Proposal for an Oriya Script Root Zone Label Generation Ruleset (LGR)

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1 General Information/ Overview/ Abstract

The purpose of this document is to give an overview of the proposed Root Zone Level Generation Rules for the Oriya script. It includes a discussion of relevant features of the script, the communities or languages using it, the process and methodology used and information on the contributors. The formal specification of the LGR can be found in the accompanying XML document:

Proposal-LGR-Orya-20180808.xml

Labels for testing can be found in the accompanying text document:

Oriya-Test-Labels-20180808.txt

2 Script for which the LGR is proposed

ISO 15924 Code: Orya

ISO 15924 Key N°: 327

ISO 15924 English Name: Oriya (Odia)

Latin transliteration of native script name: oḍiā

Native name of the script: ଓଡ଼ିଆ

Maximal Starting Repertoire (MSR) version: MSR-3

3 Background on Script and Principal Languages using it

Odia (known in Unicode as Oriya) is an Eastern Indic language spoken by about 40 million people mainly in the Indian state of Odisha (Orissa), and also in parts of West Bengal, Jharkhand, Chhattisgarh and Andhra Pradesh. Oriya (Odia) is one of the many official

languages of India. It is the official language of Odisha, and the second official language of Jharkhand. Eminent Linguists like John Beames, G. A. Grierson, L.S.S. O'Malley, Suniti Kumar Chatterjee, S. N. Rajaguru, John Boulton and others consider Odia as one of the most ancient languages of India. In Indic family of languages, Oriya (Odia) is closest to Sanskrit and least influenced by foreign languages. Only these two Indic languages (viz. Sanskrit and Odia) have got classical tag due to their rich, uninfluenced and long literary history. According to National Mission for Manuscripts, after Sanskrit (11,66,743), Odia (2,13,088) has the largest number of documented manuscripts in the India.

Odia was previously spelt as Oriya, and Odisha as Orissa. However, Odia and Odisha are now the preferred names officially in English as they are closer to their native names: ଓଡ଼ିଆ (oḍiā) [ɔɖiaː] and ଓଡ଼ିଶା (oḍiśā) [ɔɖisaː].

With reference to Wikipedia (https://en.wikipedia.org/wiki/Odia_language) Oriya (Odia) language is also used by minority populations of the neighboring states of Jharkhand, West Bengal, Chhattisgarh and Andhra Pradesh. The region has been known at different stages of history as Kalinga, Udra, Utkala or Koshala. Odisha was a vast empire in ancient and medieval times, extending from the Ganges in the north to the Godavari in the south. During British rule, however, Odisha lost its political identity and formed parts of the Bengal and Madras Presidencies. The present state of Odisha was formed in 1936.

The modern Oriya (Odia) language is formed mostly from Pali words with significant Sanskrit influence. About 28% of modern Oriya (Odia) words have Adivasi origins, and about 2% have Hindustani (Hindi/Urdu), Persian, or Arabic origins. The earliest written texts in the language are about thousand years old. The first Oriya (Odia) newspaper was Utkala Deepika first published on 4 August 1866.

Among the Indo-European languages of India, only Oriya (Odia) and Sanskrit have been recognized as classical languages; and of the six Indian languages that have been conferred classical language status Oriya (Odia) was recognized most recently (in 2014).[1] It forms the basis of Odissi dance and Odissi music.[2]

Oriya script seems to be a variant of Devanāgarī, the main difference being the absence of the shirorekha or the line above the character and also its more rounded shapes. Since initially it was used for commercial ends, it has been referred to as śarāphi (banker's) or mahājani (trader's) script.

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[1] Criteria for this status include: high antiquity of its early texts/recorded history over a period of 1500–2000 years; a body of ancient literature/texts, which is considered a valuable heritage by generations of speakers; a literary tradition that is original and not borrowed from another speech community;
[2]The variety of Oriya dialects etc. is reviewed in Appendix B.

The Oriya (Odia) script is used to write Oriya (Odia) language and a number of other languages spoken in Odisha such as Munda, Santali, Kui, Ho and Sanskrit.

3.1 The Evolution of the Script

The Oriya (Odia) script developed from the Kalinga script, one of the many descendants of the Brahmi script of ancient India. (Rajaguru, S.N., Odia Lipira Kramabikash, Odia Sahitya Akademi, page 2). The earliest known inscription in the Oriya (Odia) language, in the Kalinga script, dates from 1051. It descends from Odra-Magadhi Prakrit similar to Ardha Magadhi, prevalent in eastern India over 1,500 years ago.

The curved appearance of the Oriya script is a result of the practice of writing on palm leaves, which have a tendency to tear if written in straight lines.

The diagram below shows the major stages in the evolution of Oriya attesting its late divergence from Devanāgarī.

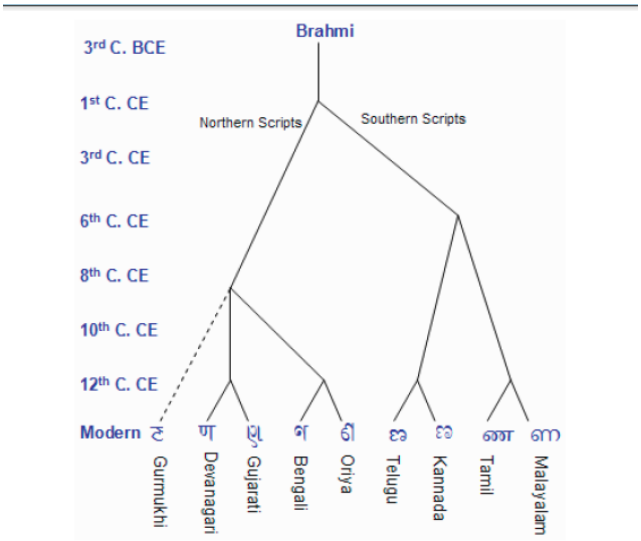

Figure 1: Pictorial depiction of Evolution of Oriya

Literature in the Oriya (Odia) language (Odia: ଓଡ଼ିଆ ସାହିତ୍ୟ) is the predominant literature of the state of Odisha in India.

3.2 Periods of Odia History

Oriya (Odia) language literature (Odia: ଓଡ଼ିଆ ସାହିତ୍ୟ) is the predominant literature of the state of Odisha in India.

Historians have divided the history of the Oriya (Odia) literature into five main stages: Old Oriya (Odia) (8th century to 1300), Early Middle Oriya (Odia) (1300 to 1500), Middle Oriya (Odia) (1500 to 1700), Late Middle Oriya (Odia) (1700 to 1850) and Modern Oriya (Odia) (1850 to present).

