Font setup for Greek with XeTeX/LuaTeX

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The file greek-euenc.def provides support for Greek LICR macros and upcasing of text with XeTeX and LuaTeX. It is automatically loaded by the *textalpha* and *alphabeta* packages as well as *babel-greek*, if the font encoding is set to one of the Unicode font encodings EU1 or EU2 (usually via the *fontspec* package for font setup with LuaTeX and XeTeX).

Contents

1 Requirements

1.1 euenc

The *euenc* package sets up the EU1 and EU2 unicode font encodings for XeTeX and LuaTeX respectively. However, it does not include support for the Greek script. It is

normally loaded by *fontspec*.

1.2 suitable Unicode fonts

With the XeTeX or LuaTeX engines, the user must ensure that the selected font contains Greek glyphs (the default Latin Modern fonts have only capital Greek letters). There are no errors for missing glyphs, just warnings in the log file (but not the console output) and empty spaces in the output document.

Examples for suitable fonts are the *Deja Vu*, *Free Serif* or *Linux Libertine* OpenType fonts.

2 Usage

`greek-euenc.def` is usually not loaded directly, but by one of *textalpha*, *alphabeta*, or *Babel* (with the language option greek). If these packages are loaded after *fontspec*, Unicode font setup is amended for use of the Greek script.

3 LICR input

The LaTeX internal character representation (LICR) is a verbose but fail-safe 7-bit ASCII encoding that can be used unaltered under both, 8-bit TeX and XeTeX/LuaTeX. Use cases are macro definitions and generated text.

See the source of this document, `greek-euenc-doc.tex` for the input used in the examples below.

3.1 Greek alphabet

Greek letters via LICR macros:

Α Β Γ Δ Ε Ζ Η Θ Ι Κ Λ Μ Ν Ξ Ο Π Ρ Σ Τ Υ Φ Χ Ψ Ω

α β γ δ ε ζ η θ ι κ λ μ ν ξ ο π ρ σ τ υ φ χ ψ ω

The small sigma is set with a different glyph if it ends a word:

σ textsigma
ς textfinalsigma or textvarsigma

The `\textautosigma` macro/feature, which automatically chooses the glyph according to the position, is not implemented for Unicode fonts.

3.2 Diacritics

Greek diacritics can be input by named macro or symbol macro:

άά ´κ´κ ὰὰ ᾿χ᾿χ ϊϊ ¨χ¨χ ᾶᾶ ˜χ˜χ ᾳᾳ ͺχͺχ ἀἀ ᾿χ᾿χ

Up-to-date XeTeX normalizes base letter and combining diacritics to the corresponding pre-composed character if such a mapping is defined in the Unicode standard. This fails with LuaTeX:

ά ά ὰ ὰ ϊ ϊ ᾶ ᾶ ᾳ ᾳ ἀ ά

2

3.2.1 perispomeni vs. tilde

The Greek *perispomeni* has the look of a tilde but the semantic of a circumflex accent. The "named" \accperispomeni macro uses COMBINING GREEK PERISPOMENI, while the standard tilde-accent macro \~ uses the COMBINING TILDE which is not normalized to GREEK LETTER ... WITH PERISPOMENI characters.

Composite definitions for \~ select the pre-composed character:

$\tilde{\alpha} = \tilde{\alpha}$, $\tilde{\eta} = \tilde{\eta}$, $\tilde{\iota} = \tilde{\iota}$, $\tilde{\upsilon} = \tilde{\upsilon}$, $\tilde{\omega} = \tilde{\omega}$

3.2.2 combined diacritics

Combined accents are defined using combining diacritical characters.

ῗ ῗ ῗ ἴ ἴ ἴ ὶ ὶ ὶ ᾶ ᾶ ᾶ ῖ ῖ ῖ ᾱ ᾱ ᾱ

ῒ ῒ ῒ ἲ ἲ ἲ ὺ ὺ ὺ ᾲ ᾲ ᾲ ῗ ῗ ῗ ᾰ ᾰ ᾰ

ῒ ῒ ῒ ἢ ἢ ἢ ὼ ὼ ὼ ᾴ ᾴ ᾴ ῗ ῗ ῗ ᾶ ᾶ ᾶ

Composite diacritics overlap when they are not normalized to a pre-composed character. However, this is not a major problem in the real world, as pre-composed characters exist in Unicode for all letters that are actually used in (ancient, polytonic or monotonoc) Greek.

