SCRIPT GRAMMAR FOR KANNADA LANGUAGE

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0. INTRODUCTION

The term **script grammar** refers to the behaviour pattern of the writing system of a given language. Languages which have written representations do not use a haphazard manner of storing the information within the system, but use a coherent pattern which is similar to the linguistic grammar of a given language. With the help of specialists (not necessarily linguist) who work in the area of the written representation of the language, the manner in which the shapes of the characters of the language and the representation of the conjunct forms is provided. In other words the Script Grammar deals with the surface structure of the language and tries to provide the best possible "fit" for shapes and their representation. Since this is a highly subjective issue, the shapes provided here are recommendations at the best and conform to the perception of the mandating body/evaluators that consensually arrive at the "best possible fit" which is acceptable to a majority of users. An example will make the above clear. Although Marathi and Hindi share the same script Devanāgarī, not only do they not share the same character inventory but in addition the representation of certain characters is different. Thus the Marathi /la/ is different from the Hindi /la/ in so far as the placement of the stem is concerned Hindi ल Marathi ल. This ensures that the Script Grammar conforms to the language in question and provides the character shapes acceptable to a given user community. It should be noted that this does not mean monotony. The Hindi and Marathi /la/ can have a variety of forms once the intrinsic structure of the character is determined.

Script Grammar is the term used to define:

- the writing system used to inscribe a given language
- the history of the script and language (wherever available)
- the syllabic structure of the writing system of the language
- the rule ordering of the characters within the syllable (akshar)
- description of the syllabic clusters
- collation order of the characters: lexical / dictionary sorting order

1. OBJECTIVES OF SCRIPT GRAMMAR

The Objectives of the script grammar for each language can be divided into two major parts:

Societal:

- Provide a visual representation of shapes that are deemed to be in conformity with the perception of a given community
- Ensure thereby that this perception is safe-guarded
- Through wide-spread dissemination and creation of appropriate tools ensure that within the given linguistic community, all media tries to adopt the given shape.

Technical:

- Classify the language in terms of its ISO and also whether it belongs to the Abjad, Akshar (Alphasyllabary) class.
- Provide an inventory of the characters pertinent to the language and classify the same in terms of their taxonomy.
- As a corollary determine whether the inventory is in conformity to the Syllable formalism as stipulated in ISCII'91 and subsequently adopted by Unicode.
- Since Brahmi is written from left to right, and since certain characters do not follow the linear L to R order, provide an inventory of displaced catenators i.e. characters such as Mātrās that concatenate to the Consonant
- Propose the best shape representation of the individual characters as well as of the ligatures used within a given script. As a corollary request the expert(s) to identify the largest possible strings of such ligatures.
- Finally provide the collation order pertinent to that script/language, which would be of great utility to high-end NLP as well as to CLDR's in the pertinent language. The collation order for Marathi is different from Hindi although both languages share the same script. Thus in Marathi क्ष, ज्ञ are placed at the end of the consonant inventory i.e. after ह् in the sort order. In Hindi क्ष is sorted along with क and ज्ञ with ज.

2. EN

3. D USERS FOR SCRIPT GRAMMAR

The script-grammar specific to a given language can be used by a large number of users.

- Most importantly it can be used by font developers desirous of developing a font which is compliant with the perception of the characters and ligatures of a language by its user community.

- Certain features of the script grammar such as the shapes can also be used for testing OCR and OHWR. Similarly information regarding Ligatures as well as collation order can help in high-end NLP work such as detecting invalid combinations, correct implementation of syllable structure, prediction routines to name a few. Information regarding collation and character sets can be also used for CLDR.

- They allow the font designer to design a font which is in compliance with the norms and standards of that particular script. A major problem which will be dealt with in the template is one of ligatures. The final list of ligatures defined by the script grammar allows the font designer to write specific rules for such glyphs.

- It permits the software developer to design and implement the keyboard and the input mechanism which will meet the requirement of the particular linguistic community.

- The collation or sort order as described in a Script Grammar permits the software developer to write software functions/ routines for sorting data in all applications.

- Script Grammars are equally important for keyboard design, especially when supplemented by frequency data from a corpus.

As can be seen the script grammar has a wide range of use and can be of utility to font developers, Indian language developers and linguists in the area of computation.

4. SCOPE

This script grammar document contains following information about the language and the script used for writing the language.

1. Name of the language and its representation in the 3 letter mnemonic as per ISO 639.1 & 639.3 standard.
2. Script used to inscribe the given language
3. The structure of the script used for writing the language
    - Rule ordering of the characters within the syllable formation is a language
    - Description of the syllabic clusters of the script
    - Collation order of the characters: lexical / dictionary sorting order
    - Compliance of the script with Unicode.

These will be treated within the relevant sections of the script grammar

4. TERMINOLOGY[1]

Abjad: A writing system in which each symbol always or usually stands for a consonant. The long vowels are indicated. However the short vowels are rarely marked and the reader needs to supply these. Example: Urdu written in Perso-Arabic Script is an example of this writing system.

Abugida: also called an alphasyllabary, is a segmental writing system in which consonant–vowel sequences are written as a unit: each unit is based on a consonant letter, and vowel notation is obligatory but secondary[2]

Akshar: see **Abugida**

Allographs: Variants of the representation of a character. Thus ae and æ [U+00E6] in Latin alphabet are allographs.

Allo-Script: The term relates to languages which share a common script. Thus Devanāgarī is used to write 9 official languages. However these languages do not use the same set of characters. Thus Marathi uses the retroflex lla ळ [U+ 0933] which Hindi does not use. Flaps used in Hindi ड़ [U+095C] ढ़ [U+095D] are not used in Konkani. These sub-sets of scripts based on a single "matricial" script are termed as allo-scripts.

Alphabet: A set of letters used in writing a language. Example: The English Alphabet.

Aspirated consonant: A consonant which is pronounced with an extra puff of air coming out at the time of release of the oral obstruction. This has a sound of an extra "h".

Basic alphabet: The minimal set of letters which can be used for uniquely encoding every word of a language. The basic alphabet for English consists of only the upper-case letters A-Z

Catenators: Also termed as Concatenators are characters which are concatenated to another character. In the Brahmi script these are the Mātrās or Vowel modifiers which are adjoined to the consonant and add a vocalic value to the consonant.

Conjunct: The Indic scripts are noted for a large number of consonant conjunct forms that serve as orthographic abbreviations (ligatures) of two or more adjacent letterforms. This abbreviation takes place only in the context of a consonant cluster….Under normal circumstances, a consonant cluster is depicted with a conjunct

[1] As in the case of the BIS Document, in order to make the terminology accessible for all readers, examples have been chosen from English/Latin scripts, wherever possible. Some definitions have been excerpted from the BIS ISCII91 document and suitably modified where necessary.

2 Wikipedia definition

glyph if such a glyph is available in the current font. In the absence of a conjunct glyph, the one or more dead consonants that form part of the cluster are depicted using half-form glyphs. In the absence of half-form glyphs, the dead consonants are depicted using the nominal consonant forms combined with visible virama signs.[3]

Consonant: A letter representing a speech sound in which the breath is at least partly obstructed,

Diacritic: A mark added to a letter which distinguishes it from the same letter without a mark, usually having a different phonetic value or stress.

Displaced Catenator: (see Catenator) Within the Brahmi script, the writing system is linear and moves from left to right. However in the case of some catenators this rules is not observed and the catenator (wholly or partially) is placed to the right of the consonant to which it relates. The short vowel I in Devanāgarī is an example of a displaced catenator.

Display composing: The process of organizing the basic shapes available in a font in order to display (or print) a word.

Display rendition: The process by which a string of characters is displayed (or printed). In this process several consecutive characters may combine with each other on the screen. The sequence of display of the characters may become different.

Eyebrow repha: (See **Eyelash ra)**

Eyelash ra: The eyelash ra is used in Konkani, Nepali and Marathi. It is treated as different from the र् (repha) by certain linguists. While the former is treated as a flap, the latter is a continuant trill (*cf.*, Kalyan Kale and Anjali Soman. 1986). There are cases in Marathi of minimal pairs such as: आचार्यास "to the teacher" vs. आचार्‌यास "to the cook" or दर्या /darya/ "ocean" vs. दर्‌या /darya/ "valleys".

Font: A set of symbols used for display or printing of a script in a particular style.

International numerals: The conventional 0 to 9 digits used in English for denoting numbers. These are also known as Indo-Arabic numerals (to differentiate them from the Roman numerals like IX for 9).

Latin alphabet: The alphabet used for writing the language of ancient Rome. Also known as the Roman alphabet. The alphabet is used today for writing English and European languages.

Letter: A character representing one or more of the simple or compound sounds used in speech. It can be any of the alphabetic symbols.

[3] Unicode 6.0 Chapter 9.0 pp 6-7

Ligature: (see **Conjunct**)

Nasal consonant: A consonant pronounced with the breath passing through the nose. Example *m n* in English.

Nasalized vowel: A vowel pronounced with the breath passing both through the nose and the mouth. In Indian scripts this is denoted by a Chandrabindu and gives the vowel/vowel modifier over which it placed a nasal value. Example: जाँच

Phonetic alphabet: An alphabet which has direct correspondence between letters and sounds Example: The International Phonetic Alphabet..

Pure consonant: A consonant which does not have any vowel implicitly associated with it.

Rafar: A special case of a ligature constituted by the adjunction of ra followed by a halanta to consonant. The resultant combination places the ra on top of the consonant to which it is adjoined. In case the consonant itself is adjoined to another consonant, the rafar is placed above the consonant e.g. र्+क र्क , र्+घ्+य र्घ्य

Rakar: A special case of a ligature constituted by the adjunction of a consonant followed by a halanta to ra. In a large number of Brahmi scripts the ra is adjoined to the stem of consonant to which it relates. In the case of consonants which have no stem such as the dental retroflexes in Devanāgarī, the rakar is placed below the consonant to which it relates.

Repha: (see **Rafar)**

Roman script: The script based on the ancient Roman alphabet, with the letters A-Z and additional diacritic marks. Used for writing a language which is not usually written in the Roman alphabet.

Script: A distinctive and complete set of characters used for the written form of one or more languages.

Script numerals: The 0 to 9 digits in a script, which have shapes distinct from their international counterparts.

Syllable: A unit of pronunciation uttered without interruption, forming whole or part of a word, and usually having one vowel or diphthong sound optionally surrounded by one or more consonants

Transliteration: Representation of words with the closest corresponding letters in an alphabet of a different language.

Vowel: A letter representing a speech sound made with the vibration of the vocal cords, but without audible obstruction

Vowel sign: A graphic character associated with a letter, to indicate a vowel to be associated with that character (Mātrā in Hindi).

5. PHILOSOPHY AND UNDERLYING PRINCIPLES

The script grammar is based on the following principles:

1. The Grammar aims to depict the surface grammar of the written language: the manner in which characters as well as conjuncts are depicted

2. Where a given script admits many languages, it is pre-suppose that such languages will prescribe different representations for a given shape or conjunct according to the perception of the native users of that language

3. Corollary to the above the result is a script and allo-scripts i.e. a given script shared by many languages is not uniformly deployed across all the languages but is subject to variations and modulations.

4. The term Grammar is used here in a non-normative sense: what is prescribed is in the form of recommendations provided by experts who visualize the shape of the given script in their mother tongue in a specific manner. Subjective variations may occur[4]

5. The Grammar is limited to its synchronic use i.e. the manner in which a given language as of today admits a character set within the script used to write it. It is not diachronic or historical in nature and does not study the evolution of the given script across centuries.

[4] It is recommended that such variations be culled by placing the Grammars of different scripts in public review.

6. SCRIPT GRAMMAR STRUCTURE

The script grammar provided below has the following parts.

Part 6.1. deals with peripheral elements such as the ISO of the language, the writing system used: (Alphasyllabic) Abugida or Abjad.

Part 6.2. treats of the syllabic structure. It verifies whether the character set of the language complies with the ISCII syllabic structure and if not which cases are not compliant.

Part 6.3 is the script grammar proper and describes the character set as well as the conjunct shapes of the given script along with the collation order

6.1. PERIPHERAL ELEMENTS OF THE SCRIPT GRAMMAR

These constitute the elements that are peripheral to the Script Grammar. The main parameters considered are the mnemonic and name of the language (needed for CLDR and also for language tags), the writing system used to inscribe the language and wherever possible a short history of the language.

6.1.1. Name of the language and its representation in the 3 letter mnemonic as per ISO 639.1. & 639.3

Name of the Language: KANNADA
ISO Mnemonics: *kan* (as per 639.3)
This refers to a one line description of the language and its mnemonic representation as per the ISO. In the case of Kannada, the above information is pertinent.

6.1.2. Identification of the writing system(s) used to inscribe the given language

Kannada is written using the Kannada script. It is an alphasyllabary with the akshar as its core.
This is a one line description of the script used to write the language. However in case the language uses more than one script, all the scripts in question are specified, provided these constitute the official language of the given state.

All scripts derived from Brahmi are Abugidas i.e. syllabary driven systems. The main features of Abugidas are as under:

- The consonant has an implicit vowel built-in which is normally the schwa.
- The inherent vowel can be modified by the addition of other vowels or muted by a diacritic termed as a Virama or Halanta
- Vowels can be handled as full vowels with a vocalic value
- When two or more consonants join together they form ligatures which can be recognized by their shape ರ್ಾ.

Abugidas/Alphasyllabaries because of their syllabic structure require a special description which is the subject of the discussion in 6.2. below.

6.1.3. Amendments needed in Unicode for Kannada language

The following amendment is felt to the computational experts.

6.2. CONFORMITY TO THE SYLLABLE STRUCTURE

Kannada language complies with the syllable (akshar) structure described above. It can admit up to h consonant clusters.

Alphasyllabaries are determined by the notion of the syllable or the Akshar. The compositional grammar of the syllable determines it well-formedness. This is through a series of formal constraints based on a Backus-Naur Formalism which is given below. The syllable (akshar), first defined in the ISCII document (1991), identifies the following character 'sub-sets' for the purposes of identifying the syllable (akshar). In what follows the syllable analysis will be restricted to Kannada.

(C) Consonants

ಕ	ಖ	ಗ	ಘ	ಙ
ಚ	ಛ	ಜ	ಝ	ಞ
ಟ	ಠ	ಡ	ಢ	ಣ
ತ	ಥ	ದ	ಧ	ನ
ಪ	ಫ	ಬ	ಭ	ಮ
ಯ	ರ	ಱ	ಲ	ವ
ಶ	ಷ	ಸ	ಹ	ಳ
ೞ				

(V) Vowels

ಅ	ಆ	ಇ	ಈ	ಉ	ಊ	ಋ	ೠ	ಌ	ೡ
ಎ	ಏ	ಐ	ಒ	ಓ	ಔ	ೕ			

(M) Mātrās or Vowel Modifiers

ಁ	ಂ	ಃ	಄	ಽ	ೃ	ೄ	◌	◌
ೆ	ೇ	ೈ	ೊ	ೋ	ೌ			

(D) Diacritics

ಂ Anuswāra	Anuswāra, a nasal, is denoted by a dot above the letter after which it is to be pronounced. For example, ರಾಜ್ಯಂ. This falls under Nasal category.
ಃ Wisarga	Wisarga, denoted by two dots placed above the other. For example, ದುಃಖದ. This falls under aspirate category
◌ Awagraha	For extra length with long vowels

(H):Halanta ◌್ - Halant used in most writing systems of the Indian subcontinent to signify the lack of an inherent vowel.

