Documentation for the greektonoi.sty package and greektonoi.map mapping.

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2016/01/01

Abstract

The greektonoi package offers the possibility to directly type or paste in ancient Greek texts with diacritical marks and transforming monotonic texts to polytonic ones. To insert accents and breathings we use a method similar to the common `Beta Code` convention.

This file documents version 0.2 of greektonoi.sty.

Contents

1 Introduction

The polytonic(multi-accents) writing system in Greece was abolished by the Greek parliament since 1982. However, the need for using it has not been eliminated. Many publishing houses, the Orthodox Church of Greece, writers, scholars and other individuals continue to write by using the polytonic system. Fortunatelly, almost all

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the monotonic and polytonic Greek characters are included in the Unicode sets by the www.unicode.org: Unicode Greek and Coptic code set (with codes U + 0370 - U+03FF), Greek Extended code set (from U + 1F00 - U+1FFF) and Combining Diacritical Marks code set (U + 0300 - U+036F) as well. The Greek diphthong (δίφθογος) 'ου' is one of the few letter combinations that are not included (see https://en.wikipedia.org/wiki/Ou_(ligature)). In general, writing in the polytonic system (in electronic devices) remains a difficult problem. The problem has been successfully confronted with TEX and its branches. We created a package greektonoi.sty and a map file greetonoi.map that gives us the opportunity to include pollytonic letters in our texts by using the XƎTEX engine. They can also be used in order to easily (though not automatically) convert monotonic texts into polytonic ones.

2 Design Details

Writing polytonic texts in LATEX can be usually performed by using the Greek option of babel package. So with the instruction:

```
\usepackage[polutonikogreek]{babel}
```

in the preamble of our file, we can immediately start writing a polytonic text. The insertion of accents and breathings is an easy task without using any special combinations of keys and dead keys directly from the keyboard. The encodings are: to insert the greek accent(tonos) we simply use the symbol '(U+0027), we put the diaeresis using the symbol " (U+0022). For the acute accent we use the same character as for the greek accent, we insert the vareia(grave) with the symbol `(U+ 0060) and the circumflex (perispomeni) with the symbol ~(U+007E). The encodings for the breathings are: we use the symbol >(U+003E) for the psili(smooth, lenis), we use the symbol <(U+003C) for the daseia (asper, dense) and for the iota subscript (υπογεγραμμένη) we use the symbol |(U+OO7C). In order to write, for example, the word ἀμαρτία we simply insert <amart'ia (see http://tex.stackexchange.com/questions/210843/how-do-i-write-amartia-in-polytonic-greek).

Another possibility is to use the betababel package (see http://ftp.yzu.edu.tw/CTAN/macros/latex/contrib/betababel/betatest.pdf). This uses the same concepts with the exception that the encodings are different from the ones previously used. So we insert the psili with), the daseia with (, the diaeresis with +, the acute accent with /, the vareia (grave accent) with \, the circumflex accent with the symbol = and the iota subscript with the symbol |.

The main problem with the above methodologies is that the output is *not* unicode and as a result it can not used again. Also, there is not enough flexibility: For example, the */)ANDRA will provide the correct result with the betababel package but the */)ANDRA will not. Another problem that emerges is that most of the above combinations are inserted using the Shift key which is regarded as time consuming and makes typing more difficult in case of one hand typing.

3 The mapping file greektonoi.map

The XeTeX engine gives us endless possibilities for the easy use of Unicode fonts of ttf and otf font format without installing them in our computer. The packages, babel and betababel, mentioned above, cannot be used, unfortunately, with the XeTeX engine. Because of that, we decided to design from scratch a proper mapping file to work with the option `\setmainlanguage[variant=polytonic]{greek}` of the polygossia package. In greektonoi.map there are almost 3,000 accent combinations in order to easily insert the polytonic symbols. The new encodings are : `(U+0027) and '(U+0060) for bareia, - (U+002D) and |(U+007C) for the iota subscript, the) (U+0029) and] (U+005D) for the psili, the =(U+003D) for circumflex, the ((U+0028) and [(U+005B) for the daseia and the "(U+0022) or +(U+002B) for the diaeresis. We can put the usual tonos(acute accent) with the normal way by simply using the Greek keyboard (using, for example, a combination of ; with a vowel in PCs) or with the symbol /(U+002F). The symbols |, (,), +, /, = and `correspond to the symbols |, (,) , +, /, = and \ that we see in the betababel package.

