Critical review of Rachana (L2/05-210) and arguments for encoding Malayalam Chillu

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1 Rachana Document (L2/05-210) Review

Following sections point out that the arguments in Rachana document (L2/05-210) are in odds with facts.

1.1 Confusing code points as base characters

Rachana (L2/05-210) expresses a genuine concern that, by encoding, chillus are given base character status. That is not true. Code points are not base characters. This is a kind of explained in UTR#17 (Character Encoding Model).

Regarding collation, Rachana (L2/05-210) states:

"Only when two characters or sequences differ in [collation] value (or weight) at the primary level, is there a need to differentiate them at the encoding level."

This is also not true:
• Even though, English lowercase and uppercase characters are encoded separately, they differ only in tertiary level in Default Unicode Collation Element Table (DUCET). Refer UTS#10 (Unicode Collation Algorithm).
• There are lot of codepoints without any primary weight. An indic example would be Visarga.

In a philosophical way, characters are for humans and codepoints are for computers. Human can understand the character from its word context which is not available/usable for a computer using codepoint. Collation Element Table is a way to connect these two.

1.2 Chillu-C1 + C2 is not equivalent to C1 + Virama + C2

Abstract

• Chillu-C1 + C2 is not equivalent to C1 + Virama + C2, in contrast to the claims in Rachana document (L2/05-210) section 3.
• Chillu issue is has existence independent of Samvruthokaram related issues.

Proof

It is proved thru following counter-example.

If Chillu-C1 + C2 is equivalent to C1 + Virama + C2, following two Malayalam words cannot have different Unicode encodings:

• /pin_nilaavum/
• /pinnilaavum/

Thus argument in the section 3 of Rachana (L2/05-210) is incorrect.

Why should they have different encodings?

The words /pin_nilaavum/ and /pinnilaavum/ are different in all 3 essential attributes of a word:

• Meaning. /pin_nilaavum/ means 'and shadow of moonlight'. /pinnilaavum/ means 'will be behind'.
• Orthography. The first 'na' of /pin_nilaavum/ is chillu while we have the conjunct double of 'na' in /pinnilaavum/.
• Pronunciation. The second 'na' of /pinnilaavum/ is an alveolar and that of /pin_nilaavum/ is dental.

So these two words should have two different Unicode encodings. This argument is exactly same as why 'apple' and 'banana' should have two different Unicode encodings.

The difference should be in some non-joiner characters

See pages 389 to 391 in chapter 15 of Unicode 4.0.0

"ZERO WIDTH NON-JOINER and ZERO WIDTH JOINER are format control characters. Like other such characters, they should be ignored by processes that analyze text content. For example, a spelling-checker..."
or find/replace operation should filter them out. (See Section 2.11, Special Characters and Noncharacters, for a general discussion of format control characters.)"

(thanks to Mahesh Pai)

**More examples**

/\u0abd/ Meaning 'big curtain'
/\u0baa/ Meaning 'wild forest'
/\u0bbd/ Meaning 'eye boundary'
/\u0bb9/ Meaning 'peace of Kanvan - the mythical character'.

/\u0bbf/ Meaning 'his/her modesty'
/\u0bc0/ Meaning 'policy of a woman'

/\u0bc4/ Meaning 'explosion of mind'
/\u0bc9/ Meaning 'fury of a lady'

Above examples are just few from vast number of them possible with following generic patterns:

- character capable of forming chillu + semi-vowel
- ꜁ + ꜁

**Counter-challenge from Kenneth Whistler**

If separate characters are encoded for Malayalam Chillus, so that the "challenge" distinction were to be encoded as:

"mn" is U+0D28, U+0D4D, U+0D28

"n n" is U+0DXX, U+0D4D, U+0D28

Implementers are then faced with determining what to do with the following sequence:

"???" is U+0D28, U+0D4D, U+200D, U+0D28

That sequence, of course, exists now, and would be a legitimate and possible sequence even if a Chillu-n is encoded. So how would a rendering engine render that sequence, and how would it be distinguished, by an end user or a text process such as a search engine, from the proposed U+0DXX, U+0D4D, U+0D28 sequence for "n n"?
That counter-challenge needs a "solution" for the encoding of Chillu characters to make sense for Malayalam. For if there is no solution forthcoming, addition of Chillu characters would potentially be *increasing* the ambiguity potential for the Unicode representation of Malayalam text, rather than decreasing it.

