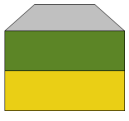
CARDO

A Unicode Font for
Biblical, Classical,
Medieval Studies
and for Linguistics

Version 1.04

USER'S MANUAL

David J. Perry

Greentop  Publishing

Manual for the Cardo font, version 1.04

Version 1.04 released April 2011. Information about the most recent version can be obtained from the author's website, http://scholarsfonts.net.

The body of this manual is set in Cardo, with Myriad Pro used for headings and for the names of packages and Consolas for code samples. Keyboard keys are shown in the Linux Biolinum Keyboard font.

The portrait of Pietro Bembo (page iv) and the page from his book *De Aetna* (page 4) are taken from Wikimedia Commons, http://commons.wiki media.org/wiki/Main_Page, and are believed to be in the public domain.

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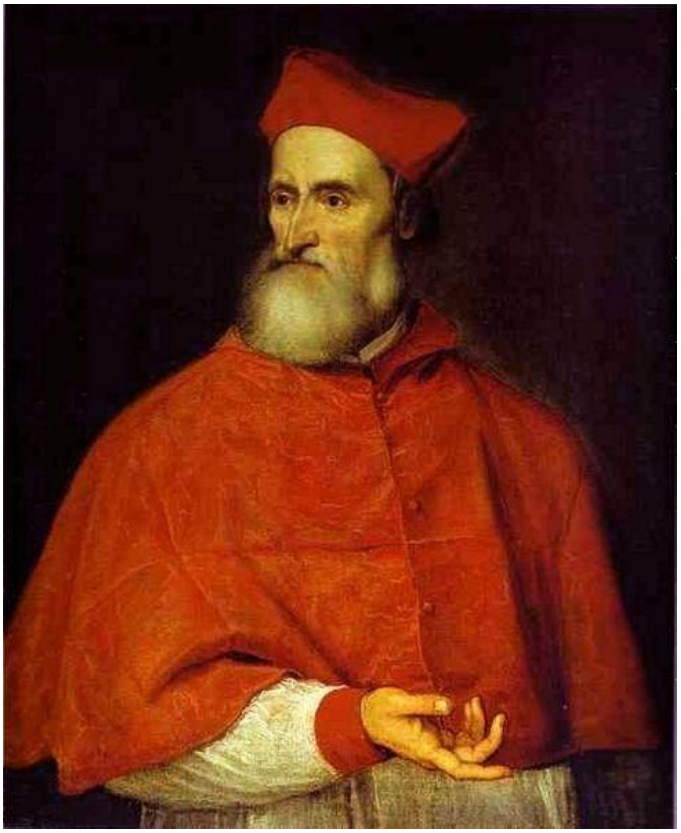


Portrait of Pietro Bembo by Titian. This imposing portrait shows Bembo as an old man after his appointment as a Cardinal in 1539. See “Origin and Design” on page 5 for more about Bembo's connection to a typeface.

Introduction 1

1.1 This version of Cardo

VERSION 1.04 is a significant upgrade to Cardo. There is not a huge number of new characters, compared to the 1400 that were added in version .98. This release does, however, bring Cardo up to date with Unicode 5.2[1] and version 3.0 of the MUFI recommendation; the majority of new characters in this release belong to the latter. Another significant addition consists of several characters needed for Roman epigraphy that I proposed for Unicode. This release is the first to include italic and boldface versions as part of the master Cardo package (the italic was initially released separately in February 2011). For complete details about the new characters in this version, see page 11.

The most recent version of Cardo can always be obtained from the author's website, http://scholarsfonts.net.

Plans for future versions include adding the Runic and Gothic blocks and glyph variants for the Old Italic characters. I also plan to add additional characters to the italic and boldface versions, particularly to support Greek.

1.2 Getting Started

Installing the Font

In general, you install Cardo the same way that you would install any other font into your operating system. If you are not accustomed to adding fonts, see the following sections.

First, on any operating system, extract the font files from the zip archive you downloaded. You can put the files anywhere you want, as long as you can find them later; the desktop works fine.

[1] Unicode 6.0 had been released at the time this was written, but 6.0 contains no new characters that were considered appropriate for Cardo.

Mac OS X

If you have OS 10.3 or more recent, it is probably best to use the facilities provided by Font Book (or one of its third-party competitors) to manage your fonts. However, you can still drag fonts to the appropriate directory if you wish. The two best places are /Library/Fonts, which will make the font(s) available to anyone using the computer, or ~/Library/Fonts, which allows only the person in whose directory the font appears to use it.

Windows

There are several ways to install fonts, depending partly on which version of Windows you have.

- The easiest, if you have Vista or Win7, is to right-click on the font file and choose Install from the popup menu.
- Open a directory window of C:\Windows and drop the font file(s) onto the Fonts folder.
- Open a directory of C:\Windows\Fonts:
    - Drag the font file(s) into the \Fonts directory OR
    - Click the Alt key to open the menu bar, then choose File▸Install New Font; navigate to the folder containing the font file(s) and double-click to install. (In older versions of Windows, the menu bar is displayed automatically.)

Linux

Because the exact process for installing fonts varies depending on your Linux distribution, it is not possible to give complete instructions here. One good resource is http://www.linuxjournal.com/content/installing-fonts-linux. After you install the font(s), you should log out and back in again to make sure that the new font(s) will be available to all applications.

On-screen versus Printed Appearance

Please remember that the print quality will normally be better than the on-screen display. If you have Windows XP or more recent and an LCD monitor, the appearance of Cardo may be greatly improved if you turn on ClearType font smoothing. For directions, see http://scholarsfonts.net/clear_type.html. Mac OS X now offers a similar anti-aliasing technology. I am told that Linux does a better job of rendering Cardo (at least the TrueType version) on-screen than Windows does.

.ttf versus .otf Versions

Up through to v. 1.04, Cardo has been distributed only as an OpenType font with TrueType outlines (file extension `.ttf`, also known as TrueType-flavor OT). Future

versions may include both `.ttf` files and PostScript-flavor OT font files (extension `.otf`).[2] There seems to be great variability in on-screen appearance: some find the `.otf` versions better, for others the `.ttf` versions look more attractive. This seems to depend on the combination of hardware and software on your computer.

Don't install both versions at once.

1.3 About This Manual

If you wish to print the manual, it has been set up to come out correctly if your printer supports double-sided printing. Remember that your printer settings can affect the quality of the output. You can print on either US letter paper or on the A4 paper used in many other countries without reformatting.

Chapter 2 presents general information about Cardo while Chapter 3 deals with the characters that Cardo contains. The OpenType features of Cardo are explained in Chapter 4. Chapter 5 provides tables that show all the Private Use characters in Cardo, since there is no other way for users to know what is available; but please see the cautions about using the Private Use Area found on page 23. These tables are printed with a green shading as an additional reminder that PUA characters should always be used with caution.

Names of characters on the keyboard are given in a boxed sans-serif font (Shift, Alt), etc.) Clickable links in the PDF, whether to external URLs or to other locations in this document, are in blue.

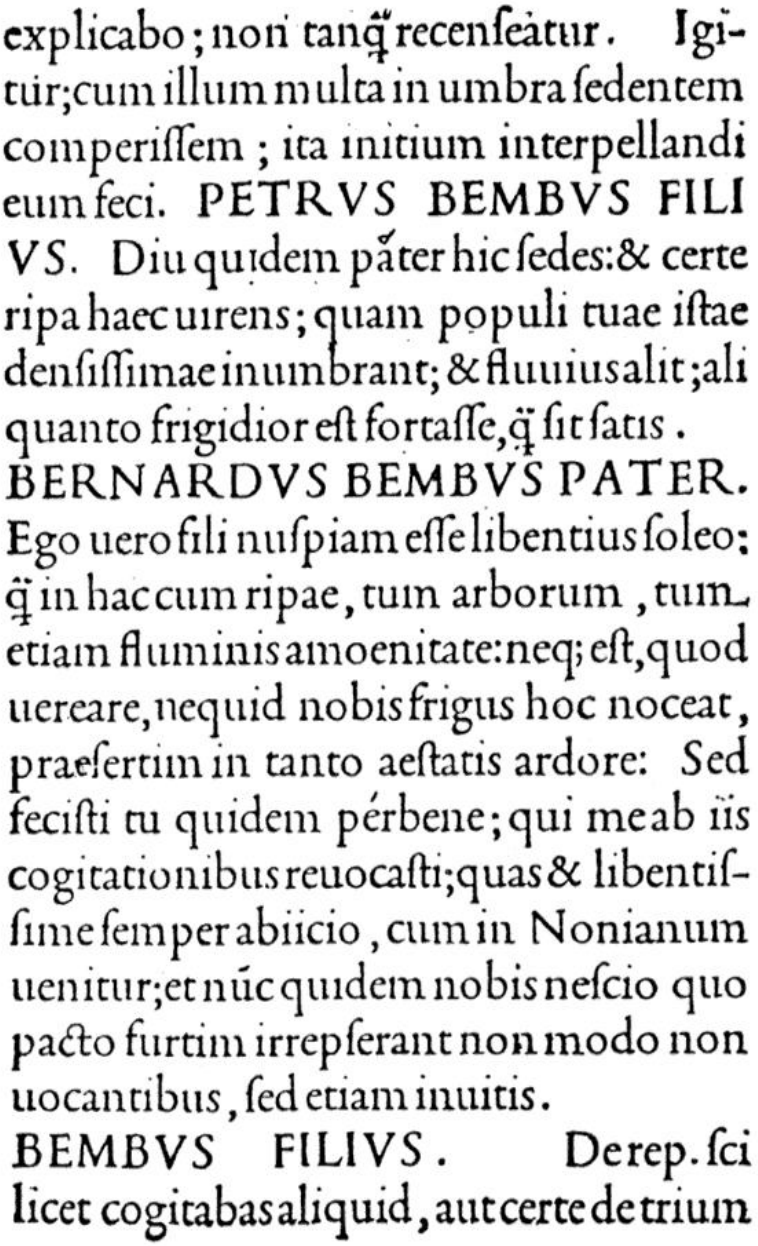
1.4 For Additional Information

To take advantage of everything that a font such as Cardo has to offer, you may need additional information such as the following:

- What special characters for scholars are available in Unicode?
- What issues are involved in using Unicode Greek or Hebrew?
- How can I enter unusual characters into my documents easily?
- What are combining marks and why are they important?
- What are OpenType features and why are the useful?

These and many other issues are addressed in depth in my book *Document Preparation for Classical Languages*, second edition. Rather than repeat information such as how to enter characters into your document in this manual, I have given references to *Document Preparation* where the information is discussed in greater depth than it could be here. *Document Preparation* is available as a downloadable PDF and as a color or black and white paperback (xiii + 218 pp); for samples and information about how to order see http://scholarsfonts. net/docproc.

[2] I would include both in the current release, but do not have good software at the present time to add the the OpenType positioning tables to `.otf` fonts; I hope this will change soon.


explicabo; non tanq̃ recenſeatur. Igi-
tur; cum illum multa in umbra ſedentem
comperiſſem ; ita initium interpellandi
eum feci. PETRVS BEMBVS FILI
VS. Diu quidem pãter hic ſedes: & certe
ripa haec uirens; quam populi tuae iſtae
denſiſſimae inumbrant; & fluuius alit; ali
quanto frigidior eſt fortaſſe, q̃ ſit ſatis .
BERNARDVS BEMBVS PATER.
Ego uero fili nuſpiam eſſe libentius ſoleo;
q̃ in hac cum ripae, tum arborum , tum
etiam fluminis amoenitate: neq; eſt, quod
uereare, nequid nobis frigus hoc noceat,
praeſertim in tanto aeſtatis ardore: Sed
feciſti tu quidem pérbene; qui me ab iis
cogitationibus reuocaſti; quas & libentiſ-
ſime ſemper abiicio , cum in Nonianum
uenitur; et nũc quidem nobis neſcio quo
pacto furtim irrepſerant non modo non
uocantibus , ſed etiam inuitis.
BEMBVS FILIVS. De rep. ſci
licet cogitabas aliquid, aut certe de trium

A sample of the type from Pietro Bembo's *De Aetna*, published by Aldus Manutius in 1496. As with many early printed books, *De Aetna* makes use of abbreviations that reflect the practice of handwritten manuscripts; e.g., the abbreviation for *tanquam* on the first line. Note also the use of the long 's', as in *densissimae*, line 7, and throughout the page. The alternate 'm' at the end of line 11 is available in Cardo as an alternate glyph for the standard 'm'. The 'ct' ligature in the fourth line from the bottom is included in the Discretionary Ligatures feature.

About Cardo 2

2.1 General Information about Cardo

Cardo is a large Unicode font[3] specifically designed for the needs of classicists, biblical scholars, medievalists, and linguists. Since it may be used to prepare materials for publication, it also contains features that are required for high-quality typography, such as ligatures, text figures (also known as old style numerals), true small capitals and a variety of punctuation and space characters. It may also be used to document and discuss the features of Unicode that are applicable to the these disciplines, as we work to help colleagues understand the value (and limitations) of Unicode.

Cardo is freely available, subject to the license terms given below. I do have one request: if you find the font useful, or if you have suggestions for improvement, please email me and tell me about what you are doing with Cardo (see Contact Information below). Knowing that people are using the font makes the time and effort I put into it worthwhile.

2.2 Origin and Design

This font is my version of a typeface cut by Francesco Griffo for the Renaissance printer Aldus Manutius. It was first used to print *De Aetna*, an account by the young Italian scholar and poet Pietro Bembo of his visit to the famous volcano (see the sample on page 4). This typeface was first revived by Stanley Morrison for the Monotype Corporation in 1929 under the name Bembo and has since appeared in several versions (Aetna, Aldine 401 and others). I chose it mainly because it is a classic book face, suitable for scholarship, and also because it is easier to get various diacritics sized and positioned for legibility with this design than with some others.