(N) Nukta ◌◌ - is used in Kannada

Vedic Signs:
0CF1: Kannada Sign Jihwāmūlīya

0CF2: Kannada Sign Upādhmānīya

(Used in Historical and Comparative linguistic and literary works of Kannada)

Each of these sub-types has its restrictions in terms of what can precede or follow it within a syllable (akshar), as shown in the table below:

PRECEDED BY	SUBTYPE	FOLLOWED BY
-, H	**C**	M,D,H
-	**V**	D
C	**M**	D
C,V,M	**D**	-
C	**H**	C

C can be preceded by H or no subtype and followed by any one of the following: M,D,H
V can be preceded by no subtype and followed by D but not by another sub-type.
M can be preceded by C and followed by D.
D can be preceded by C, V, M and followed by no other subtype. It closes the syllable (akshar).
H can be preceded by C alone and followed only by C and no other sub-set.

6.2.1. Syllable (akshar) Types

The formalism defines the syllable (akshar) in terms of both what can constitute a syllable (akshar) and what cannot. A valid syllable (akshar) as per this definition can be of only two types:

1. A vowel syllable (akshar): a full vowel.
2. A consonant syllable (akshar): a full consonant (having a weak vowel or a mātrā)

The three other subsets viz. Mātrās, Diacritics, Halanta cannot constitute a syllable (akshar) by themselves or in combination among themselves.

6.2.1.1. The Vowel syllable (akshar) is of the following types:

6.2.1.1.1. A pure vowel all by itself: ಅ, /a/ ಆ /ā/ etc.
6.2.1.1.2. A vowel followed by a modifier i.e. either anuswāra or wisarga or awagraha: ಅಃ /āH/

6.2.1.2. The Consonant syllable (akshar) can be of the following types:
6.2.1.2.1. A full consonant (with or without Nukta) i.e. with the inherent vowel : ಕ : /ka/
6.2.1.2.2. A consonant followed by a mātrā i.e. the inherent vowel being substituted by another vowel: ಕೀ /ki:/
6.2.1.2.3. A consonant followed by a modifier: ಕಂ /kə̃/, ಹಃ /haH/
6.2.1.2.4. A consonant followed by a mātrā and a modifier: ಕುಂ /kũ/, ದುಃ /duH/.
6.2.1.2.5. A consonant cluster i.e. a dead (Consonant + Halanta) followed by a full consonant followed optionally by a mātrā, a modifier or a combination of both. These result in a ligature or what is often termed as *yuktākshara.*

ತ್ಕ /tka/ ತ್ಕಂ /tkã/, ತ್ಕಃ /tkaH/ ತುಕ್ಂ /tkũ/, ತುಡ /tdu/.

The above permutations and combinations result in 7 major syllable (akshar) types. Of these the last type introduces the problem of the number of consonant clusters. ISCII (91, p.23) provides for up to three consonant clusters as the “worst case” i.e. the largest possible string. This is functional for modern Prakrits where the largest consonantal cluster rarely exceeds three consonant. Sanskrit is an exception where in a single word, four consonants can come together: कार्त्स्न्य /kārtsnya/ "wholeness", "entirety".

This means that theoretically the following forms can be postulated:

1. Vowel Set: With the Vowel as the node.
   V VD
2. Consonant set: With the Consonant as the node (an implicit or modified vowel is pre-implied).

Node	Mātrā	Modifier	Mātrā+Modifier
C	CM	CD	CMD
CHC	CHCM	CHCD	CHCMD
CHCHC	CHCHCM	CHCHCD	CHCHCMD
CHCHCHC	CHCHCHCM	CHCHCHCD	CHCHCHCM

A total number of 16 theoretical syllables is therefore possible. It will be seen that the written syllable (akshar) is not very different in structure from the phonetic syllable and that the movement from the written to the spoken levels is made feasible by application of certain rules.

This formal structure of the syllable (akshar) explained above is common to all Brahmi based scripts (with a few variations). It will form the basis of an exhaustive description of the characters as well as their ligatural representations.

6.3 SCRIPT GRAMMAR PROPER

This section lays down in detail the different parameters of the Script Grammar for Kannada. These are:

6.3.1. The Character Set of Kannada.
6.3.2. The Consonant mātrā combinations of Kannada.
6.3.3. The Ligature Set of Kannada.
6.3.4. Collocation Order of Kannada
6.3.5. Cardinal Numbers used in Kannada.

6.3.1. The Character Set of Kannada.

This section provides detailed information about the characters in the language and the list of the same and also more importantly shows the manner in which the character is to be written. Each subsection comprises therefore two parts: the basic character set and the shape each character should have, as mandated by the experts who have designed the script grammar of Kannada.

This comprises the following:
6.3.1.1. The Consonant Set
6.3.1.2. The Vowel Set
6.3.1.3. The Mātrā Set
6.3.1.4. Displaced Catenators
6.3.1.5. Shape of the combination of ra (rakar,repha)
6.3.1.6. The Set of Diacritics
6.3.1.7. Numerals
6.3.1.8. Punctuation marks
6.3.1.9. Other symbols
Each of these will be analyzed in detail:

6.3.1.1. The Consonant Set

The Consonant set of Kannada comprises the following characters:
Basic Consonant inventory arranged as per their Vargas. The exact shapes and order, as desired by the experts are provided in the table below:

	-voiced -aspirated	-voiced +aspirated	+voiced -aspirated	+voiced +aspirated	Nasal
Velar	ಕ	ಖ	ಗ	ಘ	ಙ
Palatal	ಚ	ಛ	ಜ	ಝ	ಞ
Retroflex	ಟ	ಠ	ಡ	ಢ	ಣ
Dental	ತ	ಥ	ದ	ಧ	ನ
Bi-labial	ಪ	ಫ	ಬ	ಭ	ಮ

Other consonants

ಯ	ರ	ಱ	ಲ	ವ	ಶ
ಷ	ಸ	ಹ	ಳ	ೞ	

Note: Ligatures ಕ್ಷ ತ್ರ ಜ್ಞ are not listed in the consonants list and they are part of the CHC cluster (see: 6.3.3.1).

6.3.1.2. The Vowel Set

The Vowel set of Kannada is as under:

ಅ	KANNADA LETTER A
ಆ	KANNADA LETTER AA
ಇ	KANNADA LETTER I
ಈ	KANNADA LETTER II
ಉ	KANNADA LETTER U
ಊ	KANNADA LETTER UU
ಋ	KANNADA LETTER VOCALIC R
ೠ	KANNADA LETTER VOCALIC RR
ಌ	KANNADA LETTER VOCALIC L
ೡ	KANNADA LETTER VOCALIC LL
ಎ	KANNADA LETTER E
ಏ	KANNADA LETTER EE
ಐ	KANNADA LETTER AI
ಒ	KANNADA LETTER O
ಓ	KANNADA LETTER OO
ಔ	KANNADA LETTER AU

As per expert recommendations the character set should be written as under:

ಅ ಆ ಇ ಈ ಉ ಊ ಋ ೠ ಌ ೡ ಎ ಏ ಐ ಒ ಓ ಔ

6.3.1.3. The Mātrā Set

The Mātrā (Vowel Modifier Set) of Kannada is as under:

Mātrās Names	Mātrās Sign	Where is it used ?	Consonant Shapes formed
1. Kannada sign AA	ಾ	ಆ	ಕ್ + ಆ = ಕಾ
2. Kannada sign I (stands to the left of the consonant)	ಿ	ಇ	ಕ್ + ಇ = ಕಿ

3. Kannada sign II	ೀ	ಈ	ಕ್ + ಈ = ಕೀ
4. Kannada sign U	ು	ಉ	ಕ್ + ಉ = ಕು
5. Kannada sign UU	ೂ	ಊ	ಕ್ + ಊ = ಕೂ
6. Kannada sign vocalic R	ೃ	ಋ	ಕ್ + ಋ = ಕೃ
7. Kannada sign vocalic RR	ೄ	ೠ	ಕ್ + ೠ = ಕೄ
8. Kannada sign vocalic L	ೢ	ಌ	ಕ್ + ಌ = ಕೢ
9. Kannada sign vocalic LL	ೣ	ೡ	ಕ್ + ೡ = ಕೣ
10. Kannada sign E	ೆ	ಎ	ಕ್ + ಎ = ಕೆ
11. Kannada sign EE	ೇ	ಏ	ಕ್ + ಏ = ಕೇ
12. Kannada sign AI	ೈ	ಐ	ಕ್ + ಐ = ಕೈ
13. Kannada sign O	ೊ	ಒ	ಕ್ + ಒ = ಕೊ
14. Kannada sign OO	ೋ	ಓ	ಕ್ + ಓ = ಕೋ
15. Kannada sign AU	ೌ	ಔ	ಕ್ + ಔ = ಕೌ

As per expert recommendations the character set should be written as under:

ಀ	ಁ	ಂ	ಃ	಄	ಅ	ಆ	ಇ	ಈ
ಉ	ಊ	ಋ	ಌ	ೠ	ೡ			

6.3.1.4. Displaced Catenators

Under normal circumstances Vowel Modifiers also known as catenators (since they concatenate to the preceding consonant) in Brahmi based scripts are written from left to right in linear order (with the exception of Consonant stacks). However certain modifiers are displaced and are placed to the left of the consonant to which they concatenate. There are no displaced catenators in Kannada.

CATENATOR	POSITION	EXAMPLE

6.3.1.5. Shape of the combination of ra (rakar, repha)

The ರ /ra/ takes a variety of shapes known as rakar (ಾ = Bottom Rakāra) and repha (rafar ◌್ರ = Side Rakāra) depending on its position. When conjoined before a consonant by means of the halant, it changes shape to ◌್ರ and is placed to the right of the consonant or consonant clusters to which it relates. When it is conjoined after a consonant with the help of a halanta, it appends to the consonant in the following shape ◌ಾ depicted to the lower right of the character.

Kannada has the following combinations of ರ /ra/:

RAFARS = SIDE RAFAR (◌್ರ)
Rafar: ಕ್ರ ರ್ಕ
Examples are given below.

1. /karma/ - Saṁsṛka ಕರ್ಮ
2. /ārkiṭekcar/ - English ಆರ್ಕಿಟೆಕ್ಚರ್ (architecture)
3. /kharcu/ - Urdu ಖರ್ಚು
4. /farḍinyaṇḍ/ - Swiss ಫರ್ಡಿನ್ಯಂಡ್ (Proper name as in **Ferdinand** de Saussure)
5. /arkāwattu/ - Saṁskṛta and Kannada Blend - ಅರ್ಕಾವತ್ತು (Name of the Side Rakar [◌್ರ] in Kannada)

RAKAR = BOTTOM RAKAR (◌ಾ)
Rakar ಕ್ರ ಚ್ರ
Examples of words where Rakars are used in Kannada language are given below:

1. /karrane/ ಕರ್ರನೆ ‘blackish’
2. /caṁdra/ ಚಂದ್ರ ‘moon’
3. /śāstra/ ಶಾಸ್ತ್ರ ‘ritual’

6.3.1.6. Diacritics
These are as under in the case of Kannada:

◌ಂ - Anuswar
◌್ - Halant
◌ಃ - Visarga
◌ೀ - For extra length with long vowels e.g.

Chandrabindu is not part of the Kannada character set

6.3.1.7. Numerals
Following are the numbers used in Kannada language. Use of English numerals occurs in handwritten text as well as some of the official documents.

Numeral Shapes	Explanation
೦	Kannada Digit Zero

೧	Kannada Digit One
೨	Kannada Digit Two
೩	Kannada Digit Three
೪	Kannada Digit Four
೫	Kannada Digit Five
೬	Kannada Digit Six
೭	Kannada Digit Seven
೮	Kannada Digit Eight
೯	Kannada Digit Nine

6.3.1.8. Punctuation Markers

Kannada uses punctuation markers from the Latin set. such as . , ; : " ' ( ) [ ] etc.
However the abbreviation marker is often used in Kannada ॰

Pūrna and Dīrgha Virāma (full-stop/danda) Dewanāgarī code block: 0964, 0965 ।,॥ are used in poetry alone.

A list of punctuations is provided below:

Sr. No.	Name of the marker	Marker Shape
01	Full Stop or Period	.
02	Question Mark	?
03	Exclamation Mark	!
04	Apostrophe	’
05	Semi Colon	;
06	Colon	:
07	Hyphen	-
08	Dash	--
09	Ellipsis mark	...
10	Oblique	/
11	Double quotation mark	" "
12	Single quotation mark	‘ ’
13	Cross	XXX
14	As Above	- - " - -
15	Round Brackets	( )
16	Square Brackets	[ ]
17	Curly Brackets	{ }
18	Abbreviation Sign	(॰)
19	Devanāgarī Danda	|
20	Devanāgarī Double Danda	||
21	Addition symbol	+
22	Equals	=
23	Symbol for ‘AND” – Ampersand	&
24	Symbol for Percentage	%

25	Symbol frequently used in editing	^
26	Asterisk	*
27	Symbol for ‘AT’	@
28	Symbol used in editing	#
29	Symbol of alternative elements - Tilde	~
30	Greater than	>
31	Less than	<
32	Plus or minus	±
33	Reverse solidus	\
34	Division symbol	÷
35	Zero width Joiner	U+200D
36	Zero width Non Joiner	U+200C

6.3.1.9. Other Symbols

These are religious, currency markers etc. included in Unicode:

□: Rupee Sign as mandated by Government of India.

6.3.2. Consonant Mātrā Combinations.

These refer to the shapes generated when a Mātrā is adjoined to the Consonant. The layout of these is in the shape of a matrix where the first horizontal row refers to the active consonant and the first vertical column refers to the vowel-modifier.

Due to constraints of space and also clarity, for each class a series of 3 tables are provided.

Table 1: ಕ ಖ ಗ ಘ ಙ
Table 2: ಚ ಛ ಜ ಝ ಞ
Table 3: ಟ ಠ ಡ ಢ ಣ
Table 4: ತ ಥ ದ ಧ ನ
Table 5: ಪ ಫ ಬ ಭ ಮ
Table 6: ಯ ರ ಱ ಲ ವ
Table 7: ಶ ಷ ಸ ಹ ಳ ೞ

Wherever there is an X it implies that the combination does not exist. For the font developer this is an indication that for this particular combination which is not possible in the language but needs to be accommodated in the font table, a simple linear combination be provided.
e.g. Although the combination of ಐ + Mātrā is theoretically not possible it needs to be handled at the font level in the anticipation that a user could type this combination. The font would show the following:

The classes are as under:
6.3.2.1. refers to a simple concatenation of Consonant and Mātrā combinations.
6.3.2.2. refers to a concatenation of Consonant and Mātrā + Nasal marker combinations. Other diacritics such as awagraha and wisarga have been avoided, since these are linear in nature, are adjoined to the combination and do not in any way modify the structure of the shapes.

6.3.2.1 Consonant and Mātrā combinations.

This set refers to a simple concatenation of Consonant and Mātrā.