3.3 Use of Oriya language beyond India

According to Wikipedia, https://en.wikipedia.org/wiki/Odia_language the Oriya (Odia) diaspora constitutes a sizeable number of speakers in several countries around the world, pushing the number of Oriya (Odia) speakers globally to 55 million.

It has a significant presence in eastern countries such as Bangladesh, Indonesia, mainly carried by the sadhaba, ancient traders from Odisha, who carried the language along with the culture during the old-day trading, and in western countries such as the United States, Canada, Australia and England as well. The language has also spread to Burma, Malaysia, Fiji, Sri Lanka and countries of the Middle East. Written Oriya (Odia) (or the standard Oriya (Odia) is used for official purpose. It has elements from different local Oriya (Odia) dialects but it usually avoids words of foreign origin such as Arabic and Persian. It has also assimilated many tribal words prevalent in Odisha.

3.4 Notable features

The Oriya script is a syllabic alphabet written left to right in horizontal lines, in which all consonants have an inherent vowel. Diacritics, which can appear above, below, before or after the consonant they belong to, are used to change the inherent vowel.

When they appear at the beginning of a syllable, vowels are written as independent letters.

When certain consonants occur together, special conjunct shapes are used which combine the essential parts of each letter.

The chart below shows		**Avargya consonants**	
IPA	Oriya (Odia)	IPA	Oriya (Odia)
b	ବ		ୟ
$b^ɦ$	ଭ	j	ଯ
ɖ	ଡ	r	ର
$ɖ^ɦ$	ଢ	l	ଲ
ɖ	ଡ଼	ɭ	ଳ

ɖʱ	ଢ	ʋ	ୱ
d͡ʒ	ଜ	w	ୱ
d͡ʒʱ	ଝ	s	ସ
g	ଗ	ʂ	ଷ
gʱ	ଘ	ɕ	ଶ
h	ହ	ɦ	ହ
k	କ	ŋ,ɲ,ɳ,n,m,ɪ̃	ଂ
kʰ	ଖ	ɪ̃	ଁ
ɲ	ଞ	ɦ	ଃ
m	ମ	**Vowels and Matras**	
n	ନ	**IPA**	**Vowels**	**Matras**
ɳ	ଣ	ə	ଅ	
ŋ	ଙ	aː	ଆ	ା
p	ପ	ɪ	ଇ	ି
pʰ	ଫ	iː	ଈ	ୀ
ɾ	ର	ʊ	ଉ	ୁ
ɽ	ଡ଼	uː	ଊ	ୂ
ɽʱ	ଢ଼	ɾ̩	ଋ	ୃ
s	ସ	eː	ଏ	େ
t̪	ତ	ɛː	ଐ	ୈ
t̪ʰ	ଥ	oː	ଓ	ୋ
ʈ	ଟ	ɔː	ଔ	ୌ
ʈʰ	ଠ			
t͡ʃ	ଚ			
t͡ʃʰ	ଛ			

Table 1: International Phonetic Alphabet Oriya Pronunciations

3.5 Structured consonants

The structured consonants are classified according to the place of articulation and are classified accordingly into five structured groups. These consonants are shown here with their IAST (International Alphabet of Sanskrit Transliteration)[3] transcriptions.

[3] International Alphabet of Sanskrit Transliteration (I.A.S.T.) is a transliteration scheme that allows the lossless romanization of Indic scripts as employed by Sanskrit and related Indic languages. IAST makes it

	voiceless	voiceless aspirate	voiced	voiced aspirate	nasal
Velars	କ (ka)	ଖ (kha)	ଗ (ga)	ଘ (gha)	ଙ (ṅa)
Palatals	ଚ (ca)	ଛ (cha)	ଜ (ja)	ଝ (jha)	ଞ (ña)
Retroflex	ଟ (ṭa)	ଠ (ṭha)	ଡ (ḍa)	ଢ (ḍha)	ଣ (ṇa)
Dentals	ତ (ta)	ଥ (tha)	ଦ (da)	ଧ (dha)	ନ (na)
Labials	ପ (pa)	ଫ (pha)	ବ (ba)	ଭ (bha)	ମ (ma)

Table 2:structured consonants

3.6 Unstructured consonants

The unstructured consonants are consonants that do not fall into any of the above categories: ଯ (ja), ୟ (ia), ର (ra), ଲ (la), ଳ (ḷa), ୱ(va),ୱ (wa), ଶ (sa), ଷ (sa), ସ (sa), ହ (ha)

3.7 The implicit vowel killer Halant (Virama)

Halant character is used after a consonant to "strip" it of its inherent vowel. A consonant syllable cannot end with halant. With a few exceptions, most of the Oriya words are svaranta (i.e ending with a vowel).

A syllable containing halant characters may be shaped with no visible halant signs, as the halants enable different consonants to form conjuncts.

Halant form of consonants - The form produced by adding the halant to the nominal shape. The halant form is used in syllables that have no vowel or as the half form when no distinct shape for the half form exists.

Half form of consonants (pre-base form) - A variant form of consonants which appear to the left of the base consonant, if they do not participate in a ligature. Consonants in their half form precede the ones forming the base glyph. Some Indic scripts, like Devanagari have distinctly shaped half forms for most of the consonants. If no distinct shape exists, the full form will display with an explicit Virama (same shape as the halant form).

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possible for the reader to read the Indic text unambiguously, exactly as if it were in the original Indic script. Example: କ 0B15 (ka), ଖ 0B16 (kha) etc.

3.8 Nukta (– U+0B3C):

The nukta sign is used in Oriya language just like any other Indian scripts. It is used with a few consonants to represent sounds found only in words borrowed from Perso-Arabic. It can be commonly used with “ଡ” U+0B21, “ଢ” U+0B22, “କ” U+0B15, “ଖ” U+0B16, “ଗ” U+0B17, “ଚ” U+0B1A, “ଜ” U+0B1C, and “ଫ” U+0B2B to show that words having these consonants with a nukta are to be pronounced in the Perso-Arabic style.

3.9 Visarga “ଃ” (U+0B03) and Avagraha “ଽ” (U+0B3D):

The Visarga (“ଃ” (U+0B03) is frequently used in Sanskrit and represents a sound very close to /h/. Example, ଦୁଃଖ /du:kh/ sorrow (U+0B26 U+0B41 U+0B03 U+0B16).

The Avagraha"ଽ"(U+0B3D) creates an extra stress on the preceding vowel and is used in Sanskrit texts. It is rarely used in other languages using Oriya. In case of LGR, the Avagraha is not part of the repertoire as it is barred in the Maximal Starting Repertoire.

3.10 Candrabindu (ଁ - U+0B01):

Candrabindu denotes nasalization of the preceding vowel and consonants as in ଅଁଳ। /ãala/name of seasonal fruit (U+0B05 U+0B01 U+0B33 U+0B3E). Oriya users commonly use it for writing the words and sounds of Sanskrit language.