3.2.3 sub-iota

The sub-iota (ypogegrammeni/prosgegrammeni) is input after the base letter.

\prosgegrammeni sets a spacing GREEK PROSGEGRAMMENI: Αͺ Κ͵.

\ypogegrammeni sets a COMBINING GREEK YPOGEGRAMMENI. A Greek capital letter followed by COMBINING GREEK YPOGEGRAM-MENI is normalized to the corresponding GREEK CAPITAL LETTER ... WITH [.. AND] PROSGEGRAMMENI), if a mapping exists in the Unicode standard: ᾳ ῃ Ἀ Ἢ.

3.3 Additional Greek symbols

3.3.1 symbols for Greek numbers

ϟ textkoppa
Ϟ textKoppa
ϙ textqoppa (archaic koppa)
Ϙ textQoppa (archaic Koppa)
ϛ textstigma
Ϛ textStigma (Sigma-Tau-Ligature in CB-fonts)[1]
ϡ textsampi
Ϡ textSampi
ϝ textdigamma
Ϝ textDigamma
ʹ textdexiakeraia
͵ textaristerikeraia

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[1] the name "stigma" originally applied to a medieval sigma-tau ligature, whose shape was confusingly similar to the cursive digamma

TeX math		Unicode	
symbol	var symbol	"letter"	"symbol"
π	ϖ	π	ϖ
ρ	ϱ	ρ	ϱ
θ	ϑ	θ	ϑ
ϵ	ε	ε	ϵ
ϕ	φ	φ	ϕ
β	*missing*	β	ϐ
κ	*missing*	κ	ϰ
Θ	*missing*	Θ	ϴ

Table 1: Greek symbol variants in TeX and Unicode

3.3.2 symbol variants

Mathematical notation uses variant shapes of some Greek letters as additional symbols. The variations have no syntactic meaning in Greek text and text fonts may use the variant shapes in place of the "regular" ones as a stylistic choice.

Unicode defines separate code points for the symbol variants. TeX supports some of the variant shape symbols in mathematical mode, but its concept of "standard" vs. "variant" symbols differs from the distinction between "GREEK LETTER ..." vs. "GREEK ... SYMBOL" in the Unicode standard (see Table 1).

`greek-euenc.def` defines three TextCommands for each of these letters:

`\text<name>` selects the Unicode GREEK LETTER ... variant,

`\text<name>symbol` selects the Unicode GREEK ... SYMBOL variant,

`\textvar<name>` selects the variant shape according to TeX' mathematical mode

See Table 2 for the full list. The *alphabeta* package defines short macros that work in text and math mode.

3.3.3 Ancient Greek Numbers

Ancient Greek Numbers are missing in most fonts (including Libertine and Deja Vu). The "FreeSerif" font works fine:

𐅊𐅋𐅌𐅍

If the LGR font encoding is loaded via «fontenc» in the document preamble, Ancient Greek Numbers (as well as any other character) from LGR encoded 8-bit TeX fonts can be used after a font-encoding switch. babel-greek defines the `\textgreek` command for this purpose.

𐅉𐅊𐅋𐅌

4   Latin transcription

The Latin transcription known from LGR encoded 8-bit fonts[2] does not work with Unicode fonts.

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[2] See the teubner package or the file usage.pdf from the *babel-greek* package for a description.

text		mathematics	
macro	output	macro	output
\textpi	π	\pi	π
\textvarpi	ϖ	\varpi	ϖ
\textpisymbol	ϖ		
\textrho	ρ	\rho	ρ
\textvarrho	ϱ	\varrho	ϱ
\textrhosymbol	ϱ		
\texttheta	θ	\theta	θ
\textvartheta	ϑ	\vartheta	ϑ
\textthetasymbol	ϑ		
\textepsilon	ε	\epsilon	ϵ
\textvarepsilon	ε	\varepsilon	ε
\textepsilonsymbol	ϵ		
\textphi	φ	\phi	ϕ
\textvarphi	φ	\varphi	φ
\textphisymbol	ϕ		
\textbeta	β	\beta	β
\textvarbeta	ϐ	*missing*	
\textbetasymbol	ϐ		
\textkappa	κ	\kappa	κ
\textvarkappa	ϰ	\varkappa	$\varkappa$
\textkappasymbol	ϰ		
\textTheta	Θ	\Theta	Θ
\textvarTheta	ϴ	*missing*	
\textThetasymbol	ϴ		