Consonant and Mātrā combinations Set 1

	ಕ	ಖ	ಗ	ಘ	ಙ
ಂ	ಕಾ	ಖಾ	ಗಾ	ಘಾ	ಙಾ
ಂ	ಕಿ	ಖಿ	ಗಿ	ಘಿ	ಙಿ
ಂ	ಕೀ	ಖೀ	ಗೀ	ಘೀ	ಙೀ
ಂ	ಕು	ಖು	ಗು	ಘು	ಙು
ಂ	ಕೂ	ಖೂ	ಗೂ	ಘೂ	ಙೂ
ಂ	ಕೃ	ಖೃ	ಗೃ	ಘೃ	ಙೃ
ಂ	ಕೄ	ಖೄ	ಗೄ	ಘೄ	ಙೄ
ಂ	ಕೆ	ಖೆ	ಗೆ	ಘೆ	ಙೆ
ಂ	ಕೇ	ಖೇ	ಗೇ	ಘೇ	ಙೇ
ಂ	ಕೈ	ಖೈ	ಗೈ	ಘೈ	ಙೈ
ಂ	ಕೊ	ಖೊ	ಗೊ	ಘೊ	ಙೊ
ಂ	ಕೋ	ಖೋ	ಗೋ	ಘೋ	ಙೋ
ಂ	ಕೌ	ಖೌ	ಗೌ	ಘೌ	ಙೌ
ಂ	ಕ್	ಖ್	ಗ್	ಘ್	ಙ್

Consonant and Mātrā combinations Set 2

This set is in continuation of set 1 which shows consonant and Matra combinations.

	ಚ	ಛ	ಜ	ಝ	ಞ
ಂ	ಚಾ	ಛಾ	ಜಾ	ಝಾ	ಞಾ
ಿ	ಚಿ	ಛಿ	ಜಿ	ಝಿ	
ೀ	ಚೀ	ಛೀ	ಜೀ	ಝೀ	
ು	ಚು	ಛು	ಜು	ಝು	ಞು
ೂ	ಚೂ	ಛೂ	ಜೂ	ಝೂ	ಞೂ
ೃ	ಚೃ	ಛೃ	ಜೃ	ಝೃ	ಞೃ
ೄ	ಚೄ	ಛೄ	ಜೄ	ಝೄ	ಞೄ
ೆ	ಚೆ	ಛೆ	ಜೆ	ಝೆ	ಞೆ
ೇ	ಚೇ	ಛೇ	ಜೇ	ಝೇ	ಞೇ
ೈ	ಚೈ	ಛೈ	ಜೈ	ಝೈ	ಞೈ
ೊ	ಚೊ	ಛೊ	ಜೊ	ಝೊ	ಞೊ
ೋ	ಚೋ	ಛೋ	ಜೋ	ಝೋ	ಞೋ
ೌ	ಚೌ	ಛೌ	ಜೌ	ಝೌ	ಞೌ
್	ಚ್	ಛ್	ಜ್	ಝ್	ಞ್

Consonant and Mātrā combinations Set 3

This set is in continuation of set 2 which shows consonant and Matra combinations.

	ಟ	ಠ	ಡ	ಢ	ಣ
ಾ	ಟಾ	ಠಾ	ಡಾ	ಢಾ	ಣಾ
ಿ	ಟಿ	ಠಿ	ಡಿ	ಢಿ	ಣಿ
ೀ	ಟೀ	ಠೀ	ಡೀ	ಢೀ	ಣೀ
ು	ಟು	ಠು	ಡು	ಢು	ಣು
ೂ	ಟೂ	ಠೂ	ಡೂ	ಢೂ	ಣೂ
ೃ	ಟೃ	ಠೃ	ಡೃ	ಢೃ	ಣೃ
ೄ	ಟೄ	ಠೄ	ಡೄ	ಢೄ	ಣೄ
ೆ	ಟೆ	ಠೆ	ಡೆ	ಢೆ	ಣೆ
ೇ	ಟೇ	ಠೇ	ಡೇ	ಢೇ	ಣೇ
ೈ	ಟೈ	ಠೈ	ಡೈ	ಢೈ	ಣೈ
ೊ	ಟೊ	ಠೊ	ಡೊ	ಢೊ	ಣೊ
ೋ	ಟೋ	ಠೋ	ಡೋ	ಢೋ	ಣೋ
ೌ	ಟೌ	ಠೌ	ಡೌ	ಢೌ	ಣೌ
್	ಟ್	ಠ್	ಡ್	ಢ್	ಣ್

Consonant and Mātrā combinations Set 4

This set is in continuation of set 3 which shows consonant and Matra combinations.

	ತ	ಥ	ದ	ಧ	ನ
ಾ	ತಾ	ಥಾ	ದಾ	ಧಾ	ನಾ
ಿ	ತಿ	ಥಿ	ದಿ	ಧಿ	ನಿ
ೀ	ತೀ	ಥೀ	ದೀ	ಧೀ	ನೀ
ು	ತು	ಥು	ದು	ಧು	ನು
ೂ	ತೂ	ಥೂ	ದೂ	ಧೂ	ನೂ
ೃ	ತೃ	ಥೃ	ದೃ	ಧೃ	ನೃ
ೄ	ತೄ	ಥೄ	ದೄ	ಧೄ	ನೄ
ೆ	ತೆ	ಥೆ	ದೆ	ಧೆ	ನೆ
ೇ	ತೇ	ಥೇ	ದೇ	ಧೇ	ನೇ
ೈ	ತೈ	ಥೈ	ದೈ	ಧೈ	ನೈ
ೊ	ತೊ	ಥೊ	ದೊ	ಧೊ	ನೊ
ೋ	ತೋ	ಥೋ	ದೋ	ಧೋ	ನೋ
ೌ	ತೌ	ಥೌ	ದೌ	ಧೌ	ನೌ
್	ತ್	ಥ್	ದ್	ಧ್	ನ್

Consonant and Mātrā combinations Set 5

This set is in continuation of set 4 which shows consonant and Matra combinations.

	ಪ	ಫ	ಬ	ಭ	ಮ
ಾ	ಪಾ	ಫಾ	ಬಾ	ಭಾ	ಮಾ
ಿ	ಪಿ	ಫಿ	ಬಿ	ಭಿ	ಮಿ
ೀ	ಪೀ	ಫೀ	ಬೀ	ಭೀ	ಮೀ
ು	ಪು	ಫು	ಬು	ಭು	ಮು
ೂ	ಪೂ	ಫೂ	ಬೂ	ಭೂ	ಮೂ
ೃ	ಪೃ	ಫೃ	ಬೃ	ಭೃ	ಮೃ
ೄ	ಪೄ	ಫೄ	ಬೄ	ಭೄ	ಮೄ
ೆ	ಪೆ	ಫೆ	ಬೆ	ಭೆ	ಮೆ
ೇ	ಪೇ	ಫೇ	ಬೇ	ಭೇ	ಮೇ
ೈ	ಪೈ	ಫೈ	ಬೈ	ಭೈ	ಮೈ
ೊ	ಪೊ	ಫೊ	ಬೊ	ಭೊ	ಮೊ
ೋ	ಪೋ	ಫೋ	ಬೋ	ಭೋ	ಮೋ
ೌ	ಪೌ	ಫೌ	ಬೌ	ಭೌ	ಮೌ
್	ಪ್	ಫ್	ಬ್	ಭ್	ಮ್

Consonant and Mātrā combinations Set 6

This set is in continuation of set 5 which shows consonant and Matra combinations.

	ಯ	ರ	ಱ	ಲ	ವ
ಾ	ಯಾ	ರಾ	ಱಾ	ಲಾ	ವಾ
ಿ	ಯಿ	ರಿ		ಲಿ	ವಿ
ೀ	ಯೀ	ರೀ		ಲೀ	ವೀ
ು	ಯು	ರು	ಱು	ಲು	ವು
ೂ	ಯೂ	ರೂ	ಱೂ	ಲೂ	ವೂ
ೃ	ಯೃ	ರೃ	ಱೃ	ಲೃ	ವೃ
ೄ	ಯೄ	ರೄ	ಱೄ	ಲೄ	ವೄ
ೆ	ಯೆ	ರೆ	ಱೆ	ಲೆ	ವೆ
ೇ	ಯೇ	ರೇ		ಲೇ	ವೇ
ೈ	ಯೈ	ರೈ		ಲೈ	ವೈ
ೊ	ಯೊ	ರೊ		ಲೊ	ವೊ
ೋ	ಯೋ	ರೋ		ಲೋ	ವೋ
ೌ	ಯೌ	ರೌ	ಱೌ	ಲೌ	ವೌ
್	ಯ್	ರ್		ಲ್	ವ್

Consonant and Mātrā combinations Set 7

This set is in continuation of set 6 which shows consonant and Matra combinations.

	ಳ	ಷ	ಸ	ಹ	ಳ	ಱ
ಁ	ಳಁ	ಷಁ	ಸಁ	ಹಁ	ಳಁ	ಱಁ
ಂ	ಳಂ	ಷಂ	ಸಂ	ಹಂ	ಳಂ	
ಃ	ಳಃ	ಷಃ	ಸಃ	ಹಃ	ಳಃ	
ಅ	ಳಅ	ಷಅ	ಸಅ	ಹಅ	ಳಅ	ಱಅ
ಆ	ಳಆ	ಷಆ	ಸಆ	ಹಆ	ಳಆ	ಱಆ
ಇ	ಳಇ	ಷಇ	ಸಇ	ಹಇ	ಳಇ	ಱಇ
ಈ	ಳಈ	ಷಈ	ಸಈ	ಹಈ	ಳಈ	ಱಈ
ಉ	ಳಉ	ಷಉ	ಸಉ	ಹಉ	ಳಉ	ಱಉ
ಊ	ಳಊ	ಷಊ	ಸಊ	ಹಊ	ಳಊ	ಱಊ
ಋ	ಳಋ	ಷಋ	ಸಋ	ಹಋ	ಳಋ	ಱಋ
ಌ	ಳಌ	ಷಌ	ಸಌ	ಹಌ	ಳಌ	ಱಌ
ಎ	ಳಎ	ಷಎ	ಸಎ	ಹಎ	ಳಎ	
ಏ	ಳಏ	ಷಏ	ಸಏ	ಹಏ	ಳಏ	
ಐ	ಳಐ	ಷಐ	ಸಐ	ಹಐ	ಳಐ	
ಒ	ಳಒ	ಷಒ	ಸಒ	ಹಒ	ಳಒ	
ಓ	ಳಓ	ಷಓ	ಸಓ	ಹಓ	ಳಓ	
ಔ	ಳಔ	ಷಔ	ಸಔ	ಹಔ	ಳಔ	ಱಔ
ಕ್	ಳಕ್	ಷಕ್	ಸಕ್	ಹಕ್	ಳಕ್	ಱಕ್

6.3.2.2 Consonant and Mātrā +Nasal combinations. Set 1

This set refers to a Consonant and Mātrā + Nasal marker combinations.

	ಕ	ಖ	ಗ	ಘ	ಙ
ಂ	ಕಂ	ಖಂ	ಗಂ	ಘಂ	ಙಂ
ಾ ಂ	ಕಾಂ	ಖಾಂ	ಗಾಂ	ಘಾಂ	ಙಾಂ
ಿ ಂ	ಕಿಂ	ಖಿಂ	ಗಿಂ	ಘಿಂ	ಙಿಂ
ೀ ಂ	ಕೀಂ	ಖೀಂ	ಗೀಂ	ಘೀಂ	ಙೀಂ
ು ಂ	ಕುಂ	ಖುಂ	ಗುಂ	ಘುಂ	ಙುಂ
ೂ ಂ	ಕೂಂ	ಖೂಂ	ಗೂಂ	ಘೂಂ	ಙೂಂ
ೃ ಂ	ಕೃಂ	ಖೃಂ	ಗೃಂ	ಘೃಂ	ಙೃಂ
ೄ ಂ	ಕೄಂ	ಖೄಂ	ಗೄಂ	ಘೄಂ	ಙೄಂ
◌ ಂ	ಕ◌ಂ	ಖ◌ಂ	ಗ◌ಂ	ಘ◌ಂ	ಙ◌ಂ
◌ ಂ	ಕ◌ಂ	ಖ◌ಂ	ಗ◌ಂ	ಘ◌ಂ	ಙ◌ಂ
ೆ ಂ	ಕೆಂ	ಖೆಂ	ಗೆಂ	ಘೆಂ	ಙೆಂ
ೇ ಂ	ಕೇಂ	ಖೇಂ	ಗೇಂ	ಘೇಂ	ಙೇಂ
ೈ ಂ	ಕೈಂ	ಖೈಂ	ಗೈಂ	ಘೈಂ	ಙೈಂ
ೊ ಂ	ಕೊಂ	ಖೊಂ	ಗೊಂ	ಘೊಂ	ಙೊಂ
ೋ ಂ	ಕೋಂ	ಖೋಂ	ಗೋಂ	ಘೋಂ	ಙೋಂ
ೌ ಂ	ಕೌಂ	ಖೌಂ	ಗೌಂ	ಘೌಂ	ಙೌಂ

Consonant and Mātrā +Nasal combinations **Set 2**

This set is in continuation of set 1 which shows consonant and Matra combinations.

	ಚ	ಛ	ಜ	ಝ	ಞ
ಂ	ಚಂ	ಛಂ	ಜಂ	ಝಂ	ಞಂ
ಾ ಂ	ಚಾಂ	ಛಾಂ	ಜಾಂ	ಝಾಂ	ಞಾಂ
ಿ ಂ	ಚಿಂ	ಛಿಂ	ಜಿಂ	ಝಿಂ	ಞಿಂ
ೀ ಂ	ಚೀಂ	ಛೀಂ	ಜೀಂ	ಝೀಂ	ಞೀಂ
ು ಂ	ಚುಂ	ಛುಂ	ಜುಂ	ಝುಂ	ಞುಂ
ೂ ಂ	ಚೂಂ	ಛೂಂ	ಜೂಂ	ಝೂಂ	ಞೂಂ
ೃ ಂ	ಚೃಂ	ಛೃಂ	ಜೃಂ	ಝೃಂ	ಞೃಂ
ೄ ಂ	ಚೄಂ	ಛೄಂ	ಜೄಂ	ಝೄಂ	ಞೄಂ
ೆ ಂ	ಚೆಂ	ಛೆಂ	ಜೆಂ	ಝೆಂ	ಞೆಂ
ೆ ಂ	ಚೆಂ	ಛೆಂ	ಜೆಂ	ಝೆಂ	ಞೆಂ
ೈ ಂ	ಚೈಂ	ಛೈಂ	ಜೈಂ	ಝೈಂ	ಞೈಂ
ೀ ಂ	ಚೀಂ	ಛೀಂ	ಜೀಂ	ಝೀಂ	ಞೀಂ
ೈ ಂ	ಚೈಂ	ಛೈಂ	ಜೈಂ	ಝೈಂ	ಞೈಂ
ೊ ಂ	ಚೊಂ	ಛೊಂ	ಜೊಂ	ಝೊಂ	ಞೊಂ
ೋ ಂ	ಚೋಂ	ಛೋಂ	ಜೋಂ	ಝೋಂ	ಞೋಂ
ೌ ಂ	ಚೌಂ	ಛೌಂ	ಜೌಂ	ಝೌಂ	ಞೌಂ

Consonant and Mātrā +Nasal combinations **Set 3**

This set is in continuation of set 2 which shows consonant and Matra combinations.