3.11 Anusvara (ଂ - U+0B02):

Anusvara replaces a conjunct group of a Nasal Consonant + Halant + Consonant belonging to that particular varga. The Anusvara represents a homorganic nasal. Before a non-varga consonant the Anusvara represents a nasal sound. For example: ଏବଂ (0B0F+0B2C+0B02), ସଂଖ୍ୟା (0B38+0B02+0B16+0B4D+0B5F+0B3E), etc.

3.12 Matra sign (Dependent Vowel)

It is used to represent a vowel sound that is not inherent to the consonant. Dependent vowels are referred to as "matras". They are always depicted in combination with a single consonant, or with a consonant cluster. The greatest variation among different Indian scripts is found in the rules for attaching dependent vowels to base characters. The rules specific to Oriya are mentioned in Section 6 (Variants) and Section 7 (WLE Rules).

Following table explains the correlation between a vowel and its matra sign.

Vowel and its matra sign					
Glyph	Unicode	Name	Glyph	Unicode	Name
ଅ	U+0B05	ORIYA LETTER A			
ଆ	U+0B06	ORIYA VOWEL LETTER AA	ା	U+0B3E	ORIYA VOWEL SIGN AA
ଇ	U+0B07	ORIYA VOWEL LETTER I	ି	U+0B3F	ORIYA VOWEL SIGN I
ଈ	U+0B08	ORIYA VOWEL LETTER II	ୀ	U+0B40	ORIYA VOWEL SIGN II
ଉ	U+0B09	ORIYA VOWEL LETTER U	ୁ	U+0B41	ORIYA VOWEL SIGN U
ଊ	U+0B0A	ORIYA VOWEL LETTER UU	ୂ	U+0B42	ORIYA VOWEL SIGN UU
ଋ	U+0B0B	ORIYA VOWEL LETTER VOCALIC R	ୃ	U+0B43	ORIYA VOWEL SIGN VOCALIC R
ଏ	U+0B0F	ORIYA VOWEL LETTER E	େ	U+0B47	ORIYA VOWEL SIGN E
ଐ	U+0B10	ORIYA VOWEL LETTER AI	ୈ	U+0B48	ORIYA VOWEL SIGN AI
ଓ	U+0B13	ORIYA VOWEL LETTER O	ୋ	U+0B4B	ORIYA VOWEL SIGN O
ଔ	U+0B14	ORIYA VOWEL LETTER AU	ୌ	U+0B4C	ORIYA VOWEL SIGN AU
ଌ	U+0B0C	ORIYA LETTER VOCALIC L	ୢ	U+0B62	ORIYA VOWEL SIGN VOCALIC L
ୡ	U+0B61	ORIYA LETTER VOCALIC LL	ୣ	U+0B63	ORIYA VOWEL SIGN VOCALIC LL

Table 3: Vowel and its Matra Sign

“ଌ” U+0B0C, “ୡ” U+0B61, “ୢ” U+0B62 and ”ୣ” U+0B63 are hardly in use in modern days.

4 Overall Development Process and Methodology

Under the Neo-Brahmi Generation Panel, there are many different scripts belonging to separate Unicode blocks. Each of these scripts is the basis for a separate LGR proposal; however Neo-Brahmi GP ensures that the fundamental philosophy behind building these various script LGRs is same across the different scripts being considered. This is the Oriya (Odia) LGR, which caters to Oriya (Odia) languages written using Oriya (Odia) belonging to EGIDS scale 1 to 4.

4.1 Guiding Principles

The NBGP adopts the following broad principles for the selection of code-points in the repertoire across the board for all the scripts within its scope.

4.1.1 Inclusion principles:

4.1.1.1 Modern usage:

Every character proposed should be in the everyday usage of a particular linguistic community. The characters which have been encoded in the Unicode for transcription purposes only or for archival purposes will not be considered for inclusion in the code-point repertoire.

4.1.1.2. Unambiguous use:

Every character proposed should have unambiguous understanding among the linguistic about its usage in the language.

4.1.2 Exclusion principles:

The main exclusion principle is that of External Limits on Scope. These comprise of protocols or standards which are pre-requisites to the Label Generation Rules etc. All further principles are in fact subsumed under these limitations but have been spelt out separately for the sake of clarity.

4.1.2.1 External Limits on Scope:

The code point repertoire for root zone being a very special case, up the ladder in the protocol hierarchies, the canvas of available characters for selection as a part of the Root Zone code point repertoire is already constrained by various protocol layers beneath it. The following three main protocols/standards act as successive filters:

i. The Unicode Chart:

Out of all the characters that are needed by the given script, if the character in question is not encoded in Unicode, it cannot be incorporated in the code point repertoire. Such cases are quite rare, given the elaborate and exhaustive character inclusion efforts made by Unicode consortium.

ii. IDNA Protocol:

Unicode being the character encoding standard for providing the maximum possible representation of a given script/language, it has encoded as far as possible all the possible characters needed by the script. However, the Domain name being a specialized case, it is governed by an additional protocol known as IDNA (Internationalized Domain Names in

Applications). The IDNA protocol excludes some characters out of Unicode repertoire from being part of the domain names.

Example: Oriya script frequently uses “ଡ” (U+0B21), “ଢ” (U+0B22) as well as their respective allophones “ଡ଼”, and “ଢ଼”. In Oriya (Odia) script, these differ in use of nukta. Thus “ଡ଼” and “ଢ଼” as distinct letters are not allowed but their decomposed form i.e. “ଡ”, “ଢ” followed by Oriya (Odia) sign nukta (U+0B3C) can be used. Similarly, for allophones of other consonants like କ (U+0B15), ଖ (U+0B16), ଗ (U+0B17), ତ (U+0B1A), ଜ (U+0B1C), ଫ (U+0B2B) nukta can be used.

iii. Maximal Starting Repertoire:

As the Root Zone LGR is used for creation of the root zone TLDs, which in turn are an even more specialized case of domain name labels, the Root Zone LGR procedure introduces additional exclusions for characters allowed by IDNA.

Example: Oriya Sign Avagraha "ଽ" (U+0B3D) even if allowed by IDNA protocol, is not permitted in the Root Zone Repertoire as per the [MSR].

Maximal Starting Repertoire also excludes invisible characters Zero Width Non-Joiner (U+200C) and Zero Width Joiner (U+200D). These are required in certain cases where a typical visual shape of an akshar is desired.

To sum up, the restrictions start off with admitting only such characters as are part of the code-block of the given script/language. This is further narrowed down by the IDNA Protocol and finally an additional filter in the form of Maximal Starting Repertoire restricts the character set associated with the given language even more.