Table 2: Macros for Greek symbol variants

Is is possible to set up LGR encoded fonts parallel to Unicode fonts (see the preamble of the source file `greek-euenc-doc.tex` for an example). The `\textgreek` macro can then be used for the input of Greek letters via the *Latin transcription*, e.g. «logos» becomes «λογος» and «\>aupn\'ia» becomes «ἀυπνία».

Mark that you cannot use Unicode input with LGR encoded fonts except when running in 8-bit compatibility mode. LICR macros work in both, Unicode font encoding and LGR: compare Ἰανουαρίου (Unicode font set up via fontspec) vs. Ἰανουαρίου (LGR-encoded 8-bit font set up via NFSS commands).

5 UPPERCASE and lowercase

Capital Greek letters have Greek diacritics (except the dialytika and sub-iota) to the left (instead of above) and drop them if text is set in UPPERCASE, e.g. μαΐστρος ↦ ΜΑΪΣΤΡΟΣ.

The uccode/lccode corrections (taken from Apostolos Syropoulos xgreek package) ensure dropping of accents with `\MakeUppercase` for literal Unicode characters.

@uclclist additions ensure that upcasing also drops Greek diacritics. However, when the tonos, varia, and perispomeni accents are input using the symbol macros (\' \` \~), this does not work, as they cannot be distinguished from Latin acute, grave, and tilde accents.[3] If these accents should be dropped by MakeUppercase, they must be input as named macro:

άά άά ὰὰ ὰὰ ↦ ΑΆ ΑΆ ΑᾺ ΑᾺ

5.0.1 hiatus

Tonos and dasia mark a *hiatus* (break-up of a diphthong) if placed on the first vowel of a diphtong (άι, άυ, έι, ἄι, ἄυ, ἔι). A dialytika must be placed on the second vowel if they are dropped.

The «hiatus» feature works with macro input:

άυλος ↦ ΑΫΛΟΣ, ἄυλος ↦ ΑΫΛΟΣ,

μάινα ↦ ΜΑΪΝΑ, κέικ↦ ΚΕΪΚ, ἀυπνία ↦ ΑΫΠΝΙΑ.

It does not work with Unicode literals:

άι, άυ, έι, ἄι, ἄυ, ἔι ↦ ΑΙ, ΑΥ, ΕΙ, ΑΙ, ΑΥ, ΕΙ

or accent-macro + Unicode literals (yet?):

άι, άυ, έι, ἀι, ἀυ, έι ↦ ΑΙ, ΑΥ, ΕΙ, ΑΙ, ΑΥ, ΕΙ

6 Character Tables

The following tables list the Greek Unicode characters. In the input, the LICR macro is followed by the corresponding literal Unicode character.

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[3]This might be fixed with \accACUTE, \accGRAVE, and \accTILDE definitions with corresponding @uclclist entries and composite definitions.

6.1 Greek and Coptic Unicode block

Seldom used characters that are not part of LGR encoded TeX fonts have no LICR definition:

″ „‚‚ ¨
´῾ ΆΆ ¨ ΈΈ ΉΉ ΊΙ ΌΌ ΎΥ ΏΩ
ῒῗ ΑΑ ΒΒ ΓΓ ΔΔ ΕΕ ΖΖ ΗΗ ΘΘ ΙΙ ΚΚ ΛΛ ΜΜ ΝΝ ΞΞ ΟΟ
ΠΠ ΡΡ ΣΣ ΤΤ ΥΥ ΦΦ ΧΧ ΨΨ ΩΩ ΪΪ ΫΫ άά έέ ήή ίί
ῢῧ αα ββ γγ δδ εε ζζ ηη θθ ιι κκ λλ μμ νν ξξ οο
ππ ρρ ςς σσ ττ υυ φφ χχ ψψ ωω ϊϊ ϋϋ όό ύύ ώώ
ϐ ϑ Ϝ Ϝ Ϋ́ ϕ ϖ ϙϙ ϙϙ ϚϚ ϛϛ ϜϜ ϝϝ ϞϞ ϟϟ
ϴϴ ϕϕ
ϰ ϱ ϲ Θ ϵ϶ Ϲ Ͻ Ϲ Ͻ