	ಟ	ಠ	ಡ	ಢ	ಣ
ಂ	ಟಂ	ಠಂ	ಡಂ	ಢಂ	ಣಂ
ಾ ಂ	ಟಾಂ	ಠಾಂ	ಡಾಂ	ಢಾಂ	ಣಾಂ
ಿ ಂ	ಟಿಂ	ಠಿಂ	ಡಿಂ	ಢಿಂ	ಣಿಂ
ೀ ಂ	ಟೀಂ	ಠೀಂ	ಡೀಂ	ಢೀಂ	ಣೀಂ
ು ಂ	ಟುಂ	ಠುಂ	ಡುಂ	ಢುಂ	ಣುಂ
ೂ ಂ	ಟೂಂ	ಠೂಂ	ಡೂಂ	ಢೂಂ	ಣೂಂ
ೃ ಂ	ಟೃಂ	ಠೃಂ	ಡೃಂ	ಢೃಂ	ಣೃಂ
ೄ ಂ	ಟೄಂ	ಠೄಂ	ಡೄಂ	ಢೄಂ	ಣೄಂ
◌ ಂ	ಟ◌ಂ	ಠ◌ಂ	ಡ◌ಂ	ಢ◌ಂ	ಣ◌ಂ
◌ ಂ	ಟ◌ಂ	ಠ◌ಂ	ಡ◌ಂ	ಢ◌ಂ	ಣ◌ಂ
ೆ ಂ	ಟೆಂ	ಠೆಂ	ಡೆಂ	ಢೆಂ	ಣೆಂ
ೇ ಂ	ಟೇಂ	ಠೇಂ	ಡೇಂ	ಢೇಂ	ಣೇಂ
ೈ ಂ	ಟೈಂ	ಠೈಂ	ಡೈಂ	ಢೈಂ	ಣೈಂ
ೊ ಂ	ಟೊಂ	ಠೊಂ	ಡೊಂ	ಢೊಂ	ಣೊಂ
ೋ ಂ	ಟೋಂ	ಠೋಂ	ಡೋಂ	ಢೋಂ	ಣೋಂ
ೌ ಂ	ಟೌಂ	ಠೌಂ	ಡೌಂ	ಢೌಂ	ಣೌಂ

Consonant and Mātrā +Nasal combinations **Set 4**

This set is in continuation of set 3 which shows consonant and Matra combinations.

	ತ	ಥ	ದ	ಧ	ನ
ಂ	ತಂ	ಥಂ	ದಂ	ಧಂ	ನಂ
ಾ ಂ	ತಾಂ	ಥಾಂ	ದಾಂ	ಧಾಂ	ನಾಂ
ಿ ಂ	ತಿಂ	ಥಿಂ	ದಿಂ	ಧಿಂ	ನಿಂ
ೀ ಂ	ತೀಂ	ಥೀಂ	ದೀಂ	ಧೀಂ	ನೀಂ
ು ಂ	ತುಂ	ಥುಂ	ದುಂ	ಧುಂ	ನುಂ
ೂ ಂ	ತೂಂ	ಥೂಂ	ದೂಂ	ಧೂಂ	ನೂಂ
ೃ ಂ	ತೃಂ	ಥೃಂ	ದೃಂ	ಧೃಂ	ನೃಂ
ೄ ಂ	ತೄಂ	ಥೄಂ	ದೄಂ	ಧೄಂ	ನೄಂ
ೆ ಂ	ತೆಂ	ಥೆಂ	ದೆಂ	ಧೆಂ	ನೆಂ
ೇ ಂ	ತೇಂ	ಥೇಂ	ದೇಂ	ಧೇಂ	ನೇಂ
ೈ ಂ	ತೈಂ	ಥೈಂ	ದೈಂ	ಧೈಂ	ನೈಂ
ೊ ಂ	ತೊಂ	ಥೊಂ	ದೊಂ	ಧೊಂ	ನೊಂ
ೋ ಂ	ತೋಂ	ಥೋಂ	ದೋಂ	ಧೋಂ	ನೋಂ
ೌ ಂ	ತೌಂ	ಥೌಂ	ದೌಂ	ಧೌಂ	ನೌಂ

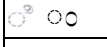
Consonant and Mātrā +Nasal combinations **Set 5**

This set is in continuation of set 4 which shows consonant and Matra combinations.

	ಪ	ಫ	ಬ	ಭ	ಮ
ಂ	ಪಂ	ಫಂ	ಬಂ	ಭಂ	ಮಂ
ಾ ಂ	ಪಾಂ	ಫಾಂ	ಬಾಂ	ಭಾಂ	ಮಾಂ
ಿ ಂ	ಪಿಂ	ಫಿಂ	ಬಿಂ	ಭಿಂ	ಮಿಂ
ೀ ಂ	ಪೀಂ	ಫೀಂ	ಬೀಂ	ಭೀಂ	ಮೀಂ
ು ಂ	ಪುಂ	ಫುಂ	ಬುಂ	ಭುಂ	ಮುಂ
ೂ ಂ	ಪೂಂ	ಫೂಂ	ಬೂಂ	ಭೂಂ	ಮೂಂ
ೃ ಂ	ಪೃಂ	ಫೃಂ	ಬೃಂ	ಭೃಂ	ಮೃಂ
ೄ ಂ	ಪೄಂ	ಫೄಂ	ಬೄಂ	ಭೄಂ	ಮೄಂ
ೆ ಂ	ಪೆಂ	ಫೆಂ	ಬೆಂ	ಭೆಂ	ಮೆಂ
ೇ ಂ	ಪೇಂ	ಫೇಂ	ಬೇಂ	ಭೇಂ	ಮೇಂ
ೈ ಂ	ಪೈಂ	ಫೈಂ	ಬೈಂ	ಭೈಂ	ಮೈಂ
ೊ ಂ	ಪೊಂ	ಫೊಂ	ಬೊಂ	ಭೊಂ	ಮೊಂ
ೋ ಂ	ಪೋಂ	ಫೋಂ	ಬೋಂ	ಭೋಂ	ಮೋಂ
ೌ ಂ	ಪೌಂ	ಫೌಂ	ಬೌಂ	ಭೌಂ	ಮೌಂ

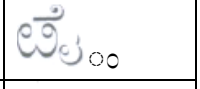
Consonant and Mātrā +Nasal combinations **Set 6**

This set is in continuation of set 5 which shows consonant and Matra combinations.

	ಯ	ರ	ಱ	ಲ	ವ
ಂ	ಯಂ	ರಂ	ಱಂ	ಲಂ	ವಂ
ಾ ಂ	ಯಾಂ	ರಾಂ	ಱಾಂ	ಲಾಂ	ವಾಂ
ಿ ಂ	ಯಿಂ	ರಿಂ		ಲಿಂ	ವಿಂ
ೀ ಂ	ಯೀಂ	ರೀಂ		ಲೀಂ	ವೀಂ
ು ಂ	ಯುಂ	ರುಂ	ಱುಂ	ಲುಂ	ವುಂ
ೂ ಂ	ಯೂಂ	ರೂಂ	ಱೂಂ	ಲೂಂ	ವೂಂ
ೃ ಂ	ಯೃಂ	ರೃಂ	ಱೃಂ	ಲೃಂ	ವೃಂ
ೄ ಂ	ಯೄಂ	ರೄಂ	ಱೄಂ	ಲೄಂ	ವೄಂ
ೆ ಂ	ಯೆಂ	ರೆಂ	ಱೆಂ	ಲೆಂ	ವೆಂ
ೇ ಂ	ಯೇಂ	ರೇಂ		ಲೇಂ	ವೇಂ
ೈ ಂ	ಯೈಂ	ರೈಂ		ಲೈಂ	ವೈಂ
ೊ ಂ	ಯೊಂ	ರೊಂ		ಲೊಂ	ವೊಂ
ೋ ಂ	ಯೋಂ	ರೋಂ		ಲೋಂ	ವೋಂ
ೌ ಂ	ಯೌಂ	ರೌಂ	ಱೌಂ	ಲೌಂ	ವೌಂ

Consonant and Mātrā +Nasal combinations **Set 7**

This set is in continuation of set 6 which shows consonant and Matra combinations.

	ಶ	ಷ	ಸ	ಹ	ಳ	ಱ
ಂ	ಶಂ	ಷಂ	ಸಂ	ಹಂ	ಳಂ	ಱಂ
ಾ ಂ	ಶಾಂ	ಷಾಂ	ಸಾಂ	ಹಾಂ	ಳಾಂ	ಱಾಂ
ಿ ಂ	ಶಿಂ	ಷಿಂ	ಸಿಂ	ಹಿಂ	ಳಿಂ	
ೀ ಂ	ಶೀಂ	ಷೀಂ	ಸೀಂ	ಹೀಂ	ಳೀಂ	
ು ಂ	ಶುಂ	ಷುಂ	ಸುಂ	ಹುಂ	ಳುಂ	ಱುಂ
ೂ ಂ	ಶೂಂ	ಷೂಂ	ಸೂಂ	ಹೂಂ	ಳೂಂ	ಱೂಂ
ೃ ಂ	ಶೃಂ	ಷೃಂ	ಸೃಂ	ಹೃಂ	ಳೃಂ	ಱೃಂ
ೄ ಂ	ಶೄಂ	ಷೄಂ	ಸೄಂ	ಹೄಂ	ಳೄಂ	ಱೄಂ
ಂ ಂ	ಶ ಂ	ಷ ಂ	ಸ ಂ	ಹ ಂ	ಳ ಂ	ಱ ಂ
ಂ ಂ	ಶ ಂ	ಷ ಂ	ಸ ಂ	ಹ ಂ	ಳ ಂ	ಱ ಂ
ೆ ಂ	ಶೆಂ	ಷೆಂ	ಸೆಂ	ಹೆಂ	ಳೆಂ	
ೇ ಂ	ಶೇಂ	ಷೇಂ	ಸೇಂ	ಹೇಂ	ಳೇಂ	
ೈ ಂ	ಶೈಂ	ಷೈಂ	ಸೈಂ	ಹೈಂ	ಳೈಂ	
ೊ ಂ	ಶೊಂ	ಷೊಂ	ಸೊಂ	ಹೊಂ	ಳೊಂ	
ೋ ಂ	ಶೋಂ	ಷೋಂ	ಸೋಂ	ಹೋಂ	ಳೋಂ	
ೌ ಂ	ಶೌಂ	ಷೌಂ	ಸೌಂ	ಹೌಂ	ಳೌಂ	ಱೌಂ

6.3.3. The Ligature Set of Kannada.

Kannada has a large set of ligatural forms. These are combinations of Consoanant+Halanta+Consonant (CHC) or CHCHC or even rarer CHCHCHC. The CHC combinations which are the most frequent are arranged in the shape of a matrix: the abscissa or horizontal axis refers to the Consonant which constitutes the ligature and the ordinate or vertical axis shows the consonant which forms the ligature and which is followed by a halanta.
As in 6.3.2. the ligature sets are divided into the following
6.3.3.1 CHC (in a matrix)
6.3.3.2 CHCHC
6.3.3.3.CHCHCHC

6.3.3.1. CHC (combination of two consonants)

These ligatures are presented as in the earlier case of Consonant+Mātrā combinations in three sets. A lot of "slots" have an X marked, showing that the experts have deemed that such a ligature is not possible in the language. However in these cases, the font developer is to assume that the ligature is linear in nature.
The following set shows a combination of two consonants. To know how particular combinations forms, **select one consonant from the first column and second from first row**. For e.g. Combination of consonant "ಠ್" and "ಠ" is ligature "ಠ್ಠ".

The **Unicode version 6.0.0** gives following description on the cluster formation in Kannada script:

In Kannada, conjunct formation tends to be graphically regular, using the following pattern:
• The first consonant of the cluster is rendered with the implicit vowel or a different dependent vowel appearing as the terminal element of the cluster.
• The remaining consonants (consonants between the first consonant and the terminal vowel element) appear in conjunct consonant glyph forms in phonetic order. They are generally depicted directly below or to the lower right of the first consonant. (Unicode 6.0.0 – Ch. 09 pp. 305).

Description: In the C_1 + H + C_2 clusters all the **thirty six consonants** (inclusive of ರ **/ra/ = 0CB0**) which participate in the C_1 position will take the full form and the C_2 take sub-base allograph forms and they are generally depicted directly below or to the lower right of the full form of first consonant in the same order. The allograph of the vowel that terminates the cluster is added to the full form of the C_1 consonant. If the vowel allograph of the terminating vowel is a two-part allograph of the vowel then, the second part of the two-part allograph is placed after the C_2 sub-base allograph form. All the sub-base form of the consonants are given in **Appendix I**.
Since the consonant ರ **/ra/ = 0CB0** is a **partially exceptional consonant** which produce **two sets of ligatures, complementation of two types has been presented in the Appendix II.** The alternative set of the ligatures for the CHC pattern ರ **/ra/ = 0CB0** in C_1 position have been presented in the sub-section 6.3.3.1.1.

