

GreekKeys: Keyboards and fonts for specialized scholarly use

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GreekKeys is a custom polytonic Greek keyboard program with accompanying fonts that has been useful—for more than three decades now—to scholars, teachers, and students of the ancient and medieval Greek worlds. GreekKeys fonts and keyboards provide easy access to many specialized characters (e.g., for metrics, epigraphy, and papyrology) that are absent from most system fonts and that would otherwise have to be entered in roundabout or obscure ways. The latest version (GreekKeys 2015) runs both under Mac OS and Microsoft Windows, and it includes four different Unicode encoded OpenType fonts: *New Athena Unicode*, *AtticaU*, *KadmosU*, and *BosporosU*.

1 A brief history of GreekKeys

Before the introduction of the Macintosh computer in 1984, individual scholars in classical studies had no easy choices for preparing copy that included polytonic Greek along with roman characters. The old systems included (1) adding handwritten Greek words within spaces left blank in a typescript; (2) leaving blank spaces in the typescript and then running the page through a separate Greek typewriter to fill in the gaps; (3) using an IBM Selectric typewriter with removable type ball, constantly shifting between the standard ball with roman type and a custom-made ball for polytonic Greek (the Greek ball from IBM itself would serve only the needs of Greek symbols for mathematics and other sciences). In the 1980s some “minicomputer” systems capable of multilingual word-processing became available in the price range of \$70,000 to \$100,000, and for the technically-savvy there were ways to trick a UNIX mainframe into outputting Greek using escape sequences in the ASCII code.

The first Macintosh operating system and the availability to users of the utility known as Resource Editor changed the situation radically. Not long after the first Macs became available (for about \$2,500), George B. Walsh, a classicist at the University of Chicago, developed a couple of simple polytonic fonts and also a keyboard resource for input. The product was called SMK GreekKeys (SMK being the initials of Walsh’s wife). The characters of the standard ASCII set found in the fonts supplied with the OS were replaced by plain Greek characters and the various precomposed characters with diacritics found in standard ancient texts, and the available slots within the 254 character limit were barely enough to serve the purpose. The keyboard resource was used to define deadkey sequences that gave access to the accented characters, and these took advantage of the intelligent design of the role of the Macintosh keyboard’s Option key (⌥). In the original design of GreekKeys, for instance, Option-q would be pressed first to indicate that the vowel typed next should have an acute accent. A few years later the keyboard resource was redesigned so that the option sequences were located on the number row rather than the first row of letters (so now Option-1 was the deadkey for acute accent), and this became the GreekKeys Universal keyboard.

The GreekKeys system as created by Walsh enabled many “desktop publishing” efforts. For example, my own textbook *Introduction to Attic Greek* was published by University of California Press in 1993 partly because I was able to free the press of the difficulty and expense of typesetting it. I had worked on it over many years and eventually had it in Microsoft Word files. A book designer at the press specified the styles to be used, and I applied those styles and ultimately generated PostScript files that were used by the printer who manufactured the books. Despite its usefulness and wide adoption among classicists using Macs, traditional GreekKeys had disadvantages. It used a non-standard encoding, differing from several other non-standard encodings produced by other software authors (many of whom came to polytonic Greek from the direction of Biblical studies) as well as from codepages recognized by Microsoft. It was also not a cross-platform product, and in the 1990s there were times when it seemed that Apple and the Macintosh computer might disappear at any moment.

Walsh died at a tragically young age in 1989. His widow, Susan M. Kastendiek, donated GreekKeys to the American Philological Association (APA), the professional society of North American classics professors [which officially changed its name recently to Society for Classical Studies (SCS)]. Jeffrey Rusten, a classicist at Cornell University, took up support and development of the product, adding new fonts and providing a version that worked, for a short time in the 1990s, with the developing Windows OS.

In 2001 I took over support for the project. Because of my extensive experience in multi-language word-processing with MS Word for Mac, I had al-

ready been for several years the person who supplied to Rusten's online FAQ the various workarounds that were needed every time Microsoft produced a new version of Word for the Mac (then, as now, several of the autocorrect and autoformat features of Word needed to be turned off to prevent gibberish from replacing what you type). In 2001 there were three problems to be faced: (1) in the short term, the traditional GreekKeys fonts needed some revisions in order to continue to work with programs that were starting to be cognizant of Unicode; (2) a transition to Unicode encoding of the fonts had to be planned and executed; (3) the introduction of Mac OS X raised the problem of how the traditional GreekKeys keyboard could even be installed and how a Unicode keyboard could be created to replace it. Short-term fixes were found for the traditional product, but it was deprecated as of the end of 2005. The Unicode version went through experimental developments from 2002 to 2004 and in 2005 GreekKeys Unicode (still for Macs only) became available as the recommended version for use. Further enhancements and the addition of keyboards for Windows XP and beyond highlighted GreekKeys 2008, and recently GreekKeys 2015 has added a few more refinements and corrections and updated the documentation and the installers for the latest OS versions from Apple and Microsoft.