The use of the Shift key in most of the above cases could be minimized with the use of the symbols: -, [,], ", /, = and ` or ' respectively that doesn't use the Shift key in order to insert them (except for the "(U+0022)). The last symbol " is not usually imported properly in the text with some editors such as Word, for example(MS Word wrongly imports the character «(U+00AB)). In this case, we could alternatively use the symbol +. We could insert these auxiliary symbols in our text in any possible order. The only mnemonic rule we have set is: all of the diacritical marks are placed to the left of the vowel in any order. The iota subscript (| or -) should definitely come just before or just after the vowel. To taking, for example, the word ἁμαρτίᾳ, we write [αμαρτία- or (αμαρτία| or [αμαρτ/ια| or (αμαρτ/ι-α. The first two combinations [αμαρτία- or (αμαρτία|, are very useful in case we have already the (monotonic) word αμαρτία (or a whole monotonic text that we would like to convert to a polytonic one using greektonoi.map). We simply add the proper symbols on the left of the vowels that we are interested in and we get the pollytonic text in the output.

Example: In order to have the pollytonic text

> Τῃ πάντα διδούσῃ καὶ ἀπολαμβανούσῃ φύσει ὁ πεπαιδευμένος καὶ αἰδήμων λέγει· «δὸς, ὃ θέλεις, ἀπόλαβε, ὃ θέλεις». Λέγει δὲ τοῦτο οὐ καταθρασυνόμενος, ἀλλὰ πειθαρχῶν μόνον καὶ εὐνοῶν αὐτῇ.

from the corresponding monotonic we could type:

> Τη- πάντα διδούση| κα`ι ]απολαμβανούση| φύσει [ο πεπαιδευμένος κα`ί α]ιδήμων λέγει· «δ`ος, `(ο θέλεις,]απόλαβε, [`ο θέλεις». Λέγει δ`ε το=υτο ο)υ καταθρασυνόμενος,]αλλ`ά πειθαρχ=ών μόνον κα`ι ε]υνο=ων α]υτ=|η.

Throughout this process, we noticed a problem with the use of the symbols] and [after the use of the double backslash \\. For example, the \\[`υ =]υ causes a problem but the \\(`υ =]υ or \\{} [`υ =]υ does not. The use of the double { and } is a simple solution in order to separate the \\ from the subsequent words. We will provide a complete example of greektonoi enconding using XeLaTeX engine below.

```
\documentclass[a4paper]{article}
\usepackage{fontspec}
\setmainfont{Arial}
\usepackage{polyglossia}
\setmainlanguage[variant=polytonic]{greek}
\newfontfamily\greekfont{GFS Neohellenic}
\newfontfamily\baske[Mapping=greektonoi]{GFS Baskerville}
\begin{document}
{\baske Τη- πάντα διδούση| κα`ι ]απολαμβανούση| φύσει [ο πεπαιδευμένος
κα`ι α]ιδήμων λέγει· «δ`ος, `[ο θέλεις, ]απόλαβε, `[ο θέλεις». Λέγει δ`ε
το=υτο ο]υ καταθρασυνόμενος, ]αλλ'α πειθαρχ=ών μόνον κα'ι ε]υνο=ων α]υτ=η-.
}\par
{\greekfont \addfontfeature{Mapping=greektonoi} Τη- πάντα διδούση| κα`ι
]απολαμβανούση| φύσει (ο πεπαιδευμένος κα`ί α)ιδήμων λέγει·
 «δ`ος, [`ο θέλεις, ]απόλαβε, [`ο θέλεις». Λέγει δ`ε το=υτο ο]υ
 καταθρασυνόμενος,  ]αλλ`ά
πειθαρχ=ών μόνον κα`ι ε]υνο=ων α]υτ=η-.}
\end{document}
```

The output is

Τῃ πάντα διδόσῃ καὶ ἀπολαμβανόσῃ φύσει ὁ πεπαιδευμένος καὶ αἰδήμων λέγει· «δὸς, ὃ θέλεις, ἀπόλαβε, ὃ θέλεις». Λέγει δὲ τοῦτο ὁ καταθρασυνόμενος, ἀλλὰ πειθαρχῶν μόνον καὶ εὐνοῶν αὐτῇ.