CHC (combination of two consonants) - Set 1

	ಕ	ಖ	ಗ	ಘ	ಙ
ಕ್	ಕ್ಕ	ಕ್ಖ	ಕ್ಗ	ಕ್ಘ	ಕ್ಙ
ಖ್	ಖ್ಕ	ಖ್ಖ	ಖ್ಗ	ಖ್ಘ	ಖ್ಙ
ಗ್	ಗ್ಕ	ಗ್ಖ	ಗ್ಗ	ಗ್ಘ	ಗ್ಙ
ಘ್	ಘ್ಕ	ಘ್ಖ	ಘ್ಗ	ಘ್ಘ	ಘ್ಙ
ಙ್	ಙ್ಕ	ಙ್ಖ	ಙ್ಗ	ಙ್ಘ	ಙ್ಙ
ಚ್	ಚ್ಕ	ಚ್ಖ	ಚ್ಗ	ಚ್ಘ	ಚ್ಙ
ಛ್	ಛ್ಕ	ಛ್ಖ	ಛ್ಗ	ಛ್ಘ	ಛ್ಙ
ಜ್	ಜ್ಕ	ಜ್ಖ	ಜ್ಗ	ಜ್ಘ	ಜ್ಙ
ಝ್	ಝ್ಕ	ಝ್ಖ	ಝ್ಗ	ಝ್ಘ	ಝ್ಙ
ಞ್	ಞ್ಕ	ಞ್ಖ	ಞ್ಗ	ಞ್ಘ	ಞ್ಙ
ಟ್	ಟ್ಕ	ಟ್ಖ	ಟ್ಗ	ಟ್ಘ	ಟ್ಙ
ಠ್	ಠ್ಕ	ಠ್ಖ	ಠ್ಗ	ಠ್ಘ	ಠ್ಙ
ಡ್	ಡ್ಕ	ಡ್ಖ	ಡ್ಗ	ಡ್ಘ	ಡ್ಙ
ಢ್	ಢ್ಕ	ಢ್ಖ	ಢ್ಗ	ಢ್ಘ	ಢ್ಙ
ಣ್	ಣ್ಕ	ಣ್ಖ	ಣ್ಗ	ಣ್ಘ	ಣ್ಙ
ತ್	ತ್ಕ	ತ್ಖ	ತ್ಗ	ತ್ಘ	ತ್ಙ
ಥ್	ಥ್ಕ	ಥ್ಖ	ಥ್ಗ	ಥ್ಘ	ಥ್ಙ
ದ್	ದ್ಕ	ದ್ಖ	ದ್ಗ	ದ್ಘ	ದ್ಙ
ಧ್	ಧ್ಕ	ಧ್ಖ	ಧ್ಗ	ಧ್ಘ	ಧ್ಙ
ನ್	ನ್ಕ	ನ್ಖ	ನ್ಗ	ನ್ಘ	ನ್ಙ
ಪ್	ಪ್ಕ	ಪ್ಖ	ಪ್ಗ	ಪ್ಘ	ಪ್ಙ
ಫ್	ಫ್ಕ	ಫ್ಖ	ಫ್ಗ	ಫ್ಘ	ಫ್ಙ
ಬ್	ಬ್ಕ	ಬ್ಖ	ಬ್ಗ	ಬ್ಘ	ಬ್ಙ
ಭ್	ಭ್ಕ	ಭ್ಖ	ಭ್ಗ	ಭ್ಘ	ಭ್ಙ
ಮ್	ಮ್ಕ	ಮ್ಖ	ಮ್ಗ	ಮ್ಘ	ಮ್ಙ
ಯ್	ಯ್ಕ	ಯ್ಖ	ಯ್ಗ	ಯ್ಘ	ಯ್ಙ
ರ್	ರ್ಕ	ರ್ಖ	ರ್ಗ	ರ್ಘ	ರ್ಙ
ಱ್	ಱ್ಕ	ಱ್ಖ	ಱ್ಗ	ಱ್ಘ	ಱ್ಙ
ಲ್	ಲ್ಕ	ಲ್ಖ	ಲ್ಗ	ಲ್ಘ	ಲ್ಙ
ವ್	ವ್ಕ	ವ್ಖ	ವ್ಗ	ವ್ಘ	ವ್ಙ
ಳ್	ಳ್ಕ	ಳ್ಖ	ಳ್ಗ	ಳ್ಘ	ಳ್ಙ
ೞ್	ೞ್ಕ	ೞ್ಖ	ೞ್ಜ	ೞ್ಫ	ೞ್ಙ
ಸ್	ಸ್ಕ	ಸ್ಖ	ಸ್ಗ	ಸ್ಘ	ಸ್ಙ
ಹ್	ಹ್ಕ	ಹ್ಖ	ಹ್ಗ	ಹ್ಘ	ಹ್ಙ
ೡ್	ೡ್ಕ	ೡ್ಖ	ೡ್ಗ	ೡ್ಘ	ೡ್ಙ
ಽ್	ಬಿ್ಕ	ಬಿ್ಖ	ಬಿ್ಗ	ಬಿ್ಘ	ಬಿ್ಙ

CHC (combination of two consonants) - Set 2

	ಚ	ಛ	ಜ	ಝ	ಞ
ಕ್	ಕ್ಚ	ಕ್ಛ	ಕ್ಜ	ಕ್ಝ	ಕ್ಞ
ಖ್	ಖ್ಚ	ಖ್ಛ	ಖ್ಜ	ಖ್ಝ	ಖ್ಞ
ಗ್	ಗ್ಚ	ಗ್ಛ	ಗ್ಜ	ಗ್ಝ	ಗ್ಞ
ಘ್	ಘ್ಚ	ಘ್ಛ	ಘ್ಜ	ಘ್ಝ	ಘ್ಞ
ಙ್	ಙ್ಚ	ಙ್ಛ	ಙ್ಜ	ಙ್ಝ	ಙ್ಞ
ಚ್	ಚ್ಚ	ಚ್ಛ	ಚ್ಜ	ಚ್ಝ	ಚ್ಞ
ಛ್	ಛ್ಚ	ಛ್ಛ	ಛ್ಜ	ಛ್ಝ	ಛ್ಞ
ಜ್	ಜ್ಚ	ಜ್ಛ	ಜ್ಜ	ಜ್ಝ	ಜ್ಞ
ಝ್	ಝ್ಚ	ಝ್ಛ	ಝ್ಜ	ಝ್ಝ	ಝ್ಞ
ಞ್	ಞ್ಚ	ಞ್ಛ	ಞ್ಜ	ಞ್ಝ	ಞ್ಞ
ಟ್	ಟ್ಚ	ಟ್ಛ	ಟ್ಜ	ಟ್ಝ	ಟ್ಞ
ಠ್	ಠ್ಚ	ಠ್ಛ	ಠ್ಜ	ಠ್ಝ	ಠ್ಞ
ಡ್	ಡ್ಚ	ಡ್ಛ	ಡ್ಜ	ಡ್ಝ	ಡ್ಞ
ಢ್	ಢ್ಚ	ಢ್ಛ	ಢ್ಜ	ಢ್ಝ	ಢ್ಞ
ಣ್	ಣ್ಚ	ಣ್ಛ	ಣ್ಜ	ಣ್ಝ	ಣ್ಞ
ತ್	ತ್ಚ	ತ್ಛ	ತ್ಜ	ತ್ಝ	ತ್ಞ
ಥ್	ಥ್ಚ	ಥ್ಛ	ಥ್ಜ	ಥ್ಝ	ಥ್ಞ
ದ್	ದ್ಚ	ದ್ಛ	ದ್ಜ	ದ್ಝ	ದ್ಞ
ಧ್	ಧ್ಚ	ಧ್ಛ	ಧ್ಜ	ಧ್ಝ	ಧ್ಞ
ನ್	ನ್ಚ	ನ್ಛ	ನ್ಜ	ನ್ಝ	ನ್ಞ
ಪ್	ಪ್ಚ	ಪ್ಛ	ಪ್ಜ	ಪ್ಝ	ಪ್ಞ
ಫ್	ಫ್ಚ	ಫ್ಛ	ಫ್ಜ	ಫ್ಝ	ಫ್ಞ
ಬ್	ಬ್ಚ	ಬ್ಛ	ಬ್ಜ	ಬ್ಝ	ಬ್ಞ
ಭ್	ಭ್ಚ	ಭ್ಛ	ಭ್ಜ	ಭ್ಝ	ಭ್ಞ
ಮ್	ಮ್ಚ	ಮ್ಛ	ಮ್ಜ	ಮ್ಝ	ಮ್ಞ
ಯ್	ಯ್ಚ	ಯ್ಛ	ಯ್ಜ	ಯ್ಝ	ಯ್ಞ
ರ್	ರ್ಚ	ರ್ಛ	ರ್ಜ	ರ್ಝ	ರ್ಞ
ಱ್	ಱ್ಚ	ಱ್ಛ	ಱ್ಜ	ಱ್ಝ	ಱ್ಞ
ಲ್	ಲ್ಚ	ಲ್ಛ	ಲ್ಜ	ಲ್ಝ	ಲ್ಞ
ವ್	ವ್ಚ	ವ್ಛ	ವ್ಜ	ವ್ಝ	ವ್ಞ
ಳ್	ಳ್ಚ	ಳ್ಛ	ಳ್ಜ	ಳ್ಝ	ಳ್ಞ
ಷ್	ಷ್ಚ	ಷ್ಛ	ಷ್ಜ	ಷ್ಝ	ಷ್ಞ
ಸ್	ಸ್ಚ	ಸ್ಛ	ಸ್ಜ	ಸ್ಝ	ಸ್ಞ
ಹ್	ಹ್ಚ	ಹ್ಛ	ಹ್ಜ	ಹ್ಝ	ಹ್ಞ
ೞ್	ೞ್ಚ	ೞ್ಛ	ೞ್ಜ	ೞ್ಝ	ೞ್ಞ
ೱ್	ೱ್ಚ	ೱ್ಛ	ೱ್ಜ	ೱ್ಝ	ೱ್ಞ

CHC (combination of two consonants) - Set 3

	ಟ	ಠ	ಡ	ಢ	ಣ
ಕ್	ಕ್ಟ	ಕ್ಠ	ಕ್ಡ	ಕ್ಢ	ಕ್ಣ
ಖ್	ಖ್ಟ	ಖ್ಠ	ಖ್ಡ	ಖ್ಢ	ಖ್ಣ
ಗ್	ಗ್ಟ	ಗ್ಠ	ಗ್ಡ	ಗ್ಢ	ಗ್ಣ
ಘ್	ಘ್ಟ	ಘ್ಠ	ಘ್ಡ	ಘ್ಢ	ಘ್ಣ
ಙ್	ಙ್ಟ	ಙ್ಠ	ಙ್ಡ	ಙ್ಢ	ಙ್ಣ
ಚ್	ಚ್ಟ	ಚ್ಠ	ಚ್ಡ	ಚ್ಢ	ಚ್ಣ
ಛ್	ಛ್ಟ	ಛ್ಠ	ಛ್ಡ	ಛ್ಢ	ಛ್ಣ
ಜ್	ಜ್ಟ	ಜ್ಠ	ಜ್ಡ	ಜ್ಢ	ಜ್ಣ
ಝ್	ಝ್ಟ	ಝ್ಠ	ಝ್ಡ	ಝ್ಢ	ಝ್ಣ
ಞ್	ಞ್ಟ	ಞ್ಠ	ಞ್ಡ	ಞ್ಢ	ಞ್ಣ
ಟ್	ಟ್ಟ	ಟ್ಠ	ಟ್ಡ	ಟ್ಢ	ಟ್ಣ
ಠ್	ಠ್ಟ	ಠ್ಠ	ಠ್ಡ	ಠ್ಢ	ಠ್ಣ
ಡ್	ಡ್ಟ	ಡ್ಠ	ಡ್ಡ	ಡ್ಢ	ಡ್ಣ
ಢ್	ಢ್ಟ	ಢ್ಠ	ಢ್ಡ	ಢ್ಢ	ಢ್ಣ
ಣ್	ಣ್ಟ	ಣ್ಠ	ಣ್ಡ	ಣ್ಢ	ಣ್ಣ
ತ್	ತ್ಟ	ತ್ಠ	ತ್ಡ	ತ್ಢ	ತ್ಣ
ಥ್	ಥ್ಟ	ಥ್ಠ	ಥ್ಡ	ಥ್ಢ	ಥ್ಣ
ದ್	ದ್ಟ	ದ್ಠ	ದ್ಡ	ದ್ಢ	ದ್ಣ
ಧ್	ಧ್ಟ	ಧ್ಠ	ಧ್ಡ	ಧ್ಢ	ಧ್ಣ
ನ್	ನ್ಟ	ನ್ಠ	ನ್ಡ	ನ್ಢ	ನ್ಣ
ಪ್	ಪ್ಟ	ಪ್ಠ	ಪ್ಡ	ಪ್ಢ	ಪ್ಣ
ಫ್	ಫ್ಟ	ಫ್ಠ	ಫ್ಡ	ಫ್ಢ	ಫ್ಣ
ಬ್	ಬ್ಟ	ಬ್ಠ	ಬ್ಡ	ಬ್ಢ	ಬ್ಣ
ಭ್	ಭ್ಟ	ಭ್ಠ	ಭ್ಡ	ಭ್ಢ	ಭ್ಣ
ಮ್	ಮ್ಟ	ಮ್ಠ	ಮ್ಡ	ಮ್ಢ	ಮ್ಣ
ಯ್	ಯ್ಟ	ಯ್ಠ	ಯ್ಡ	ಯ್ಢ	ಯ್ಣ
ರ್	ರ್ಟ	ರ್ಠ	ರ್ಡ	ರ್ಢ	ರ್ಣ
ಱ್	ಱ್ಟ	ಱ್ಠ	ಱ್ಡ	ಱ್ಢ	ಱ್ಣ
ಲ್	ಲ್ಟ	ಲ್ಠ	ಲ್ಡ	ಲ್ಢ	ಲ್ಣ
ವ್	ವ್ಟ	ವ್ಠ	ವ್ಡ	ವ್ಢ	ವ್ಣ
ಳ್	ಳ್ಟ	ಳ್ಠ	ಳ್ಡ	ಳ್ಢ	ಳ್ಣ
ಷ್	ಷ್ಟ	ಷ್ಠ	ಷ್ಡ	ಷ್ಢ	ಷ್ಣ
ಸ್	ಸ್ಟ	ಸ್ಠ	ಸ್ಡ	ಸ್ಢ	ಸ್ಣ
ಹ್	ಹ್ಟ	ಹ್ಠ	ಹ್ಡ	ಹ್ಢ	ಹ್ಣ
ಳ್	ಳ್ಟ	ಳ್ಠ	ಳ್ಡ	ಳ್ಢ	ಳ್ಣ
ೞ್	ೞ್ಟ	ೞ್ಠ	ೞ್ಡ	ೞ್ಢ	ೞ್ಣ

CHC(combination of two consonants) - Set 4

	ತ	ಥ	ದ	ಧ	ನ
ಕ್	ಕ್ತ	ಕ್ಥ	ಕ್ದ	ಕ್ಧ	ಕ್ನ
ಖ್	ಖ್ತ	ಖ್ಥ	ಖ್ದ	ಖ್ಧ	ಖ್ನ
ಗ್	ಗ್ತ	ಗ್ಥ	ಗ್ದ	ಗ್ಧ	ಗ್ನ
ಘ್	ಘ್ತ	ಘ್ಥ	ಘ್ದ	ಘ್ಧ	ಘ್ನ
ಙ್	ಙ್ತ	ಙ್ಥ	ಙ್ದ	ಙ್ಧ	ಙ್ನ
ಚ್	ಚ್ತ	ಚ್ಥ	ಚ್ದ	ಚ್ಧ	ಚ್ನ
ಛ್	ಛ್ತ	ಛ್ಥ	ಛ್ದ	ಛ್ಧ	ಛ್ನ
ಜ್	ಜ್ತ	ಜ್ಥ	ಜ್ದ	ಜ್ಧ	ಜ್ನ
ಝ್	ಝ್ತ	ಝ್ಥ	ಝ್ದ	ಝ್ಧ	ಝ್ನ
ಞ್	ಞ್ತ	ಞ್ಥ	ಞ್ದ	ಞ್ಧ	ಞ್ನ
ಟ್	ಟ್ತ	ಟ್ಥ	ಟ್ದ	ಟ್ಧ	ಟ್ನ
ಠ್	ಠ್ತ	ಠ್ಥ	ಠ್ದ	ಠ್ಧ	ಠ್ನ
ಡ್	ಡ್ತ	ಡ್ಥ	ಡ್ದ	ಡ್ಧ	ಡ್ನ
ಢ್	ಢ್ತ	ಢ್ಥ	ಢ್ದ	ಢ್ಧ	ಢ್ನ
ಣ್	ಣ್ತ	ಣ್ಥ	ಣ್ದ	ಣ್ಧ	ಣ್ನ
ತ್	ತ್ತ	ತ್ಥ	ತ್ದ	ತ್ಧ	ತ್ನ
ಥ್	ಥ್ತ	ಥ್ಥ	ಥ್ದ	ಥ್ಧ	ಥ್ನ
ದ್	ದ್ತ	ದ್ಥ	ದ್ದ	ದ್ಧ	ದ್ನ
ಧ್	ಧ್ತ	ಧ್ಥ	ಧ್ದ	ಧ್ಧ	ಧ್ನ
ನ್	ನ್ತ	ನ್ಥ	ನ್ದ	ನ್ಧ	ನ್ನ
ಪ್	ಪ್ತ	ಪ್ಥ	ಪ್ದ	ಪ್ಧ	ಪ್ನ
ಫ್	ಫ್ತ	ಫ್ಥ	ಫ್ದ	ಫ್ಧ	ಫ್ನ
ಬ್	ಬ್ತ	ಬ್ಥ	ಬ್ದ	ಬ್ಧ	ಬ್ನ
ಭ್	ಭ್ತ	ಭ್ಥ	ಭ್ದ	ಭ್ಧ	ಭ್ನ
ಮ್	ಮ್ತ	ಮ್ಥ	ಮ್ದ	ಮ್ಧ	ಮ್ನ
ಯ್	ಯ್ತ	ಯ್ಥ	ಯ್ದ	ಯ್ಧ	ಯ್ನ
ರ್	ರ್ತ	ರ್ಥ	ರ್ದ	ರ್ಧ	ರ್ನ
ಱ್	ಱ್ತ	ಱ್ಥ	ಱ್ದ	ಱ್ಧ	ಱ್ನ
ಲ್	ಲ್ತ	ಲ್ಥ	ಲ್ದ	ಲ್ಧ	ಲ್ನ
ವ್	ವ್ತ	ವ್ಥ	ವ್ದ	ವ್ಧ	ವ್ನ
ಶ್	ಶ್ತ	ಶ್ಥ	ಶ್ದ	ಶ್ಧ	ಶ್ನ
ಷ್	ಷ್ತ	ಷ್ಥ	ಷ್ದ	ಷ್ಧ	ಷ್ನ
ಸ್	ಸ್ತ	ಸ್ಥ	ಸ್ದ	ಸ್ಧ	ಸ್ನ
ಹ್	ಹ್ತ	ಹ್ಥ	ಹ್ದ	ಹ್ಧ	ಹ್ನ
ಳ್	ಳ್ತ	ಳ್ಥ	ಳ್ದ	ಳ್ಧ	ಳ್ನ
ೞ್	ೞ್ತ	ೞ್ಥ	ೞ್ದ	ೞ್ಧ	ೞ್ನ