Origin of the name Cardo.

The name Cardo is an allusion to Bembo's appointment late in life as a Cardinal in the Catholic Church, as he is shown in the famous painting by Titian (page iv). More importantly, however, *cardo*, the Latin word for “hinge," suggests my original motivation for getting involved in font production. In the late 1990s I had become

[3] “Large” refers to the number of characters and Unicode ranges supported. One website states that the reference is to the rather tall ascenders and descenders in Cardo; not so.

very interested in Unicode and the advantages that it offered for multilingual and scholarly computing. I wanted to experiment with using Unicode, add characters that were missing from most available fonts, use the PUA for characters not yet encoded, and share the results of my work. At the time, there was no suitable font that I could legally modify. That may seem like a strange statement now (2011), when there are a number of good-quality open source fonts available; but such was the case at the time. So I decided to try creating my own to "open the door," so to speak, to Unicode and advanced font features for scholars.

All characters were drawn by me after studying printed versions of the fonts mentioned above. In order to support many languages, I have designed many additional Latin letters not found in the original samples I consulted and have added a large number of symbols that are useful for scholars.

The Greek letters.

The Greek characters were designed to appear well when mixed with the Latin letterforms of Cardo. Designing Greek characters for such a purpose presents a different set of challenges than designing a standalone Greek font. While I do not believe that these are the most beautiful or elegant Greek characters ever designed, I do think they succeed in working with the Latin characters and, perhaps more important, are legible at text sizes. The accents have been placed farther from the base characters than is often done. This positioning will be obvious when Greek text is printed at large sizes; however, at normal text sizes the larger distance between base character and accent helps keep the accents clear.

The Hebrew characters.

The Hebrew letters, vowels, and accents are designed to match those used in the *Biblia Hebraica Stuttgartensia* (BHS) as closely as possible and so have no claim to originality. As with the Greek characters, the Hebrew vowels and accents have been made large enough to be easily legible at text sizes.

2.3 System Requirements

This is a large Unicode font.

Mac OS X.

On the Mac, you need OS X plus a Unicode-aware editor or word processor. An excellent option is Mellel, a Unicode-based word processor designed for scholars. It supports OpenType beginning with version 1.8—this was a first for the Mac—and it easily handles right to left text. Mac Word 2004 and 2008 are Unicode-based, but Word 2001 and X do not work. You can also use recent versions of OpenOffice, NeoOffice, Nisus, and other word processors.

Windows.

For Windows, you need at least Windows 2000 and a word processor that can handle Unicode-based documents: either Microsoft Word 97 or more recent, or OpenOffice 3.2[4] or later. (For more information about OpenOffice, a full-featured, open-source suite comparable to Microsoft Office that is attacting considerable interest these days, see www.openoffice.org; note however that OpenOffice does not yet

[4] OpenOffice has handled Unicode well since version 1.0, but support for OpenType fonts was not introduced until 3.2 in 2009.

handle characters in the supplementary planes.) If you want to use Hebrew in true right-to-left fashion, you must have at least Word 2000 or XP running under Windows 2000 or XP. Current versions of OpenOffice also support RTL text; early versions did not. You can also use a plain text Unicode editor; one excellent choice is Babel Pad (freely available from http://www.babelstone.co.uk/).

You can browse the contents of any font and copy characters to the clipboard by using the Character Map utility that comes with Windows. Character Map still does not support Unicode values beyond the Basic Multilingual Plane; an excellent alternative is Andrew West's BabelMap, freely available from his web site at the following url; http://www.babelstone.co.uk/.

Linux.

For Linux systems: As far as I know, Cardo works on all current Linux distributions.

Entering characters into your docu-

Regardless of your operating system or software, you need a way to get all these characters into your documents. Chapter 4 of *Document Preparation* (see page 3) goes into great detail about all the different ways to accomplish this task on Windows and OS X, including installing keyboards for specific languages, customizing keyboards, and using utilities such as BabelMap and Character Palette. Cardo contains many characters located in the Supplementary Planes of Unicode. See below under "Accessing Characters in the Supplementary Planes" (page 22) for more details about how to use these characters.

2.4 About the Italic and Boldface Versions

Many users have requested italic and bold versions of Cardo, particularly the italic which is needed for book titles and such. An italic and a boldface font are included with ver. 1.04. Because Cardo contains so many characters, creating these additional fonts is a major undertaking. Therefore they both will be released in stages, beginning with the Latin characters. The chart on page 19 shows which characters are present in the different versions as of April 2011. I do plan to add more characters to the italic in the future. Check the web page for updated font files and an updated chart showing which characters have been created. Users will also note that the bold and italic fonts contain all the characters in Cardo roman, but only a certain percentage of them have been made bold or italic. It is much easier to construct the OpenType features if I leave all characters in the font rather than delete them and add them back after they are made bold or italic.

2.5 General Usage Notes

Kerning

'Kerning' is the typographer's term for adjusting the space between letters for best appearance. Without kerning, some words contain noticeable white space between the letters. Compare the following:

AWAY AWAY

The word on the left in the previous line has no kerning, while kerning has been applied to the word on the right.

For best appearance, always turn on kerning in your word processor (except at very small sizes, 9 or 10 points and smaller). In Cardo, this is particularly important in the italic, which has more kern pairs than the roman and boldface fonts. See Figure 1 on page 28 for a screenshot showing how to do this in Word for Windows.

Horizontal Spacing

Kerning, discussed above, is one aspect of the horizontal spacing of characters. Graphics people refer to this horizontal spacing as "tracking." The letterspacing in Cardo is fairly tight. You may wish to experiment with loosening the tracking a small—very small—amount using the controls in your word processor or page layout program. Let your eyes be the guide here; if it looks good, then leave it alone.

Text set in all capitals should normally have the tracking increased. This is true of almost all fonts, not just Cardo.

2.6 Limitations and Known Problems

Character design and repertoire are not final. Please send me any comments that you have so that I can improve future versions. The most recent version will always be available from my web page, which is located at http://scholarsfonts.net.

About Combining Marks

Definitions.

A combining mark is an accent or diacritical mark that is designed to be positioned over a base letter. The Unicode Standard contains many combinations of base letter plus accent mark, such as Ä or Ū. These are referred to as precomposed combinations because they are encoded as single units, rather than in decomposed form as a base letter followed by a combining mark.

Some time ago the Unicode Consortium decided not to include any additional precomposed combinations in the Standard. See §1.6 of *Document Preparation*, page 12ff., for a very detailed discussion of the whole issue of combining marks. This decision caused problems because for a long time there was almost no support for combining marks in fonts and word processors. A font must contain OpenType tables to

position the combining accents properly and software must be written to make use of these tables. Many recent programs will position combining marks properly, if the font supports them; for instance, Microsoft Word for Windows has done so since version 2003.

Functionality of combining marks in Cardo.

Cardo contains all the combining marks in the Unicode Standard that are applicable to the Latin and Greek scripts, but I have not yet created the necessary OpenType positioning features to make them work well. This is definitely on my to-do list for a future version. As a "down payment" on this task I have added lookups to Cardo roman 1.04 that position the combining underdot correctly under Latin and Greek letters. An underdot is very often used to indicate doubtful readings and I thought this would be a helpful place to begin. This version also automatically replaces a normal 'i' or 'j' with a dotless version when a combining accent above follows and the accent is properly positioned. Note that that the combining marks in version 1.04 automatically back up over the previous character—but not necessarily by the right amount, except for the combining underdot or marks over 'i' and 'j', nor will combining marks above be raised to fit correctly over capital letters.[5]

So: if you need particular combinations of base letter plus combining mark, please let me know. My interest right now is in supporting combinations that do not exist in precomposed form in Unicode. Perhaps ultimately I will support all the precomposed combinations in decomposed form, but that will be a lot of work and there is normally no reason to avoid using the precomposed versions.

If you are looking for fonts that do support combining marks, I can recommend two, both open source fonts:

Charis SIL	http://scripts.sil.org/CharisSILfont and
Junicode	http://junicode.sourceforge.net/.

Problems with Extra-tall Characters

Cardo contains a number of characters that are significantly taller than average. These include all the capital letters with two accent marks, h-circumflex, and some of the combining Latin letters from the MUFI recommendation found in the PUA at U+F011–U+F02C.

The tops of such characters will be clipped off on screen in many Windows applications. (In some cases the clipping will not be noticeable unless you zoom in on the characters at a very high magnification.) Some printers, including common inkjets, will print the characters clipped; others, including most PostScript and monochrome laser printers, will print the characters correctly. If your printer truncates them, you can create a PDF file and then print the PDF, where they will be printed correctly. When a character with a descender (g, p, q, y) happens to come exactly above one of the extra-tall characters they will collide and look bad. In such cases you

[5] Mac users should note that OS X, unlike Windows, tries to position combining marks correctly even if the font does not contain specific positioning information. Sometimes this works well and sometimes it does not.

need to edit the document so that the descender comes in a different position on the line or increase the line spacing.

Prior to releasing version 1.04 I contemplated changing the vertical metrics to fix this problem. This would result in slightly larger line spacing and so cause problems for users with existing documents that they want to edit (page breaks would change). I also experimented with using shorter versions of capital letters and did not like the results. So it seemed best to leave the vertical metrics unchanged and use one of the workarounds described in the previous paragraph, especially since the extra-tall characters are not frequently used.

Line Spacing on Mac OS X

Earlier versions of Cardo had line spacing that was too large when used on a Mac. This was caused by an automatic setting in FontLab that I did not know how to fix until recently. Version 1.04 has the same line spacing on OS X as on Windows, and Mac users will get more text on a page. If you have existing documents that you want to edit while preserving the original page breaks, you should keep a copy of your old version of Cardo to use when necessary (don't install more than one version at a time, of course.

Characters in Boxes

You may notice a few characters that consist of a glyph surrounded by a box. These are characters for which I have reserved slots in the database but have not yet drawn. They will appear in a future version of Cardo. The glyph in the box indicates the script or type of character involved; for instance, an insular letter 'M' denotes a character from the MUFI recommendation. For technical reasons it is often easier to reserve slots rather than add totally new characters later.

Please note that these boxes with round edges are not the same as the blank rectangles that indicate you have requested a character not available in the font you are using.

Note about Brackets

Earlier versions of the Unicode Standard included a number of brackets designed for use in East Asian typography (beginning at U+3008) and some people used them as critical signs in classical and medieval texts. Asian ideographs are designed to fit into a square, and narrow characters such as brackets often have extra space added to make them fit the square (referred to as "wide" forms). Unicode 4.0 states that the CJK brackets are to be considered wide characters and has encoded new, unambiguously narrow, brackets for mathematical and other uses. These should be used as editorial signs signs since the CJK signs may cause spacing problems. I have not removed the Asian brackets from Cardo to preserve backwards compatibility, but they should not be used in the future.

2.7 Contacting the Developer

A current email address will always be available at http://scholarsfonts.net/contact; as of April 2011, it is `hospes02@scholarsfonts.net`, but this address will be changed if it starts to get a lot of spam. Please email me if you have questions or suggestions for improvement. I really would appreciate hearing reactions from users; such feedback will play a large role in determining the future development of this font.

2.8 Acknowledgments

A number of people have been helpful in my work on Cardo: Dave Crossland, Rodney Decker, Florian Grammel, Odd Einar Haugen, Edward C. D. Hopkins, Joop Jagers, James Kass, Juan-José Marcos, Paul Nelson, Nick Nicholas, Maria Pantelia, Richard Peevers, Patrick Rourke, and John Wells, as well as numerous contributors to the Unicode and OpenType mailing lists. Many thanks to all of them. I am responsible for any problems that remain.

Cardo is produced using FontLab Studio 5, a professional font editor developed by FontLab Ltd. I would also like to thank the Microsoft Typography Group, which has developed and made available gratis to font developers two important tools: VOLT facilitates the addition of OpenType features, while Font Validator performs very thorough checks on a completed font.

2.9 Revision History

Version 1.04

This manual accompanies version 1.04 of Cardo, released in April 2011. Versions 1.00–1.03 were development versions, never released. 1.04 is the first version that includes italic and boldface fonts as part of the package. The italic was initially released as a standalone download in February 2011. The following characters were added to Cardo roman 1.04:

- All characters included in the MUFI Recommendation 3.0 (earlier versions of Cardo supported MUFI 2.0); these MUFI characters represent by far the largest number of new characters in Cardo 1.04.
- A number of characters used by scholars that were added Unicode 5.1 and 5.2, including some needed for Latin epigraphy that I had proposed. These and the MUFI characters are mainly in the Latin Extended-C and Latin Extended-D ranges of Unicode. There are also some glyph variants of these characters.
- Many glyph variants for the Unicode Roman numeral characters, which can be accessed either through stylistic sets 2–13 or through their PUA codepoints.

- U+2E31 WORD SEPARATOR MIDDLE DOT; this character is important for Roman epigraphy, since it is the best choice for the interpunct. There are also several glyph variants for the interpunct, accessible through the stylistic alternates feature as well as through the PUA codepoints.
- Two missing Hebrew characters, U+05A2 HEBREW ACCENT ATNAH HAFUKH and U+05C7 HEBREW POINT QAMATS QATAN, added to the roman font.
- Retrograde versions of some of the Old Italic characters; these are located in the PUA and can also be accessed through Stylistic Set 1.
- Greek capital Yot, proposed for Unicode and tentatively assigned to U+037F.
- U+25B6, BLACK RIGHT-POINTING TRIANGLE.
- A Carystian glyph variant of U+10144, GREEK ACROPHONIC ATTIC FIFTY, located in the SPA-A at U+F02E0.

