Unicode request for subscript modifier-letter support

Kirk Miller, kirkmiller@gmail.com
2021 January 11

Of lower case subscript basic Latin letters, Unicode currently lacks b c d f g q w y z. Of subscript Greek, Unicode supports β γ ρ φ χ. The only additional subscript of an IPA letter is schwa ə.

In IPA transcription, some authors restrict superscript modifiers to sequential sounds (onsets, on/off-glides, releases and weakly or incompletely articulated sounds), transcribing simultaneous articulation instead with subscripts. This partially follows UPA conventions. An example is Yuen Ren Chao (1968) *Language and Symbolic Systems*, p. 32 ff, which uses subscript n r j. Penhallurick (1991) uses subscript Ꞅ Ꞥ ꞥ Ꞧ ꞧ for r-coloring of a preceding vowel, as opposed to a superscript, which indicates a weakened rhotic consonant. In some Americanist traditions as well, superscript and subscript are distinguished, but so far I’ve only found subscript a e i o u, which are already supported by Unicode.

In diplomatic (as opposed to normalized) transliteration of abugidas that have conjuncts (i.e., the placement of one letter under another to indicate the lack of an intervening vowel), a Latin subscript may be used for the second element of the conjunct. Cambodian, for example, would have subscript b c d f n η q w y, though I have yet to find Cambodian manuscripts in diplomatic transliteration, and thus cannot attest to subscript η or q. Subscript ň (seen in the examples) and ç should presumably be handled as n and c plus a diacritic.

For Americanist notation, the American Anthropological Association (*Phonetic Transcription Of Indian Languages*, 1916, p. 9) says, “If it is desired to distinguish between vocalic timbres and weakly articulated voiceless vowels on the one hand and vocalic glides and weakly articulated voiced vowels on the other hand, superior vowels (⁺) may be used for the former, inferior vowels (₋) for the latter.” The letters that are not supported in subscript are open o and Greek α ε ι υ ω (lesai). (So far, only ⟨⟨⟩⟩ has been attested.) In SIL fonts, most Americanist combining diacritics appear to work properly on subscripts, or at least on some of them: dieresis ⟨ También de las especie minerals⟩, single dot ⟨También de las especie minerals⟩ and vertical stroke ⟨También de las especie minerals⟩, though the ogonek needs work: ⟨También de las especie minerals⟩.

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Figure 1. Hammerich (1934: 59). This snippet view is not particularly clear, but shows weak elements of diphthongs printed in small script (yellow), as was common at the time. The Spanish RFE phonetic alphabet uses this convention, though only ⟨d⟩ is attested. These small letters are simply typographic variants of subscripts and should be encoded as such.
## Characters

**Latin and IPA**

- `\u{1DF20}` Latin Subscript Small Letter Turned Alpha. Figure 24.
- `\u{1DF21}` Latin Subscript Small Letter B. Figures 2–3.
- `\u{1DF22}` Latin Subscript Small Letter C. Figures 2–3, 5–6.
- `\u{1DF23}` Latin Subscript Small Letter D. Figures 2–4.
- `\u{1DF24}` Latin Subscript Small Letter D with Stroke. Figure 7.
- `\u{1DF25}` Latin Subscript Small Letter Eth. Figure 27.
- `\u{1DF26}` Latin Subscript Small Letter Open E. Figure 27.
- `\u{1DF27}` Latin Subscript Small Letter F. Figure 27.
- `\u{1DF28}` Latin Subscript Small Letter Gamma. Figures 8–10.
- `\u{1DF29}` Latin Subscript Small Letter Open E. Figure 27.
- `\u{1DF2A}` Latin Subscript Small Letter Phi. Figure 28.
- `\u{1DF2B}` Latin Subscript Small Capital R. Figures 11, 14.
- `\u{1DF2C}` Latin Subscript Small Letter Turned R. Figures 11, 14.
- `\u{1DF2D}` Latin Subscript Small Capital Inverted R. Figures 11–12.
- `\u{1DF2E}` Latin Subscript Small Letter R with Tail. Figures 11–12.
- `\u{1DF2F}` Latin Subscript Small Letter Esh. Figure 25.
- `\u{1DF30}` Latin Subscript Small Capital U. Figure 27.
- `\u{1DF31}` Latin Subscript Small Letter Upsilon. Figure 24.
- `\u{1DF32}` Latin Subscript Small Letter Turned V. Figures 26–27.
- `\u{1DF33}` Latin Subscript Small Letter W. Figures 15–16, 18.
- `\u{1DF34}` Latin Subscript Small Letter Y. Figures 17, 19.
- `\u{1DF35}` Latin Subscript Small Letter Z. Figures 20–23.