**Solution to Ken's challenge**

Half-form of NA ([op]) is not chillu. It is described in detail in section 2.2.

Now, we can use the rules from PRI#37 (L2/04-279 - Functions of ZERO WIDTH JOINER in Indic Scripts) to show the behavior of the challenge sequence. It will form the conjunct double /nn/ as per the second bullet in the section 7-proposal of PRI#37.

### 1.3 One chillu for two base characters

In section 4, Rachana Document (L2/05-210) establishes that chillu-ظروف is not chillu-ظروف. However, real issue is not with chillu-ظروف. It is with chillu-ظروف and chillu-ظروف; because they also are chillu-ظروف and chillu-ظروف, respectively.

This fact is clearly established in the foremost grammar book of Malayalam: Keralapaanineeyam by A. R. Rajaraja Varma. See the relevant scan from the section Peethika: 4. Varnnavikaarangal below:

![Possible solutions and their implications](image)

**Possible solutions and their implications**
I am considering only chillu-ඍ/උ right now. These thoughts are applicable to chillu-ඌ/඄ as well.

1. Encode this chillu as chillu-ඍ only. That is, only RA + VIRAMA + ZWJ will form the chillu. This would cause wrong collation ordering for words with chillu-ඍ. That is, /kaarr_mEgham/ from the above example will get wrong place in the collation order.
2. Both RA + VIRAMA + ZWJ and RRA + VIRAMA + ZWJ form chillu-ඍ/උ. This gives a uniqueness rule (refer section 5) warning: “if this scheme is allowed, a document (eg: a wiktionary.org document) written by multiple people using various inputting tools can quite possibly have different ‘spellings’ for a word, without reader or writer being aware of it. This can cause many problems including ineffective searches and inconsistent collation”.

This is an example where codepoint and base characters of a language need to differ. A human can deduce base character from its word context which is not available/usable for a computer employing codepoints.

Thus collation correctness of chillu forming characters to their underlying letter identity is impossible in codepoint-space without the help of sophisticated text processing at higher levels. This would in turn mean, the collation correctness is not an argument until a new solution or perspective is proposed. Till then, both the choices of, encoding chillu with a control/format character and giving independant codepoint for it, have to be evaluated with respect to rest of the merits these options have.

1.4 Samruthokaram grapheme: history and current status

Summary

It is not what Rachana Document (L2/05-210) claims.

There are two different sets of graphemes used for samvruthokaram.

Usage 1: the sign of U + chandrakkala (visible virama)
Usage 2: chandrakkala (visible virama) alone.

These two practices co-exist today and had been like that for at least a century.

Details

In KeralaPanineeyam - the foremost grammar book of Malayalam - A. R. Rajaraja Varma criticizes those who argue for samvruthokaram to be written without the sign of U. This, in turn, tells us when KeralaPanineeyam was written (cir. 1896) the grapheme of samvruthokaram was an issue. See following scan from the book:
Frohnemeyer writes about this in University of Madras book printed in 1913. (thanks to Eric Muller)

§ 19. There is a half-vowel “ँ” at the end of many words, which is the shortest among all sounds, so that many people in writing Malayalam drop it altogether. People in the south of Malabar do pronounce it even like “म” inherent in every consonant. As the vowel “ँ” is too much and the inherent “म” does not indicate the sound at all, in all the books printed at Mangalore the sign “።” is used to point out this half vowel: कनू (kaṇū) cve; नदू (adū) it, that thing, etc. In books published in the south, specially in Travancore, the sign “።” is put above the final letter having the vowel ड added to it. Ex. “नदू”。 The reason given is that the final vowel is only half pronounced, and that, therefore, the vowel should be expressly written before the sign is put above it.