4.1.2.2 No Fraction Marks:

The TLDs being identifiers, fraction markers present in Brahmi based languages such as given below will not be included.

Fraction signs

0B72	୲	ORIYA FRACTION ONE QUARTER
0B73	୳	ORIYA FRACTION ONE HALF
0B74	୴	ORIYA FRACTION THREE QUARTERS
0B75	୵	ORIYA FRACTION ONE SIXTEENTH
0B76	୶	ORIYA FRACTION ONE EIGHTH
0B77	୷	ORIYA FRACTION THREE SIXTEENTHS

Figure 2: Fraction Marks in Oriya

4.1.2.3 No Symbols and Abbreviations:

Abbreviations, weights and measures and other such iconic characters like Isshar"ୱ" (U+0B70) will not be included.

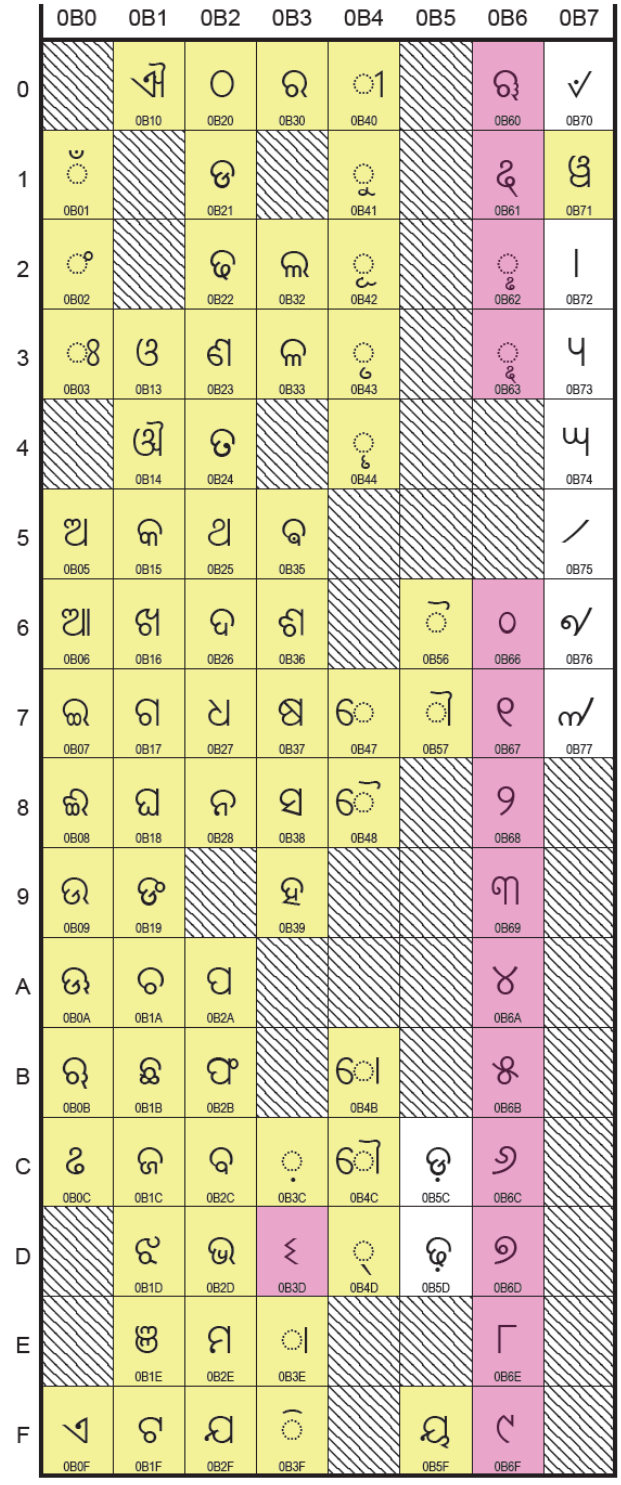
4.1.2.4 No Rare and Obsolete Characters:

There are characters which have been added to Unicode to accommodate rare forms especially like Oriya LETTER VOCALIC RR"ୠ" (U+0B60) and Oriya LETTER VOCALIC LL"ୡ" (U+0B61) as well as their Matra forms) “ୄ“ (U+0B44) and "ୣ" (U+0B63). All such characters will be excluded. This is in compliance with the Conservatism principle as laid down in the Root Zone LGR procedure.

5 Repertoire

This section provides the relevant section of [MSR] applicable to the Oriya script on which Oriya code point repertoire for the Root Zone LGR is based on. Section 5.1 details the code-point repertoire that the Neo-Brahmi Generation Panel [NBGP] proposes to be included in the Oriya Root Zone LGR.

5.1 Oriya Section of Maximal Starting Repertoire [MSR] Version 3



Color convention:
All characters that are included in the [MSR]- Yellow background

PVALID in IDNA2008 but excluded from the [MSR]- Pinkish background

Not PVALID in IDNA2008 - White background

Figure 3: Oriya Code Page from MSR-3

5.2 Code Point Repertoire

The table below lists all the code points included in the repertoire for Oriya script. For each of the code points, language references have been given in the last column.

Sr. No.	Unicode Code Point	Glyph	Character Name	Language with EGIDS	Indic Syllabic Category	References
1	0B01	ଁ	ORIYA SIGN CANDRABINDU	2-Oriya	Candrabindu	[0], [101], [102], [103], [104], [105]
2	0B02	ଂ	ORIYA SIGN ANUSVARA	2-Oriya	Anusvara	[0], [101], [102], [103], [104], [105]
3	0B03	ଃ	ORIYA SIGN VISARGA	2-Oriya	Visarga	[0], [101], [102], [103], [104], [105]
4	0B05	ଅ	ORIYA LETTER A	2-Oriya	Vowel	[0], [101], [102], [103], [104], [105]
5	0B06	ଆ	ORIYA LETTER AA	2-Oriya	Vowel	[0], [101], [102], [103], [104], [105]
6	0B07	ଇ	ORIYA LETTER I	2-Oriya	Vowel	[0], [101], [102], [103], [104], [105]
7	0B08	ଈ	ORIYA LETTER II	2-Oriya	Vowel	[0], [101], [102], [103], [104], [105]
8	0B09	ଉ	ORIYA LETTER U	2-Oriya	Vowel	[0], [101], [102], [103], [104], [105]
9	0B0A	ଊ	ORIYA LETTER UU	2-Oriya	Vowel	[0], [101], [102], [103], [104], [105]
10	0B0B	ଋ	ORIYA LETTER VOCALIC R	2-Oriya	Vowel	[0], [101], [102], [103], [104], [105]
11	0B0F	ଏ	ORIYA LETTER E	2-Oriya	Vowel	[0], [101], [102], [103], [104], [105]
12	0B10	ଐ	ORIYA LETTER AI	2-Oriya	Vowel	[0], [101], [102], [103], [104], [105]