Other changes include:

- The combining marks are now zero-width, which means they will automatically back up over the preceding character; but see page 8 for more about using them.
- U+05B8 HEBREW POINT QAMATS shortened to contrast with the new HEBREW POINT QAMATS QATAN.
- The diphthongs with stress marks have been moved to avoid conflicts with MUFI characters; they are now located at U+FB10–U+FB15.
- The commaaccent characters for Romanian have been revised to reflect the currently preferred method of encoding these characters.
- Many characters have been renamed in the font database. Users do not normally need to know anything about how characters are named, but correctly named characters work better in PDF files and make it easier to copy text from PDF to other applications.
- The kerning has been changed on a few pairs and some additional pairs added. These changes are not large *but may cause text in existing documents to reflow*.
- A digital signature has been added to the roman .ttf file so that Windows will display it with an **O** icon and so that Word will utilize the OpenType features found in the roman font (which it will not do without a signature).

Version .99

This release (May 2010) fixed some vertical metrics problems and was the first version to be released under the OFL; no new characters were added with this release, although a spacing problem with one of the Yiddish characters was fixed. This version was also selected for inclusion in the Google Font Directory; for more about this, see http://code.google.com/webfonts.

Version .98

Version .98 (2004) was a major upgrade to Cardo with the inclusion of over 1400 additional characters, including for the first time characters outside the Basic Multilingual Plane:

- All the Greek characters proposed by the Thesaurus Linguae Graecae that have received approval from the Unicode Technical Committee, plus important glyph variants of these characters; about 200 characters.
- Some precomposed Greek epigraphical characters in the PUA.
- A large number of variant forms of Greek letters for epigraphy and numismatics.
- Rare characters from the TLG database that were not proposed by the TLG for inclusion in Unicode; these are in the PUA.
- U+05C6 HEBREW PUNCTUATION NUN HAFUKHA, sometimes called reversed nun.
- The Old Italic block of Unicode (but no glyph variants).
- The medievalist diacritical marks missing from the Combining Diacritics block, along with all other combining marks in Unicode 4.0 and those slated for Unicode 4.1.
- All the official Unicode characters found in the MUFI recommendation 1.0 as well as all of the PUA characters.
- The entire Spacing Modifier Letters range along with a few additional IPA characters (click symbols and arrows).
- A set of true small capitals and oldstyle (lining) numerals, along with OpenType features to access them.
- A number of other miscellaneous Unicode characters.

Design of some of the IPA characters was also improved. Beginning with this version, the quality of the character outlines has been improved with the help of the Font Validator tool supplied by Microsoft Typography.

2.10 License Information

Cardo is released under the SIL Open Font License, the text of which appears below. More information about this license can be found at http://scripts.sil.org/OFL.

This Font Software is licensed under the SIL Open Font License, Version 1.1. This license is copied below, and is also available with a FAQ at: http://scripts.sil.org/OFL.

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PREAMBLE

The goals of the Open Font License (OFL) are to stimulate worldwide development of collaborative font projects, to support the font creation efforts of academic and linguistic communities, and to provide a free and open framework in which fonts may be shared and improved in partnership with others.

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Characters and More Characters 3

3.1 What Cardo Offers

Cardo contains lots and lots of characters (about 3800 in the roman version of 1.04).

Previous editions of this manual contained charts showing many of these characters. At the time those tables were prepared, the code charts in The Unicode Standard were not available on line; since they are available now, and since it would take a great deal of space to reproduce the charts, they are not included in this edition. The table on page 20 provides clickable links to the relevant charts on the Unicode website for those who need them.

Chapters 7–10 of *Document Preparation* (see page 3) contain much important information about using the Greek, Hebrew, Medieval and IPA characters respectively.

General Repertoire Notes.

The original goal was to include most of the Unicode characters that might be useful for scholarly work. Some of the mathematical symbols and the astrological signs, which are found in Beta Code, and some metrical and epigraphical characters have also been included. In addition, I have included a number of characters that are useful for good-looking typography, such as the 'f' and long 's' ligatures, lowercase (also called old style) and proportional numerals, small capitals, and the various spaces. Beginning with version .98, Cardo contains OpenType tables that will allow you apply ligatures, numeral variants, and true small capitals if you use software that supports OT typography for Latin-script languages. Refer to "Using the OpenType Features of Cardo" (page 25) for more information.

Combining Diacritical Marks in Cardo.

Cardo contains all the characters in the Combining Diacritical Marks range and most of those in the Combining Diacritical Marks Supplement, although it does not provide automatic positioning of all marks over all base letters. See Chapter 1.6 of *Document Preparation* for an in-depth discussion of this issue, which may be very important to scholars and users of certain languages that are not covered by precomposed shapes in Unicode. I am committed to providing much more complete support for combining marks in future versions of Cardo. As a "down payment" on this work, version 1.04 now supports the correct positioning of the combining underdot beneath Latin and Greek letters. It also supports combining marks above the letters 'i'

and 'j'; the normal dotted shapes of these letters will be automatically replaced by dotless versions before the combining marks are applied.

3.2 Coordination with Other Projects

This release of Cardo has been designed specifically to work with the following projects:

THESAURUS LINGUAE GRAECAE DATABASE: Cardo 1.04 contains all the characters needed to print the texts in the TLG database. This includes all the Unicode characters that TLG has mapped to various Beta code entities, including the many characters proposed by the TLG staff and accepted into Unicode; glyph variants of some of these characters, particularly the Greek letters that are needed for printing acrophonic numerals and musical notation; and some additional characters that TLG did not consider appropriate for Unicode but which they feel would be useful to have available. Earlier versions of Cardo contained some of these characters and a chart showing their Beta Code equivalents. TLG has published a quick reference guide showing the Unicode characters that should be used as equivalents of items in Beta Code; it is available in PDF form at http://www.tlg.uci.edu/quickbeta.pdf. This guide supercedes the charts in earlier versions of the Cardo manual. For more details, including the full Beta Code manual, see the TLG website http://www. tlg.uci.edu. Cardo is, as far as I know, the only font that can print every character in the TLG database, taking advantage of glyph variants of some Unicode characters and supplying others in the PUA. See page 55ff. for these special TLG characters.

MEDIEVAL UNICODE FONT INITIATIVE: Cardo 1.04 contains all the Unicode characters found in the Recommendation of the Medieval Unicode Font Initiative, version 3.0; it also contains all of the MUFI Private Use Area characters; for details, see http://www.mufi.info/specs/. There are several other fonts that support the MUFI recommendation, and Cardo is compatible with any of them, with one exception. The MUFI character LATIN CAPITAL LETTER M WITH HIGH MACRON at U+E1B8 is found in Cardo at U+E1D1, since there is an epsilon with macron, grave, and smooth breathing at E1B8 (part of a set of non-Unicode precomposed Greek characters that has been in Cardo's PUA for a long time). Please note that there is no chart in this manual that shows all the MUFI characters, since there are so many of them. Interested medievalists should see the PDF file available from the MUFI website or the online MUFI database at tinyurl.com/mufidb.

3.3 Character Repertoire in Cardo

Cardo includes the Unicode ranges shown in Table 1 on the following page; there is complete coverage for each range unless otherwise noted.

There are also many additional Unicode characters that are useful for scholars, such as double brackets, angle brackets, etc. that come from different areas of Unicode. These are all included in Cardo; for a complete listing, see Table 5.1, pages 92–93, of *Document Preparation* (see page 3 for information about the book).

There are many additional characters in Cardo's PUA, including the old style numerals, and small capitals as well as additional precomposed Greek character combinations. These characters are all tabulated in Chapter 5, beginning on page 31. Epigraphers will be partiuclarly interested in the variants of Roman numerals and of characters in the Ancient Symbols range; information about stylistic alternates in presented in Chapter 4 of this manual.

3.4 Using the Greek Characters

Some care needs to be exercised when using Unicode Greek: several characters in the Greek block have been deprecated while others should be used only in mathematical contexts. For information about these and additional complexities of Unicode Greek, see the GreekKeys website at http://socrates.berkeley.edu/~pinax/greekkeys/, especially the “Technical Details" page, or Chapter 7 of *Document Preparation* (see page 3).

If you want to use acrophonic numerals or ancient Greek musical notation in a document, you will need to use the sans-serif variants of the Greek alphabet found in the PUA. For example, the acrophonic numeral for 71 would display as 𝈅ΔΔI using the standard Unicode values. Cardo provides the OpenType Stylistic Set 1 for Greek that will automatically display capitals in a sans-serif form. If your program does not support OT features, you will have to use the PUA values to access the sans-serif variants. Using one of these methods, the numeral can be more properly displayed as 𝈅ΔΔI. See Chapter 4 for more about OT features.

Cardo contains a number of precomposed Greek combinations not found in Unicode in the PUA, U+E197–U+E1CF; these are mainly epsilon-and omicron combinations needed by epigraphers. Two other fonts for classicists, New Athena Unicode and Vusillus Old Face, have adopted the same character assignments in the PUA, so it is easy to switch among these fonts if desired.

Table 1. Unicode Ranges in Cardo. The columns at the left indicate which versions of Cardo contain the characters: roman, italic, and bold respectively.

Click on any of the names in the right-hand column to go to the corresponding online code chart at http://www.unicode.org

**These characters should not be used; rely on OT features instead.

R	*I*	**B**	Unicode Range
R	*I*	**B**	Basic Latin
R	*I*	**B**	Latin-1 Supplement
R	*I*	**B**	Latin Extended-A
R	*I*	**B**	Latin Extended-B (selected chars. for European languages & linguistics)
R			IPA Extensions
R	*I*		Latin Extended-C (two Claudian letters)
R	*I*		Latin Extended-D (most characters)
R	*I*		Phonetic Extensions (selected characters)
R			Spacing Modifier Letters
R			Combining Diacritical Marks
R			Combining Diacritical Marks Supplement (most characters)
R	*I*	**B**	General Punctuation (selected characters)
R	*I*		Subscripts and Superscripts
R	*I*		Latin Extended Additional (selected characters)
R			Greek and Coptic
R			Greek Extended
R			Hebrew
R			Miscellaneous Technical (selection including metrical characters)
R			Dingbats (selected characters)
R	*I*		Supplemental Punctuation (New Testament critical signs, ancient editorial signs, etc.)
R			Miscellaneous Symbols (signs of the zodiac etc.)
R			Alphabetic Presentation Forms (except the Armenian characters) **
R			Old Italic
R			Ancient Symbols
R			Ancient Greek Numbers
R			Ancient Greek Musical Notation
R			Mathematical Alphanumeric Symbols (selected characters for biblical apparatus)

3.5 Using the Hebrew Characters

General Notes about Hebrew

For the Hebrew characters to work correctly, you must set up Hebrew support both in Windows and in Word. On the Mac, you must have at least OS 10.2. But note that the vowels and cantillation marks probably won't line up properly in OS X, because it does not use the OpenType features that are built into Cardo to handle this positioning on Windows and Linux (unless you are using Mellel or InDesign).

Order of Character Entry

If you are using the Hebrew characters, you must enter your text in this order:

base letter – dagesh – sin/shin dot – vowel – accent

Windows itself does not care what order you use, as long as the base character comes first. However, when I constructed the OpenType tables, I used the order given above. There is no reason that additional OT tables could not be added to allow for other orders, but I do not have time to do this now. *If you have a Unicode Hebrew text that has been normalized to Form C, it will not work with Cardo* (because Form C requires a different order than the one mentioned above). I hope to add additional OT tables that will address this problem. See *Document Preparation*, pages 159–160, for more details about normalization.

For a furtive patah, enter the patah after the consonant and the OT lookup will move it to the right.

Additional Notes

Unicode originally did not include the reversed nun character. It was subsequently added to the standard at U+05C6. Earlier versions of Cardo had a reversed nun in the Private Use Area at U+F300, which I have retained for backwards compatibility, while adding the official codepoint.

On rare occasions in Hebrew one needs to use two cantillation marks over a single base character. In earlier versions of Windows and Office this was not possible, but it should work with no problem now. If you are running old software you may need to upgrade.

3.6 Accessing Characters in the Supplementary Planes

Note that the Old Italic, Ancient Greek Numbers, and Ancient Greek Musical Notation ranges are located in the Supplementary Multilingual Plane and that there are many glyph variants and rare characters in the Supplementary Private Area-A. The original design of Unicode provided for about 65,000 characters (now called the Basic Multilingual Plane or BMP). The designers anticipated that this might not be sufficient and allowed for 15 additional groups of 65,000 characters, referred to as supplementary planes. Some software still has not been updated to allow use of these characters. Windows NT, 2000, and XP and Mac OS X were the first operating systems to support supplementary characters. Even under these operating systems or more recent versions, some word processors give you access to the supplementary characters and some do not.

If your program does support supplementary characters, you may be able to enter a character's five digit Unicode value (e.g., 10140), also known as a scalar value, or you may have to enter a pair of surrogate characters such as D800 DD40. Both scalar values and surrogate pairs are given in the charts below. Most programs nowadays let you use the scalar values, but the need for surrogates still crops up occasionally; for instance, it is the only way to get supplementary characters when using the Character Palette that comes with Mac OS X. Under Windows, Notepad XP and Word XP and 2003 (or more recent) provide a convenient method of entering any Unicode character, including those in the supplementary planes: type the hexadecimal value followed by Alt-x. Under Mac OS X, Unicode-aware programs can use the hex entry method: install it in the same way as you would a keyboard layout and then hold down ⌥ while typing the hex value.

Even the most recent version of Windows's Character Map and Word's Insert▸Symbol do not show characters in the supplementary planes. Andrew West's BabelMap utility is an excellent alternative for those who need supplementary characters; go to www.babelstone.co.uk.

In the past some programs required that Uniscribe (a Windows component) be activated in order to see supplementary characters. If you are using such older software, do as follows: in Windows XP, go to Start▸Settings▸Control Panel, double-click the "Regional and Language Options" icon, choose the Languages tab, and click in the box next to "Install files for complex scripts and right to left languages."