**Greek**

- `\u{0379}` Greek Subscript Small Letter Mu. Figure 28.
<table>
<thead>
<tr>
<th></th>
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<th>.2</th>
<th>.3</th>
<th>.4</th>
<th>.5</th>
<th>.6</th>
<th>.7</th>
<th>.8</th>
<th>.9</th>
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<th>B</th>
<th>C</th>
<th>D</th>
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</tbody>
</table>

**Properties**

0379;GREEK SUBSCRIPT SMALL LETTER MU;Lm;0;L;<sub> 03BC;;;N;;;;;
1DF20;LATIN SUBSCRIPT SMALL LETTER TURNED ALPHA;Lm;0;L;<sub> 0252;
    ;;;N;;;;;
1DF21;LATIN SUBSCRIPT SMALL LETTER B;Lm;0;L;<sub> 0062;;;N;;;;;
1DF22;LATIN SUBSCRIPT SMALL LETTER C;Lm;0;L;<sub> 0063;;;N;;;;;
1DF23;LATIN SUBSCRIPT SMALL LETTER D;Lm;0;L;<sub> 0064;;;N;;;;;
1DF24;LATIN SUBSCRIPT SMALL LETTER D WITH STROKE;Lm;0;L;<sub> 0111;
    ;;;N;;;;;
1DF25;LATIN SUBSCRIPT SMALL LETTER ETH;Lm;0;L;<sub> 00F0;;;N;;;;;
1DF26;LATIN SUBSCRIPT SMALL LETTER OPEN E;Lm;0;L;<sub> 025B;;;N;;;;;
1DF27;LATIN SUBSCRIPT SMALL LETTER F;Lm;0;L;<sub> 0066;;;N;;;;;
1DF28;LATIN SUBSCRIPT SMALL LETTER G;Lm;0;L;<sub> 0067;;;N;;;;;
1DF29;LATIN SUBSCRIPT SMALL LETTER GAMMA;Lm;0;L;<sub> 0263;;;N;;;;;
1DF2A;LATIN SUBSCRIPT SMALL LETTER PHI;Lm;0;L;<sub> 0278;;;N;;;;;
1DF2B;LATIN SUBSCRIPT SMALL CAPITAL R;Lm;0;L;<sub> 0280;;;N;;;;;
1DF2C;LATIN SUBSCRIPT SMALL LETTER TURNED R;Lm;0;L;<sub> 0279;
    ;;;N;;;;;
1DF2D;LATIN SUBSCRIPT SMALL CAPITAL INVERTED R;Lm;0;L;<sub> 0281;
    ;;;N;;;;;
1DF2E;LATIN SUBSCRIPT SMALL LETTER R WITH TAIL;Lm;0;L;<sub> 027D;
    ;;;N;;;;;
1DF2F;LATIN SUBSCRIPT SMALL LETTER ESH;Lm;0;L;<sub> 0283;;;N;;;;;
1DF30;LATIN SUBSCRIPT SMALL CAPITAL U;Lm;0;L;<sub> 1D1C;;;N;;;;;
1DF31;LATIN SUBSCRIPT SMALL LETTER UPSILON;Lm;0;L;<sub> 028A;
    ;;;N;;;;;
1DF32;LATIN SUBSCRIPT SMALL LETTER TURNED V;Lm;0;L;<sub> 028C;
    ;;;N;;;;;
1DF33;LATIN SUBSCRIPT SMALL LETTER W;Lm;0;L;<sub> 0077;;;N;;;;;
1DF34;LATIN SUBSCRIPT SMALL LETTER Y;Lm;0;L;<sub> 0079;;;N;;;;;
1DF35;LATIN SUBSCRIPT SMALL LETTER Z;Lm;0;L;<sub> 007A;;;N;;;;;
References