Τῃ πάντα διδούσῃ καὶ ἀπολαμβανούσῃ φύσει ὁ πεπαιδευμένος καὶ αἰδήμων λέγει· «δὸς, ὃ θέλεις, ἀπόλαβε, ὃ θέλεις». Λέγει δὲ τοῦτο οὐ καταθρασυνόμενος, ἀλλὰ πειθαρχῶν μόνον καὶ εὐνοῶν αὐτῇ.

In the above example we used two new font families, the GFS Neohellenic and GFS Baskerville from the Greek Font Society (see `http://www.greekfontsociety.gr/pages/en_typefaces.html`). For the first typeface we used greektonoi mapping only locally ie. only for the part of our text that is included inside the

```
{\greekfont  \addfontfeature{Mapping=greektonoi} ...},
```

We used the greektonoi.map mapping and the second typeface named `\baske` for a whole text area (that uses the `\baske` typeface). In order to receive the pdf output from the above code we have to install the greektonoi mapping or alternatively, put the file greektonoi.tec in the same folder that we have saved the above code(with the .tex extention).

4 The greektonoi package

The greektonoi.map mapping is useful only in large polytonic texts written without any math symbols or other TEX commands in the middle. The use of [and] to insert breathings is completely improper in texts that include TEX commands because

these characters are used to delimit the set of variables from the body of the command. Therefore, we created greektonoi.sty package which is more suitable for such cases. There are almost nine hundred commands stored in the package to easily and effectively facilitate the import of greek numerals, polytonic archaic Greek, accents, breathings and other symbols. The commands have been using letters from the Greek alphabet (β, ψ, δ, π and so on) although in a revised future version we intend to extend the package with commands that use only ascii characters for those users that do not have the greek keyboard. In greektonoi.sty underlie the same concepts as in greektonoi.map. The vareia(**β**αρεία) is inserted using the letter β, for psili(**ψ**ιλή) we use ψ, daseia(**δ**ασεία) is inserted with δ and the circumflex(**π**ερισπωμένη) is inserted by typing π. For iota subscript (υπογεγραμμ**έ**νη) we use the letter μ, for tonos the letter τ and for diaeresis(δια**λ**υτικά) the λ character. So, in order to write the text above by using exclusively the greektonoi.sty package we could type the following:

```
\documentclass[a4paper]{article}
\usepackage{fontspec}
\setmainfont{Arial}
\usepackage{polyglossia}
\setmainlanguage[variant=polytonic]{greek}
\newfontfamily\baske{GFS Baskerville}
\usepackage{greektonoi}
\begin{document}
{\baske Τ\μη πάντα διδούσ\μη κα\βι \ψα{}πολαμβανούσ\ημ φύσει \δο πεπαιδευμένος
 κα\βί α\ψι{}δήμων λέγει\; \<<δ\βος, \δβο θέλεις, \ψα{}πόλαβε, \βδο θέλεις\>>.
 Λέγει δ\βε το\πυ{}το ο\ψυ καταθρασυνόμενος, \ψα{}λλ\βά πειθαρχ\πών μόνον κα\βι
 ε\ψυ{}νο\πων α\ψυ{}τ\πμη.
}
\end{document}
```

It should be noted that the use of the double {} is necessary to separate a command from the rest of the word. For example: \ψαπολαμβανούσ\ημ is not correct because there is no command named \ψαπολαμβανούσ The {} combination separates the initial ἀ (written with the command \ψα) of the word ἀπολαμβανούσῃ from πολαμβανούσῃ (which uses the command \ημ or equivalently the \μη to put the iota subscript below η). It should be also noted that if a space or other any final character (comma, semicolon, colon, quotation mark and so on) follows then the use of {} is not nessesary. We can alternatively use the commands \/ or \] to avoid in this case the use of Shift key to type the {}. We could also use the tilde character ~ (U + 007E) for this case. Certainly, the latter uses the Shift key so the time required for typing of \] (two characters), for example, is the same as the time required for the combination Shift + tilde. If we prefer the tilde symbol for separation purposes then we should put the command `\tildeON` somewhere in the beginning of main part of the code. The command `\tildeOFF` restores the ~(tilde) to its normal LaTeX use.