MakeUppercase:

″ „‚‚ ¨
¨ ΆΑ ¨ ΈΕ ΉΗ ΊΙ ΌΟ ΎΥ ΏΩ
ΪΪ ΑΑ ΒΒ ΓΓ ΔΔ ΕΕ ΖΖ ΗΗ ΘΘ ΙΙ ΚΚ ΛΛ ΜΜ ΝΝ ΞΞ ΟΟ
ΠΠ ΡΡ ΣΣ ΤΤ ΥΥ ΦΦ ΧΧ ΨΨ ΩΩ ΪΪ ΫΫ ΆΑ ΈΕ ΉΗ ΊΙ
ΫΫ ΑΑ ΒΒ ΓΓ ΔΔ ΕΕ ΖΖ ΗΗ ΘΘ ΙΙ ΚΚ ΛΛ ΜΜ ΝΝ ΞΞ ΟΟ
ΠΠ ΡΡ ΣΣ ΣΣ ΤΤ ΥΥ ΦΦ ΧΧ ΨΨ ΩΩ ΪΪ ΫΫ ΌΟ ΎΥ ΏΩ
Β Θ Ϝ Ϝ Ϋ Φ Π ϘϘ ϘϘ ϚϚ ϚϚ ϜϜ ϜϜ ϞϞ ϞϞ
ϴϴ ϴϴ
Κ Ρ Ϲ Θ Ε ϶ Ϲ Ͻ Ϲ Ͻ

MakeLowercase:

″ „‚‚ ¨
´῾ άά ¨ έέ ήά ίί όό ύύ ώώ
ῒῗ αα ββ γγ δδ εε ζζ ηη θθ ιι κκ λλ μμ νν ξξ οο
ππ ρρ σσ ττ υυ φφ χχ ψψ ωω ϊϊ ϋϋ άά έέ ήή ίί
ῢῧ αα ββ γγ δδ εε ζζ ηη θθ ιι κκ λλ μμ νν ξξ οο
ππ ρρ ςς σσ ττ υυ φφ χχ ψψ ωω ϊϊ ϋϋ όό ύύ ώώ
ϐ ϑ υ ύ ϋ ϕ ϖ ϙϙ ϙϙ ϛϛ ϛϛ ϝϝ ϝϝ ϟϟ ϟϟ
λλ λλ
ϰ ϱ ϲ θ ϵ ϲ ͻ ϵ ϶

The lowercase of Σ is σ (GREEK SMALL LETTER SIGMA).[4] The lowercase of Ϛ (GREEK LETTER STIGMA) is ϛ.

6.2 Greek Extended Unicode block

There are no LICR definitions for spacing diacritical characters.

ἀὰ ἀά ἀᾶ ἀᾶ ἀᾶ ἀᾶ ἀᾶ ἀᾶ ἈᾺ ἈΆ Ἀᾶ Ἀᾶ Ἀᾶ Ἀᾶ Ἀᾶ Ἀᾶ
ἐὲ ἐέ ἒὲ ἒέ ἒέ ἒέ ἘῈ ἘΈ ἚῈ ἚΈ ἚΈ ἚΈ
ἠὴ ἠή ἠῆ ἠῆ ἠῆ ἠῆ ἠῆ ἠῆ ἩῊ ἩΉ ἫῊ ἫΉ ἫῊ ἫΉ ἫῊ ἫῊ
ἰὶ ἰί ἰῖ ἰῖ ἰῖ ἰῖ ἰῖ ἰῖ ἸῚ ἸΊ ἺῚ ἺΊ ἺῚ ἺΊ ἺῚ ἺῚ
ὀὸ ὀό ὂὸ ὂό ὂό ὂό ὈῸ ὈΌ ὊῸ ὊΌ ὊῸ ὊΌ
ὐὺ ὐύ ὒὺ ὒύ ὒύ ὒύ ὒύ ὒύ ὙῪ ὙΎ ὛῪ ὛΎ
ὠὼ ὠώ ὢὼ ὢώ ὢώ ὢώ ὢώ ὢώ ὨῺ ὨΏ ὪῺ ὪΏ ὪῺ ὪΏ ὪῺ ὪῺ
ὰὰ άά ὲὲ έέ ὴὴ ήή ὶὶ ίί ὸὸ όό ὺὺ ύύ ὼὼ ώώ
ᾀᾀ ᾁᾁ ᾂᾂ ᾃᾃ ᾄᾄ ᾅᾅ ᾆᾆ ᾇᾇ ᾈᾈ. ᾉᾉ. ᾊᾊ. ᾋᾋ. ᾌᾌ. ᾍᾍ. ᾎᾎ. ᾏᾏ.