Sr. No.	Unicode Code Point	Glyph	Character Name	Language with EGIDS	Indic Syllabic Category	References
13	0B13	ଓ	ORIYA LETTER O	2-Oriya	Vowel	[0], [101], [102], [103], [104], [105]
14	0B14	ଔ	ORIYA LETTER AU	2-Oriya	Vowel	[0], [101], [102], [103], [104], [105]
15	0B15	କ	ORIYA LETTER KA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
16	0B16	ଖ	ORIYA LETTER KHA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
17	0B17	ଗ	ORIYA LETTER GA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
18	0B18	ଘ	ORIYA LETTER GHA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
19	0B19	ଙ	ORIYA LETTER NGA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
20	0B1A	ଚ	ORIYA LETTER CA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
21	0B1B	ଛ	ORIYA LETTER CHA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
22	0B1C	ଜ	ORIYA LETTER JA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
23	0B1D	ଝ	ORIYA LETTER JHA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
24	0B1E	ଞ	ORIYA LETTER NYA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
25	0B1F	ଟ	ORIYA LETTER TTA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
26	0B20	ଠ	ORIYA LETTER TTHA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
27	0B21	ଡ	ORIYA LETTER DDA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]

Sr. No.	Unicode Code Point	Glyph	Character Name	Language with EGIDS	Indic Syllabic Category	References
28	0B22	ଢ	ORIYA LETTER DDHA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
29	0B23	ଣ	ORIYA LETTER NNA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
30	0B24	ତ	ORIYA LETTER TA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
31	0B25	ଥ	ORIYA LETTER THA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
32	0B26	ଦ	ORIYA LETTER DA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
33	0B27	ଧ	ORIYA LETTER DHA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
34	0B28	ନ	ORIYA LETTER NA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
35	0B2A	ପ	ORIYA LETTER PA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
36	0B2B	ଫ	ORIYA LETTER PHA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
37	0B2C	ବ	ORIYA LETTER BA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
38	0B2D	ଭ	ORIYA LETTER BHA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
39	0B2E	ମ	ORIYA LETTER MA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
40	0B2F	ଯ	ORIYA LETTER YA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
41	0B30	ର	ORIYA LETTER RA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
42	0B32	ଲ	ORIYA LETTER LA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]

Sr. No.	Unicode Code Point	Glyph	Character Name	Language with EGIDS	Indic Syllabic Category	References
43	0B33	ଳ	ORIYA LETTER LLA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
44	0B35	ୱୱ	ORIYA LETTER VA	2-Oriya	Consonant	[6], [101], [102], [103], [104], [105]
45	0B36	ଶ	ORIYA LETTER SHA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
46	0B37	ଷ	ORIYA LETTER SSA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
47	0B38	ସ	ORIYA LETTER SA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
48	0B39	ହ	ORIYA LETTER HA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
49	0B3C	◌଼	ORIYA SIGN NUKTA	2-Oriya	Nukta	[0], [101], [102], [103], [104], [105]
50	0B3E	◌ା	ORIYA VOWEL SIGN AA	2-Oriya	Matra	[0], [101], [102], [103], [104], [105]
51	0B3F	◌ି	ORIYA VOWEL SIGN I	2-Oriya	Matra	[0], [101], [102], [103], [104], [105]
52	0B40	◌ୀ	ORIYA VOWEL SIGN II	2-Oriya	Matra	[0], [101], [102], [103], [104], [105]
53	0B41	◌ୁ	ORIYA VOWEL SIGN U	2-Oriya	Matra	[0], [101], [102], [103], [104], [105]
54	0B42	◌ୂ	ORIYA VOWEL SIGN UU	2-Oriya	Matra	[0], [101], [102], [103], [104], [105]
55	0B43	◌ୃ	ORIYA VOWEL SIGN VOCALIC R	2-Oriya	Matra	[0], [101], [102], [103], [104], [105]
56	0B47	◌େ	ORIYA VOWEL SIGN E	2-Oriya	Matra	[0], [101], [102], [103], [104], [105]

Sr. No.	Unicode Code Point	Glyph	Character Name	Language with EGIDS	Indic Syllabic Category	References
57	0B48	◌ୈ	ORIYA VOWEL SIGN AI	2-Oriya	Matra	[0], [101], [102], [103], [104], [105]
58	0B4B	◌ୋ	ORIYA VOWEL SIGN O	2-Oriya	Matra	[0], [101], [102], [103], [104], [105]
59	0B4C	◌ୌ	ORIYA VOWEL SIGN AU	2-Oriya	Matra	[0], [101], [102], [103], [104], [105]
60	0B4D	◌୍	ORIYA SIGN VIRAMA	2-Oriya	Halant	[0], [101], [102], [103], [104], [105]
61	0B56	◌ୖ	ORIYA AI LENGTH MARK	2-Oriya	Matra	[2], [101], [102], [103], [104], [105]
62	0B5F	ୟ	ORIYA LETTER YYA	2-Oriya	Consonant	[0], [101], [102], [103], [104], [105]
63	0B71	ୱ	ORIYA LETTER WA	2-Oriya	Consonant	[6], [101], [102], [103], [104], [105]

Table 4: Code Point Repertoire

5.2.1 Code Points Excluded

Sr. No.	Unicode Code Point	Glyph	Character Name	Language with EGIDS	Indic Syllabic Category	Reference
1	0B0C	ଌ	ORIYA LETTER VOCALIC L	2-Oriya	Vowel	[0], [101], [102], [103], [104], [105]
2	0B44	◌ୄ	ORIYA VOWEL SIGN VOCALIC RR	2-Oriya	Matra	[9], [101], [102] [103] [104] [105]
3	0B57	ୗ	ORIYA AU LENTH MARK	2-Oriya	Matra	[0], [101], [102] [103] [104] [105]

Table 5: Code Point Excluded from Repertoire

Since the matra ◌ୗ (U+0B57) ORIYA AU LENTH MARK is not in current use by the Oriya Community, it is decided by the NBGP to exclude it. Also, “ଋ” U+0B0C, “ୠ” U+0B61, “ୡ” U+0B62 and ”ୣ” U+0B63 are hardly in use in modern days.

5.2.2 Variables involved

C → Consonant

M → Matra

V → Vowel

B → Anusvara

H → Halant / Virama

N → Nukta

C1 → {କ 0B15, ଖ 0B16, ଗ 0B17, ଚ 0B1A, ଜ 0B1C, ଡ0B21, ଢ0B22, ଫ 0B2B}

X → Visarga

D → Candrabindu

6 Variants

6.1 In-Script Variants

In Oriya script, there are no characters/character sequences which can be created by using the Oriya characters permitted as per the [MSR] and look identical. There are no in-script variants.