CHC (combination of two consonants) - Set 5

	ಪ	ಫ	ಬ	ಭ	ಮ
ಕ್	ಕ್ಪ	ಕ್ಫ	ಕ್ಬ	ಕ್ಭ	ಕ್ಮ
ಖ್	ಖ್ಪ	ಖ್ಫ	ಖ್ಬ	ಖ್ಭ	ಖ್ಮ
ಗ್	ಗ್ಪ	ಗ್ಫ	ಗ್ಬ	ಗ್ಭ	ಗ್ಮ
ಘ್	ಘ್ಪ	ಘ್ಫ	ಘ್ಬ	ಘ್ಭ	ಘ್ಮ
ಙ್	ಙ್ಪ	ಙ್ಫ	ಙ್ಬ	ಙ್ಭ	ಙ್ಮ
ಚ್	ಚ್ಪ	ಚ್ಫ	ಚ್ಬ	ಚ್ಭ	ಚ್ಮ
ಛ್	ಛ್ಪ	ಛ್ಫ	ಛ್ಬ	ಛ್ಭ	ಛ್ಮ
ಜ್	ಜ್ಪ	ಜ್ಫ	ಜ್ಬ	ಜ್ಭ	ಜ್ಮ
ಝ್	ಝ್ಪ	ಝ್ಫ	ಝ್ಬ	ಝ್ಭ	ಝ್ಮ
ಞ್	ಞ್ಪ	ಞ್ಫ	ಞ್ಬ	ಞ್ಭ	ಞ್ಮ
ಟ್	ಟ್ಪ	ಟ್ಫ	ಟ್ಬ	ಟ್ಭ	ಟ್ಮ
ಠ್	ಠ್ಪ	ಠ್ಫ	ಠ್ಬ	ಠ್ಭ	ಠ್ಮ
ಡ್	ಡ್ಪ	ಡ್ಫ	ಡ್ಬ	ಡ್ಭ	ಡ್ಮ
ಢ್	ಢ್ಪ	ಢ್ಫ	ಢ್ಬ	ಢ್ಭ	ಢ್ಮ
ಣ್	ಣ್ಪ	ಣ್ಫ	ಣ್ಬ	ಣ್ಭ	ಣ್ಮ
ತ್	ತ್ಪ	ತ್ಫ	ತ್ಬ	ತ್ಭ	ತ್ಮ
ಥ್	ಥ್ಪ	ಥ್ಫ	ಥ್ಬ	ಥ್ಭ	ಥ್ಮ
ದ್	ದ್ಪ	ದ್ಫ	ದ್ಬ	ದ್ಭ	ದ್ಮ
ಧ್	ಧ್ಪ	ಧ್ಫ	ಧ್ಬ	ಧ್ಭ	ಧ್ಮ
ನ್	ನ್ಪ	ನ್ಫ	ನ್ಬ	ನ್ಭ	ನ್ಮ
ಪ್	ಪ್ಪ	ಪ್ಫ	ಪ್ಬ	ಪ್ಭ	ಪ್ಮ
ಫ್	ಫ್ಪ	ಫ್ಫ	ಫ್ಬ	ಫ್ಭ	ಫ್ಮ
ಬ್	ಬ್ಪ	ಬ್ಫ	ಬ್ಬ	ಬ್ಭ	ಬ್ಮ
ಭ್	ಭ್ಪ	ಭ್ಫ	ಭ್ಬ	ಭ್ಭ	ಭ್ಮ
ಮ್	ಮ್ಪ	ಮ್ಫ	ಮ್ಬ	ಮ್ಭ	ಮ್ಮ
ಯ್	ಯ್ಪ	ಯ್ಫ	ಯ್ಬ	ಯ್ಭ	ಯ್ಮ
ರ್	ಪ್ರ	ಫ್ರ	ಬ್ರ	ಭ್ರ	ಮ್ರ
ಱ್	ಱ್ಪ	ಱ್ಫ	ಱ್ಬ	ಱ್ಭ	ಱ್ಮ
ಲ್	ಲ್ಪ	ಲ್ಫ	ಲ್ಬ	ಲ್ಭ	ಲ್ಮ
ವ್	ವ್ಪ	ವ್ಫ	ವ್ಬ	ವ್ಭ	ವ್ಮ
ಳ್	ಳ್ಪ	ಳ್ಫ	ಳ್ಬ	ಳ್ಭ	ಳ್ಮ
ಷ್	ಷ್ಪ	ಷ್ಫ	ಷ್ಬ	ಷ್ಭ	ಷ್ಮ
ಸ್	ಸ್ಪ	ಸ್ಫ	ಸ್ಬ	ಸ್ಭ	ಸ್ಮ
ಹ್	ಹ್ಪ	ಹ್ಫ	ಹ್ಬ	ಹ್ಭ	ಹ್ಮ
ೞ್	ೞ್ಪ	ೞ್ಫ	ೞ್ಬ	ೞ್ಭ	ೞ್ಮ
ೱ್	ೱ್ಪ	ೱ್ಫ	ೱ್ಬ	ೱ್ಭ	ೱ್ಮ

CHC (combination of two consonants) - Set 6

	ಯ	ರ	ಱ	ಲ	ವ
ಕ್	ಕ್ಯ	ಕ್ರ	ಕ್ಱ	ಕ್ಲ	ಕ್ವ
ಖ್	ಖ್ಯ	ಖ್ರ	ಖ್ಱ	ಖ್ಲ	ಖ್ವ
ಗ್	ಗ್ಯ	ಗ್ರ	ಗ್ಱ	ಗ್ಲ	ಗ್ವ
ಘ್	ಘ್ಯ	ಘ್ರ	ಘ್ಱ	ಘ್ಲ	ಘ್ವ
ಙ್	ಙ್ಯ	ಙ್ರ	ಙ್ಱ	ಙ್ಲ	ಙ್ವ
ಚ್	ಚ್ಯ	ಚ್ರ	ಚ್ಱ	ಚ್ಲ	ಚ್ವ
ಛ್	ಛ್ಯ	ಛ್ರ	ಛ್ಱ	ಛ್ಲ	ಛ್ವ
ಜ್	ಜ್ಯ	ಜ್ರ	ಜ್ಱ	ಜ್ಲ	ಜ್ವ
ಝ್	ಝ್ಯ	ಝ್ರ	ಝ್ಱ	ಝ್ಲ	ಝ್ವ
ಞ್	ಞ್ಯ	ಞ್ರ	ಞ್ಱ	ಞ್ಲ	ಞ್ವ
ಟ್	ಟ್ಯ	ಟ್ರ	ಟ್ಱ	ಟ್ಲ	ಟ್ವ
ಠ್	ಠ್ಯ	ಠ್ರ	ಠ್ಱ	ಠ್ಲ	ಠ್ವ
ಡ್	ಡ್ಯ	ಡ್ರ	ಡ್ಱ	ಡ್ಲ	ಡ್ವ
ಢ್	ಢ್ಯ	ಢ್ರ	ಢ್ಱ	ಢ್ಲ	ಢ್ವ
ಣ್	ಣ್ಯ	ಣ್ರ	ಣ್ಱ	ಣ್ಲ	ಣ್ವ
ತ್	ತ್ಯ	ತ್ರ	ತ್ಱ	ತ್ಲ	ತ್ವ
ಥ್	ಥ್ಯ	ಥ್ರ	ಥ್ಱ	ಥ್ಲ	ಥ್ವ
ದ್	ದ್ಯ	ದ್ರ	ದ್ಱ	ದ್ಲ	ದ್ವ
ಧ್	ಧ್ಯ	ಧ್ರ	ಧ್ಱ	ಧ್ಲ	ಧ್ವ
ನ್	ನ್ಯ	ನ್ರ	ನ್ಱ	ನ್ಲ	ನ್ವ
ಪ್	ಪ್ಯ	ಪ್ರ	ಪ್ಱ	ಪ್ಲ	ಪ್ವ
ಫ್	ಫ್ಯ	ಫ್ರ	ಫ್ಱ	ಫ್ಲ	ಫ್ವ
ಬ್	ಬ್ಯ	ಬ್ರ	ಬ್ಱ	ಬ್ಲ	ಬ್ವ
ಭ್	ಭ್ಯ	ಭ್ರ	ಭ್ಱ	ಭ್ಲ	ಭ್ವ
ಮ್	ಮ್ಯ	ಮ್ರ	ಮ್ಱ	ಮ್ಲ	ಮ್ವ
ಯ್	ಯ್ಯ	ಯ್ರ	ಯ್ಱ	ಯ್ಲ	ಯ್ವ
ರ್	ರ್ಯ	ರ್ರ	ರ್ಱ	ರ್ಲ	ರ್ವ
ಱ್	ಱ್ಯ	ಱ್ರ	ಱ್ಱ	ಱ್ಲ	ಱ್ವ
ಲ್	ಲ್ಯ	ಲ್ರ	ಲ್ಱ	ಲ್ಲ	ಲ್ವ
ವ್	ವ್ಯ	ವ್ರ	ವ್ಱ	ವ್ಲ	ವ್ವ
ಳ್	ಳ್ಯ	ಳ್ರ	ಳ್ಱ	ಳ್ಲ	ಳ್ವ
ಷ್	ಷ್ಯ	ಷ್ರ	ಷ್ಱ	ಷ್ಲ	ಷ್ವ
ಸ್	ಸ್ಯ	ಸ್ರ	ಸ್ಱ	ಸ್ಲ	ಸ್ವ
ಹ್	ಹ್ಯ	ಹ್ರ	ಹ್ಱ	ಹ್ಲ	ಹ್ವ
ಳ್	ಳ್ಯ	ಳ್ರ	ಳ್ಱ	ಳ್ಲ	ಳ್ವ
ೞ್	ೞ್ಯ	ೞ್ರ	ೞ್ಱ	ೞ್ಲ	ೞ್ವ

CHC(combination of two consonants) - Set 7

	ಶ	ಷ	ಸ	ಹ	ಳ	ಱ
ಕ್	ಕ್ಶ	ಕ್ಷ	ಕ್ಸ	ಕ್ಹ	ಕ್ಳ	ಕ್ಱ
ಖ್	ಖ್ಶ	ಖ್ಷ	ಖ್ಸ	ಖ್ಹ	ಖ್ಳ	ಖ್ಱ
ಗ್	ಗ್ಶ	ಗ್ಷ	ಗ್ಸ	ಗ್ಹ	ಗ್ಳ	ಗ್ಱ
ಘ್	ಘ್ಶ	ಘ್ಷ	ಘ್ಸ	ಘ್ಹ	ಘ್ಳ	ಘ್ಱ
ಙ್	ಙ್ಶ	ಙ್ಷ	ಙ್ಸ	ಙ್ಹ	ಙ್ಳ	ಙ್ಱ
ಚ್	ಚ್ಶ	ಚ್ಷ	ಚ್ಸ	ಚ್ಹ	ಚ್ಳ	ಚ್ಱ
ಛ್	ಛ್ಶ	ಛ್ಷ	ಛ್ಸ	ಛ್ಹ	ಛ್ಳ	ಛ್ಱ
ಜ್	ಜ್ಶ	ಜ್ಷ	ಜ್ಸ	ಜ್ಹ	ಜ್ಳ	ಜ್ಱ
ಝ್	ಝ್ಶ	ಝ್ಷ	ಝ್ಸ	ಝ್ಹ	ಝ್ಳ	ಝ್ಱ
ಞ್	ಞ್ಶ	ಞ್ಷ	ಞ್ಸ	ಞ್ಹ	ಞ್ಳ	ಞ್ಱ
ಟ್	ಟ್ಶ	ಟ್ಷ	ಟ್ಸ	ಟ್ಹ	ಟ್ಳ	ಟ್ಱ
ಠ್	ಠ್ಶ	ಠ್ಷ	ಠ್ಸ	ಠ್ಹ	ಠ್ಳ	ಠ್ಱ
ಡ್	ಡ್ಶ	ಡ್ಷ	ಡ್ಸ	ಡ್ಹ	ಡ್ಳ	ಡ್ಱ
ಢ್	ಢ್ಶ	ಢ್ಷ	ಢ್ಸ	ಢ್ಹ	ಢ್ಳ	ಢ್ಱ
ಣ್	ಣ್ಶ	ಣ್ಷ	ಣ್ಸ	ಣ್ಹ	ಣ್ಳ	ಣ್ಱ
ತ್	ತ್ಶ	ತ್ಷ	ತ್ಸ	ತ್ಹ	ತ್ಳ	ತ್ಱ
ಥ್	ಥ್ಶ	ಥ್ಷ	ಥ್ಸ	ಥ್ಹ	ಥ್ಳ	ಥ್ಱ
ದ್	ದ್ಶ	ದ್ಷ	ದ್ಸ	ದ್ಹ	ದ್ಳ	ದ್ಱ
ಧ್	ಧ್ಶ	ಧ್ಷ	ಧ್ಸ	ಧ್ಹ	ಧ್ಳ	ಧ್ಱ
ನ್	ನ್ಶ	ನ್ಷ	ನ್ಸ	ನ್ಹ	ನ್ಳ	ನ್ಱ
ಪ್	ಪ್ಶ	ಪ್ಷ	ಪ್ಸ	ಪ್ಹ	ಪ್ಳ	ಪ್ಱ
ಫ್	ಫ್ಶ	ಫ್ಷ	ಫ್ಸ	ಫ್ಹ	ಫ್ಳ	ಫ್ಱ
ಬ್	ಬ್ಶ	ಬ್ಷ	ಬ್ಸ	ಬ್ಹ	ಬ್ಳ	ಬ್ಱ
ಭ್	ಭ್ಶ	ಭ್ಷ	ಭ್ಸ	ಭ್ಹ	ಭ್ಳ	ಭ್ಱ
ಮ್	ಮ್ಶ	ಮ್ಷ	ಮ್ಸ	ಮ್ಹ	ಮ್ಳ	ಮ್ಱ
ಯ್	ಯ್ಶ	ಯ್ಷ	ಯ್ಸ	ಯ್ಹ	ಯ್ಳ	ಯ್ಱ
ರ್	ರ್ಶ	ರ್ಷ	ರ್ಸ	ರ್ಹ	ರ್ಳ	ರ್ಱ
ಱ್	ಱ್ಶ	ಱ್ಷ	ಱ್ಸ	ಱ್ಹ	ಱ್ಳ	ಱ್ಱ
ಲ್	ಲ್ಶ	ಲ್ಷ	ಲ್ಸ	ಲ್ಹ	ಲ್ಳ	ಲ್ಱ
ವ್	ವ್ಶ	ವ್ಷ	ವ್ಸ	ವ್ಹ	ವ್ಳ	ವ್ಱ
ಶ್	ಶ್ಶ	ಶ್ಷ	ಶ್ಸ	ಶ್ಹ	ಶ್ಳ	ಶ್ಱ
ಷ್	ಷ್ಶ	ಷ್ಷ	ಷ್ಸ	ಷ್ಹ	ಷ್ಳ	ಷ್ಱ
ಸ್	ಸ್ಶ	ಸ್ಷ	ಸ್ಸ	ಸ್ಹ	ಸ್ಳ	ಸ್ಱ
ಹ್	ಹ್ಶ	ಹ್ಷ	ಹ್ಸ	ಹ್ಹ	ಹ್ಳ	ಹ್ಱ
ಳ್	ಳ್ಶ	ಳ್ಷ	ಳ್ಸ	ಳ್ಹ	ಳ್ಳ	ಳ್ಱ
ೞ್	ೞ್ಶ	ೞ್ಷ	ೞ್ಸ	ೞ್ಹ	ೞ್ಳ	ೞ್ಱ