3.7 Important Caution Regarding the Private Use Area

Cardo contains a large number of characters in the Private Use Area (PUA) and the Supplementary Private Area-A (SPA-A). Such characters are not a part of the Unicode Standard. Many of these are from the MUFI recommendation; others are glyph variants of TLG characters; some are precomposed combinations useful for Greek epigraphy; some are characters needed for high-quality typography, such as small capitals; and there are some other miscellaneous characters. All PUA characters are shaded in green in the charts in Chapter 5. For more about problems with PUA characters and about alternatives (use of combining marks, OpenType features, and XML markup), see *Document Preparation* (see page 3 for information about the book).

> Be aware that using any characters in the Private Use Areas may cause problems when searching, sorting, spell-checking, copying text or exchanging data with others. Use of such characters in databases is strongly discouraged. They may be used for the sake of appearance in printed documents where searching and sorting are not an issue.

The best way to use characters that are not part of Unicode, but are variants of characters in the standard, is via OpenType features (see next chapter). However, since not all programs support OT features at the present time, the only way for many users to access non-Unicode characters is to place them in the Private Use Area. Some are found in the Private Use Area of the Basic Multilingual Plane, which begins at U+E000; others are found in the Supplementary Private Use Area-A (Plane 15), which begins at U+F0000 (see "Accessing Characters in the Supplementary Planes" on page 6). The text figures and small capitals are placed in the same codepoints that they occupied in the past in fonts from Adobe Systems™ and some other vendors, but this use has no official sanction in Unicode (and Adobe no longer assigns PUA values to their small caps and oldstyle numerals). The small capitals with macron, small capital ezh, yogh, and wynn, and long-s ligatures are my own creation.

OpenType Features 4

4.1 The Importance of OpenType

By far the best way to access variant glyphs (including text figures and ligatures) is via OpenType features, which solves the problem discussed on page 23. OT fonts can change the appearance of text without affecting the underlying Unicode characters, thereby preserving the ability to search, sort, and spell-check text (although there aren't many spellcheckers for ancient languages). For a detailed discussion of OpenType, including the current state of software support for OT features, consult Chapter 2 of *Document Preparation* (see page 3 for information about the book).

4.2 The OpenType Features in Cardo

Cardo includes OpenType tables that implement the following features:

Latin script

- standard ligatures (ff, fi, fl, ffi, ffl)
- discretionary ligatures (ct, ſt, Th)
- old style numerals, also known as lowercase numerals or text figures
- proportional numerals
- small capitals (not in italic font). Note that these are true small capitals, properly designed to harmonize with the lowercase letters in Cardo. Microsoft Word and some other programs provide 'small capitals' by scaling the uppercase letters, but these do not look as good as true small capitals. Word does not use the OpenType small capitals even when a font contains them.
- subscripts and superscripts. As with small capitals, these are properly designed small numerals, not scaled-down versions of the regular numbers.
- kerning
- historical forms (long s; see caution below)
- historical ligatures (long s ligatures and a few for Roman epigraphy)
- stylistic alternates: access to all alternate glyphs for a character. Note that this is the only way to access the alternate 'm' glyph with a long right leg, as shown in the sample of Aldus' typeface on page 4.

- stylistic set #1: changes some characters, such as the en-dash, that may be used for metrics into shapes that harmonize better with the metric-specific characters (not in italic font)

About the Historical Forms feature.

Please note that the historical forms feature, which replaces the regular lowercase 's' glyph with a long 's' except at the end of words, does not always reflect historical practice. Words of Latin derivation with prefixes ending in 's' sometimes were typeset using a regular 's' at the end of the prefix, i.e., 'transmute' rather than 'tranſmute.' This was done, for instance, in some printings of Shakespeare's plays.[6] If you wish to reproduce this practice, you need to highlight the text in question and deselect the historical ligatures feature—or, probably better, enter the long 's' character (U+017F) directly into your document when you want it. Also note that some software does not process the space character when processing OT features; in such cases the long s will incorrectly appear at the ends of words.[7]

As mentioned on page 8 above, version 1.04 supports the combining underdot with Latin and Greek letters and various combining accents above the letters 'i' and 'j'. Also, an 'M' followed by a COMBINING LATIN SMALL LETTER O, U+0366, will automatically be replaced by a proper glyph for the Roman modius.

Old Italic script

- Stylistic alternates: gives access to all alternate glyphs for a character.
- Stylistic set #1: replaces the generic right to left Old Italic characters with mirrored versions for left to right typesetting.

See the discussion on page 50 for more about the mirrored characters that Cardo supplies as alternates for the Old Italic characters.

Greek script

- Old style numerals, also known as lowercase numerals or text figures.
- Proportional numerals.
- Stylistic alternates: access to all alternate glyphs for a character .
- Stylistic set #1: automatically changes regular Greek capitals (serifed form) into a sans-serif form for use in inscriptions and acrophonic numerals .
- Stylistic set #2: changes some characters, such as the en-dash, that may be used for metrics into shapes that harmonize better with the metric-specific Unicode characters (not in italic font).

[6] Thanks to CHECK EMAIL for bringing this to my attention.

[7] For a fascinating history of the long s, see http://babelstone.blogspot.com/2006/07/long-and-short-of-letter-s.html. Usage of the long s varied over time; a single OT feature cannot reproduce all the different uses.

Hebrew script

- Discretionary ligatures: supplies the aleph-lamed ligature.
- All other OT features in Hebrew are applied automatically to position the vowels and accents correctly.

4.3 Using the OpenType Features

Microsoft Word.

Microsoft Word 2010 is the first version of Word for Windows to support advanced typography through OpenType features. It supports ligatures, various styles of numerals, stylistic sets, and contextual alternates, but not true small capitals (as explained in §2.2 above) or stylistic alternates. Note that Word 2010 will not apply the OT features contained in roman versions of Cardo prior to 1.04, even though versions later than .98 contain OT tables that work in other applications.[8] (The italic and boldface OpenType features do work in Word.)

To use Word's OT features, open the Font dialog by pressing Ctrl-D or clicking the small box on the ribbon to the right of the Fonts label; then click the Advanced tab. You will see the dialog shown in the screen shot in Figure 1 on the following page. Note that standard ligatures and contextual alternates are turned off by default, even though they should be on according to the OpenType Specification. Also note that you must turn on kerning manually in Word, in the same Font▸Advanced dialog.

Word 2011 on the Mac also supports the OT features in Cardo and other fonts.

[8] This is because Word requires a digital signature in OpenType fonts that use TrueType outlines, i.e., end in a .ttf extension; such a signature was added to Cardo roman in 1.04.

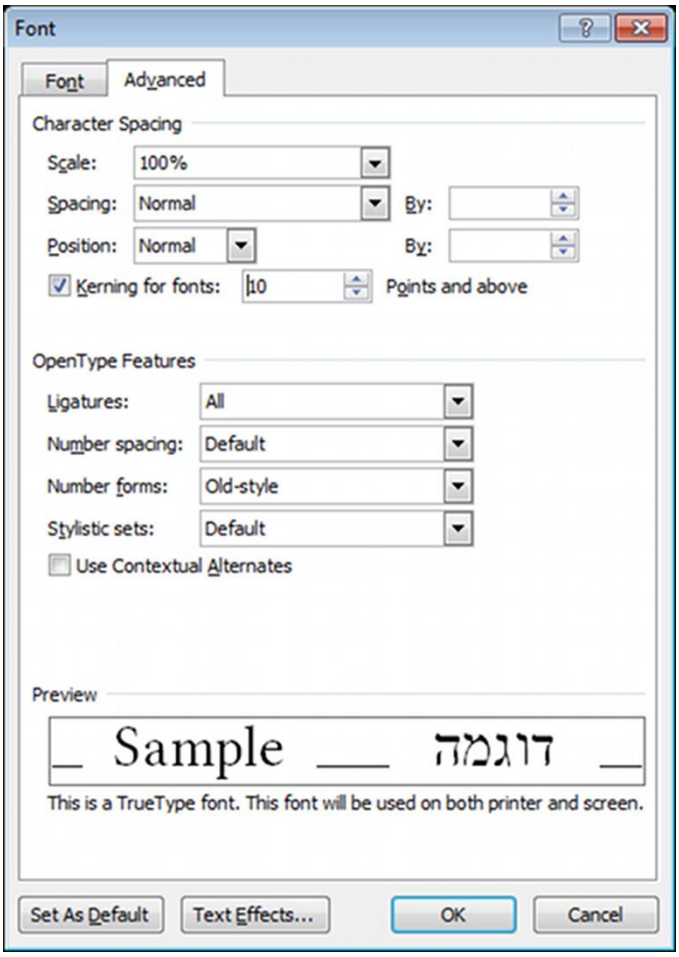

Figure 1. Word 2010 OpenType controls. Note the checkbox under Character Spacing to apply kerning, which is off by default, and the four dropdown lists under OpenType Features to apply ligatures, number forms, and stylistic sets. If the font you are using contains contextual alternates, you must check that box also; this feature is supposed to be on by default, but Word does not follow the OT specification in this regard (as with kerning).

Using Adobe InDesign.

The InDesign screenshot in Figure 1 shows Sigma highlighted in the list of uppercase Greek letters. The user has then opened the Glyphs palette, located at the bottom of the screen, which shows all the variants of Sigma in Cardo (note that some are retrograde). Double-clicking any of these variants changes the glyph shown in the document but not the underlying Unicode value, which is still U+03A3, GREEK CAPITAL LETTER SIGMA.

If you have access to InDesign, you can download a test document from my website http://scholarsfonts.net that provides more complete instructions and samples to try. Quark Express also supports OT features.

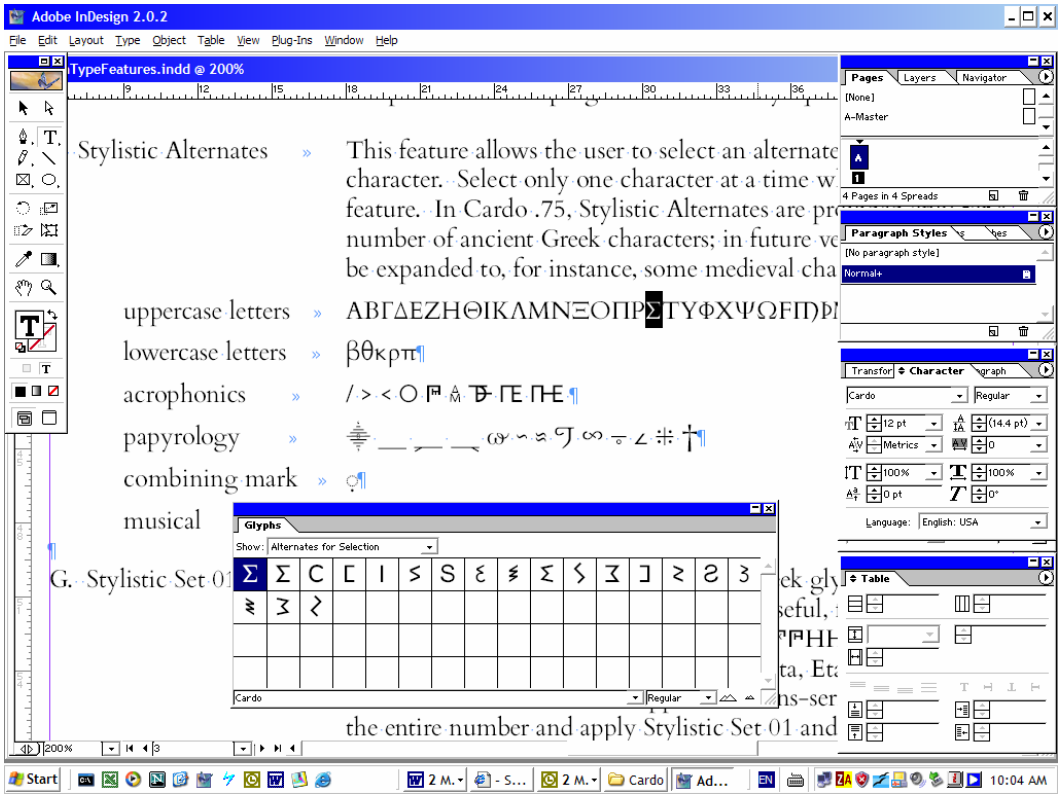

Figure 2. Stylistic Alternates in Adobe InDesign.

OpenType on OS X.

Mac OS X, which originally made use of its own Apple Advanced Typography (AAT) features rather than OpenType, now supports most OT features as well. Therefore the features for Latin and Greek scripts listed on page 25 will work under OS X in any word processor that takes advantage of the text handling built into the OS, of which there are several. Mac Hebrew, however, continues to require a native AAT font; so, unless you are using Mellel or InDesign, the Hebrew vowel points and cantillation marks in Cardo will not work properly.

The XeTeX and XeLaTeX formats of Donald Knuth's TeX typesetting system support OpenType as well as AAT and Graphite. Xe(La)TeX is available for Mac, Windows, and Linux; at the time this was written, it was the only software on Linux that supports OT features.

For more about OpenType and other smart font technologies, including the current state of software support, consult Chapter 2 of *Document Preparation* (see page 3 for information about the book).

Private Use Characters in Cardo 5

5.1 Introduction

About the PUA Characters

The green shading on the tables in this chapter is a reminder that these characters are not a part of the Unicode standard and so are placed in the Private Use Area. See the warning about using PUA characters on page 23 above for more details.

Provided that the limitations of the PUA are kept in mind, these characters may be legitimately useful in some circumstances. They are tabulated in this chapter because users will otherwise have no way of knowing what PUA characters Cardo contains.