Boas, Goddard, Sapir & Kroeber (1916) Phonetic Transcription of Indian Languages: Report of Committee of American Anthropological Association (Smithsonian Miscellaneous Collections 66.6)
Louis Leonor Hammerich (1934) Tysk fonetik
RFE (1915) ‘Alfabeto fonético de la revista de filología española’, Revista de filología española, vol. II.
Subscript b c d g (b c d g)

Used for conjuncts in diplomatic transliteration of alphasyllabaries such as Javanese. A subscript thus indicates a different glyph or phonetic realization than the full letter, and must be retained for accurate transliteration. (A similar convention uses superscript vowels for plene writing of adjads.) Subscript b c d w are attested. Subscript g should occur, as they transliterate letters of the Javanese script that have conjunct (subscript) forms, but so far I have not found them in texts. Subscript f q occur in Javanese in foreign loans, and they also have conjunct forms. (Q is also a common convention in the area for glottal stop.) Subscript n occurs in Javanese, but can be handled by the font: ⟨ₙ⟩. See also illustration subscript w above; the y z found below are also expected as conjuncts in Javanese.

Subscripting in the diplomatic transliteration is not predictable from the normalized transliteration. For example, in Kozok (2015: P/5/6), normalized geγγah rabutti rampassi is diplomatic ⟨gaggaḥ rabutₜirampasₛi⟩, with neither the second g in gg nor the p in mp subscript.

Subscript b d g are also used for unreleased stops in Chinese.

Figure 2. Kozok (2015: 69). The conjuncts commonly occur after nasals, but note ⟨sₐ, pₐ⟩ here and next, also ⟨kₐ⟩ on p. 67.

Figure 3. Kozok (2015: 71)
Figure 4. Pulleyblank (1962: 215). Later on the page Pulleyblank says that all three final plosives appear to have been implosive. (“Implosive” here seems to mean unreleased.) In this notation the three would be -\(\text{-}b\), -\(\text{-}d\), -\(\text{-}g\).

**Dansk Dialektologi i Tiåret 1965–74**

Figure 5. Andersen (1977:107). This ‘nasal curl’, semantically equivalent to an ogonek, is typeset in the Dania font that has been shared with me as a subscript ‘c’, and this published example appears to be a subscript ‘c’ as well.

Figure 6. Grønnum (2005: 419). In this publication as well, the ‘nasal curl’ is typeset as a subscript ‘c’.

**Subscript \(\text{ð}\) (\(\text{a}\))**

The traditional Spanish phonetic alphabet (the RFE, or *Revista de filología española*, alphabet) uses reduced letters, equivalent to subscripts, for reduced sounds. \(\langle \text{ð} \rangle\) in particular is provided for; I have not seen others. The RFE alphabet is used and taught today in Spanish-language universities, notably in Spain and Mexico. Apart from reduced sounds, it is covered by Unicode.
Figure 7. RFE (1915: 374–375). Contrast between normal ⟨d⟩, small ⟨d⟩ and small voiceless ⟨ʰ⟩, in the consonant table. The RFE alphabet chart has been reproduced many times over the past century, including in 2020 by Alexander Iribar of the phonetics laboratory at the University of Deusto in the Spanish Basque country. The second clip shows that reducing font size to indicate phonetic reduction is a productive convention, but I’ve only seen ⟨d⟩ used in this way.
**Subscript gamma (γ)**

Used for simultaneous velarization as opposed to a velar offglide (Bickford & Floyd) or relatively weak velarization (Hickey).

> In the Irish of Roscommon/East Galway, Ring and Cape Clear voiced sibilants have been reported as the outcome of nasalising /s/, e.g. *i Sasana [i zasənə] ‘in England’.*

Figure 8. Hickey (2011) *The Dialects of Irish*, p. 31. Subscript notation is described next.

> [nγ] The body of the tongue is arched downwards away from the palate; the tip of the tongue is behind the upper teeth (concave tongue configuration).

> [n̥] There is an apico-alveolar contact with slight lowering of the body of the tongue away from the palate.