2 GreekKeys today: the fonts

When George Walsh began the project, he supplied bitmapped fonts that could be printed on the Apple ImageWriter (a dot-matrix printer). The original fonts were called *Sparta* and *Salamis*, and in order to cope with some unusual characters (such as dotted letters) there were alternative versions *Sparta+* and *Salamis+*. Later he created the font *Attika*. With the spread of laser printers and the development of PostScript fonts, Marc Cogan of Allotype Typographics developed two PostScript fonts using the traditional GreekKeys encoding (*Kadmos* and *Bosporos*). Jeffrey Rusten developed *Athenian* font, and *Athenian* and *Attika* fonts were soon available in TrueType and PostScript versions.

Rusten's design for *Athenian* was based on various Greek upright fonts illustrated in Victor Scholderer, *Greek Printing Types 1465-1927* (London 1927): that of Nicolaus Jenson (1472, plate 7), the Complutum Greek Testament (ca. 1510), Robert Proctor's "Otter" (1910, plate 59) and Victor Scholderer's "New Hellenic" (1927, plate 58). TrueType *Athenian* was eventually distributed as a freeware font because, before Unicode was sufficiently developed and supported, various websites were using traditional GreekKeys encoding. With the advent of Unicode for polytonic Greek, *Athenian* was re-encoded by Rusten as *Athena Unicode* font. When I took over support of GreekKeys, I greatly expanded the range of characters in *Athena Unicode* and renamed it *New Athena*

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 ΑΒΓΔΕΖΗΘΙΚΛΜΝΞΟΠΡΣΣΤΥΦΧΨΩϞΜϜΪΣ

Ἔφη γὰρ αὐτοὺς τοὺς Ῥωμαίους αἰτίους εἶναι τοῦ μὴ πειθαρχεῖν αὐτοῖς τοὺς Ἕλληνας, ἀλλὰ παρακούειν καὶ τῶν γραφομένων καὶ τῶν παραγγελλομένων. δεῖν γὰρ οὐσῶν αἰρέσεων κατὰ τὸ παρὸν ἐν πάσαις ταῖς δημοκρατικαῖς πολιτείαις, καὶ τῶν μὲν φασκόντων δεῖν ἀκολουθεῖν τοῖς γραφομένοις ὑπὸ Ῥωμαίων καὶ μήτε νόμον μήτε στήλην μήτ' ἄλλο μηθὲν προυργιαίτερον νομίζειν τῆς Ῥωμαίων προαιρέσεως, τῶν δὲ τοὺς νόμους προφερομένων καὶ τοὺς ὄρκους καὶ στήλας καὶ παρακαλούντων τὰ πλήθη μὴ ῥαδίως ταῦτα παραβαίνειν, ἀχαϊκώτεραν εἶναι παρὰ πολὺ ταύτην τὴν ὑπόθεσιν καὶ νικητικώτεραν ἐν τοῖς πολλοῖς. ἐξ οὗ τοῖς μὲν αἰρουμένοις τὰ Ῥωμαίων ἀδοξίαν συνεξακολουθεῖν παρὰ τοῖς ὄχλοις καὶ διαβολήν, τοῖς δ' ἀντιπράττουσιν τάναντία.

Figure 1: A sample of the *New Athena Unicode* font. Alphabet set at 14 pt with 18 pt leading. Text from Polybius' *Histories* (24.9) set at 10 pt with 14 pt leading.

Unicode (NAU). Like *Athenian* before it, this font has been made available for free to assist websites that were moving to using Unicode Greek in browser displays. It is now governed by an Open Font License. Figure 1 is an image of the standard characters.

New Athena Unicode has been repeatedly revised over the past decade at the request of users and in response to the expansion of Unicode coverage. It now contains Coptic characters (in a form familiar to scholars working on the early centuries of Coptic writing), a great many roman characters with diacritics needed in linguistics and various European languages, special epigraphic characters, some ancient and medieval Greek musical symbols, and characters needed for transliteration of ancient Demotic Egyptian (needed by Egyptologists and papyrologists). Apart from the regular Greek characters and the precombined characters recognized by Unicode, NAU contains Greek characters with dot below or with line above, and Greek vowels with macron or breve as well as diacritics.

Version 5 of NAU (2015) contains almost 2200 glyphs, 1842 with Unicode code points and the remainder precomposed substitution glyphs. Substitutions are governed by OpenType feature tables, so that well-formed precomposed characters appear for combinations that have to be entered as multiple Unicode code points. Previously the substitutions were defined in *liga* tables, but in the Version 5 the same rules are instead in *ccmp* tables, which means that the substitutions work automatically in most modern applications.