Cardo contains a number of glyph variants of Unicode characters, identified in list A below. These are mostly located in the Supplementary Private Use Area-A (abbreviated SPA-A), beginning at U+F0000; the small capitals, oldstyle numerals, additional precomposed Greek characters, and some other variants are found in the original Private Use Area since they date back to the earliest versions of Cardo. All these glyph variants are included in the Stylistic Alternates feature for those who are using Adobe InDesign, Microsoft Publisher, XeTeX, Mellel, or another program that can take advantage of this important OpenType feature.

Additional characters not found in Unicode are also in the SPA-A; see list B on the following page.

Organization of the PUA Charts

The charts of the PUA characters are organized as follows:

A. Glyph variants of characters encoded in the Unicode Standard.

These are ordered by the Unicode value of the characters of which they are variants.

B. Characters that do not exist in Unicode.

These are ordered by their PUA values.

5.2 Variants of Encoded Characters

Characters for High Quality Typesetting

Remember that characters shaded in green are in the PUA; see page 23. They are listed here only for the benefit of people who used them with previous versions of Cardo, when OpenType features were not as well supported as they are now. It is better by far to enter such characters with the the appropriate OT features (Old Style Numerals, Ligatures, and Historical Ligatures). In future versions of Cardo, it is likely that these characters will no longer have PUA assignments—in fact, I almost removed them in this release. So get used to the OT features.

TEXT FIGURES (OLD STYLE FIGURES)

0	U+F730	OLDSTYLE DIGIT ZERO
1	U+F731	OLDSTYLE DIGIT ONE
2	U+F732	OLDSTYLE DIGIT TWO
3	U+F733	OLDSTYLE DIGIT THREE
4	U+F734	OLDSTYLE DIGIT FOUR
5	U+F735	OLDSTYLE DIGIT FIVE
6	U+F736	OLDSTYLE DIGIT SIX
7	U+F737	OLDSTYLE DIGIT SEVEN
8	U+F738	OLDSTYLE DIGIT EIGHT
9	U+F739	OLDSTYLE DIGIT NINE

LIGATURES

N.B.: the MUFI PUA contains some additional ligatures.

ﬀ	U+FB00	LATIN SMALL LIGATURE FF
ﬁ	U+FB01	LATIN SMALL LIGATURE FI
ﬂ	U+FB02	LATIN SMALL LIGATURE FL
ﬃ	U+FB03	LATIN SMALL LIGATURE FFI
ﬄ	U+FB04	LATIN SMALL LIGATURE FFL
ﬅ	U+FB05	LATIN SMALL LIGATURE LONG S T
ﬆ	U+FB06	LATIN SMALL LIGATURE ST
ct		c_t (accessible only via OpenType feature)
Th		T_h (accessible only via OpenType feature)
ſi	U+E191	longs_i
ſſ	U+E192	longs_longs
ſl	U+E193	longs_l
ſſi	U+E194	longs_longs_i
ſſl	U+E195	longs_longs_l
ſh	U+EBA1	longs_h
ſt	U+FB05	longs_t

The Unicode values for the true small capitals in the Private Use Area are as follows:

ᴀ	F761	ʙ	F762	ᴄ	F763	ᴅ	F764	ᴇ	F765	ꜰ	F766
ɢ	F767	ʜ	F768	ɪ	F769	ᴊ	F76A	ᴋ	F76B	ʟ	F76C
ᴍ	F76D	ɴ	F76E	ᴏ	F76F	ᴘ	F770	ǫ	F771	ʀ	F772
ꜱ	F773	ᴛ	F774	ᴜ	F775	ᴠ	F776	ᴡ	F777	x	F778
ʏ	F779	ᴢ	F77A	œ	F6FA	ƿ	F77D	ȝ	F77E	ȝ	F77F
ł	F6F9	š	F6FD	ž	F6FF	ss	F806				
à	F7E0	á	F7E1	â	F7E2	ã	F7E3	ä	F7E4	å	F7E5
æ	F7E6	ç	F7E7								
è	F7E8	é	F7E9	ê	F7EA	ë	F7EB				
ì	F7EC	í	F7ED	î	F7EE	ï	F7EF	ð	F7F0	ñ	F7F1
ò	F7F2	ó	F7F3	ô	F7F4	õ	F7F5	ö	F7F6	ø	F7F8
ù	F7F9	ú	F7FA	û	F7FB	ü	F7FC				
ý	F7FD	þ	F7FE	ÿ	F7FF						
ā	F800	ē	F801	ī	F802	ō	F803	ū	F804	ȳ	F805
!	F721	¡	F7A1	&	F726	?	F73F	¿	F7BF		

Small cap versions of diacritics:

breve	F6F4	caron	F6F5	circumflex	F6F6
dotaccent	F6F7	dbl acute	F6F8	ogonek	F6FB
ring	F6FC	tilde	F6FE	dieresis	F7A8
macron	F7AF	acute	F7B4	cedilla	F7B8

Miscellaneous Latin-Script Alternates:

ʙ (tall B)	F418	ɪ (tall I)[9]	F419	ᴛ (tall T)	F420
ꝑ (OE Thorn)	F340	ꝑ (OE thorn)	F341		

[9] Unicode now has the I-longa at U+A7FE. It should be used instead of this character, which is retaind for backwards compatibility.

Glyph Variants of Uppercase Greek Letters

This table lists the variants of uppercase Greek letters found in Cardo.

The first glyph in each group is a sans-serif version of the standard Greek uppercase letter, designed to harmonize with the other characters in Cardo. These sans-serif forms are useful for printing acrophonic numerals, musical texts, and so forth.

After the standard letterform come less common glyph shapes. This table is largely based on one compiled by Edward C. D. Hopkins showing the various glyphs found on ancient coins; for complete details, see his very thorough website located at http://www.parthia.com/fonts/glyphchart.htm.

There is a good deal of overlap among the variants; for example, Alpha sometimes appears in shapes that look like Delta, Lambda, or even Iota. In such cases cross-references are given in light print to the appropriate forms.

Some inscriptions and coins use retrograde glyphs. These come in a group after the forward-facing variants for each letter. Not all characters need separate retrograde forms, of course (e.g., Omicron and Theta). Those who are using the SPA-A values to access the variants can get the retrograde forms by changing the third digit of the Unicode value from zero to one; for example, the retrograde version of Ꭿ F0006 is Ꮃ F0106.

Since these characters are in a Private Use Area, users should exercise caution; see page 23 for more information. All these glyph variants are included in the Stylistic Alternates feature for those who are using Adobe InDesign, Mellel, or another program that can take advantage of this OpenType feature. The first glyph in each group, the sans-serif variant of the regular shape, can also be accessed through Stylistic Set 1. You may need to mark the text as Greek before this stylistic set will work.

Ꭺ	F0000	Alpha.01	
Ꭻ	F0001	Alpha.02	
Ꭽ	F0002	Alpha.03	F0102 Ꭽ retrograde
Ꭿ	F0003	Alpha.04	F0103 Ꭿ retrograde
Ꮁ	F0004	Alpha.05	F0104 Ꮁ retrograde
Ꮅ	F0005	Alpha.06	F0105 Ꮅ retrograde
Ꮇ	F0006	Alpha.07	F0106 Ꮃ retrograde
Ꮃ	F0007	Alpha.08	F0107 Ꮇ retrograde
Δ		Alpha.09	= Delta.01
Λ		Alpha.10	= Lambda.01
I		Alpha.11	= Iota.01
Ᏼ	F0010	Beta.01	F0110 Ᏼ retrograde
Ᏽ	F0011	Beta.02	F0111 Ᏽ retrograde
S		Beta.03	= Sigma.06 / F00C6 Ꮥ retrograde
ᒧ	F0013	Beta.04	F0113 ᒪ retrograde
ᐯ	F0014	Beta.05	F0114 ᐱ retrograde

ᵡ	F0015	Beta.06	F0115 ᵡ retrograde
ᶜ		Beta.07	= Gamma.07 / F0126 ᶝ retrograde
ᴏ		Beta.08	= Omicron.02
ᴉ		Beta.09	= Iota.01
˂		Beta.10	= Gamma.02 / F0121 ˃ retrograde
ᵞ	F001A	Beta.11	F011A ᵞ retrograde
ᴦ	F0020	Gamma.01	F0120 ᴧ retrograde
˂	F0021	Gamma.02	F0121 ˃ retrograde
ᶠ	F0022	Gamma.03	F0122 ᶣ retrograde
ᒪ	F0023	Gamma.04	F0123 ᒧ retrograde
ᴧ	F0024	Gamma.05	F0124 ᴨ retrograde
ᴧ		Gamma.06	= Lambda.02 / ᴖ Lambda.02r retrograde
ᶜ	F0026	Gamma.07	F0126 ᶝ retrograde
ᴧ		Gamma.08	= Lambda.01
ᐃ	F0028	Delta.01	
ᐅ	F0029	Delta.02	F0129 ᐊ retrograde
ᗡ	F002A	Delta.03	F012A ᗣ retrograde
ᴧ		Delta.04	= Lambda.01
ᴱ	F0030	Epsilon.01	F0130 ᴟ retrograde
ᴲ	F0031	Epsilon.02	F0131 ᴟ retrograde
ᒪ		Epsilon.03	= Gamma.04 / ᒧ Gamma.04r retrograde
ᴴ		Epsilon.04	= Eta.07
ᴓ	F0034	Epsilon.05	F0134 ᴓ retrograde
ᴞ	F0035	Epsilon.06	F0135 ᴝ retrograde
ᴞ	F0036	Epsilon.07	F0136 ᴝ retrograde
ᴱ	F0037	Epsilon.08	F0137 ᴟ retrograde
ᴞ	F0038	Epsilon.09	F0138 ᴝ retrograde
ᴠ	F0039	Epsilon.10	F0139 ᴡ retrograde
ᒪ	F003A	Epsilon.11	F013A ᒧ retrograde
ᴉ		Epsilon.12	= Iota.01
ᴯ	F003C	Epsilon.13	F013C ᴟ retrograde
ᴣ	F003D	Epsilon.14	F013D ᴣ retrograde
ᴲ	F003E	Epsilon.15	F013E ᴟ retrograde
ᴠ	F003F	Epsilon.16	F013F ᴡ retrograde
ᑐ	F0040	uni03DA.01	aka Stigma.01; F0140 ᑏ retrograde
ᑎ	F0041	uni03DA.02	aka Stigma.02; F0141 ᑍ retrograde
ᑏ	F0042	uni03DA.03	aka Stigma.03; F0142 ᑋ retrograde
ᒪ		uni03DA.04	= Epsilon.11; aka Stigma.04
ᖘ	F0044	uni03DA.05	aka Stigma.05; F0144 ᖚ retrograde
ᖘ	F0045	uni03DA.06	aka Stigma.06; F0145 ᖚ retrograde
ᖘ	F0046	uni03DA.07	aka Stigma.07; F0146 ᖚ retrograde
ᖴ	F0048	uni03DC.01	aka Digamma.01; F0148 ᖵ retrograde
ᐱ	F0049	uni03DC.02	aka Digamma.02; F0149 ᐳ retrograde

Ⅼ	F004A	uni03DC.03	aka Digamma.03; F014A ⅃ retrograde
⅋	F004B	uni03DC.04	aka Digamma.04; F014B ⅁ retrograde
Ⅿ	F004C	uni03DC.05	aka Digamma.05; F014C Ⅿ retrograde
⅋		uni03DC.06	= Nu.03; aka Digamma.06
Ⅿ		uni03DC.07	= Nu.01; aka Digamma.07
Ⅳ	F004F	uni03DC.08	aka Digamma.08; F014F Ⅳ retrograde
⅄	F0050	uni03DC.09	aka Digamma.09; F0150 ⅄ retrograde
Z	F0052	Zeta.01	F0152 Ƹ retrograde
I	F0053	Zeta.02	
ǂ	F0054	Zeta.03	
H	F0056	Eta.01	
⊟	F0057	Eta.02	
⊟	F0058	Eta.03	
⊟	F0059	Eta.04	F0159 ⊟ retrograde
⊟	F005A	Eta.05	
⊟	F005B	Eta.06	F015B ⊟ retrograde
⊢	F005C	Eta.07	F015C ⊣ retrograde
E		Eta.08	= Epsilon.01 / Ǝ Epsilon.01r retrograde
⊖	F0060	Theta.01	capital letter theta sans-serif
⊙	F0061	Theta.02	
⊖	F0062	Theta.03	
⊞	F0063	Theta.04	
⊠	F0064	Theta.05	
⊡	F0065	Theta.06	
⊕	F0066	Theta.07	
⊗	F0067	Theta.08	
⟐	F0068	Theta.09	
⌖	F0069	Theta.10	
⌖	F006A	Theta.11	
⌖	F006B	Theta.12	
⁖	F006C	Theta.13	
⊟		Theta.14	= Eta.02
◻		Theta.15	= Omicron.02
I	F0070	Iota.01	
≤		Iota.02	= Sigma.05 / ≾ Sigma.05r retrograde
↳	F0072	Iota.03	F0172 ↵ retrograde
↾	F0073	Iota.04	F0173 ↿ retrograde
ε	F0074	Iota.05	F0174 ɜ retrograde
S		Iota.06	= Sigma.06 / ƨ Sigma.06r retrograde
ǂ	F0076	Iota.07	
K	F0077	Kappa.01	F0177 ʞ retrograde
⊬	F0078	Kappa.02	F0178 ⊦ retrograde
Ⅿ		Kappa.03	= Nu.01 / ᴎ Nu.01r retrograde