Figure 9. Hickey (2014: list just before §1.8.5; no page number in ebook). In the paragraph before §1.2 Hickey explains that a subscript gamma is used for southern dialects that have weak velarization. There is a similar distinction between [nʲ] (palatal) and [n̥] (palatalized alveolar).

**Subscript ɹ ɽ ʀ ʁ (ɹ ɽ ʀ ʁ)**

> The following subscript IPA letters indicate r-colouring of a preceding vowel: ɹ t r ʁ

Figure 10. Bickford & Floyd (2006: 162)

**Subscript ɹ ɽ ʀ ʁ (ɹ ɽ ʀ ʁ)**

> The following subscript IPA letters indicate r-colouring of a preceding vowel: ɹ t r ʁ

Figure 11. Penhallurick (1991) *The Anglo-Welsh Dialects of North Wales*, p. xviii. Subscript ɹ ɽ ʀ ʁ are used in the data.
Figure 12. Penhallurick (1991: 85). Subscriptɨ along with superscriptɾ.

Figure 13. Penhallurick (1991: 85). Subscriptɹ. I have not found subscriptɾ in this volume, but it is used in the data it was drawn from (see first figure above). The data is published in volume 3 of D.R. Parry (director, U. of Swansea) & Penhallurick (ed.) *Survey of Anglo-Welsh Dialects*, which I don’t have access to.

Figure 14. Ellis (1889) *On Early English Pronunciation*, part V, p. 78.
Subscript $w$ and $y$ ($w_y$)

Americanist usage, occasional IPA usage per above, and used for the transcription of conjuncts of abugida scripts.

Figure 15. Burquest (2009: 130)

Figure 16. Boas, Goddard, Sapir & Kroeber (1916: 15)

Figure 17. Ibid. (subsequent paragraph to previous figure)
Figure 18. Kozok (2015: 71). A letter may be twice subscripted for a double conjunct (e.g. p. 72, line 26/4), but that is not semantically distinct from a simple conjunct and so perhaps does not require Unicode support.

Figure 19. Skjærvø (2002: 343)

**Subscript z (z)**

Subscripts are used for fricative release in some French sources, filling the role played by superscripts in English. An example is subscript s and z for the frication of [tˢ] and [dᶻ] (allophones of /t/ and /d/ in Quebequois French). Also expected for foreign loans in Javanese (below).

Patricia Keating used it during her tenure as president of the IPA.

Figure 20. Charbonneau & Jacques (1972: 77). Subscript z is even used in the title of the article, “[tₛ] et [dᶻ] en français canadien.”

Figure 21. Charbonneau & Jacques (1972: 87)

Figure 22. Keating (2018: 27).
There are totally 12 vowels in Suzhou Chinese, which are $[i\_z \, y\_z \, u \, i \, y \, \varnothing \, \varepsilon \, o \, \text{æ} \, a \, \gamma \, \iota]$. Two pairs of vowel quality, the test words associated with high level tone [44] with zero initial consonant were selected. The test words were:

$[i\_z^{44}]$ (coat) $[i\iota^{44}]$ (smoke).

**Figure 23.** Ling (2007: 573)

**Subscript $\nu$ and $\sigma$ ($\nu \sigma$)**

Figure 24. Tatham & Morton (2016: 59). Subscript # and $\nu \, d \, g \, o \, z$ for English.

**Subscript $\jmath$ ($\jmath$)**

Wickelgren could only index his objects according to their immediate linear context: $X_o \chi_o \sigma_r \sigma_l \, o \, \jmath \, o \, \sigma_l$. This will not do because the variants must be derived before the representation not after it.