6.2 Cross-Script Variants

A cross-script variant label, also sometimes referred to as "Whole Label confusable", is the variant case where one label in one script can be composed in such a way that it can resemble another entire label in a different script.

Every individual LGR under NBGP provides a set of cross-script variant code points that it identifies with members of other related scripts.

NBGP has ensured that not only the individual characters but also most of the akshar variations are taken into consideration during the cross-script variant analysis of Oriya with all the other scripts under NBGP. It was achieved by sharing a list of most of the akshar combinations with all the other script teams ('most' is used here as all the possible Consonant + Halant + Consonant +… cases cannot be practically covered. Case of all the Oriya "Consonant + Halant + Consonant" was included in the analysis).

Oriya script has a set of possible cross-script variants with the Malayalam script. Cases listed in Table 6 are cross-script variants between Oriya and Malayalam. This follows the NBGP Cross-script Variant inclusion policy available in Appendix D.

It is to be noted that none of the combinations listed in Table 6a are termed to be equivalents of each other semantically or otherwise. They are only grouped because they are considered visually same by the two script communities.

NBGP has ensured that Oriya and Malayalam LGR teams propose a same set of cross-script variants by meeting face-to-face on many occasions as well as through mail communications. The same set of cross-script variants (with Malayalam) is supposed to be found in the Malayalam LGR documents.

Variant Set	Oriya		Malayalam	
	CP	Glyph	CP	Glyph
1.	0B20	ଠ	0D20	ഠ

Table 6a: Variant set between Oriya script and Malayalam script

Oriya script also has a set of possible cross-script variants with the Myanmar script. Cases listed in Table 6b are cross-script variants between Oriya and Myanmar. This follows the NBGP Cross-script Variant inclusion policy available in Appendix D.

Variant Set	Oriya		Myanmar	
	CP	Glyph	CP	Glyph
1.	0B20	ଠ	101D	ဝ

Table 6b: Variant set between Oriya script and Malayalam script

The cases listed in Appendix B are the visually confusable code points for reference, but they are not defined as variant code points.

7 Whole Label Evaluation Rules (WLE)

This section provides the whole label evaluation rules for text written in Oriya script. The rules have been drafted in such a way that they can be easily translated into the LGR specification.
Below are the symbols used in the WLE rules for each of the "Indic Syllabic Category" as mentioned in Table 4: Code point repertoire
In addition, a few additional symbols define the appropriate subsets for various rules.

C → Consonant
M → Matra
V → Vowel
B → Anusvara
H → Halant / Virama
N → Nukta
C1 → {କ 0B15 KA, ଖ 0B16 KHA, ଗ 0B17 GA, ଚ 0B1A CA, ଜ 0B1C JA, ଡ0B21 DDA, ଢ 0B22 DDHA,
ଫ 0B2B PHA}
X → Visarga
D → Candrabindu

Rule1: N(◌଼) must be preceded only by C1
For example:
ଡ(0B21)+(0B3C) = ଡ଼
ଢ(0B22)+ (0B3C) = ଢ଼

Rule2: B (◌଼) must be preceded by V, C, N or M
i) B may be preceded by V (examples: ଆଂଶ,)
ii) B may be preceded by C, (example: ସଂସାର, ବଂଶ)
iii) B may be preceded by N (example: ଡ଼ଂଗା)
iv) B may be preceded by M, (examples: ସିଂହ, ମାଂସ, ବିଂଶ, ସୁତରାଂ)

Rule3: X (ଃ) must be preceded by C, V, N or M

i) X may be preceded by C, (example: ପ୍ରାୟତଃ, କ୍ରମଶଃ)

ii) X may be preceded by N (example: ଡ଼ଃ)

iii) X may be preceded by M, (examples: ଦୁଃଖ, ଦୁଃଖିତ)

iv) X may be preceded by V, (examples: ଅଃ, ଆଃ, ଇଃ, ଉଃ) commonly used when writing Sanskrit or when there is religious requirement

Rule4: D (ଁ) must be preceded by V, C, N or M

i) D may be preceded by V (examples: ପାଇଁ, ଯେଉଁ ,ନିଆଁ)

ii) D may be preceded by C (example: ମୁହଁ, ପହଁରା, ନୁହଁ)

iii) D may be preceded by N (example: ଡ଼ାଁଶ)

iv) D may be preceded by M (examples: ନାହିଁ, ନାଁ, ଗାଁରେ)

Rule5: H (୍) must be preceded by C or N

i) H may be preceded by C, (example: ଠିକ୍, ଭୁଲ୍)

ii) H may be preceded by N (example: ଡ଼ୟୁଟି, ଡ୍ରାଗନ)

Rule6: M must be preceded by C or N

i) M may be preceded by C (example: ମୁହଁ, ପହଁରା, ନୁହଁ)

ii) M may be preceded by N (example:ଡ଼ାଇମିଟର)

8 Contributors

This proposal is prepared and submitted by Mr. Kuldeep Patnaik (Freelancer) and reviewed by Dr. Debashishya Jethy Oriya (Odia) linguistic analyst, translating medical science to Odia, coauthor of a book (Odia equivalents of scientific terms) from Central Institution of Indian Languages, Mysore.

Following NBGP members helped Mr. Kuldeep Patnaik to take crucial decision while working together for nine Indian languages including Oriya (Odia).

Position	Name	Organization	Country	Language Expertise
Co-Chair	Ajay Data	Data Xgen Technologies	India	Hindi, English
Co-Chair	Mahesh D. Kulkarni	C-DAC	India	Marathi, Hindi

Co-Chair	Udaya Narayana Singh	Visva-Bharati, Santiniketan, West Bengal	India	Bengali, Maithili, Hindi, English
Member Member Member	Akshat S. Joshi Atiur Rahman Khan Dr Debasishya Jethy	C-DAC C-DAC Oriya (Odia) linguistic analyst	India India India	Hindi, Marathi Bangla Odia
Member Member Member Member	Jay Paudyal Neha Gupta Shanmugam R Veena Solomon	Consultant C-DAC C-DAC (freelancer)	India India India India	Hindi Hindi Tamil Malayalam

Following is the list of other NBGP members with their language expertise.