𐤊		Kappa.04	= Eta.01 / 𐤇 Eta.01r retrograde
𐤋		Kappa.05	= Phi.02
𐤌		Kappa.06	= Nu.07
𐤍	F007D	Kappa.07	F017D 𐤉 retrograde
𐤎		Kappa.08	= Chi.01
𐤏	F007F	Kappa.09	F017F 𐤈 retrograde
𐤐	F0080	Lambda.01	
𐤑	F0081	Lambda.02	F0181 𐤒 retrograde
𐤓		Lambda.03	= Gamma.01 / 𐤂 Gamma.01 retrograde
𐤔		Lambda.04	= Delta.01
𐤕		Lambda.05	= Gamma.04 / 𐤃 Gamma.04r retrograde
𐤖		Lambda.06	= Gamma.05 / 𐤄 Gamma.05r retrograde
𐤗	F0086	Lambda.07	F0186 𐤅 retrograde
𐤘	F0087	Lambda.08	F0187 𐤆 retrograde
𐤙	F0088	Mu.01	
𐤚	F0089	Mu.02	
𐤛	F008A	Mu.03	F018A 𐤝 retrograde
𐤜	F008B	Mu.04	F018B 𐤜 retrograde
𐤝		Mu.05	= Pi.01
𐤞	F008D	Mu.06	= u10311; separate glyph here for sorting
𐤟	F008E	Mu.07	
𐤠	F0090	Nu.01	F0190 𐤌 retrograde
𐤡	F0091	Nu.02	F0191 𐤛 retrograde
𐤢	F0092	Nu.03	F0192 𐤋 retrograde
𐤣	F0093	Nu.04	F0193 𐤋 retrograde
𐤤		Nu.05	= Chi.01
𐤥		Nu.06	= Eta.01 / 𐤇 Eta.01r retrograde
𐤦	F0096	Nu.07	F0196 𐤊 retrograde
𐤧		Nu.08	= Iota.03 / 𐤉 Iota.024 retrograde
𐤨	F0098	Xi.01	
𐤩		Xi.02	= Iota.07
𐤪	F009A	Xi.03	F019A 𐤧 retrograde
𐤫	F009B	Xi.04	
𐤬	F009C	Xi.05	
𐤭	F009D	Xi.06	
𐤮		Xi.07	= Phi.02
𐤯		Xi.08	= Chi.01
𐤰		Xi.09	= Zeta.02
𐤱	F00A1	Omicron.01	capital letter omicron sans-serif
𐤲	F00A2	Omicron.02	
𐤳	F00A3	Omicron.03	
𐤴	F00A4	Omicron.04	
𐤵	F00A5	Omicron.05	

Ω	F00A6	Omicron.06	
Θ		Omicron.07	= Theta.01
C		Omicron.08	= uni03F9.01 (lunate sigma.01)
Π	F00A9	Pi.01	capital letter pi sans-serif
Γ	F00AA	Pi.02	F01AA ⅂ retrograde
Π	F00AB	Pi.03	
P		Pi.04	= Rho.08 / ꟼ Rho.08r retrograde
II	F00AD	Pi.05	
C		Pi.06	= uni03F9.01 / uni03F9.01r Ↄ retrograde
M		uni03FA.01	aka San.01; = Mu.06
M		uni03FA.02	aka San.02 ; = Mu.2
Ϙ	F00B2	uni03D8.01	aka Koppa.01
ϙ	F00B3	uni03D8.02	aka Koppa.02
Ϙ	F00B4	uni03D8.03	aka Koppa.03
ϙ	F00B5	uni03D8.04	aka Koppa.04
Ϙ	F00B6	uni03D8.05	aka Koppa.05
P	F00B7	Rho.01	F01B7 ꟼ retrograde
P	F00B8	Rho.02	F01B8 ꟼ retrograde
H		Rho.03 = Eta.07	
Γ	F00BA	Rho.04	F01BA ⅂ retrograde
I		Rho.05 = Iota.01	
R	F00BC	Rho.06	F01BC Я retrograde
R	F00BD	Rho.07	F01BD Я retrograde
P	F00BE	Rho.08	F01BE ꟼ retrograde
R	F00BF	Rho.09	F01BF Я retrograde
P	F00C0	Rho.10	F01C0 ꟻ retrograde
Σ	F00C1	Sigma.01	F01C1 ƺ retrograde
C	F00C2	uni03F9.01	aka Sigma.02; F01C2 Ↄ retrograde
Ɛ		Sigma.03	= Epsilon.11 / Ⅎ Epsilon 11r retrograde
I		Sigma.04	= Iota.01
≤	F00C5	Sigma.05	F01C5 ≥ retrograde
S	F00C6	Sigma.06	F01C6 Ƨ retrograde
ε	F00C7	Sigma.07	F01C7 ɜ retrograde
≰	F00C8	Sigma.08	F01C8 ≱ retrograde
Σ	F00C9	Sigma.09	F01C9 ƺ retrograde
ς	F00CA	Sigma.10	F01CA ≳ retrograde
Þ	F00CB	uni03F7.01	aka Sho.01; F01CB ꝺ retrograde
T	F00CC	Tau.01	
⊥	F00CD	Tau.02	F01CD ⊥ retrograde
I		Tau.03 = Iota.01	
⊡		Tau.04 = Eta.07	
Y	F00D0	Upsilon.01	
V	F00D1	Upsilon.02	

∇	F00D2	Upsilon.03	
ϒ	F00D3	Upsilon.04	F01D3 ϒ retrograde
ϓ	F00D4	Upsilon.05	F01D4 ϔ retrograde
⋃	F00D5	Upsilon.06	
Φ	F00D6	Phi.01	capital letter phi sans-serif
+	F00D7	Phi.02	
Ⅲ	F00D8	Phi.03	
I		Phi.04	= Iota.01
X		Phi.05	= Chi.01
⊢⊡		Phi.06	= Eta.07
⊘	F00DC	Phi.07	F01DC ⦸ retrograde
⊕	F00DE	Phi.08	
⊙		Phi.09	= Theta.02
·ı·	F00DF	Phi.10	
X	F00E0	Chi.01	
↓	F00E1	Chi.02	
ϒ		Chi.03	= Psi. 02
+		Chi.04	= Phi.02
Ψ	F00E4	Psi.01	capital letter psi sans-serif
ϒ	F00E5	Psi.02	
↓		Psi.03	= Chi.02
X		Psi.04	= Chi.01
Ⲭ	F00E8	Psi.05	
Ⲯ	F00E9	Psi.06	
Ω	F00EA	Omega.01	capital letter omega sans-serif
ω	F00EB	Omega.02	
⊙		Omega.03	= Theta.02
O		Omega.04	= Omicron.01
Λ		Omega.05	= Lambda.01
Ш	F00EF	Omega.06	
Ω	F00F0	Omega.07	
⋂	F00F1	Omega.08	
ℴ	F00F2	Omega.09	
∘		Omega.10	= Omicron.04
ʊ	F00F4	Omega.11	
ѽ	F00F5	Omega.12	
ϡ	F00F6	uni03E0.01	aka Sampi.01; F01F6 ϟ retrograde
Ͳ	F00F7	uni03E0.02	aka Sampi.02
T		Sampi.03	= Tau.01
Ψ	F00F9	uni03E0.04	aka Sampi.04

General Punctuation

Cardo supports many characters in this range, which contains a wide variety of punctuation characters used in multiple scripts. See the complete code chart found online at http://www.unicode.org/charts/PDF/U2000.pdf. Some glyph variants for ancient Greek punctuation characters are provided by Cardo in the Supplementary Private Use Area-A, along with one Latin punctuation mark:

⁋	U+204B	REVERSED PILCROW SIGN (Latin paragraphus)
	⸋	U+F452 glyph variant in PUA
	⸋	U+F1E1 glyph variant in PUA
	⸋	U+2647 glyph variant
⁜	U+205C	DOTTED CROSS
	⸎	U+F021E glyph variant in SPA-A
	⸎	U+F021F glyph variant in SPA-A
⸎	U+2E0E	EDITORIAL CORONIS
	⸎	U+F0220 glyph variant in SPA-A
	⸎	U+F0221 glyph variant in SPA-A
	⸎	U+F0222 glyph variant in SPA-A
	⸎	U+F0223 glyph variant in SPA-A
	⸎	U+F0224 glyph variant in SPA-A
⸏	U+2E0F	PARAGRAPHOS
	⸏	U+F0230 glyph variant in SPA-A
	⸏	U+F0231 glyph variant in SPA-A
⸐	U+2E10	FORKED PARAGRAPHOS
	⸐	U+F0235 glyph variant in SPA-A
⸑	U+2E11	REVERSED FORKED PARAGRAPHOS
	⸑	U+F0236 glyph variant in SPA-A

Supplemental Punctuation

Selected characters from this range include the set of New Testament Editorial Symbols, U+2E00–U+2E0D, the Ancient Greek Textual Symbols, U+2E0E–U+2E16, a variety of brackets, and the WORD SEPARATOR MIDDLE DOT, the best choice for encoding the Latin interpunct. See the complete Unicode range chart available from http://www.unicode.org/charts/PDF/U2E00.pdf. For the Latin hedera, see U+2766 FLORAL HEART BULLET. Some glyph variants in for characters in this range are provided by Cardo as follows:

⁜	U+205C	DOTTED CROSS
	⁜	U+F021E glyph variant in SPA-A
	⁜	U+F021F glyph variant in SPA-A
⸎	U+2E0E	EDITORIAL CORONIS
	⸎	U+F0220 glyph variant in SPA-A
	⸎	U+F0221 glyph variant in SPA-A
	⸎	U+F0222 glyph variant in SPA-A
	⸎	U+F0223 glyph variant in SPA-A
	⸎	U+F0224 glyph variant in SPA-A
⸏	U+2E0F	PARAGRAPHOS
	⸏	U+F0230 glyph variant in SPA-A
	⸏	U+F0231 glyph variant in SPA-A
⸐	U+2E10	FORKED PARAGRAPHOS
	⸐	U+F0235 glyph variant in SPA-A
⸑	U+2E11	REVERSED FORKED PARAGRAPHOS
	⸑	U+F0236 glyph variant in SPA-A
·	U+2E31	WORD SEPARATOR MIDDLE DOT (best for interpunct)
	·	U+F4B5 glyph variant in PUA
	·	U+F4B6 glyph variant in PUA
	·	U+F4B7 glyph variant in PUA
	·	U+F4B8 glyph variant in PUA
	·	U+F4B9 glyph variant in PUA wedge
	·	U+F4BA glyph variant in PUA
	·	U+F4BB glyph variant in PUA
	✶	U+2736 glyph variant

Number Forms

Cardo supports the Roman numerals found in this range of Unicode. See the complete code chart at http://www.unicode.org/charts/PDF/U2150.pdf. A large number of glyph variants is located in the PUA:

Ⅾ	U+0044	LATIN CAPITAL LETTER D
	Ð	F413 glyph variant in PUA (normal ancient shape for 500)
ↀ	U+2180	ROMAN NUMERAL ONE THOUSAND CD
	∞	U+221E glyph variant
	⋈	UF437+ glyph variant in PUA
ↁ	U+2181	ROMAN NUMERAL FIVE THOUSAND
	Ɗ	U+F472 glyph variant in PUA
	⏗	U+F473 glyph variant in PUA
	⏘	U+F474 glyph variant in PUA
	⏙	U+F475 glyph variant in PUA
	⏚	U+F476 glyph variant in PUA
	⏛	U+F477 glyph variant in PUA
	⏜	U+F478 glyph variant in PUA
	⏝	U+F479 glyph variant in PUA
	⏞	U+F47A glyph variant in PUA
	⏟	U+F47B glyph variant in PUA
	⏠	U+F47C glyph variant in PUA
	IↃↃ	U+F47D glyph variant in PUA
ↂ	U+2182	ROMAN NUMERAL TEN THOUSAND
	ↀ	U+F482 glyph variant in PUA
	ↀ⏗	U+F483 glyph variant in PUA
	ↀ⏘	U+F484 glyph variant in PUA
	ↀ⏙	U+F485 glyph variant in PUA
	ↀ⏚	U+F486 glyph variant in PUA
	ↀ⏛	U+F487 glyph variant in PUA
	ↀ⏜	U+F488 glyph variant in PUA
	ↀ⏝	U+F489 glyph variant in PUA
	ↀ⏞	U+F48A glyph variant in PUA
	ↀ⏟	U+F48B glyph variant in PUA
	ↀ⏠	U+F48C glyph variant in PUA
	CCIↃↃ	U+F48D glyph variant in PUA
↓	U+2186	ROMAN NUMERAL FIFTY EARLY FORM
	↓	F411 glyph variant in PUA
	⊥	F412 glyph variant in PUA

ↁ U+2187	ROMAN NUMERAL FIFTY THOUSAND
ↁ	U+F492 glyph variant in PUA
ↁ	U+F493 glyph variant in PUA
ↁ	U+F494 glyph variant in PUA
ↁ	U+F495 glyph variant in PUA
ↁ	U+F496 glyph variant in PUA
ↁ	U+F497 glyph variant in PUA
ↁ	U+F498 glyph variant in PUA
ↁ	U+F499 glyph variant in PUA
ↁ	U+F49A glyph variant in PUA
ↁ	U+F49B glyph variant in PUA
ↁ	U+F49C glyph variant in PUA
ↁ	U+F49D glyph variant in PUA
ↂ U+2188	ROMAN NUMERAL ONE HUNDRED THOUSAND
ↂ	U+F4A2 glyph variant in PUA
ↂ	U+F4A3 glyph variant in PUA
ↂ	U+F4A4 glyph variant in PUA
ↂ	U+F4A5 glyph variant in PUA
ↂ	U+F4A6 glyph variant in PUA
ↂ	U+F4A7 glyph variant in PUA
ↂ	U+F4A8 glyph variant in PUA
ↂ	U+F4A9 glyph variant in PUA
ↂ	U+F4AA glyph variant in PUA
ↂ	U+F4AB glyph variant in PUA
ↂ	U+F4AC glyph variant in PUA
ↂ	U+F4AD glyph variant in PUA

Dingbats

One character from the Dingbats range, U+2766 FLORAL HEART BULLET, is included here since it is the proper character for the Latin hedera; a glyph variant is provided to match more closely the form found in Roman inscriptions.