Even though, the following poem by N. N. Kakkad is printed (in 1988) in old orthography, the samvruthokaram is represented with chandrakkala (visible virama) alone.
When new orthography became common for printing in later years, the usage of chandrakkala alone for samvruthokaram became even more widespread. Vast majority of the printed material after ~1994 uses chandrakkala alone for samvruthokaram. As an example, see following poem by Balachandran Chullikkadu (written in 1970; printed in 1996 by DC books):

Current status and brief history of grapheme(s) used for samvruthokaram is convincingly described by Dr. Scaria Zacharia in 1996 as a footnote description in Keralapanineeyam, centennial edition from DC books:

Translation: "In the old Malayalam, there was no separate grapheme to indicate samvruthokaram. It used to be written and printed as /paaTTa/ (patt~) and /naaTa/ (naaT~) (refer transliteration scheme in section 6). In the second half of 19th century, Basel missionaries started to use chandrakkala (visible virama) to indicate samvruthokaram (L.V.R. 1940: 329). Same words have been printed with and
without samvruthokaram in Gundert's works. There is no unity in Malayalam in the issue of grapheme for samvruthokaram. In southern Kerala, the sign of U and chandrakkala together is the grapheme for samvruthokaram. However, in northern Kerala, just chandrakkala (visible virama) alone is enough."

1.5 Collation is a non-issue with encoding chillu

It is demonstrated thru a suggested scheme for Malayalam in AllKeys table of DUCET. The scheme is described thru examples:

(Please refer the transliteration scheme in section 6.)

n~                   = [1A2B.0020]
n_                   = [1A2B.0021]
nu~                  = [1A2B.0023]
n a                   = n ~ -a      = [1A2B.0020], [1A08.0020]
n a a                 = n ~ -aa     = [1A2B.0020], [1A0A.0020]
...
n a u                 = n ~ -au     = [1A2B.0020], [1A17.0020]
n a a                   = n ~ a       = [1A2B.0020], [1A08.0021]
...

Together with anuswara

m_k a                 = ng ~ k ~ -a  = [1A1C.0022], [1A18.0020], [1A08.0020]
...
m j a                 = ny ~ j ~ -a  = [1A21.0022], [1A1F.0020], [1A08.0020]
...
m t a                 = ny ~ j ~ -a  = [1A2B.0022], [1A27.0020], [1A08.0020]
...
m y a                 = m ~ y ~ -a  = [1A30.0022], [1A31.0020], [1A08.0020]
...

Notes

• /n/ and /~/ together form a contraction.
• /na/ is represented by an expansion. The symbol of /a/ is a fictitious entity appear only in collation.
• /n_/ , /n~/ and /nu~/ are same in primary level. But they are different in secondary level. One could very well differentiate /nu~/ from /n~/ in primary level also. This is just a usage example of a generic framework: splitting Consonant and Consonant+vowel-sign as /n ~ -x/

Thoughts

1. Chillus and virama forms are diacritics of base character. So diacritics themselves have to be level-1 ignorable; but should have some weight in level-2.
2. The AllKeys file containing the Default Unicode Collation Element Table (DUCET) does not currently handle Malayalam accurately. For example, ZWJ is by default ignorable, and NNA + VIRAMA + ZWJ, NNA + VIRAMA are treated as equal.
3. If Chillus are encoded, the following equivalence should NOT be used for tailoring:

0D7F = 0D15 0D4D 200D
The behavior of 0D15 0D4D 200D is different from chillu as explained in the solution to Ken's counter-challenge in section 1.2.