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[4] With LICRs, it is \textautosigma.

ἤἤ ἤἤ ἤἤ ἤἤ ἤἤ ἤἤ ἤἤ ἤἤ Ἠ.Ἠ. Ἡ.Ἡ. Ἢ.Ἢ. Ἣ.Ἣ. Ἤ.Ἤ. Ἥ.Ἥ. Ἦ.Ἦ. Ἧ.Ἧ.
ὤὤ ὤὤ ὤὤ ὤὤ ὤὤ ὤὤ ὤὤ ὤὤ Ὠ.Ὠ. Ὡ.Ὡ. Ὢ.Ὢ. Ὣ.Ὣ. Ὤ.Ὤ. Ὥ.Ὥ. Ὦ.Ὦ. Ὧ.Ὧ.
ἄἄ ᾱᾱ ὰὰ ᾳᾳ ᾴᾴ ᾶᾶ ᾷᾷ ᾸᾸ ᾹᾹ Ὰ'Ὰ Ά'Ά A.A. ' ' .. ' '
˜˜˜˜ ἤἤ ῃῃ ῄῄ ῆῆ ῇῇ Ὲ'Ὲ Έ'Έ Ὴ'Ὴ Ή'Ή H.H. ` ˝ ˝ ˜ ˜
ῐῐ ῑῑ ῒῒ ΐΐ ῖῖ ῗῗ Ῐ�‖ Ῑῖ ῚI ΊI ` ˝ ˝ ˝ ˜ ˜
ὐὐ ῡῡ ὺὺ ύύ ῤῤ ῥῥ ῦῦ ῧῧ Ῠῦ Ῡῖ Ὺῖ Ύῖ 'Ῥ'Ῥ ˝ ˝ ˝ ˝ ` '
ὠὠ ῳῳ ὠὠ ῶῶ ῷῷ Ὸ'Ὸ Ό'Ό Ὼῶ Ώῶ Ω.Ω. ´ ' ' ˗