Position	Name	Organization	Country	Language Expertise
Member	Abhijit Dutta	Wikimedia	India	Bengali, Hindi
Member	Anivar A. Aravind	Indic Project	India	Malayalam
Member	Anupam Agrawal	Tata Consultancy Service	India	Hindi, Bengali
Member	Arvind Bhandari	Gujarat University	India	Gujarati
Member	Ashish Modi	Data Xgen Technologies	India	Hindi
Member	Bal Krishna Bal	Kathmandu University	Nepal	Nepali
Member	BalaramPrasain	Tribhuvan University	Nepal	Nepali
Member	BASANTA KUMAR PANDA	Regional Institute of Education (NCERT)	India	Odia
Member	BhimDhoj Shrestha	Consultant	Nepal	Nepali, Newar
Member	Chitrita Chatterjee	Internet and Mobile Association of India (IAMAI)	India	Multiple languages represented by members of IAMAI
Member	DEBAJIT SHARMA	AnundoramBorooah Institute of Language Art and Culture	India	Assamese
Member	Dev DassManandhar	Consultant	Nepal	Nepali,Newar
Member	Dhanalakshmi KT	Northern Trust	India	Kannada
Member	Ganesh Murmu	Ranchi University	India	Santali
Member	GangadharPanday	Babul Films Society	India	Telugu
Member	Ghanashyam Nepal	Benares Hindu University& University of North Bengal	India	Nepali

Member	Girish Chandra Mishra	Language Technology Centre, Ravenshaw University	India	Odia
Member	Gurpreet Singh Lehal	Punjabi University Patiala	India	Panjabi
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Member	Kuldeep Patnaik (Editor)	Freelancer	India	Odia
Member	Mukesh Saini	Essel Group	India	Hindi
Member	N. DeivaSundaram	NDS Lingsoft Solutions Pvt Ltd	India	Tamil
Member	NirajanParajuli	NREN	Nepal	Nepali
Member	Nishit Jain	C-DAC	India	Hindi
Member	PawanChitrakar	Gapsco	Nepal	Nepali
Member	Prabhakar Pandey	C-DAC	India	Hindi
Member	Prasad PK	A-one Publishers	India	Malayalam
Member	Prateek Pathak	ISOC Mumbai	India	Devanagari
Member	Raiomond Doctor	NLP Consultant	India	English, Hindi, Marathi, Gujarati
Member	Rajib Chakraborty	Society for Natural Language Technology Research	India	Bangla (Bengali)
Member	Rajiv Kumar	NIXI	India	
Member	S.Maniam	International Forum IT for Tamil	Singapore	Tamil
Member	Santhosh Thottingal	Wikimedia foundation	India	Malayalam, Sourashtra, Tamil
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Member	SwarnaPrabhaChainary	Guwahati University	India	Bodo
Member	U.B. Pavanaja	http://vishvakannada.com/	India	Kannada
Member	Uma Maheshwar G	CALTS, Univ. of Hyderabad	India	Telugu
Member	Uttam Shrestha Rana	NPNOG	Nepal	Nepali
Member	Vinay Murarka	Consultant; https://मेरा.भारत	India	Hindi

Table 7: Contributors and NBG Panel

9 References

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10 Appendix A: Cross-script Confusable Code Points

Oriya script has a set of possible cross-script confusable code points with the Gujarati, Bengali, Telugu, and Kannada.

10.1 Oriya and Gujarati

The following characters are visually confusable. The NBGP discussed and concluded that they are similar code points but should not be considered as variant code points.

Oriya	Gujarati
◌ଃ (0B03)	◌ઃ (0A83)
ପ (0B2A)	ઘ (0A98)
ଥ (0B25)	થ (0AA5)

Table 8: Confusable code points between the Oriya and Gujarati scripts

10.2 Oriya and Bengali

The following characters are visually confusable. The NBGP discussed and concluded that they are similar code points and should not be considered as variant code points.

Bengali	Oriya
ও (0993)	ଓ (0B13)

Table 9: Confusable code points between the Oriya and Bengali scripts

The following characters were discussed and the NBGP concluded that they are neither variant code points nor confusable code points.

Bengali	Oriya	Resolution
ঘ (0998)	ଘ (0B38)	Distinguishable

Table 10: Other resolutions between Oriya script and Bengali script

10.3 Oriya and Telugu

The following characters were discussed and the NBGP concluded that they are not variant code points nor confusable code points

Oriya	Telugu	Resolution
ଠ (0B20)	ఠ (0C30)	Distinguishable
ଠ (0B20)	ಠ (0C20)	Distinguishable

Table 11: Other resolutions between the Oriya and Telugu scripts

10.4 Oriya and Kannada

The following characters were discussed and the NBGP concluded that they are not variant code points nor confusable code points

Oriya	Kannada	Resolution
ଠ (0B20)	ಠ (0CB0)	Distinguishable
ଠ (0B20)	ಠ (0CA0)	Distinguishable

Table 12: Other resolutions between the Oriya and Kannada scripts

11 Appendix B: Oriya Dialects

There are different ways of speaking and meaning of words in local Oriya Language. However the script remains the same.[4]

11.1.1.1 Standard Odia

Kataki Odia or *The Odia of Mughalbandi region* considered as Standard Odia due to literary traditions. It is spoken mainly in the eastern half of the state of Odisha, with little variation, in districts like Khurdha, Puri, Cuttack, Jajpur, Jagatsinghpur, Kendrapada, Dhenkanal, Angul and Nayagarh district.

11.1.1.2 Major forms, or dialects

Midnapori Odia:
Spoken in the undivided Midnapore District of West Bengal.
Singhbhumi Odia:
Spoken in East Singhbhum, West Singhbhum and Saraikela-Kharsawan district of Jharkhand
Baleswari Odia:
Spoken in Baleswar, Bhadrak and Mayurbhanj district of Odisha.
Ganjami Odia:
Spoken in Ganjam and Gajapati districts of Odisha and Srikakulam district of Andhra Pradesh.
Sambalpuri Odia:
Spoken in
Bargarh, Bolangir, Boudh, Debagarh, Jharsuguda, Kalahandi, Nuapada, Sambalpur and Subarnapur districts of Odisha and by some people in Raigarh, Mahasamund, Raipur districts of Chhattisgarh state.
Desiya Odia:
Spoken in
Koraput, Rayagada, Nowrangpur and Malkangiri Districts of Odisha and in the hilly regions of Vishakhapatnam, Vizianagaram District of Andhra Pradesh.
Bhatri:
Spoken in South-western Odisha and eastern-south Chhattisgarh.
Halbi:
Spoken in undivided Bastar district of Chhattisgarh. Halbi is a mixture of Odia and Marathi with influence of Chatishgarhi tribal languages.
Phulbani Odia:

[4]Extracted from Wikipedia, https://en.wikipedia.org/wiki/Odia_language#Major_forms_or_dialects

Spoken in Phulbani, Phulbani Town, Khajuripada block of Kandhamal, and in nearby areas bordering Boudh district .This language gained momentum during the amalgamation of Kandhamal(Phulbani), and Boudh, region into a single district Phulabani,