For example, the sequence U+03B1, U+0306, U+0313, U+0301 (alpha, combining breve, combining smooth breathing, combining acute accent), without a substitution, would appear as a jumble of diacritics poorly placed or overlapping on top of small alpha. That is what will appear with most fonts. In the ccmp table, this sequence is defined so as to be represented by a single precomposed glyph in which the combining elements are correctly placed. But the four codepoints are still in the textual data, and if you use the delete/backspace key repeatedly, then the glyph will first be replaced by alpha with breve and smooth, then by alpha with breve, then by alpha, and finally will be completely deleted. In contrast, if you input the same precomposed glyph using the PUA code point U+EB0C (used before the fonts supported OpenType substitutions), then a single use of the delete key will remove the glyph.

NAU font is freely downloadable and is available with an Open Font License in regular, bold, italic, and bold italic styles, in .ttf format for regular use and .woff for web developers. The current download URL has been <http://apagreekkeys.org/NAUdownload.html>, but the new location that will be maintained in the future is <https://classicalstudies.org/publications-and-research/nau-download>.

The other three fonts owned by the SCS are not freeware, but are licensed to those who obtain the GreekKeys package either by purchase or as a benefit of membership in the SCS. These fonts contain almost 1200 characters, including basic metrical symbols and the same precomposed glyphs found in *New Athena Unicode* (for combinations of macron or breve with other diacritics and for dotted Greek characters and for lowercase Greek letters with overstroke), and the same OpenType ccmp tables to enable substitutions. They too are available in regular, bold, italic, and bold italic styles.

AttikaU font (Figure 2) is an expansion of the GreekKeys non-Unicode font *Attika*. *Attika* was designed by George B. Walsh in 1986, in tribute to the font "Attika" designed in 1953 by the renowned typographer Hermann Zapf.

KadmosU font (Figure 3) is an expansion of the non-Unicode GreekKeys-encoded font *Kadmos* designed by Marc Cogan of Allotype Typographics, who donated the font to the APA in 2004.

BosporosU font (Figure 4) is an expansion of the non-Unicode GreekKeys-encoded font *Bosporos*, also designed by Marc Cogan of Allotype Typographics and donated to the APA in 2004.

3 GreekKeys today: the keyboards

The keyboard pattern for GreekKeys Unicode is similar to that of GreekKeys Universal. The deadkeys for the accents, breathings, and combined accents and breathings are arranged in a single sequence across the number-row of the key-

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Ἔφη γὰρ αὐτοὺς τοὺς Ῥωμαίους αἰτίους εἶναι τοῦ μὴ πειθαρχεῖν αὐτοῖς τοὺς Ἕλληνας, ἀλλὰ παρακούειν καὶ τῶν γραφομένων καὶ τῶν παραγγελ-
 λομένων. δεῖν γὰρ οὐσῶν αἰρέσεων κατὰ τὸ παρὸν ἐν πάσαις ταῖς δημο-
 κρατικαῖς πολιτείαις, καὶ τῶν μὲν φασκόντων δεῖν ἀκολουθεῖν τοῖς γραφο-
 μένοις ὑπὸ Ῥωμαίων καὶ μήτε νόμον μήτε στήλην μήτ' ἄλλο μηθὲν προου-
 ργιαίτερον νομίζειν τῆς Ῥωμαίων προαιρέσεως, τῶν δὲ τοὺς νόμους προ-
 φερομένων καὶ τοὺς ὄρκους καὶ στήλας καὶ παρακαλούντων τὰ πλήθη μὴ
 ῥαδίως ταῦτα παραβαίνειν, ἀχαϊκώτερον εἶναι παρὰ πολὺ ταύτην τὴν ὑπό-
 θεσιν καὶ νικητικώτερον ἐν τοῖς πολλοῖς. ἔξ οὗ τοῖς μὲν αἰρουμένοις τὰ Ῥω-
 μαίων ἀδοξίαν συνεξακολουθεῖν παρὰ τοῖς ὄχλοις καὶ διαβολὴν, τοῖς δ' ἀν-
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Figure 2: A sample of the *AtticaU* font. Alphabet set at 14 pt with 18 pt leading. Text set at 10 pt with 14 pt leading.

board, rather than scattered at various places as on most Greek keyboards (be-
 cause they imitate the old manual Greek typewriters). This makes the position
 of the accents easy to learn for beginners and familiar to those who have been
 using GreekKeys for many years already. The GreekKeys keyboard is also dif-
 ferent from polytonic keyboards provided by Apple and Microsoft in that it
 caters to other needs of classicists, such as entering metrical symbols, entering
 characters with a macron or breve as well as diacritics, placing a combining
 dot under characters (as needed in papyrology), placing circumflex accent on
 epsilon or omicron (as needed in Greek epigraphic publications), and entering
 special symbols and punctuation used in the editing of texts of various kinds.