MakeUppercase:
ΑΑ ΑΑ ΑΑ ΑΑ ΑΑ ΑΑ ΑΑ ΑΑ ΑΑ ΑΑ ΑΑ ΑΑ ΑΑ ΑΑ ΑΑ ΑΑ
ΕΕ ΕΕ ΕΕ ΕΕ ΕΕ ΕΕ ΕΕ ΕΕ ΕΕ ΕΕ ΕΕ ΕΕ
ΗΗ ΗΗ ΗΗ ΗΗ ΗΗ ΗΗ ΗΗ ΗΗ ΗΗ ΗΗ ΗΗ ΗΗ ΗΗ ΗΗ ΗΗ ΗΗ
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ΥΥ ΥΥ ΥΥ ΥΥ ΥΥ ΥΥ ΥΥ ΥΥ ΥΥ ΥΥ ΥΥ ΥΥ
ΩΩ ΩΩ ΩΩ ΩΩ ΩΩ ΩΩ ΩΩ ΩΩ ΩΩ ΩΩ ΩΩ ΩΩ ΩΩ ΩΩ ΩΩ ΩΩ
ΑΑ ΑΑ ΕΕ ΕΕ ΗΗ ΗΗ ΙΙ ΙΙ ΟΟ ΟΟ ΥΥ ΥΥ ΩΩ ΩΩ
Α.Α. Α.Α. Α.Α. Α.Α. Α.Α. Α.Α. Α.Α. Α.Α. Α.Α. Α.Α. Α.Α. Α.Α. Α.Α. Α.Α. Α.Α. Α.Α.
Η.Η. Η.Η. Η.Η. Η.Η. Η.Η. Η.Η. Η.Η. Η.Η. Η.Η. Η.Η. Η.Η. Η.Η. Η.Η. Η.Η. Η.Η.
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˜ ¨ ˜ Η.Η. Η.Η. Η.Η. ΗΗ Η.Η. ΕΕ ΕΕ ΗΗ ΗΗ Η.Η. ˝ ˝ ˜
ῘῘ ῙῙ ῘῘ ῙῙ Ῐῖ ῙῙ ῘῘ ΙΙ ΙΙ ˝ ˝ ˜
ῨῨ ῩῩ ῨῨ ῩῩ 'Ῥ'Ῥ PP ΥΥ ῨῨ ῨῨ ῩῩ ΥΥ ΥΥ PP ¨ ˝ ¨ ˝ ` '
Ω.Ω. Ω.Ω. Ω.Ω. ΩΩ Ω.Ω. ΟΟ ΟΟ ΩΩ ΩΩ Ω.Ω. ´ ` `

MakeLowercase:
ὰὰ άά ᾶᾶ ᾶᾶ ᾶᾶ ᾶᾶ ᾶᾶ ᾶᾶ ὰὰ άά ᾶᾶ ᾶᾶ ᾶᾶ ᾶᾶ ᾶᾶ ᾶᾶ
ὲὲ έέ ῆῆ ῆῆ ῆῆ ῆῆ ῆῆ ῆῆ ῆῆ ῆῆ ῆῆ
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ὸὸ όό ῶῶ ῶῶ ῶῶ ῶῶ ὸὸ όό ῶῶ ῶῶ ῶῶ ῶῶ
ὺὺ ύύ ῦῦ ῦῦ ῦῦ ῦῦ ῦῦ ῦῦ ύύ ῦῦ ῦῦ ῦῦ
ὼὼ ώώ ῶῶ ῶῶ ῶῶ ῶῶ ῶῶ ῶῶ ὼὼ ώώ ῶῶ ῶῶ ῶῶ ῶῶ ῶῶ ῶῶ
ὰὰ άά ὲὲ έέ ἤἤ ἤἤ ίί ίί ὸὸ όό ὺὺ ύύ ὼὼ ώώ
ᾀᾀ ᾁᾁ ᾂᾂ ᾃᾃ ᾄᾄ ᾅᾅ ᾆᾆ ᾇᾇ ᾀᾀ ᾁᾁ ᾂᾂ ᾃᾃ ᾄᾄ ᾅᾅ ᾆᾆ ᾇᾇ
ῂῂ ῃῃ ῄῄ ῆῆ ῇῇ ῇῇ ῇῇ ῇῇ ῂῂ ῃῃ ῄῄ ῆῆ ῇῇ ῇῇ ῇῇ
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ἄἄ ᾱᾱ ὰὰ ᾳᾳ ᾴᾴ ᾶᾶ ᾷᾷ ἄἄ ᾱᾱ ὰὰ άά ᾳᾳ ' ' .. ' '
˜˜˜˜ ἤἤ ῃῃ ῄῄ ῆῆ ῇῇ ὲὲ έέ ἤἤ ἤἤ ῃῃ ` ˝ ˝ ˜ ˜
ῐῐ ῑῑ ῒῒ ΐΐ ῖῖ ῗῗ ῐῐ ίί ίί ` ˝ ˝ ˝ ˜ ˜
ὐὐ ῡῡ ὺὺ ύύ ῤῤ ῥῥ ῦῦ ῧῧ ὐὐ ῡῡ ὺὺ ύύ ῤῤ ˝ ˝ ˝ ˝ ` '
ὠὠ ῳῳ ὠὠ ῶῶ ῷῷ ὸὸ όό ὼὼ ώώ ῳῳ ´ ' ' ˗