Example: \ψα\]πόλαβε or equivalently \tildeON .... \ψα~πόλαβε ....\tildeOFF

5 Final Comments

The greektonoi.sty package must be stored at the same folder in which we save our code or it must be installed in our TEX system. It can be used with the greektonoi.tec or independently. It offers tremendous possibilities concerning typing polytonic greek easily or converting monotonic to polytonic using simple commands. Many commands are stored within the package through which typing even archaic greek letters could be performed. For example, to insert the left double quotes (U + 00AB, «) we can use the command \<< while the corresponding right quotes(U + 00BB, ») are inserted with the command \>>. To obtain the semicolon (U + 0387, Greek ano teleia) we use the command \; There is also the possibility to introduce numerals of the Greek system such as sambi ϡ and Ϡ (ie. the greek small letter sampi and letter sampi respectively) with the commands \σαμ and \Σαμ respectively. There are quite a few archaic symbols like digamma F (U + 03DC, Digamma) and ϝ (U + 03DD, small digamma) using the commands \Γγ and \γγ respectively and many other commands for almost every greek symbol included in the unicode code sets mentioned in the introduction. We can find them by an inspection of the table below.

6 Acknowledgements

I would like to thank the associate professor Antonis Tsolomitis of the Department of Mathematics of the University of Aegean for pointing out an error during the design process of the first version of greektonoi.map and also miss Margaret Christoforatou student of the Department of Mathematics in the University of Aegean who helped me translate this documentation at English.

7 List of greektonoi commands

Command	Output	Example
	greektonoi.map	
(or [for daseia	̔	[α ⟹ ἁ
) or] for psili	̓	)α ⟹ ἀ
| or - for iota subscript	ͅ	η| or η- or |η or -η ⟹ ῃ
" or + for diairesis	̈	"υ ⟹ ϋ, "ύ ⟹ ΰ
= for circumflex	̃	=ω ⟹ ῶ
` or ' for grave (bareia)	̀	`o or 'o or 'ό or `ό ⟹ ὸ
/ or ; (in Greek Keyboard) for accute (oxeia)	́	/o or ό ⟹ ό
	greektonoi.sty	
\--	–	
\---	—	
\/ or \] or {}	(to insert {})	
\<<	«	

Command	Output	Example
\>>	»	
\((	“	
\))	”	
\;	·	
\~	~	
\ααπ (left(α) single quotation(απ) mark)	‘	
\δαπ (right(δ) single quot. mark)	’	κα\βι {}\δαπ\δαπ ⟹ καὶ’ ’
δ for daseia	̔	\δα ⟹ ἁ
ψ for psili	̓	\ψα ⟹ ἀ
μ for iota subscript	ͅ	\μη or \ημ ⟹ ῃ
λ for diairesis	̈	\λυ ⟹ ϋ, \λύ ⟹ ΰ
π for circumflex	̃	\πω ⟹ ῶ
β for grave (bareia)	̀	\βι ⟹ ὶ
τ for accute (oxeia)	́	\τι ⟹ ί
\κρν (koronis)	̓	
Macron and Vrachy vowels		
\βρχα (alpha with vrachy)	ᾰ	
\μκρα (alpha with macron)	ᾱ	
\βρχA (capital alpha with vrachy)	Ᾰ	
\μκρA (capital alpha with macron)	Ᾱ	
\βρχι (iota with vrachy)	ῐ	
\μκρι (iota with macron)	ῑ	
\βρχI (capital iota with vrachy)	Ῐ	
\μκρI (capital iota with macron)	Ῑ	
\βρχυ (upsilon with vrachy)	ῠ	
\μκρυ (upsilon with macron)	ῡ	
\βρχY (capital upsilon with vrachy)	Ῠ	
\μκρY (capital upsilon with macron)	Ῡ	
Rounded forms		
\εβ (beta symbol)	ϐ	ϐ vs. β
\εθ(theta symbol)	ϑ	ϑ vs. θ
\εΘ(capital theta symbol)	ϴ	ϴ vs. Θ
\εφ (phi symbol)	ϕ	ϕ vs. φ
\επ (pi symbol)	ϖ	ϖ vs. π
\ερ (rho symbol)	ϱ	ϱ vs. ρ
\εκ (kappa symbol)	ϰ	ϰ vs. κ
\εε or \ηε(lunate epsilon symbol)	ϵ	ϵ vs. ε
Archaic letters		
\γρ (rho ρ with stroke i.e. **γ**ραμμή)	⳩	
\ησ (small lunate sigma **η**μισέλινο **σ**ίγμα)	ϲ	
\Hσ or \ηΣ(Capital lunate sigma **H**μισέλινο Σίγμα)	Ϲ	