	U+2766	FLORAL HEART BULLET (Latin hedera) %❦
☙		U+F449 glyph variant in PUA

Latin Extended-D

Cardo supports the five Latin epigraphic letters found in this range of Unicode. See the complete code chart at http://www.unicode.org/charts/PDF/ UA720.pdf. One letter has a glyph variant located in the PUA:

Ɯ	U+A7FD	LATIN EPIGRAPHIC LETTER INVERTED M
	Ɯ	U+F445 glyph variant in PUA

Ancient Greek Numbers

This block of characters is fully supported in Cardo 1.04 roman; see http://www.unicode.org/charts/PDF/U10140.pdf for a complete chart. Cardo includes some glyph variants of characters in this block, as follows:

𐅄	U+10144	GREEK ACROPHONIC ATTIC FIFTY
	𐅅	U+F02E0 Carystian glyph variant in SPA-A
𐅌	U+1014C	ATTIC ACROPHONIC SYMBOL FIVE HUNDRED TALENTS
	𐅋	U+F0204 glyph variant in SPA-A
𐅗	U+10157	ATTIC ACROPHONIC SYMBOL TEN MNAS
	𐅘	U+ F0205 glyph variant in SPA-A
	𐅙	U+ F0206 glyph variant in SPA-A
	𐅚	U+ F0207 glyph variant in SPA-A
𐅥	U+10165	THESPIAN ACROPHONIC SYMBOL THIRTY
	𐅦	U+F0208 glyph variant in SPA-A
	𐅧	U+F0209 glyph variant in SPA-A
	𐅨	U+F020A glyph variant in SPA-A
	𐅩	U+F020B glyph variant in SPA-A
	𐅪	U+F020C glyph variant in SPA-A
𐅩	U+10169	THESPIAN ACROPHONIC SYMBOL FIFTY
	𐅫	U+F020D glyph variant in SPA-A
	𐅬	U+F020E glyph variant in SPA-A
𐅮	U+1016E	THESPIAN ACROPHONIC SYMBOL FIVE HUNDRED
	𐅭	U+F020F glyph variant in SPA-A
	𐅯	U+F0210 glyph variant in SPA-A

The following are glyph variants of Unicode characters that are designed to be used in the printing of acrophonic numerals. They may be accessed through the Stylistic Alternates feature in programs that support OT features as well as through the SPA-A codepoints.

/	U+F0200	variant of U+002F SLASH, for 1/12 unit, Beta Code #804
>	U+F0201	variant of U+003E GREATER, for half drachma sign #1337
<	U+F0202	variant of U+003C LESS, for one half (non-Attic)
O	U+F0203	variant of U+25EF LARGE CIRCLE, 4 different values

The following characters are present in the Beta Code manual but are not found in any texts currently in the TLG database. They are included here in the SPA-A for the sake of completeness.

𐅇	U+F0211	PHYSCAN 100 MNAS
𐅍	U+F0212	ACROPHONIC 10,000 TALENTS, Beta Code #819
𐅏	U+F0213	ACROPHONIC 5,000 STATERS, Beta Code #828

Ancient Greek Papyrological Numbers

This range of Unicode is completely supported in Cardo. In addition, there are several glyph variants in the Supplementary Private Use Area-A.

𐅵	U+10175	GREEK SYMBOL HALF TYPE ONE
	𐅵	U+F0237 glyph variant in SPA-A
	𐅵	U+F0238 glyph variant in SPA-A
	𐅵	U+F0239 glyph variant in SPA-A
𐅷	U+10177	GREEK SYMBOL TWO-THIRDS
	𐅷	U+F022E glyph variant in SPA-A
𐅹	U+1017C	GREEK SYMBOL OBOL
	𐅹	U+F0226 glyph variant in SPA-A
𐅺	U+1017D	GREEK SYMBOL TWO OBOLS
	𐅺	U+F0227 glyph variant in SPA-A
𐆃	U+10183	GREEK SYMBOL LITRA
	𐆃	U+F0228 glyph variant in SPA-A
𐆅	U+10185	GREEK SYMBOL XESTES
	𐆅	U+F0229 glyph variant in SPA-A
	𐆅	U+F022A glyph variant in SPA-A
𐆆	U+10186	GREEK SYMBOL ARTABE
	𐆆	U+F022B glyph variant in SPA-A
	𐆆	U+F022C glyph variant in SPA-A

Ancient Symbols

This range, which contains Roman weights and measures, coin symbols, and military symbols, is completely supported by Cardo. See the complete code chart online at http://www.unicode.org/charts/PDF/U10190.pdf. Some glyph variants in for characters in this range are provided by Cardo in the Supplementary Private Use Area-A as follows (note that all these variants can be accessed as well through the OpenType Stylistic Alternates feature):

=	U+10190	ROMAN SEXTANS SIGN
	≃	U+F43E glyph variant in PUA
	Z	U+005A glyph variant (= LATIN CAPITAL LETTER Z)
−	U+10191	ROMAN UNCIA SIGN
	•	U+2022 glyph variant
	◡	U+23D1 glyph variant (better shape than U+02D8)
	∾	U+F436 glyph variant in PUA
	≒	U+F439 glyph variant in PUA
𐅂	U+10192	ROMAN SEMUNCIA SIGN
	Σ	U+03A3 glyph variant (= GREEK CAPITAL LETTER SIGMA)
	Σ	U+F00C9 glyph variant in SPA-A (var. of Sigma)
	∈	U+F432 glyph variant in PUA
	£	U+ F438 glyph variant in PUA
ƨ	U+10193	ROMAN SEXTULA SIGN
	∿	U+F443 glyph variant in PUA
	ι	U+F433 glyph variant in PUA (used in pairs for binae sextulae)
Ɔ	U+2108	SCRUPLE
	ƨ	U+F429 glyph variant in PUA
	⊁	U+F42B glyph variant in PUA
𐅄	U+10196	ROMAN DENARIUS SIGN
	X	U+F422 glyph variant in PUA
𐅅	U+10197	ROMAN QUINARIUS SIGN
	S	U+0053 glyph variant (= LATIN CAPITAL LETTER S)
𐅆	U+10198	ROMAN SESTERTIUS SIGN
	H	U+F42E glyph variant in PUA
	£	U+F438 glyph variant in PUA
	HS	U+F02C7 glyph variant in SPA-A
	H	U+F02C8 glyph variant in SPA-A
	S	U+F02C9 glyph variant in SPA-A
	SS	U+F02CB glyph variant in SPA-A
𐅇	U+10199	ROMAN DUPONDIUS SIGN
	H	U+F43D glyph variant in PUA
	ϟ	U+F42F glyph variant in PUA

𐆚	U+1019A	ROMAN AS SIGN
	𐆚	U+F421 glyph variant in PUA
	𐆛	U+FB16 glyph variant in PUA
	𐆜	U+FB17 glyph variant in PUA
𐆛	U+1019B	ROMAN CENTURIAL SIGN
	𐆛	U+F44B glyph variant in PUA
	𐆛	U+F44D glyph variant in PUA
	𐆛	U+F446 glyph variant in PUA (modern “typographical” version of previous)
	𐆛	U+F4B6 glyph variant in PUA
	Ↄ	U+2183 glyph variant (= ROMAN NUMERAL REVERSED ONE HUNDRED)
	ↄ	U+F447 glyph variant in PUA
	ᴣ	U+F44E glyph variant in PUA
	ᴣ	U+F448 glyph variant in PUA
	ᴣ	U+F44F glyph variant in PUA
	Z	U+005A glyph variant (= LATIN CAPITAL LETTER Z)
	Ƶ	U+01B5 glyph variant (= LATIN CAPITAL LETTER Z WITH STROKE)

The Old Italic Block of Unicode

This chart shows the Old Italic block. Cardo provides retrograde versions of all the letters that require them to reproduce inscriptions that were carved left to right or boustrophedon. Note, however, that this is not a complete solution for the needs of scholars who work with Old Italic texts. Unicode has unified the Old Italic letters, while in fact the shapes used in some languages differ from the reference glyphs in the Unicode Standard. Additional variants may be added in the future to provide more complete support; those who need such glyphs should contact the author and let him know what they require.

Scholars who work with Old Italic regularly will want to locate or create a customized keyboard to enter the letters easily. If you are using the PUA values to access the variants, note that the Old Italic characters all begin with 10 and the corresponding retrograde variants begin with 'F0' followed by the same three digits.

𐌀	U+10300	D800 DF00	OLD ITALIC LETTER A
		𐍀	U+F0300 retrograde variant in SPA-A
𐌁	U+10301	D800 DF01	OLD ITALIC LETTER BE
		𐍁	U+F0301 retrograde variant in SPA-A
𐌂	U+10302	D800 DF02	OLD ITALIC LETTER KE
		𐍂	U+F0302 retrograde variant in SPA-A
𐌃	U+10303	D800 DF03	OLD ITALIC LETTER DE
		𐍃	U+F0303 retrograde variant in SPA-A
𐌄	U+10304	D800 DF04	OLD ITALIC LETTER E
		𐍄	U+F0304 retrograde variant in SPA-A
𐌅	U+10305	D800 DF05	OLD ITALIC LETTER VE
		𐍅	U+F0305 retrograde variant in SPA-A
𐌆	U+10306	D800 DF06	OLD ITALIC LETTER ZE
		𐍆	U+F0306 retrograde variant in SPA-A
𐌇	U+10307	D800 DF07	OLD ITALIC LETTER HE
𐌈	U+10308	D800 DF08	OLD ITALIC LETTER THE
𐌉	U+10309	D800 DF09	OLD ITALIC LETTER I
𐌊	U+1030A	D800 DF0A	OLD ITALIC LETTER KA
		𐍊	U+F030A retrograde variant in SPA-A
𐌋	U+1030B	D800 DF0B	OLD ITALIC LETTER EL
		𐍋	U+F030B retrograde variant in SPA-A
𐌌	U+1030C	D800 DF0C	OLD ITALIC LETTER M
		𐍌	U+F030C retrograde variant in SPA-A
𐌍	U+1030D	D800 DF0D	OLD ITALIC LETTER N
		𐍍	U+F030D retrograde variant in SPA-A
𐌎	U+1030E	D800 DF0E	OLD ITALIC LETTER ESH
𐌏	U+1030F	D800 DF0F	OLD ITALIC LETTER O
𐌐	U+10310	D800 DF10	OLD ITALIC LETTER PE
		𐍐	U+F0310 retrograde variant in SPA-A
𐌑	U+10311	D800 DF11	OLD ITALIC LETTER SHE

𐌒	U+10312	D800 DF12	OLD ITALIC LETTER KU
𐌓	U+10313	D800 DF13	OLD ITALIC LETTER ER
		𐍓	U+F0313 retrograde variant in SPA-A
𐌔	U+10314	D800 DF14	OLD ITALIC LETTER ES
		𐍔	U+F0314 retrograde variant in SPA-A
𐌕	U+10315	D800 DF15	OLD ITALIC LETTER TE
𐌖	U+10316	D800 DF16	OLD ITALIC LETTER U
𐌗	U+10317	D800 DF17	OLD ITALIC LETTER EKS
𐌘	U+10318	D800 DF18	OLD ITALIC LETTER PHE
𐌙	U+10319	D800 DF19	OLD ITALIC LETTER KHE
𐌚	U+1031A	D800 DF1A	OLD ITALIC LETTER EF
𐌛	U+1031B	D800 DF1B	OLD ITALIC LETTER ERS
		𐍛	U+F031B retrograde variant in SPA-A
𐌜	U+1031C	D800 DF1C	OLD ITALIC LETTER CHE
		𐍜	U+F031C retrograde variant in SPA-A
𐌝	U+1031D	D800 DF1D	OLD ITALIC LETTER II
		𐍝	U+F031D retrograde variant in SPA-A
𐌞	U+1031E	D800 DF1E	OLD ITALIC LETTER UU
𐌠	U+10320	D800 DF20	OLD ITALIC NUMERAL ONE
𐌡	U+10321	D800 DF21	OLD ITALIC NUMERAL FIVE
𐌢	U+10322	D800 DF22	OLD ITALIC NUMERAL TEN
𐌣	U+10323	D800 DF23	OLD ITALIC NUMERAL FIFTY

Ancient Greek Musical Notation

The Ancient Greek Musical Notation block, U+1D200 ff., is fully supported in Cardo. See http://www.unicode.org/charts/PDF/U1D200.pdf for a complete chart. Cardo provides one glyph variant.

𝈜	U+1D23C	GREEK INSTRUMENTAL NOTATION SYMBOL 49
	Z	U+F0052 glyph variant in SPA-A

5.3 Additional Non-Unicode Characters

Diphthongs with Stress Mark

When discussing the pronunciation of Latin, it is sometimes necessary to place an acute accent over a diphthong, as in this example: “Stress the first syllable: eúgepae.” Cardo contains six such diphthong plus acute precomposed combinations. Note that they were moved to new codepoints in version 1.04, so if you have used these characters in the past you will need to update older documents.

aé	U+FB10	LATIN SMALL DIPHTHONG AE WITH ACUTE
aú	U+FB11	LATIN SMALL DIPHTHONG AU WITH ACUTE
eí	U+FB12	LATIN SMALL DIPHTHONG EI WITH ACUTE
eú	U+FB13	LATIN SMALL DIPHTHONG EU WITH ACUTE
oé	U+FB14	LATIN SMALL DIPHTHONG OE WITH ACUTE
uí	U+FB15	LATIN SMALL DIPHTHONG UI WITH ACUTE

Supplementary Greek Characters

The characters in the following table may be of use to epigraphers and others. The characters shown in this section are also found with the same PUA values in New Athena Unicode and Vusillus Oldface, if you wish to use either of those fonts instead of Cardo for these characters. Note also that some of these characters have now been accepted into Unicode. They are retained in the font for backwards compatibility, but their PUA values in the chart are set in light gray type and a cross reference is provided to the new Unicode codepoints.