6.3.3.1.1 CHC - ರ /ra/ in C_1 – Regular type in Syllable-I of a word – With Full Form

The consonant ರ /ra/ = **0CB0 in C_1** position also produce the ligatures of regular types in which C_1 takes the full form of the ರ = **0CB0**, C_2 takes sub-based form, allograph of the terminating vowel of the syllable attached to full form of the ರ = **0CB0.** If the vowel allograph of the terminating vowel is a two-part allograph of the vowel then the second part of the two-part allograph is placed after the C_2 & C_3 sub-base allograph forms. This is exactly identical to the script rules of forming conjoining ligatures of remaining 35 consonants as exemplified in the previous sub-section 6.3.3.1**.**

Set 1

	ಕ	ಖ	ಗ	ಘ	ಙ
ರ್	ರ್ಕ	ರ್ಖ	ರ್ಗ	ರ್ಘ	ರ್ಙ

Set 2

	ಚ	ಛ	ಜ	ಝ	ಞ
ರ್	ರ್ಚ	ರ್ಛ	ರ್ಜ	ರ್ಝ	ರ್ಞ

Set 3

	ಟ	ಠ	ಡ	ಢ	ಣ
ರ್	ರ್ಟ	ರ್ಠ	ರ್ಡ	ರ್ಢ	ರ್ಣ

Set 4

	ತ	ಥ	ದ	ಧ	ನ
ರ್	ರ್ತ	ರ್ಥ	ರ್ದ	ರ್ಧ	ರ್ನ

Set 5

	ಪ	ಫ	ಬ	ಭ	ಮ
ರ್	ರ್ಪ	ರ್ಫ	ರ್ಬ	ರ್ಭ	ರ್ಮ

Set 6

	ಯ	ರ	ಱ	ಲ	ವ
ರ್	ರ್ಯ	ರ್ರ	ರ್ಱ	ರ್ಲ	ರ್ವ

Set 7

	ಶ	ಷ	ಸ	ಹ	ಳ	ೞ
ರ್	ರ್ಶ	ರ್ಷ	ರ್ಸ	ರ್ಹ	ರ್ಳ	ರ್ೞ

6.3.3.2 CHCHC (combination of three consonants)

These are not as frequent as the CHC combinations. Only the major examples are listed below. The CHCHC clusters having ರ /ra/ = 0CB0 in C_1 position are dealt separately in the sub-sections 6.3.3.2.1 & 6.3.3.2.2.

C_1 + Halant + C_2 + Halant + C_3	Clustered ligature	Transcription
ಕ + ್ + ಟ + ್ + ರ	ಕ್ಟ್ರ	kṭra
ಕ + ್ + ದ+ ್ + ರ	ಕ್ದ್ರ	kdra
ಕ + ್ + ದ + ್ + ಲ	ಕ್ದ್ಲ	kdla
ಕ + ್ + ದ +್ + ವ	ಕ್ದ್ವ	kdwa
ಕ + ್ + ಸ + ್ + ತ	ಕ್ಸ್ತ	ksta
ಕ + ್ + ಸ + ್ + ದ	ಕ್ಸ್ದ	ksda
ಕ + ್ + ಸ + ್ + ಲ	ಕ್ಸ್ಲ	ksla
ಕ + ್ + ಸ + ್ + ಮ	ಕ್ಸ್ಮ	ksma
ಕ + ್ + ಷ + ್ + ಮ	ಕ್ಷ್ಮ	kṣma
ಕ + ್ + ಷ + ್ + ಣ	ಕ್ಷ್ಣ	kṣṇa
ಕ + ್ + ಷ + ್ + ರ	ಕ್ಷ್ರ	kṣra
ಕ + ್ + ಸ + ್ + ಟ	ಕ್ಸ್ಟ	kṣṭa
ಗ + ್ + ಮ +್ + ರ	ಗ್ಮ್ರ	gmra
ತ + ್ + ಕ + ್ + ರ	ತ್ಕ್ರ	tkra
ತ + ್ + ಸ + ್ + ಯ	ತ್ಸ್ಯ	tsya
ನ + ್ + ಷ + ್ + ಯ	ನ್ಷ್ಯ	nṣya
ಣ + ್ + ಗ + ್ + ರ	ಣ್ಗ್ರ	ṇgra
ಣ + ್ + ಸ + ್ + ದ	ಣ್ಸ್ದ	ṇsda
ಪ +್ + ತ + ್ + ಮ	ಪ್ತ್ಮ	ptma
ಯ + ್ + ಸ + ್ + ದ	ಯ್ಸ್ದ	ysda
ಲ +್ + ಪ +್ + ಸ	ಲ್ಪ್ಸ	lpsa
ಲ +್ + ಸ + ್ + ದ	ಲ್ಸ್ದ	lsda
ವ +್ + ನ +್ + ಗ	ವ್ನ್ಗ	wnga
ವ +್ + ರ +್ + ಗ	ವ್ರ್ಗ	wrga
ವ +್ + ಳ + ್ + ಗ	ವ್ಳ್ಗ	wḷga
ಷ + ್ + ಟ + ್ + ಕ	ಷ್ಟ್ಕ	ṣṭka

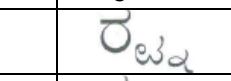
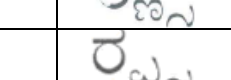
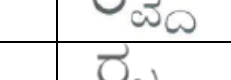
C_1 + Halant + C_2 + Halant + C_3	Clustered ligature	Transcription
ಸ + ್ + ಕ + ್ + ರ	ಸ್ಕ್ರ	skra
ಸ + ್ + ಕ + ್ + ವ	ಸ್ಕ್ವ	skwa
ಸ + ್ + ತ + ್ + ಕ	ಸ್ತ್ಕ	stka
ಸ + ್ + ತ + ್ + ರ	ಸ್ತ್ರ	stra
ಸ + ್ + ಟ + ್ + ರ	ಸ್ಟ್ರ	sṭra
ಸ + ್ + ಪ + ್ + ರ	ಸ್ಪ್ರ	spra
ಸ + ್ + ಪ + ್ + ಯ	ಸ್ಪ್ಯ	spya
ಸ + ್ + ಮ + ್ + ರ	ಸ್ಮ್ರ	smra
ಸ + ್ + ದ + ್ + ರ	ಸ್ದ್ರ	sdra
ಸ + ್ + ದ + ್ + ಲ	ಸ್ದ್ಲ	sdla
ಸ + ್ + ದ + ್ + ವ	ಸ್ದ್ವ	sdwa
ಳ + ್ + ಗ + ್ + ದ	ಳ್ಗ್ದ	ḷgda
ಳ + ್ + ಸ + ್ + ದ	ಳ್ಸ್ದ	ḷsda

6.3.3.2.1 CHCHC clusters - ರ /ra/ in C_1 – Regular type with Full Form

This section deals with the triple consonant clusters or CHCHC sequences which are having ರ /ra/ **in C_1** position, which also produce the ligatures of regular types in which C_1 takes the full form of the ರ , C_2 & C_3 takes sub-based forms, depicted to the lower right of the full form respectively, and allograph of the terminating vowel of the syllable attached to full form of the ರ**.** If the vowel allograph of the terminating vowel is a two-part allograph of the vowel then the second part of the two-part allograph is placed after the C_2 & C_3 sub-base allograph forms. This is **exactly identical to the script rules** of forming ligatures of triple clusters as exemplified in the previous sub-section**.**

The ligatures thus formed according to the above rule could participate in all the three possible position of a syllable in the word, i.e., **word initial, word medial, and word final script based syllables**.

C_1 + Halant + C_2 + Halant + C_3	Clustered ligature	Transcription
ರ + ್ + ಕ +್ + ದ	ರ್ಕ್ದ	rkda
ರ + ್ + ಗ +್ + ದ	ರ್ಗ್ದ	rgda
ರ + ್ + ಚ + ್ + ದ	ರ್ಚ್ದ	rcda

C_1 + Halant + C_2 + Halant + C_3	Clustered ligature	Transcription
ರ + ್ + ಟ + ್ + ನ		rṭna
ರ + ್ + ಟ + ್ + ಳ		rṭḷa
ರ + ್ + ಟ + ್ + ರ		rṭra
ರ + ್ + ಟ + ್ + ವ		rṭwa
ರ + ್ + ಡ + ್ + ತ		rḍta
ರ + ್ + ಡ + ್ + ಸ		rḍsa
ರ + ್ + ಣ 3 + ್ + ಸ		rṇsa
ರ + ್ + ಪ + ್ + ಸ		rpsa
ರ + ್ + ವ +್ + ದ		rwda
ರ + ್ + ಳ + ್ + ಡ		rḷḍa
ರ + ್ + ಸ + ್ + ದ		rsda
ರ + ್ + ಲ + ್ + ಸ		rlsa

6.3.3.2.2 CHCHC - ರ /ra/ in C_1 – Exceptional type with Side Rakar [ೌ]

Along with the regular rule explained in the previous sub-sections ರ in the C_1 position undergoes alternative or exceptional rule in which it takes the allograph 'Side Rakar [ೌ]', C_2 takes the full ligature, C_3 takes sub-base allograph (placed directly below or to the lower right of the C_2), allograph of the terminating vowel added to the C_2 full ligature, and the allograph of C_1 'Side Rakar [ೌ]' follows it. If the vowel allograph of the terminating vowel is a two-part ligature then the second part of the two-part allograph is placed after the 'Side Rakar [ೌ]'.

Here, one must note that, the allograph of the C_1 has been displaced from the original position and placed at the end of the conjoining ligature of the syllable. If the two-part vowel allograph is participating in the syllable then, second part of the two-part allograph of the vowel is placed after it and the 'Side Rakar [ೌ]' occupies the penultimate position.

The conjoining ligatures formed according to the above rule could participate only in the word non-initial position of a syllable in the word, i.e., **word medial, and word final script based syllables**. The ligatures produced according to this rule **CANNOT participate in the word initial script based syllables**.

The sequences of the CHCHC conjoining ligatures, given in the table below, are of the sequences given in the sub-section. The same order has been maintained.

C_1 + Halant + C_2 + Halant + C_3	Clustered ligature	Transcription
ರ + ್ + ಕ +್ + ದ	ಕ್ದ್	rkda
ರ + ್ + ಗ +್ + ದ	ಗ್ದ್	rgda
ರ + ್ + ಚ A + ್ + ದ	ಚ್ದ್	rcda
ರ + ್ + ಟ + ್ + ನ	ಟ್ನ್	rṭna
ರ + ್ + ಟ + ್ + ಳ	ಟ್ಳ್	rṭla
ರ + ್ + ಟ + ್ + ರ	ಟ್ರ್	rṭra
ರ + ್ + ಟ + ್ + ವ	ಟ್ವ್	rṭwa
ರ + ್ + ಡ + ್ + ತ	ಡ್ತ್	rḍta
ರ + ್ + ಡ+ ್ + ಸ	ಡ್ಸ್	rḍsa
ರ + ್ + ಣ + ್ + ಸ	ಣ್ಸ್	rṇsa
ರ + ್ + ಪ + ್ + ಸ	ಪ್ಸ್	Rpsa
ರ + ್ + ವ +್ + ದ	ವ್ದ್	Rwda
ರ + ್ + ಳ + ್ + ಡ	ಳ್ಡ್	rḷḍa
ರ + ್ + ಸ + ್ + ದ	ಸ್ದ್	Rsda
ರ + ್ + ಲ + ್ + ಸ	ಲ್ಸ್	Rlsa

6.3.3.3 CHCHCHC (Combination of four Consonants)

This is rare and is found only in the following:

C_1 + Halant + C_2 + Halant + C_3 + Halant + C_4	Clustered ligature	Transcription
ಕ + ್ + ಸ+ ್ + ಟ+ ್ + ರ	ಕ್ಷ್ಟ್ರ	kṣṭra
ಕ + ್ + ಸ+ ್ + ದ+ ್ + ಯ	ಕ್ಸ್ದ್ಯ	ksdya
ಕ + ್ + ಸ + ್ + ದ + ್ + ರ	ಕ್ಸ್ದ್ರ	ksdra
ಕ + ್ + ಸ + ್ + ದ + ್ + ಲ	ಕ್ಸ್ದ್ಲ	ksdla
ಕ + ್ + ಸ + ್ + ದ+ ್ + ವ	ಕ್ಸ್ದ್ವ	ksdwa
ಗ + ್ + ಳ + ್ + ದ + ್ + ರ	ಗ್ಳ್ದ್ರ	gḷdra

6.3.3.3.1 CHCHCHC ರ /ra/ = 0CB0 in C_1 – Regular type with Full Form

C_1 + Halant + C_2 + Halant + C_3 + Halant + C_4	Clustered ligature	Transcription
ರ + ್ + ಚ + ್ + ಕ + ್ + ರ	ರ್ಚ್ಕ್ರ	rckra

6.3.3.3.2 CHCHCHC ರ /ra/ = 0CB0 in C_1 – Exceptional type with Side Rakar

C_1 + Halant + C_2 + Halant + C_3 + Halant + C_4	Clustered ligature	Transcription
ರ + ್ + ಚ + ್ + ಕ + ್ + ರ	ಚ್ಕ್ರ	rckra

6.3.4 The Collation Order of Kannada.

The collation order refers to the order in which the characters in a given language are sorted. In the case of Kannada the following is the traditional sort order as determined by the experts. Unlike Hindi, Kannada treats ಕ್ಷ, ಜ್ಞ as individual characters and these come at the end of the list. The order as given below is pertinent to sorting by a computer program and is compliant with CLDR as laid down by Unicode and W3C.