[Thanks to Åke Persson for educating me on UTS#10]

2 More arguments for encoding chillu

2.1 One chillu is already encoded years back

Knowingly or unknowingly Unicode has already encoded one chillu and that is Anuswara!

The fact that Anuswara is a chillu, is described in the foremost grammar book of Malayalam: Kerala\'anineeyam by A. R. Rajaraja Varma. See the relevant scan from the section Peethika: 4.Varnnavikaarangal below:
Translation of the underlined sentence: 'Anuswara also is a chillu.'

Same opinion is echoed by L. J. Frohnmeyer (in 1913):
§ 5. There are further some final letters, which are used to indicate that a final consonant must be pronounced without adding the short ə, mentioned in § 4. So the dental “m” at the close of syllables is changed into “mə” and we read not “m” (na), but only “m” (n).

Another final consonant is “nə” (n) instead of “nə” (na). For examples (see § 12, exercises 1 and 3).

Thus ə instead of ə (n and not ra).

Thus ə instead of ə (n and not ra).

Hence the final (half) consonants are the following:

(thanks to Eric Muller and Mahesh Pai)

The history of anuswara becoming chillu is something similar to that of how vowelless ə /tha/ became chillu-wə /la/. Initially Anuswara came to Malayalam along with rest of the Sanskrit package. Later Malayalam started to use it as chillu ə /ma/. Please note that, Malayalam anuswara should not be confused with the functions of anuswara of Devanagiri. They both are different.

Current scenario can be compared to, assigning codepoints for some vowel signs and then on a later thought, encoding rest of the vowel signs as VIRAMA + ZWJ + Vowel.

So, if chillu of ə /ma/ can be encoded, then why not rest of the chillus?

I understand that this argument alone is not enough for encoding rest of the chillus. But given that our options are limited, this makes the arguments to encode chillus more compelling.

2.2 Half forms are not chillus

At least, 3 of the chillu forming consonants have half-forms different from chillus. As the first example, half-na is highlighted in this image:

Notice that half-na is not chillu-na. Below, we can see the half-consonant in action forming conjuncts with various characters:
Similar to ೉(NA), ೑ (KA) and ೐ (NNA) also have following half-forms different from their Chillu forms:

Their conjunct formation examples are:

2.3 ZWJ shouldn't be overloaded for searching

Software Engineering Pragmatism

I have been in software industry for last 10 years. I know, as many of you do, this: If one entity does not have philosophical integrity, soon its minor functional anomalies will be interpreted differently or ignored by the developers and eventually it will be a perpetual bug in most of the software applications today or to come. You all can imagine, how much priority this Malayalam bug will get in each corporation's defect tracking system.

To tell an example, couple of months back we faced with an issue of Unicode Malayalam text getting truncated in Microsoft Outlook. After some google searches we stumbled upon this piece of information: http://www.landfield.com/usefor/1997/Aug/0142.html: “...Unfortunately, the Unicode character 0x0d0a is used in the Malayalam set, so we couldn't really force 8 bit CR LF as the line terminator irrespective of the character set. Then again, how many people are posting messages in Malayalam, and how many would otherwise benefit from UCS-2 encoding?...”
Undoubtedly that would the attitude development process will take towards this special case.

I can clearly understand UTC's fondness towards ZWJ solution - it is just a one line change in the standard and chillus are history or UTC. But for Malayalam community, life with Unicode is just begun. The potential bugs in the software tools and usage difficulties (which Kevin explained) will haunt us for decades. So I would ask all to think twice before committing to overload ZWJ with language specific functions.

I still wonder what Arabic community was thinking when they allowed this to happen for them. Taking Arabic as an example, soon ZWJ will get overloaded many such language specific functions and this simple ZWJ will turn into the most unscrupulous codepoint in entire standard.

2.4 Unanswered questions

1. Isn't using CGJ a dangerous thing? Because, a document (eg: a wiktitionary.org document) written by multiple people using various inputting tools can quite possibly have different 'spellings' for a conjunct or word, without reader or writer being aware of it. This can cause many problems including ineffective searches and inconsistent collation.

