short sample based on the preamble of EXAMPLE 3:

The typeset math below follows the ISO recommendations that only variables be set in italic. Note the use of upright shapes for d , e and π . (The first two are entered as d and e , and in fonts derived from newtxmath or mtpro2, the latter is entered as \uppi .)

Simplest form of the Central Limit Theorem: Let X_1, X_2, \dots be a sequence of iid random variables with mean 0 and variance 1 on a probability space $(\Omega, \mathcal{F}, \mathbb{P})$. Then

$$\mathbb{P}\left(\frac{X_1 + \dots + X_n}{\sqrt{n}} \leq y\right) \rightarrow \mathfrak{N}(y) := \int_{-\infty}^y \frac{e^{-v^2/2}}{\sqrt{2\pi}} dv \quad \text{as } n \rightarrow \infty,$$

or, equivalently, letting $S_n := \sum_1^n X_k$,

$$\mathbb{E}f\left(S_n/\sqrt{n}\right) \rightarrow \int_{-\infty}^{\infty} f(v) \frac{e^{-v^2/2}}{\sqrt{2\pi}} dv \quad \text{as } n \rightarrow \infty, \text{ for every } f \in \mathcal{b}\mathcal{C}(\mathbb{R}).$$

2 Text effects under fontaxes

This package loads the fontaxes package in order to access italic and slanted small caps. You should pay attention to the fact that fontaxes modifies the behavior of some basic \LaTeX text macros such as \textsc and \textup . Under normal \LaTeX , some text effects are combined, so that, for example, $\text{\textbf{\textit{\textup{a}}}}$ produces bold italic a , while other effects are not, e.g., $\text{\textsc{\textup{a}}}$ has the same effect as $\text{\textup{a}}$, producing the letter a in upright, not small cap, style. With fontaxes, $\text{\textsc{\textup{a}}}$ produces instead upright small cap a . It offers a macro \texttulc that undoes small caps, so that, eg, $\text{\textsc{\texttulc{a}}}$ produces a in non-small cap mode, with whatever other style choices were in force, such as bold or italics.

3 Usage with fontspec

Because the package supplies a file named `XCharter.fontspec` whose contents list the `otf` files that correspond to each of Regular, Bold, Italic, BoldItalic, Slanted and BoldSlanted, you may load `XCharter` with just

```
\usepackage{fontspec}
\setmainfont{XCharter}
```

With unicode-encoded text, you will, in particular, have complete access to the newly added Cyrillic glyphs.

4 Using Cyrillic with pdflatex

The OT2 encoding, now considered as obsolete because it is 7-bit, is nonetheless useful to scholars who wish to write short segments using a Cyrillic script from a Western keyboard. There are two means of doing this, one using control sequences for the characters (e.g., `\CYRA` for Cyrillic A) and the other using ligatures to access the characters. Tables setting out the substitutions available may be consulted at <http://herbert.the-little-red-haired-girl.org/dvi/pdf/cyrillic.pdf>.

Note that, while the OT2 encoded font is complete, there are many gaps in the T2A encoded version, so that only Modern Russian and Ukrainian are fully covered, along with a number of characters from Old Russian and other Slavic languages.

`XCHARTER-ROMAN-TLF-OT2.TFM`:

	´0	´1	´2	´3	´4	´5	´6	´7	
´00x	Ъ ₀	Ь ₁	Ц ₂	Э ₃	І ₄	Є ₅	Ђ ₆	Ѓ ₇	"0x
´01x	Ъ ₈	Ь ₉	Ц ₁₀	Э ₁₁	і ₁₂	є ₁₃	ђ ₁₄	ѓ ₁₅	
´02x	Ю ₁₆	Ж ₁₇	Й ₁₈	Ё ₁₉	Ѹ ₂₀	Ө ₂₁	Ѕ ₂₂	Я ₂₃	"1x
´03x	ю ₂₄	ж ₂₅	й ₂₆	ё ₂₇	ѹ ₂₈	ө ₂₉	ѕ ₃₀	я ₃₁	
´04x	¨ ₃₂	! ₃₃	" ₃₄	Ђ ₃₅	˘ ₃₆	% ₃₇	' ₃₈	' ₃₉	"2x
´05x	(₄₀)	)₄₁	* ₄₂	Ђ ₄₃	, ₄₄	- ₄₅	. ₄₆	/ ₄₇	
´06x	0 ₄₈	1 ₄₉	2 ₅₀	3 ₅₁	4 ₅₂	5 ₅₃	6 ₅₄	7 ₅₅	"3x
´07x	8 ₅₆	9 ₅₇	: ₅₈	; ₅₉	« ₆₀	1 ₆₁	» ₆₂	? ₆₃	
´10x	˘ ₆₄	А ₆₅	Б ₆₆	Ц ₆₇	Д ₆₈	Е ₆₉	Ф ₇₀	Г ₇₁	"4x
´11x	Х ₇₂	И ₇₃	Ј ₇₄	К ₇₅	Л ₇₆	М ₇₇	Н ₇₈	О ₇₉	
´12x	П ₈₀	Ч ₈₁	Р ₈₂	С ₈₃	Т ₈₄	У ₈₅	В ₈₆	Щ ₈₇	"5x
´13x	Ш ₈₈	Ы ₈₉	З ₉₀	[₉₁	" ₉₂	]₉₃	Ь ₉₄	Ђ ₉₅	
´14x	' ₉₆	а ₉₇	б ₉₈	ц ₉₉	д ₁₀₀	е ₁₀₁	ф ₁₀₂	г ₁₀₃	"6x
´15x	х ₁₀₄	и ₁₀₅	ј ₁₀₆	к ₁₀₇	л ₁₀₈	м ₁₀₉	н ₁₁₀	о ₁₁₁	
´16x	п ₁₁₂	ч ₁₁₃	р ₁₁₄	с ₁₁₅	т ₁₁₆	у ₁₁₇	в ₁₁₈	щ ₁₁₉	"7x
´17x	ш ₁₂₀	ы ₁₂₁	з ₁₂₂	— ₁₂₃	— ₁₂₄	№ ₁₂₅	Ь ₁₂₆	Ђ ₁₂₇	
	"8	"9	"A	"B	"C	"D	"E	"F	

EXAMPLE OT2 PREAMBLE:

```
\documentclass{article}
\usepackage[OT2,T1]{fontenc} % loads ot2enc.def
\newcommand\cyrtext{%
\fontfamily{XCharter-TLF}\fontencoding{OT2}\selectfont} % declaration
\DeclareTextFontCommand{\textcyr}{\cyrtext} %macro with argument
```

The Russian part of the following sentence is entered as `\textcyr{a e1to --- po-russki}`.

This is text in English, then Russian: а это — по-русски.

USING T2A WITH T1:

Here's an example of using XCharter text and math, set up to allow the use of Russian with English as the main language.

```
\usepackage[OT2,T2A,T1]{fontenc} % spell out all text encodings to be used
\usepackage[utf8]{inputenc} %
\usepackage{substitutefont} % so we can use fonts other than those specified in babel
\usepackage[russian,english]{babel}
\usepackage{XCharter} %
\usepackage[charter,vvarbb,scaled=1.07]{newtxmath}
\useosf % use oldstyle figures except in math
\substitutefont{T2A}{\rmdefault}{XCharter} % use XCharter to render Russian
%\substitutefont{OT2}{\rmdefault}{XCharter} % poor man's version
```

Any utf8-encoded text typed outside of a `\foreignlanguage{}{}` block will be rendered as T1-encoded XCharter, while that within `\foreignlanguage{russian}{}` will render as T2A-encoded Cyrillic.

XCHARTER-ROMAN-TLF-T2A.TFM:

	'0	'1	'2	'3	'4	'5	'6	'7	
'00x	` ₀	' ₁	^ ₂	~ ₃	¨ ₄	˝ ₅	° ₆	ˇ ₇	"0x
'01x	˘ ₈	ˉ ₉	˙ ₁₀	˚ ₁₁	˛ ₁₂	I ₁₃	fb ₁₄	fh ₁₅	
'02x	“ ₁₆	” ₁₇	ƒj ₁₈	fk ₁₉	˘ ₂₀	— ₂₁	— ₂₂	₂₃	"1x
'03x	₂₄	l ₂₅	J ₂₆	ff ₂₇	fi ₂₈	fl ₂₉	ffi ₃₀	ffl ₃₁	
'04x	˘ ₃₂	! ₃₃	" ₃₄	# ₃₅	\$ ₃₆	% ₃₇	& ₃₈	' ₃₉	"2x
'05x	(₄₀)	)₄₁	* ₄₂	+ ₄₃	, ₄₄	- ₄₅	. ₄₆	/ ₄₇	
'06x	0 ₄₈	1 ₄₉	2 ₅₀	3 ₅₁	4 ₅₂	5 ₅₃	6 ₅₄	7 ₅₅	"3x
'07x	8 ₅₆	9 ₅₇	: ₅₈	; ₅₉	< ₆₀	= ₆₁	> ₆₂	? ₆₃	
'10x	@ ₆₄	A ₆₅	B ₆₆	C ₆₇	D ₆₈	E ₆₉	F ₇₀	G ₇₁	"4x
'11x	H ₇₂	I ₇₃	J ₇₄	K ₇₅	L ₇₆	M ₇₇	N ₇₈	O ₇₉	
'12x	P ₈₀	Q ₈₁	R ₈₂	S ₈₃	T ₈₄	U ₈₅	V ₈₆	W ₈₇	"5x
'13x	X ₈₈	Y ₈₉	Z ₉₀	[₉₁	\ ₉₂	]₉₃	^ ₉₄	_ ₉₅	
'14x	' ₉₆	a ₉₇	b ₉₈	c ₉₉	d ₁₀₀	e ₁₀₁	f ₁₀₂	g ₁₀₃	"6x
'15x	h ₁₀₄	i ₁₀₅	j ₁₀₆	k ₁₀₇	l ₁₀₈	m ₁₀₉	n ₁₁₀	o ₁₁₁	
'16x	p ₁₁₂	q ₁₁₃	r ₁₁₄	s ₁₁₅	t ₁₁₆	u ₁₁₇	v ₁₁₈	w ₁₁₉	"7x
'17x	x ₁₂₀	y ₁₂₁	z ₁₂₂	{ ₁₂₃	|₁₂₄	} ₁₂₅	~ ₁₂₆	- ₁₂₇	
'20x	Г ₁₂₈	₁₂₉	Ђ ₁₃₀	Ђ ₁₃₁	₁₃₂	₁₃₃	₁₃₄	Љ ₁₃₅	"8x
'21x	Ї ₁₃₆	₁₃₇	₁₃₈	₁₃₉	Æ ₁₄₀	₁₄₁	₁₄₂	Š ₁₄₃	
'22x	₁₄₄	Ç ₁₄₅	Ÿ ₁₄₆	Y ₁₄₇	₁₄₈	₁₄₉	Ц ₁₅₀	₁₅₁	"9x
'23x	₁₅₂	€ ₁₅₃	₁₅₄	Њ ₁₅₅	Ë ₁₅₆	№ ₁₅₇	Ɔ ₁₅₈	§ ₁₅₉	
'24x	Г ₁₆₀	₁₆₁	ђ ₁₆₂	ћ ₁₆₃	h ₁₆₄	₁₆₅	₁₆₆	љ ₁₆₇	"Ax
'25x	ï ₁₆₈	₁₆₉	₁₇₀	₁₇₁	æ ₁₇₂	₁₇₃	₁₇₄	š ₁₇₅	
'26x	₁₇₆	ç ₁₇₇	ŷ ₁₇₈	₁₇₉	₁₈₀	₁₈₁	ц ₁₈₂	₁₈₃	"Bx
'27x	₁₈₄	€ ₁₈₅	₁₈₆	њ ₁₈₇	ë ₁₈₈	„ ₁₈₉	« ₁₉₀	» ₁₉₁	
'30x	А ₁₉₂	Б ₁₉₃	В ₁₉₄	Г ₁₉₅	Д ₁₉₆	Е ₁₉₇	Ж ₁₉₈	З ₁₉₉	"Cx
'31x	И ₂₀₀	Й ₂₀₁	К ₂₀₂	Л ₂₀₃	М ₂₀₄	Н ₂₀₅	О ₂₀₆	П ₂₀₇	
'32x	Р ₂₀₈	С ₂₀₉	Т ₂₁₀	У ₂₁₁	Ф ₂₁₂	Х ₂₁₃	Ц ₂₁₄	Ч ₂₁₅	"Dx
'33x	Ш ₂₁₆	Щ ₂₁₇	Ъ ₂₁₈	Ы ₂₁₉	Ь ₂₂₀	Э ₂₂₁	Ю ₂₂₂	Я ₂₂₃	
'34x	а ₂₂₄	б ₂₂₅	в ₂₂₆	г ₂₂₇	д ₂₂₈	е ₂₂₉	ж ₂₃₀	з ₂₃₁	"Ex
'35x	и ₂₃₂	й ₂₃₃	к ₂₃₄	л ₂₃₅	м ₂₃₆	н ₂₃₇	о ₂₃₈	п ₂₃₉	
'36x	р ₂₄₀	с ₂₄₁	т ₂₄₂	у ₂₄₃	ф ₂₄₄	х ₂₄₅	ц ₂₄₆	ч ₂₄₇	"Fx
'37x	ш ₂₄₈	щ ₂₄₉	ъ ₂₅₀	ы ₂₅₁	ь ₂₅₂	э ₂₅₃	ю ₂₅₄	я ₂₅₅	
	"8	"9	"A	"B	"C	"D	"E	"F	

NOTE: Currently, the \TeX support files for T2A encoded XCharter cover only the figure styles lining, oldstyle and superiors.