ಂ ಃ ಅ ಆ ಇ ಈ ಉ ಊ ಋ ೠ ಌ ೡ ಎ ಏ ಐ ಒ ಓ ಔ ಕ ಖ ಗ ಘ ಙ ಚ ಛ ಜ ಝ ಞ ಟ ಠ ಡ ಢ ಣ ತ ಥ ದ ಧ ನ ಪ ಫ ಬ ಭ ಮ ಯ ರ ಱ ಲ ವ ಶ ಷ ಸ ಹ ಳ ಬಿ ಂಾ ಂಿ ಂೀ ಂು ಂೂ ಂೃ ಂೄ ಂ

ಂ ಂೆ ಂೇ ಂೈ ಂೊ ಂೋ ಂೌ ಂ ಂ

For computable and exhaustive ordering of the Kannada Unicode characters for a sorting machine see the **Appendix IV.**

16. REFERENCES

1. http://www.unicode.org
2. ISCII'91

17. ANNEXURES

Annexure 1: Names of experts who have contributed to the script grammar

Annexure 2: Unicode Table of Kannada [5]

Link: http://unicode.org/charts/PDF/U0C80.pdf

[5] The Unicode chart provided is for version 5.1 since the Script Grammar was prepared at that time. No considerable change in the script grammar can be seen in the updated versions of Unicode, with the possible addition of the Rupee Sign U+02B9

APPENDIX I

Allographs of the consonants

All the thirty six consonants produce sub-base forms or allographs for C_2, C_3, & C_4, positions in clusters. The forms of the consonants given in the second column below are same for the positions C_2, C_3, $C_{4...}$ C_n etc. Even the consonant ರ್ /r/ (0CB0) in these positions obeys the above mentioned regular rule. All the thirty six consonants listed above retain full ligatures when they occupy the C_1 positions in the double, triple and tetra consonantal clusters, irrespective of the cluster's position in the word (i.e. word initial cluster or non-initial cluster (word medial or word final)). Other than that the consonant ರ್ /r/ (0CB0) in C_1 position of the word medial syllables, optionally takes allograph which is given in the column third below.

Since all the allographs of consonants do not carry **inherent ಅ 'a' sound**, the consonants are given with halant '0CCD'.

Consonant + Halant	C_2 sub-base form or allograph	C_1 variant form or allograph, post-based to C_2
ಕ್ 0C95 + 0CCD	◌ಕ	nil
ಖ್ 0C96 + 0CCD	◌ಖ	nil
ಗ್ 0C97 + 0CCD	◌ಗ	nil
ಘ್ 0C98 + 0CCD	◌ಘ	nil
ಙ್ 0C99 + 0CCD	◌ಙ	nil
ಚ್ 0C9A + 0CCD	◌ಚ	nil
ಛ್ 0C9B + 0CCD	◌ಛ	nil
ಜ್ 0C9C + 0CCD	◌ಜ	nil
ಝ್ 0C9D + 0CCD	◌ಝ	nil
ಞ್ 0C9E + 0CCD	◌ಞ	nil

Consonant + Halant	C_2 sub-base form or allograph	C_1 variant form or allograph, post-based to C_2
ಟ್ 0C9F + 0CCD	◌ಬ	nil
ತ್ 0CA0 + 0CCD	◌ಱ	nil
ಡ್ 0CA1 + 0CCD	◌ಡ	nil
ಢ್ 0CA2 + 0CCD	◌ಢ	nil
ಣ್ 0CA3 + 0CCD	◌ಣ	nil
ತ್ 0CA4 + 0CCD	◌ಎ	nil
ಥ್ 0CA5 + 0CCD	◌ಥ	nil
ದ್ 0CA6 + 0CCD	◌ದ	nil
ಧ್ 0CA7 + 0CCD	◌ಧ	nil
ನ್ 0CA8 + 0CCD	◌ನ	nil
ಪ್ 0CAA + 0CCD	◌ಪ	nil
ಫ್ 0CAB + 0CCD	◌ಫ	nil
ಬ್ 0CAC + 0CCD	◌ಬ	nil
ಭ್ 0CAD + 0CCD	◌ಭ	nil
ಮ್ 0CAE + 0CCD	◌ಮ	nil
ಯ್ 0CAF + 0CCD	◌ಯ	nil

Consonant + Halant	C_2 sub-base form or allograph	C_1 variant form or allograph, post-based to C_2
ಕ್ 0CB0 + 0CCD	◌್ರ	◌್
ಖ್ 0CB1 + 0CCD	◌್ಱ	nil
ಗ್ 0CB2 + 0CCD	◌್ನ	nil
ಙ್ 0CB5 + 0CCD	◌್ವ	nil
ಚ್ 0CB6 + 0CCD	◌್ಶ	nil
ಛ್ 0CB7 + 0CCD	◌್ಷ್ಮ	nil
ಜ್ 0CB8 + 0CCD	◌್ಸ	nil
ಝ್ 0CB9 + 0CCD	◌್ಹ	nil
ಞ್ 0CB3 + 0CCD	◌್ಳ	nil
ಟ್ 0CDE + 0CCD	◌್ಱ	nil

APPENDIX II

ರ /ra/ = 0CB0 in C_1 - Complementation of two types of ligatures

The Consonant ರ /ra/ = 0CB0 in C_1 in consonant clusters (CHC, CHCHC, & CHCHCHC) behave in two ways and hence producing two sets of ligatures.

1. Type 1. ರ /ra/ = 0CB0 retains full form in C_1 position, as like remaining 35 consonants in Kannada, and the C_2 (and C_3, C_4…C_n) take/s sub-base forms which are depicted either below or lower right to the full form of the consonant ರ /ra/ = 0CB0 and the terminating vowel of the syllable is attached to the full form of ರ /ra/ = 0CB0.
    a. The ligatures thus formed **can occur** in all the **word initial, word medial and word final script based syllables.**
    b. **This is <u>exactly identical</u> to the formation of ligatures with other 35 consonants.**
    c. **In the word initial syllables ligatures of this type only can occur.**
    d. **See the sections 6.3.3.1.1, 6.3.3.2.1, & 6.3.3.3.1.**
2. Type 2. ರ /ra/ = 0CB0 takes the allograph 'Side Rakar [◌ರ್]', C_2 takes the full form, C_3 C_4…C_n take sub-base forms, and terminating vowel if the syllable is attached to the full form of C_2, and the allograph 'Side Rakar [◌ರ್]' of the ರ /ra/ = 0CB0 is placed after to it. This is an exceptional type of ligature formation.
    a. If the terminating vowel is a two-part vowel then the **second part of the vowel allograph follows the 'Side Rakar [◌ರ್]'**.
    b. The ligatures thus formed can occur only in **non-initial (script based) syllables.**
    c. These ligatures **cannot occur** in the word initial script based syllables.
    d. See the 6.3.3.1 (Row 28 in all the tables), **6.3.3.2.2, & 6.3.3.3.2.**

Both the types of ligatures can occur in the non-initial script based syllables. However, when the ligatures of regular type or Type 1 and the ligatures with 'Side Rakar [◌ರ್]'which is an exceptional type or Type 2 should be used are not predictable in the non-initial (script based) syllables.

However, general practice is that most of the non-native words to Kannada which possess a cluster in a non-initial position in which ರ = **0CB0** is in C_1 position are written with exceptional type ligatures with the allograph 'Side Rakar [◌ರ್]'. The non-native words may include words from Saṁskṛta, Prakṛta, Pāḷi, Urdu, Perso-Arabic, English, French, German etc.

E.g. 1 /ka**rm**a/ - Saṁsṛka ಕರ್ಮ

2 /ā**rk**iṭekcar/ - English ಆರ್ಕಿಟೆಕ್ಚರ್ 'architecture'

3 /kha**rc**u/ - Urdu ಖರ್ಚು

4 /far**ḍ**inyaṇ**ḍ**/ - Swiss ಫರ್ಡಿನ್ಯಂಡ್ (Proper name **Ferdinand** de Saussure)

5 /a**rk**āwattu/ - Saṁskṛta and Kannada Blend - ಅರ್ಕಾವತ್ತು (Name of the Side Rakar [ಿ] in Kannada)

Usually the native repertoire of Kannada words and word level constructions take Type 1 ligatures for non-initial script based syllables.

E.g. 6 /ba**rt**ēne/ - ಬರ್ತೇನೆ bar- + -t- + ēne
(come + present tense + I per. Sg.)

It should be mentioned that <u>one can chose to write the examples 1 to 5 in Type 1 and the example 6 with exceptional Type 2 ligatures</u>. The above mentioned rule is a sociologically constrained rule and not a formal rule. This allows **<u>a lot of subjective variation</u>** in the choice of the users of the Kannada script.

Bottom Rakar [ೂ]is the allograph of the consonant ರ = **0CB0** in **C_2** to C_n position and we need not to deal it separately. However, it should be specifically mentioned that in Modern Kannada writings from 1900 A.D. to till date the **doublet** of the consonant ರ = **0CB0** yield regular type and the consonant ರ = **0CB0** in C_2 position yield sub-based allograph the Bottom Rakar [ೂ].

Therefore ರ = **0CB0** + ್= **0CCD** + ರ = **0CB0** → ರ್ರ

ರ = **0CB0** + ್= **0CCD** + ರ = **0CB0** → ರ್ರ → **INVALID** in Modern Kannada writings.

However, it is used in the texts from the 450 AD inscriptional texts to the end of the 19th century AD. The historical and classical texts if they contain this ligature the modern publications also carry them in printing. This ligature could <u>be called on demand with the help of ZWJ function</u>. **The <u>default</u> doublet formation should be** ರ್ರ.

Therefore the regular rule **C_1 + halant + C_2 → C_1 full form** and the C_2 sub-based form should be applicable for the consonant ರ = **0CB0** in C_1 position as well.

The exceptional type could be called with the sequences
C_1 + ZWJ + halant + C_2 + Marta → C_2 full form + Matra + Side Rakar
In case of the two-part allograph or matra the resulting sequence will be as follows:
C_1 + ZWJ + halant + C_2 + Marta → C_2 full form + Matra ^{P1} + Side Rakar [ಿ] + **Matra ^{P2}**

APPENDIX III

Zero Width Joiner - ZWJ

The ZWJ function for Kannada script has been already specified in the Unicode Version 6.0.0 of the Unicode (pp. 306), with a specific focus on the ರ = **0CB0**, based on the modifications proposed by the Peter Constable (PRI – 37).

The function of the ZWJ which has already been proposed for the ರ = **0CB0**, in the Unicode Version are as follows:

1 ರ = 0CB0 *ra* + ್ = 0CCD *halant* + ಕ = 0C95 *ka* → ಕ್ರ *rka*

2 ರ = 0CB0 *ra* + **ZWJ** + ್ = 0CCD *halant* + ಕ = 0C95 *ka* → ರ್‌ *rka*

3 ಕ = 0C95 *ka* + ್ = 0CCD *halant* + ರ = 0CB0 *ra* → ಕ್ರ *kra*

The above said specification of the Unicode presumes that the ರ = **0CB0** is altogether exceptional. However, it must be noted that the consonant ರ = **0CB0** obeys the regular rule for forming cluster ligatures. Along with that it also obeys another rule which makes that consonant partially exceptional. Complementation of the two types of the ligatures has been given in the Appendix II.

In the light of the facts mentioned above, **I propose the function of the ZWJ** as for the ರ = 0CB0 as given below.

1 ರ = 0CB0 *ra* + ್ = 0CCD *halant* + ಕ = 0C95 *ka* → ರ್‌ *rka*

2 ರ = 0CB0 *ra* + ್ = 0CCD *halant* + **ZWJ** + ಕ = 0C95 *ka*→ ಕ್ರ *rka*

Since the ರ = 0CB0 in C_1 position undergoes or obeys the regular rule of cluster formation, it is better to allow the same rule to be applied for the ರ = 0CB0 in C_1 position.

Since the default rule **C_1 + halant + C_2** results into C_1 full form and the C_2 sub-based form the **same rule should be applied** for the ರ = 0CB0 in C_1 position. But this sequence by default generate the cluster ligatures of the exceptional rule with the displaced allograph the 'Side Rakar [ಿ]'. **This supposes to be rectified.**

If this modification accommodated, then **only function of the ZWJ remains** to derive the cluster ligatures with the displaced allograph the 'Side Rakar [ಿ]' of the consonant ರ = 0CB0 in C_1 position. In the Appendix II it has already been mentioned that, usage of the cluster ligatures with regular type and the exceptional types, in the word medial position, are lexically conditioned and leads to rigorous subjective decision of the users. There is no consistently predictable rule to restrict or to prioritize the usage of one type versus other in the word medial and word final positions.

On the other hand, the cluster with ರ = 0CB0 in C_1 position in the word initial syllable should **obligatorily undergo** the regular rule i.e., **C_1 + halant + C_2 → C_1**

full form and the C_2 sub-based form. There is **no exception** for this complementation rule in Kannada script rule.

Further, the report PRI – 37 describes other functions of the ZWJ which is used to get an allograph of a consonant in isolation which are as follows:

1 For a C1-conjoining consonant, the sequence < C, VIRAMA, ZWJ > can be used to display the half form of C in isolation.
2 For a C2-conjoining consonant, the sequence < SPACE, ZWJ, VIRAMA, C > can be used to display the sub- or post-base form of C in isolation. (PRI – 37. pp.14)

These functions of the ZWJ are necessary for the Kannada script.

Zero Width Non-Joiner - ZWNJ

The function of ZWNJ is to allow the consonants in a cluster with overt halant. This function is already specified in the Unicode report too. This function is accepted as it is.

E.g. $\mathbf{C_1 + halant + ZWNJ + C_2 + halant + ZWNJ + C_3 + Marta}$

$$\rightarrow \quad \mathbf{C_1^{halant} + C_2^{halant} + C_3^{Marta}}$$

However, because of the nature of Alpho-syllabry, whenever necessary we can **use our scripts like alphabetic scripts**.

In the year 2003, there is publication of a classical text by name /**siribhūwalaya**/ in Kannada, in which the whole text published with **alphabetic mode in Kannada script.** This text is a mysterious and mathematically constrained technical text (śāstra grantha) in Kannada. Even for writing linguistic research articles in Kannada we utilize the alphabetic mode of the Kannada script. To achieve this we expect the data entry in the regular mode, select the required text, and requesting for alphabetic mode.