11.1.1.3 Minor non-literary and tribal forms or dialects

Sundargadi Odia :
Variation of Odia Spoken in Sundargarh district of Odisha and in adjoining pockets of Jharkhand and Chhattisgarh.
Kalahandia Odia :
Variation of Odia spoken in undivided Kalahandi District and neighboring districts of Chhattisgarh.
Kurmi: Spoken in Northern Odisha and South west Bengal.
Sounti: Spoken in Northern Odisha and South west Bengal.
Bathudi: Spoken in Northern Odisha and South west Bengal.
Kondhan: A tribal dialect spoken in Western Odisha..
Laria: Spoken in bordering areas of Chatishgarh and Western Odisha.
Aghria: Spoken mostly by the ingenious people of Aghria caste in Western Odisha.
Bhulia: Tribal form spoken in Western Odisha.
Sadri: A mixture of Odia and Hindi language with major regional tribal influence.
Bodo Parja / Jharia: Tribal dialect of Odia spoken mostly in Koraput district of Southern Odisha .
Matia: Tribal dialect of Odia spoken in Southern Odisha.
Bhuyan: Tribal dialect of Odia spoken in Southern Odisha.
Reli: Spoken in Southern Odisha and bordering areas of Andhra Pradesh.
Kupia: Spoken by Valmiki caste people in the Indian state of Telangana and Andhra Pradesh, mostly in Hyderabad, Mahabubnagar, Srikakulam, Vizianagaram, East Godavari and Visakhapatnam districts.

12 Appendix C: Oriya Characters

Odisha State Government Primary School Grade 1 e-book “HasaKhela” [105] page 112 lists all the Oriya characters as shown in Figure 4.

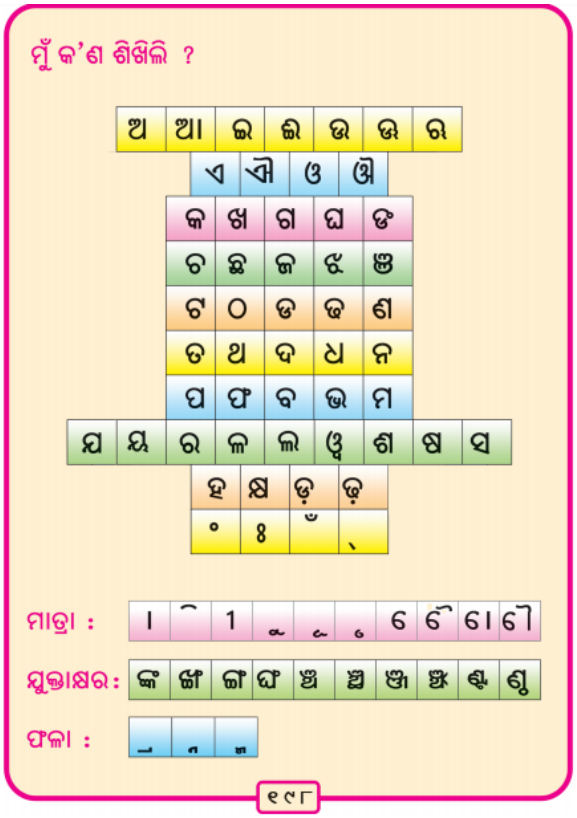

Figure 4: Odisha State Govt. Primary School Grade 1 e-book (Page 112)

13 Appendix D: NBGP Cross-script Variant Inclusion Policy

If, in any two given scripts, all the potential cross-script variants consist of dependent (e.g. Vowel Signs, Anusvara, Visarga, Chandrabindu etc.) characters **ONLY**, then that entire set can be ignored and no cross-script variants be proposed between those two scripts.

If, in any two given scripts, there is **AT LEAST ONE** non-dependent (e.g. Consonant, Vowel etc.) cross-script variant character/sequence present, all the potential cross-script variants be considered and proposed between the two scripts.

This cross-script analysis has been restricted to the scripts that have descended from the Brahmi as most of them share similar usage patterns. By and large, all of these scripts have a common set of characters that existed in Brahmi script and bear the same identities.

However, as the scripts branched out from the Brahmi, depending on various factors, the shapes of the characters changed. This change in the shape was not uniform across all the characters and the scripts. Some characters shapes did change significantly whereas some of them still retained similarity. The cross-script similarity analysis also aims to identify such cases where the same character retained almost the same shape despite being part of the different scripts. These set of characters are variants of each other in true sense than merely of co-incidental visual similarity.

Case of Malayalam and Odia (Oriya) TTHA Consonant:
This is the case of "Consonant Ttha" which happened to retain the same shape despite being part of different scripts, i.e., Malayalam and Odia. These characters are:

ഠ - MALAYALAM LETTER TTHA (U+0D20)

ଠ - ORIYA LETTER TTHA (U+0B20)

Both the characters, look exactly alike and belong to a "Consonant" category. As they are consonants, each of them, even in the simplest form i.e. the characters themselves, are valid labels. As per the NBGP cross-script variant inclusion policy, this is a valid case for inclusion. Also, even if they are single characters, when the same character combines, theoretically they can form infinite[5] number of cross-script variant labels between the scripts involved. Here are some samples of some of those labels:

Malayalam	Oriya
ഠഠഠ U+0D20 U+0D20U+0D20	ଠଠଠ U+0B20 U+0B20U+0B20
ഠഠഠഠ U+0D20 U+0D20U+0D20U+0D20	ଠଠଠଠ U+0B20 U+0B20U+0B20U+0B20
ഠഠഠഠഠ U+0D20 U+0D20U+0D20U+0D20U+0D20	ଠଠଠଠଠ U+0B20 U+0B20U+0B20U+0B20U+0B20

Since, having such labels is a realistic possibility and the corresponding labels look almost exactly alike, NBGP has proposed them as blocked variants.

NBGP acknowledges the concern that this shape is quite generic and may have parallels in other scripts not under its ambit. However, as NBGP does not have any exposure about actual usage of those characters in those particular scripts, NBGP desisted from including them in the analysis. As NBGP has already considered all the related scripts under the cross-

[5]Though theoretically infinite, this number would be limited to the number of such labels whose equivalent punycode string would not exceed 63 characters including the ACE prefix "xn--".

script variant analysis, the similarity of the characters belonging to NBGP scripts with other scripts not under the NBGP ambit, may be of a mere co-incidental visual nature.

Additionally, this concern is not limited to these two characters but for all the characters in all the scripts under the scope of the Root LGR procedure. Carrying out this analysis can practically be done only with the Generation Panels that exist while the NBGP is active. This still leaves out those scripts out of the scope which may not have a Generation Panel established yet. Hence, carrying out this exercise in entirety is quite impracticable. This conundrum can be resolved if all the such cases are handled by the "String Similarity Assessment Panel" of ICANN.