ϛ	U+E197	GREEK DRACHMA SIGN = U+1017B
✳	U+E198	GREEK DENARIUS SIGN = U+2733
ʟ	U+E199	GREEK ETOS SYMBOL = U+10179
h	U+E19B	GREEK EPIGRAPHICAL SMALL H
Ͳ	U+E19C	GREEK LETTER SAN VARIANT / DISIGMA
Ι̯	U+E1A0	INVERTED IOTA WITH BREVE BELOW
ɪ̰	U+E1A1	INVERTED IOTA WITH TILDE BELOW
ʏ̯	U+E1A2	INVERTED UPSILON WITH BREVE BELOW
ʏ̰	U+E1A3	INVERTED UPSILON WITH TILDE BELOW
Ϳ	U+E1A5	GREEK LETTER CAPITAL JOT (this will probably be assigned to U+037F in a future version of Unicode)
Ϗ	U+E1A6	GREEK CAPITAL KAI SYMBOL = U+03CF
ε̆	U+E1A9	GREEK LETTER EPSILON WITH BREVE
᾿Ρ	U+E1AA	GREEK LETTER OMICRON WITH BREVE
᾿Ρ	U+E1AB	GREEK CAPITAL LETTER RHO WITH PSILI
᾿Υ	U+E1AC	GREEK CAPITAL LETTER UPSILON WITH PSILI
῍Υ	U+E1AD	GREEK CAPITAL LETTER UPSILON WITH PSILI AND GRAVE
῎Υ	U+E1AE	GREEK CAPITAL LETTER UPSILON WITH PSILI AND ACUTE
῏Υ	U+E1AF	GREEK CAPITAL LETTER UPSILON WITH PSILI AND PERI-SPOMENI

Here are the other epsilon and omicron plus diacritic combinations:

ε̃	E1B0	ἐ̃	E1B1	ἐ̃	E1B2	ε̄	E1B3	έ	E1B4	ὲ	E1B5
ἔ	E1B6	ἕ	E1B7	ἒ	E1B8	ἓ	E1B9	ἑ̃	E1BA	ἐ̃	E1BB
᾿̃Ε	E1BC	῾̃Ε	E1BD	Ε̄	E1BE	Ε̆	E1BF	õ	E1C0	ὸ	E1C1
ὸ	E1C2	ō	E1C3	ό	E1C4	ὸ	E1C5	ὸ	E1C6	ὸ	E1C7
ὸ	E1C8	ὸ	E1C9	ὸ	E1CA	ὸ	E1CB	῾̃Ο	E1CC	῾̃Ο	E1CD
Ō	E1CE	Ŏ	E1CF								

Archaic and Idiosyncratic Musical Symbols

	Value	Name	Character Name	Beta
ꟹ	F024A	uF024A	Archaic Musical Symbol 2a / 40a	#594
ꟺ	F024B	uF024B	Archaic Musical Symbol 2b / 40b	#601
ꟻ	F024C	uF024C	Archaic Musical Symbol 4a / 6b	#595
ꟼ	F024D	uF024D	Archaic Musical Symbol 4b / 6a	#596
ꟽ	F024E	uF024E	Archaic Musical Symbol 7b	#597
ꟾ	F024F	uF024F	Archaic Musical Symbol 10b/9a (= Delta.01)	#598
ꟿ	F0250	uF0250	Archaic Musical Symbol 13a	#605
ꠀ	F0251	uF0251	Archaic Musical Symbol 15a	#606
ꠁ	F0252	uF0252	Archaic Musical Symbol 15b	#613
ꠂ	F0253	uF0253	Archaic Musical Symbol 16b / 17a	#608
ꠃ	F0254	uF0254	Archaic Musical Symbol 16a / 17b	#607
ꠄ	F0255	uF0255	Archaic Musical Symbol 18a / 19b	#609
ꠅ	F0256	uF0256	Archaic Musical Symbol 18b / 19a	#610
꠆	F0257	uF0257	Archaic Musical Symbol 20a	#611
ꠇ	F0258	uF0258	Archaic Musical Symbol 20b	#614
ꠈ	F0259	uF0259	Archaic Musical Symbol 23b / 24a	#612
ꠉ	F025A	uF025A	Archaic Musical Symbol 46a	#620
ꠊ	F025B	uF025B	Archaic Musical Symbol 46b	#626
ꠋ	F025C	uF025C	[reserved]	#568
ꠌ	F025D	uF025D	Idiosyncratic Musical Symbol	#571
ꠍ	F025E	uF025E	Instrumental Notation Symbol 53; see #675	#592
ꠎ	F025F	uF025F	Archaic Musical Symbol 32a	#617
ꠏ	F0260	uF0260	Archaic Musical Symbol 32b	#623
ꠐ	F0261	uF0261	Archaic Musical Symbol 38a	#618
ꠑ	F0262	uF0262	Archaic Musical Symbol 33b	#625
ꠒ	F0263	uF0263	Archaic Musical Symbol 44a	#619
ꠓ	F0264	uF0264	Idiosyncratic Musical Symbol	#677
ꠔ	F0265	uF0265	Idiosyncratic Musical Symbol	#680
ꠕ	F0266	uF0266	Idiosyncratic Musical Symbol	#681
ꠖ	F0267	uF0267	Idiosyncratic Musical Symbol	#682
ꠗ	F0268	uF0268	Idiosyncratic Musical Symbol	#683
ꠘ	F0269	uF0269	Idiosyncratic Musical Symbol	#685
ꠙ	F026A	uF026A	Idiosyncratic Musical Symbol	#686
ꠚ	F026B	uF026B	Idiosyncratic Musical Symbol	#687

Beta Code Characters not in Unicode

This table contains those characters found in texts in the TLG database that are so rare or poorly understood that the TLG did not propose them for inclusion in Unicode; in the Quick Beta manual they are marked "use PUA." In Cardo they are located in the Supplementary Private Use Area-A. The Beta Code value is given in the right-hand column. The drawing for some of these characters may be improved in future versions of Cardo.

=	F0270	uF0270	METRICAL LONG OVER LONG	%47
⏑	F0271	uF0271	METRICAL SHORT OVER SHORT	%48
⏑⏑	F0272	uF0272	METRICAL TRIPLE SHORTS	%49
⍥	F0273	uF0273	METRICAL LONG WITH BRACKETED ictus	%139
≡	F0274	uF0274	METRICAL TRIPLE LONG	%140
⫶	F0275	uF0275	TWO DASHES THREE DOTS CHARACTER	#107
⫶	F0276	uF0276	THREE DASHES TWO DOTS CHARACTER	#108
⫶	F0277	uF0277	TWO DASHES THREE DOTS CHARACTER ALT1	#124
⫶	F0278	uF0278	TWO DASHES FOUR DOTS CHARACTER	#126
⩓	F0279	uF0279	MINUS SIGN	#166
M	F027 A	uF027A	MYRIAD OF MYRIAD SIGN	#167
M	F027 B	uF027B	MYRIAD OF MYRIAD OF MYRIAD SIGN	#168
♌	F027C	uF027C	SIGN OF THE ZODIAC	#243
♑	F027D	uF027D	HEAVEN SIGN	#246
♉	F027E	uF027E	EARTH SIGN	#247
☌	F027F	uF027F	NEW MOON SYMBOL	#248
⍲	F0280	uF0280	IDIOSYNCRATIC ABBREVIATION	#301
⟞	F0281	uF0281	DOT AND DASH EDITORIAL SIGN	#314
⩔	F0282	uF0282	UNKNOWN EDITORIAL CHARACTER	#466
⩓	F0283	uF0283	ΠΙΘΑΝΌΝ ABBREVIATION	#501
⫛	F0284	uF0284	PI-RHO ABBREVIATION	#503
⊙	F0285	uF0285	WORM ON CIRCLE STANDING	#513
⊙	F0286	uF0286	WORM ON CIRCLE CRAWLING	#514
⌘	F0287	uF0287	COLIC AMULET SYMBOL	#521
⟘	F0288	uF0288	ANCIENT EDITORIAL CHARACTER	#530
⩎	F0289	uF0289	UNKNOWN PAPYROLOGICAL CHARACTER	#535
⍦	F028A	uF028A	UNKNOWN PAPYROLOGICAL CHARACTER	#536
⍩	F028B	uF028B	UNKNOWN PAPYROLOGICAL CHARACTER	#537
⍤	F028C	uF028C	UNKNOWN MANUSCRIPT CHARACTER	#538
⫰	F028D	uF028D	ΒΆΝΔΟΝ ΔΗΦΕΝΣΌΡΩΝ SYMBOL	#543
·:·	F028E	uF028E	SYMBOL	#544
⫰	F028F	uF028F	SYMBOL	#545
⫯	F0290	uF0290	SYMBOL	#546
⫿	F0291	uF0291	ψιλός SYMBOL	#547
⫩	F0292	uF0292	UNKNOWN ABBREVIATION	#548

≣	F0293	uF0293	FOUR HORIZONTAL LINES	#549
ɤ	F0294	uF0294	EXILE SIGN	#552
⊥	F0295	uF0295	ABOLITION OF LAW SYMBOL	#553
⅄	F0296	uF0296	NEW TESTAMENT SYMBOL	#554
ϵ	F0297	uF0297	GENTILES SYMBOL	#555
ʕ	F0298	uF0298	PROMISE SYMBOL	#557
ʒ	F0299	uF0299	BIBLICAL AMBIGUITY SYMBOL	#558
⅄	F029A	uF029A	FUTURE PROPHECY SYMBOL	#559
ϕ	F029B	uF029B	UNKNOWN ABBREVIATION	#693
⊤	F029C	uF029C	UNKNOWN ABBREVIATION	#701
⊐	F029D	uF029D	UNKNOWN EDITORIAL CHARACTER	#702
ʢ	F029E	uF029E	UNKNOWN EDITORIAL CHARACTER	#705
ʎ	F029F	uF029F	UNKNOWN EDITORIAL CHARACTER	#706
ʧ	F02A0	uF02A0	UNKNOWN EDITORIAL CHARACTER	#707
⁒	F02A1	uF02A1	UNKNOWN EDITORIAL CHARACTER	#708
♄	F02A2	uF02A2	KRONOS SYMBOL	#712
♃	F02A3	uF02A3	ZEUS SYMBOL	#713
♂	F02A4	uF02A4	ARES SYMBOL	#714
♀	F02A5	uF02A5	APHRODITE SYMBOL	#715
☿	F02A6	uF02A6	HERMES SYMBOL	#716
ℳ℘	F02A7	uF02A7	MU-RHO ABBREVIATION	#1315
÷	F02A8	uF02A8	εἶναι ABBREVIATION	#1318
⅁	F02A9	uF02A9		#1319
ˆ	F02AA	uF02AA	UNKNOWN ABBREVIATION	#1320
´	F02AB	uF02AB		#1321
≈	F02AC	uF02AC	SEA ABBREVIATION	#1327
∼	F02AD	uF02AD	RIVER ABBREVIATION	#1328
⋇	F02AE	uF02AE	IDIOSYNCRATIC PAPYROLOGICAL PUNCTUATION	#1334
Ⓘ̀	F02AF	uF02AF	UNKNOWN ABBREVIATION	#1501
⩝	F02B0	uF02B0	UNKNOWN ABBREVIATION	#1503
—	—	—— ——	(see above)	#1504
⩟	F02B1	uF02B1	UNKNOWN ABBREVIATION	#1505
ˋ ˇ	F02B2	uF02B2	UNKNOWN ABBREVIATION	#1506
ˀ	F02B3	uF02B3	UNKNOWN ABBREVIATION	#1509
Λ	F02B4	uF02B4	ABBREVIATION	#1510
π	F02B5	uF02B5	ABBREVIATION	#1511
⁄	F02B6	uF02B6	εἶναι ABBREVIATION	#1515
⅂	F02B7	uF02B7	UNKNOWN EDITORIAL CHARACTER	#1519
⊣	F02B8	uF02B8	UNKNOWN ABBREVIATION	#1520

Symbols in the PHI Latin Texts

The following symbols are found in Latin texts on the PHI CD-ROM. They have Beta code numbers although they are not used by the TLG.

⁝—	F02C0	Vitruvius	#152
⁝⁝	F02C1	Vitruvius	#153
⁝	F02C2	Vitruvius	#155
∵	F02C3	Vitruvius	#157
⁝⁝	F02C4	Vitruvius	#158
⁝⁝	F02C5	Vitruvius	#159
~	F02C6	Vitruvius	#160
ℍS	F02C7	Cato, De agri cultura	#1101
ℍ	F02C8	Cato, De agri cultura	#1102
S	F02C9	Cato, De agri cultura	#1104
=	F02CA	Cato, De agri cultura	#1106
SS	F02CB		#1107
ϒ	F02CC	Celsus, 5.22.8	#1112
ℰ	F02CD	Celsus, 5.18.7	#1113
ƨ	F02CE	Agrimensores 86.5	#1116
ɿ	F02CF	Scribonius 71 (p. 40)	#1118
⌜	F02D0	Varro 0684.071 (p. 40)	#1120
ϒ	F02D1	Varro0684.145 (p. 74); Scribonius	#1122
ℯ	F02D2	Servius, G. 1.205.15	#1123
ℂ	F02D3	Servius, A. 4.511.9	#1125
q	F02D4	Quadrantal: Volusius Maecianus (1285 001): 80	#1134
9	F02D5	Hemina: Volusius Maecianus (1285 001): 80	#1135