The keyboards for OS X are written in XML, which has made it extremely
 easy to revise them and to create localized versions for different layouts on the
 various physical keyboards that are sold with Mac computers. The program-
 ming in these keyboards allows for chaining of deadkeys, so that one can enter
 some characters in more than one way. Thus `Option-1` (for acute) followed by
`Option-4` (for smooth breathing) followed by `a` produces alpha with smooth
 and acute, and the same results from `Option-4` followed by `Option-1` followed
 by `a`, or (with just one deadkey) from `Option-6` followed by `a`. Or `Option-5`
 followed by `Shift-Option-=` followed by `a` produces alpha with macron and
 rough breathing, and the same results from `Shift-Option-=` followed by `Op-
 tion-5` followed by `a`. Other combined characters instead are produced by en-
 tering a non-spacing character after entering the relevant letter: thus typing `b`

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Figure 3: A sample of the *KadmosU* font. Alphabet set at 14 pt with 18 pt leading. Text set at 10 pt with 14 pt leading.

followed by `Option-period` will produce a beta with a dot below it (U+0323), and in the GreekKeys fonts a substitution will ensure that the dot is centered under the letter and does not overlap with any descender.

The Windows keyboards are produced with the utility Microsoft Keyboard Layout Creator from Microsoft. These are much more laborious to create and revise because they involve a complicated GUI and you cannot simply edit XML in a text editor. Microsoft's different use of the two ALT keys and its overuse of the other modifier keys for shortcuts in the OS and MS Word (sometimes with no way to turn off the supplied shortcut) make it impossible for the Windows keyboards to work as elegantly as the Mac keyboards. Furthermore, it is very difficult to produce a localized version by modifying the US version, or even to update a previous version to a newer version, because there is a bug in the saving of the changed name of a revised keyboard. While working on the 2015 revisions, a workaround was fortunately discovered. The bug arises because within each of the four `.dll` files produced when an installer is created by MSKLC, there is one place in the hex code where the old name persists instead of being revised, and this incorrect old version is the name read by the OS and displayed for the user. I used a freeware hexcode editor (HxD) to locate the fault, the number 2008, and replace those characters one-for-one with 2015.

The resulting Windows keyboards can help input more or less the same range of specialized characters as the Mac versions, although a few users re-

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Ἔφη γὰρ αὐτοὺς τοὺς Ῥωμαίους αἰτίους εἶναι τοῦ μὴ πειθαρχεῖν αὐτοῖς τοὺς Ἕλληνας, ἀλλὰ παρακούειν καὶ τῶν γραφομένων καὶ τῶν παραγγελλομένων. δυνεῖν γὰρ οὐσῶν αἰρέσεων κατὰ τὸ παρὸν ἐν πάσαις ταῖς δημοκρατικαῖς πολιτείαις, καὶ τῶν μὲν φασκόντων δεῖν ἀκολουθεῖν τοῖς γραφομένοις ὑπὸ Ῥωμαίων καὶ μήτε νόμον μήτε στήλην μήτ' ἄλλο μηθὲν προυργιαίτερον νομίζειν τῆς Ῥωμαίων προαιρέσεως, τῶν δὲ τοὺς νόμους προφερομένων καὶ τοὺς ὄρκους καὶ στήλας καὶ παρακαλούντων τὰ πλήθη μὴ ῥαδίως ταῦτα παραβαίνειν, ἀχαϊκωτέραν εἶναι παρὰ πολὺ ταύτην τὴν ὑπόθεσιν καὶ νικητικωτέραν ἐν τοῖς πολλοῖς. ἐξ οὗ τοῖς μὲν αἰρουμένοις τὰ Ῥωμαίων ἀδοξίαν συνεξακολουθεῖν παρὰ τοῖς ὄχλοις καὶ διαβολήν, τοῖς δ' ἀντιπράττουσιν τάναντία.

Figure 4: A sample of the *BosporosU* font. Alphabet set at 14 pt with 18 pt leading. Text set at 10 pt with 14 pt leading.

port insurmountable conflicts with one or another shortcut setting in their particular variation of Windows.

4 More information

The support site for GreekKeys 2008 has been located at apagreekkeys.org, while the 2008 version sold until October 2015 through a storefront at esellerate.net. The 2015 version is now available at the website of the Society of Classical Studies: <https://classicalstudies.org/publications-and-research/about-greekkeys-2015> (free to members, and for sale and download there to non-members). The documentation and FAQ can also be found at the SCS site.