**Figure 25.** Tatham & Morton (2016: 60). Subscript # and $\jmath$ for Russian.

**Subscript $\delta \varepsilon f \upsilon \Lambda$ ($\delta \varepsilon f \upsilon \Lambda$)**

unordered set for the word /str/ is not identical to that for the word /krast/: the former set is $/s_t, t_r, t_A, r_A, k_r, k_s/$, whereas the latter set is $/k_r, k_A, s_t, t_s/$. Hence, the partial activation of the unordered set of context-sensitive ems is sufficient

Figure 26. Lass (2012: 86). Subscript # and $\Lambda$ for English.

ample, in the phrase, “the fretful elk,” which we shall now represent allophonically as $/\delta x, \delta \Lambda, f, r, \epsilon, t, t \Lambda, U, \upsilon, e, k, k_s/$, the word representatives partially activate almost this entire unordered set. However, instead of the specific allophone representatives, $\delta x, \delta \Lambda, f, r, \upsilon, e, k$, the word representatives even less

Figure 27. Wickelgren (1969: 14). Subscript # and $\delta \varepsilon f \upsilon \Lambda$ for English. Subscript $\delta$ is overly large, but that is merely a typesetting issue.
Subscript Latin phi (ϕ)

| [ϕ]    | sonorizada                        |
| [ϕ]    | bilabiodental                    |
| [ϕ]    | bilabiodental con predominio del  |
|        | elemento bilabial                |
| [fϕ]   | bilabiodental con predominio del  |
|        | elemento labiodental             |
| [xϕ]   | labiovelar con predominio del     |
|        | elemento labial                  |
| [ϕ]    | labiovelar con predominio del     |
|        | elemento velar                   |
| [hϕ]   | labiofaringea                    |

Figure 28. Butragueño p. 29 ff. IPA equivalents of the RFE Spanish phonetic alphabet, as used e.g. in the *Atlas Lingüístico de México*, contrasting baseline, superscript and subscript ϕ.

Subscript mu (μ)

⟨μ⟩ is a wild card for ‘mora’, whereas subscript ⟨μ⟩ marks a segment as moraic. The distinction is analogous to ⟨σ⟩ for ‘syllable’ vs the diacritic ⟨◌̩⟩ for syllabic.

Figure 29. Bethin (1998: 250). The subscript μ’s clarify that both the liquid R and the vowel V are moraic in the ⟨CRV⟩ syllable.
### ISO/IEC JTC 1/SC 2/WG 2

**PROPOSAL SUMMARY FORM TO ACCOMPANY SUBMISSIONS FOR ADDITIONS TO THE REPERTOIRE OF ISO/IEC 10646**

Please fill all the sections A, B and C below.


---

**A. Administrative**

1. **Title:**
   
<table>
<thead>
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<th>Modifier Latin capital letters</th>
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</thead>
</table>

2. Requester's name: Kirk Miller

3. Requester type (Member body/Liaison/Individual contribution): individual

4. Submission date: 2021 January 11

5. Requester's reference (if applicable):

6. Choose one of the following:
   - This is a complete proposal: yes
   - More information will be provided later: no

---

**B. Technical – General**

1. Choose one of the following:
   - a. This proposal is for a new script (set of characters):
     - Proposed name of script: 
   - b. The proposal is for addition of character(s) to an existing block:
     - Name of the existing block: Latin Extended-G, Greek and Coptic

2. Number of characters in proposal: 23

3. Proposed category (select one from below - see section 2.2 of P&P document):
   - A-Contemporary
   - B.1-Specialized (small collection)
   - C-Major extinct
   - D-Attested extinct
   - E-Minor extinct
   - F-Archaic Hieroglyphic or Ideographic
   - G-Obscure or questionable usage symbols

4. Is a repertoire including character names provided?: yes

   a. If YES, are the names in accordance with the “character naming guidelines” in Annex L of P&P document?: yes

5. Fonts related:
   - a. Who will provide the appropriate computerized font to the Project Editor of 10646 for publishing the standard?: Kirk Miller or Michael Everson
   - b. Identify the party granting a license for use of the font by the editors (include address, e-mail, ftp-site, etc.):

6. References:
   - a. Are references (to other character sets, dictionaries, descriptive texts etc.) provided?: yes
   - b. Are published examples of use (such as samples from newspapers, magazines, or other sources) of proposed characters attached?: yes

7. Special encoding issues:
   - Does the proposal address other aspects of character data processing (if applicable) such as input, presentation, sorting, searching, indexing, transliteration etc. (if yes please enclose information?): no