Command	Output	Example
\Ητσ or \ητΣ (Capital dotted lunate sigma - **Η**μισέλινο Σίγμα **τ**ελίτσα)	Ͼ	
\ητσ (small dotted lunate sigma)	ϵ	
\αηε (reversed(α) lunate(η) epsilon(ε) symbol)	ɜ	
\αησ (small reversed lunate sigma)	ɔ	
\Αησ or \αηΣ (Capital reversed(A) lunate(η) sigma(σ))	Ɔ	
\Αητσ or \αητΣ (Capital reversed dotted lunate sigma)	Ɔ	
\ατσ (reversed dotted sigma)	ɜ	
\ɣY (Upsilon with hook(ɣ) symbol)	ϒ	
\ɣ́Y (Upsilon with acute and hook symbol)	΄ϒ	
\λɣY or \ɣŸ (Upsilon with diaeresis(λ) and hook(ɣ) symbol)	Ϋ	
\ιωτ(greek letter yot)	j	
\σαν (small letter san)	ϻ	
\Σαν (capital letter San)	Ϻ	
\σχω (greek small letter sho)	ϸ	
\Σχω (capital letter Sho)	Ϸ	
Ου Diphthongs		
\Ου or \Λου (Latin Capital Script Ou)	𝔅	
\ου or \λου (Latin small Script ou)	𝔟	
\Κου (Cyrillic uppercase letter monograph Uk)	ᲂ	
\κου (Cyrillic lower letter monograph Uk)	ᲂ	
Greek Numeral Signs and Numerals		
\καχ or ακ (lower(κ) numeral(α) sign for thousands(χ) or left(α) keraia(κ))	ʻ	
\ααμ or δκ (upper(α) numeral(α) sign for smaller values(μ) or right(δ) keraia)	ʼ	\ακ εωοε\δκ ⟹ ʻ εωοεʼ
\διγ or \γγ or \δγ (small digamma)	ϝ	
\Διγ or \Γγ or \Δγ (Capital digamma)	Ϝ	
\κοπ (small letter koppa)	ϟ	
\Κοπ (Capital letter koppa)	Ϟ	
\Ακοπ or \αΚοπ or \Κοφ (archaic(A) koppa)	Ϙ	
\ακοπ or \κοφ (small archaic koppa)	ϙ	
\σαμ (sampi)	ϡ	
\Σαμ (Sampi)	Ϡ	
\στ (small stigma)	ϛ	
\Στ (capital stigma)	Ϛ	
Some useful combinations		