2. My understanding about collation value of a codepoint is that it is directly tied both ways to search/sort functions. That is, searching and sorting is done using collation value and when collation values vary, search/sort can potentially give different results. Does collation value has any other purpose? If no, then by attaching search and sort meaning to ZWJ, aren't we actually adding a collation value to ZWJ? That is, ZWJ in turn becoming ZWJ + CGJ in case of chillus.

3. What was the reasoning behind giving vowel signs a different codepoint? Why they weren't encoded as, say, VIRAMA + AA = sign of AA

4. When do one say two words with different orthography and same meaning have two different spellings. Example: color & colour. Same way, can we say that the old and new orthography renderings of the same word, say 'ശബ്ദ' and 'ശബ്ദം' (/Sabdam/), qualify for two different spellings?

5. What is the assumption Unicode makes about the input methods? Does it assume the input method has word lookup feature or just a basic keyboard layout or inputting each Unicode codepoint by codepoint?

3 More Options

3.1 Why not encode the diacritic tail of Chillu?

I have shown in the section 1.2 that the issue of (chillu Vs chandrakkala) is not a derivative of the issue of (chandrakkala Vs samvruthokaaram). These issues have to be tackled separately. So I am taking (chillu Vs chandrakkala) alone right now.

In the primary example of section 1.2, the words differ precisely in /nn/ and /n_n/ location. We know, in the phoneme space they are different. That is, dental ന + dental ന and alveolar ന + dental ന. How is this distinction is indicated in orthography? Before explaining that, let us look at chandrakkala once more.
Chandrakkala when used for vowellessness, is acting as a language specific control character. It removes the default ‘അ’ from the consonant behind it. That is, it is acting as an attribute remover.

It is the property of any vowelless consonant to get 'help' from the consonant next to it as if that is a vowel and thus creating a conjunct. In /n_n/, this specific property is prevented. That is how alveolar n and dental n can stay close without undergoing conjunct forming transformations. How are we denoting the removal of this conjunct creation property? Are we using any specific symbols to indicate this? In fact, yes. It is a vertical tail across the letter.

Since chandrakkala exist as a separate orthographic entity detached from the letter, we can easy see its functionality. In contrast, conjunct-creation-preventer-symbol gets embedded in the orthography of a letter and that makes it difficult to recognize it.

So my conclusion (not a solution) is this: an Malayalam specific control symbol, different from chandrakkala, is present in a chillu letter. Its functionality is 1) remove the inherent അ vowel 2) then prevent the consonant from forming deep conjunct with the next letter. If we recognize, the function (1) alone, we will not solve the riddle of chillu.

This symbol could be encoded as level-1 ignorable in the collation table, as most of the diacritic marks are.

4 Final Bottom Line

Here are the two choices UTC will finally need to choose from:

1. Encode Chillus as we did for മ /ma/ and handle the issue of equivalence to the base character at higher levels of text processing.
2. Encode Chillus other than മ /ma/ as Consonant + VIRAMA + ZWJ by overloading the format character ZWJ with Malayalam specific secondary or tertiary level collation weight. Also, both RA + VIRAMA + ZWJ and RRA + VIRAMA + ZWJ will represent exactly same chillu. Similarly, both LLA + VIRAMA + ZWJ and LLLA + VIRAMA + ZWJ represent same chillu. After all these, issue of correctness of the inputted text has to be handled at higher levels of text processing.

5 Uniqueness Rule

Consider this scenario:
Two encodings are equivalent if they differ only joiners. Encodings of 'കേബി' and 'കേബി ജ' are equivalent because they are different only by a ZWNJ. Meanwhile, encodings of 'അവൻ' and 'അവന' are not because one has chillu letter, other hasn't.