---

**8. Additional Information:**

Submitters are invited to provide any additional information about Properties of the proposed Character(s) or Script that will assist in correct understanding of and correct linguistic processing of the proposed character(s) or script. Examples of such properties are: Casing information, Numeric information, Currency information, Display behaviour information such as line breaks, widths etc., Combining behaviour, Spacing behaviour, Directional behaviour, Default Collation behaviour, relevance in Mark Up contexts, Compatibility equivalence and other Unicode normalization related information. See the Unicode standard at [http://www.unicode.org](http://www.unicode.org) for such information on other scripts. Also see Unicode Character Database ([http://www.unicode.org/reports/tr44/](http://www.unicode.org/reports/tr44/)) and associated Unicode Technical Reports for information needed for consideration by the Unicode Technical Committee for inclusion in the Unicode Standard.

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### C. Technical - Justification

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<th>Answer</th>
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<td>1. Has this proposal for addition of character(s) been submitted before?</td>
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<tr>
<td>If YES explain</td>
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<td>2. Has contact been made to members of the user community (for example:</td>
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<td>National Body, user groups of the script or characters, other experts,</td>
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<tr>
<td>etc.)?</td>
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<tr>
<td>If YES, with whom?</td>
<td>proposer is a member of user community</td>
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<td>If YES, available relevant documents:</td>
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<tr>
<td>3. Information on the user community for the proposed characters (for</td>
<td>publishing</td>
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<td>example: size, demographics, information technology use, or publishing</td>
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<td>use) is included?</td>
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<td>Reference:</td>
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<td>4. The context of use for the proposed characters (type of use; common</td>
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<td>or rare)</td>
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<td>5. Are the proposed characters in current use by the user community?</td>
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<td>If YES, where? Reference:</td>
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<td>6. After giving due considerations to the principles in the P&amp;P document</td>
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<td>must the proposed characters be entirely in the BMP?</td>
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<td>If YES, is a rationale provided?</td>
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<td>If YES, reference:</td>
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<td>7. Should the proposed characters be kept together in a contiguous</td>
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<td>range (rather than being scattered)?</td>
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<td>8. Can any of the proposed characters be considered a presentation</td>
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<td>form of an existing character or character sequence?</td>
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<tr>
<td>If YES, is a rationale for its inclusion provided?</td>
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<tr>
<td>If YES, reference:</td>
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<td>9. Can any of the proposed characters be encoded using a composed</td>
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<td>character sequence of either existing characters or other proposed</td>
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<tr>
<td>characters?</td>
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<tr>
<td>If YES, is a rationale for its inclusion provided?</td>
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<tr>
<td>If YES, reference:</td>
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<tr>
<td>10. Can any of the proposed character(s) be considered to be similar</td>
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<td>(in appearance or function) to, or could be confused with, an</td>
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<tr>
<td>existing character?</td>
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<tr>
<td>If YES, is a rationale for its inclusion provided?</td>
<td></td>
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<tr>
<td>If YES, reference:</td>
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</tr>
<tr>
<td>11. Does the proposal include use of combining characters and/or use of</td>
<td>no</td>
</tr>
<tr>
<td>composite sequences?</td>
<td></td>
</tr>
<tr>
<td>If YES, is a rationale for such use provided?</td>
<td></td>
</tr>
<tr>
<td>If YES, reference:</td>
<td></td>
</tr>
<tr>
<td>Is a list of composite sequences and their corresponding glyph images</td>
<td></td>
</tr>
<tr>
<td>(graphic symbols) provided?</td>
<td></td>
</tr>
<tr>
<td>If YES, reference:</td>
<td></td>
</tr>
<tr>
<td>12. Does the proposal contain characters with any special properties</td>
<td>no</td>
</tr>
<tr>
<td>such as control function or similar semantics?</td>
<td></td>
</tr>
<tr>
<td>If YES, describe in detail (include attachment if necessary)</td>
<td></td>
</tr>
<tr>
<td>13. Does the proposal contain any Ideographic compatibility characters?</td>
<td>no</td>
</tr>
<tr>
<td>If YES, are the equivalent corresponding unified ideographic characters</td>
<td></td>
</tr>
<tr>
<td>identified?</td>
<td></td>
</tr>
<tr>
<td>If YES, reference:</td>
<td></td>
</tr>
</tbody>
</table>