Command	Output	Example
\ός or \τος	ός	
\άν or \ταν	άν	
\έν or \τεν	έν	
\ήν or \την	ήν	
\όν or \τον	όν	
\ύν or \τυν	ύν	
\ών or \των	ών	
\άς or \τας	άς	
\έρ or \τερ	έρ	
\μώω or \τμωω	ῴω	
\μώων or \τμωων	ῴων	
\ές or \τες	ές	
\ής or \της	ής	
\ίς or \τις	ίς	
\ύς or \τυς	ύς	
\ώς or \τως	ώς	
\έρ or \τερ	έρ	
\ίο or \τιο	ίο	
\ήρ or \τηρ	ήρ	
\ύω or \τυω	ύω	
\ίων or \τιων	ίων	
\ίως or \τιως	ίως	
\ίω or \τιω	ίω	
\έω or \τεω	έω	
\έων or \τεων	έων	
\έως or \τεως	έως	
\άω or \ταω	άω	
\βάς or \βας	ὰς	
\βεν or \βέν	ὲν	
\βερ or \βέρ	ὲρ	
\βες or \βές	ὲς	
\βόν or \βον	ὸν	
\βός or \βος	ὸς	
\βις or \βίς	ὶς	
\βιν or \βίν	ὶν	
\βυν or \βύν	ὺν	
\βής or \βης	ὴς	
\βηρ or \βήρ	ὴρ	
\βήν or \βην	ὴν	
\βυς or \βύς	ὺς	
\βώς or \βως	ὼς	
\βών or \βων	ὼν	
\δβας or \δβάς	ἄς	
\δβος or \δβός	ὅς	

Command	Output	Example
\δβυς or \δβύς	ὗς	
\δβεν or \δβέν	ἓν	
\δβην or \δβήν	ἠν	
\δβον or \δβόν	ὂν	
\δτεν or \δέν	ἕν	
\δτως or \δώς	ὥς	
\δτος or \δός	ὅς	
\δπων or \δπών	ὦν	
\δπις or \δπίς	ἷς	
\δπια or \δπία	ἷα	
\δπυς or \δπύς	ὗς	
\δτυω or \δύω	ὕω	
\δτια or \δία	ἵα	
\δως	ὡς	
\πδις or \πδίς	ἷς	
\πδιος or \πδίος	ἷος	
\πδιον or \πδίον	ἷον	
\πδιοί or \πδίοί	ἷοί	
\πδων or \πδών	ὦν	
\πας or \πάς	ᾶς	
\πμαον or \πμάον	ᾯον	
\παν or \πάν	ᾶν	
\πυν or \πύν	ῦν	
\πυξ or \πύξ	ῦξ	
\πυς or \πύς	ῦς	
\πψυς or \πψύς	ὗς	
\πψυν or \πψύν	ὗν	
\πψην or \πψήν	ἧν	
\πδυς or \πδύς	ὗς	
\πις or \πίς	ῖς	
\πιος or \πίος	ῖος	
\πιο or \πίο	ῖο	
\πια or \πία	ῖα	
\πδιά	ἷά	
\πδίς or \πδις	ἷς	
\πιν or \πίν	ῖν	
\πμωα or \πμώα	ᾠα	
\πων or \πών	ῶν	
\πως or \πώς	ῶς	
\πμας or \πμάς	ᾯς	
\πμώος or \πμωος	ᾠος	
\πμώα or \πμωα	ᾠα	
\πμώω or \πμωω	ᾤω	
\πής or \πης	ῆς	

Command	Output	Example
\πμης or \πμής	ᾗς	
\μης or \μής	ῃς	
\πήρ or \πηρ	ᾖρ	
\πήν or \πην	ᾖν	
\ψβαν or \ψβάν	ᾄν	
\ψταν or \ψάν	ᾅν	
\ψτον or \ψόν	ᾔν	
\ψπυς or \ψπύς	ᾕς	
\ψπυν or \ψπύν	ᾕν	
\ψτεκ or \ψέκ	ᾖκ	
\ψβην or \ψβήν	ᾗν	
\ψβων or \ψβών	ᾠν	
\ψτων or \ψών	ᾡν	
\ψβον or \ψβόν	ᾐν	
\ψτιη or \ψίη	ᾑη	
\ψτιης or \ψίης	ᾑς	
\ψτυω or \ψύω	ᾕω	
\ψπυς or \ψπύς	ᾕς	
\ψτεν or \ψέν	ᾔν	
\ψτην or \ψήν	ᾗν	
\ψπην or \ψπήν	ᾗν	
\ψις	ᾐς	
\ψεν	ᾐν	
\ψες	ᾐς	
\ψεπ	ᾐπ	
\μής	ῃς	
\μάς or \μτας	ᾴς	
\μώα	ᾠα	
\μης	ῃς	
\ρρ	ῤῥ	
\και (small kai symbol)	ϗ	
\Και (capital kai symbol)	☒(most fonts haven't it)	