Rendering equivalence is more of a subjective thing. We know 'കേബി' and 'കേബി ജ' are equivalent renderings. 'അവൻ' and 'അവന' are not equivalent renderings. 'അല്ല' and 'അൽ പ' are sometimes considered equivalent, sometimes not. These pairs can not participate in this rule.

The fonts can vary from the new orthography font Nila from Bhasha Institute to old orthography fonts like Anjali or Rachana. I don't think it is realistic to consider fonts which don't have lesser number of conjuncts than Nila.

Uniqueness Rule says:

If there is Encoding Equivalence then there should be Rendering Equivalence. (see details in section 5.1)

Also, if there is Rendering Equivalence then there should be Encoding Equivalence. (see details in section 5.2)

We can consider two versions of this rule. In the lenient version of this rule, at least one of the renderings should be valid. A rendering is valid when it is present in the dictionary or it is a word combination obeying grammar rules.

In the aggressive version of this rule, we consider all possible words, even those outside dictionary. This could be useful because these words can come from:

1. Colloquial phrases, often found in novels and stories.
2. Names of places, people etc.
3. Future words

5.1 Uniqueness Rule on Rendering

If a word is displayed correctly in one font then that word should be rendered correctly as the same word, in all fonts.
If Encodings 1 and 2 are exactly the same and Rendering 1 and 2 are different, then there is no guarantee that the text written by one will be readable to others.

If Encodings 1 and 2 are different by some joiners and Rendering 1 and 2 are different but valid, then there are following issues:

- search for rendering 1 will produce results with rendering 2
- search and replace would spoil the text
- Since typical language tools like spell checker or grammar checker is transparent to joiners (joiners are format control characters consumed by shaping engine), we will need to make special tools which are joiners-aware for Malayalam.

If Encodings 1 and 2 are different by some joiners and one of the Renderings 1 and 2 is valid and other is invalid, then there is following issue:

- Since typical language tools like spell checker or grammar checker is transparent to joiners (joiners are format control characters consumed by shaping engine), we will need to make special tools which are joiners-aware for Malayalam.

5.2 Uniqueness Rule on Encoding

Two different encodings should not render same, irrespective of the font or joiners used.

Two see why this rule is required, assume there is a conjunct formation rule for a subset of Chilli-C1 + C2 permutations and as per that rule, Chilli-NNA + DDHA (ൺ + ଢ) can form the conjunct (ൺ) in an old orthography font. Of course, NNA + VIRAMA + DDHA (ൺ + ଽବ + ଢ) will also form the same conjunct.

Therefore, a document (eg: a wiktionary.org document) written by multiple people using various inputting tools can quite possibly have both spellings for ࣣ, without reader or writer being aware of it. This can cause many problems including ineffective searches and inconsistent sorted list of words.

Antoine Leca write this related text:
"Right now (for fifteen years really), we have a similar problem with Latin in Europe: our accentuated letters have two spellings, one which is the legacy one (using unique codepoints, for example U+00EE (î) which is the one everybody uses; and the other is the genuine Unicode encoding, the one we ought to use but nobody does in reality, using the base (English) letter and then another codepoint for the accent, i.e. U+0069, U+0302 (ı) for my example above). You cannot normally see the difference, and if you do, it is just because of an imperfect Unicode support which does not render correctly the second form (things are getting better here, but still are not perfect). But if you are searching, the different spellings MAY be viewed as different, when of course it should not. Similarly, you could be allowed to enter both forms in a database field as "unique" key, when of course it should be prevented.

As this stuff is pretty evident to anyone in Europe developing in Unicode, this problems has been identified for years; and a "fix" has been developed, that is those two sequences are considered "canonically equivalent", so a "fully conforming" Unicode process should merge the two encodings for processes like searching or inserting. Please note that the majority of the tools used nowadays which deals with Unicode contents do not do that; only the tools specially prepared does it, and this comes
with a noticeable performance impact."

## 6 Transliteration Scheme

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<thead>
<tr>
<th>മ്യാസ്നാരം (Vowels)</th>
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