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Design Resource
# History of Devanagari Letterforms
Evolutionary of Devnagri Typeface
by
Chitra Gohad
IDC, IIT Bombay

**Source:**
https://dsource.in/resource/history-devanagari-letterforms

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Source:
https://dsource.in/resource/history-devanagari-letterforms/introduction

## Introduction

Devanagari evolved from the Brahmi script. The word Devanagari has been mystery to scholars, there is a hypothesis that it might be combination of two Sanskrit words 'Deva' (God, king or Brahmans) and 'Nagari' (city). Literally it combines to form 'City of Gods', 'Script of Gods'.

Devanagari, a development of Brahmi system of phonetics, is the only script which has specific signs (grapheme) for the phonetically arranged sounds of the human speech (phonemes), and it is flexible enough to write foreign sounds by attaching marks to the nearer grapheme. The Roman, Greek, Hebrew, and Arabic alphabets have certain traditional names for indicating sound pictures but there is no guarantee that one sign will have only one phonetic value.

The Devanagari script is an important and widely used script of India. It is mainly used to write Hindi, Marathi, Nepali and Sanskrit languages. It also serves as an auxiliary script for other languages such as Punjabi, Sindhi and Kashmiri.
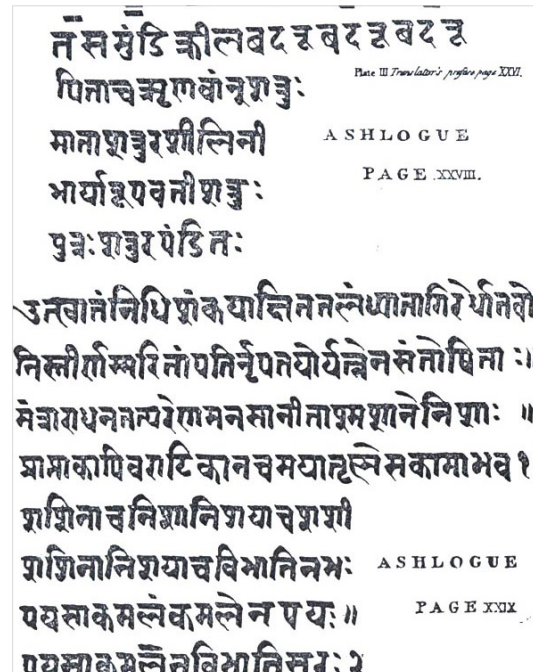


Handwritten Devanagari letterforms.
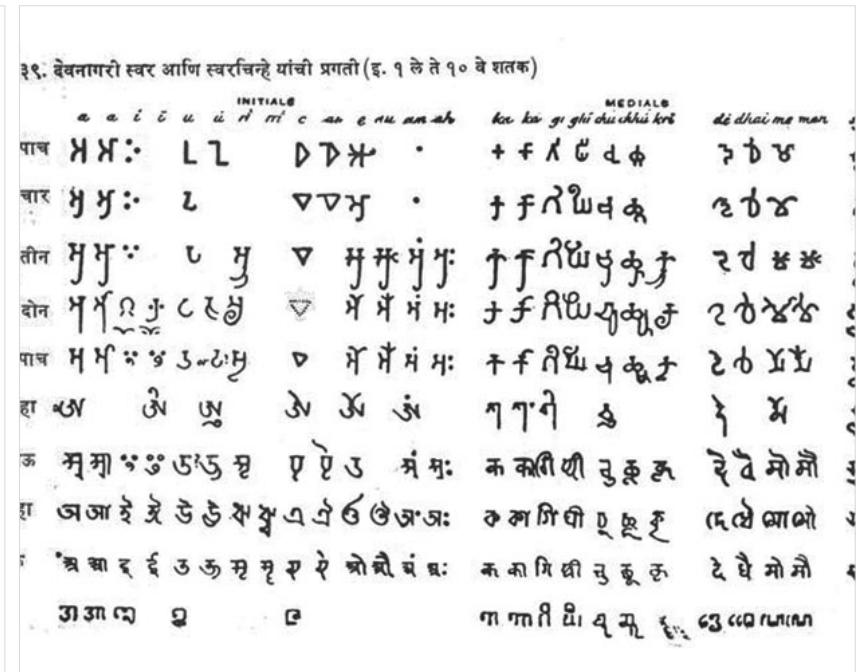


Formation of Devanagari vowels and symbols from 1st to 10th century.

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Formation of Devanagari letters from 1st to 12th century.

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## Picto-Phonetic Script

Some ascetics in pre-found meditation saw 50 petals. These included the six 'Chakras' of human body namely:-

• Muladhar (4)
• Swadhisthan (6)
• Nabhi (10)
• Anahat (12)
• Vishudhya (16)
• Aadnya (2)

They visualized these Chakras in form of pictures and tried to draw them in the soil on the land. They also tried to co-relate the different sounds produced by them to a particular petal of the Chakras. After analyzing which petals of Chakras carries which sound, they finalized the form (picture) of that particular sound. These were called 'Varnakshare' (Picto-phonetic letters).

The early writings are represented by painted symbols. These symbols were phonetic representations of sound letters. The Red Indians engraved and painted ideograms in rock shelters. The complicated designs often painted in the rock shelters of Vindhyan Sandstone hills of India are the first attempts to express the emotional enchanted pre-historic hunters and dancers. . These were the primary visual communications of pre-historic tribal groups which gradually evolved into the symbolic picto-phonetic script.

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Picto-phonetic symbolic script in Vindhya Rock Shelters (C 8000 BC)

Pre Mauryan Mahajana Pada (City Republics) Period



Painted symbols on Stone-Pebbles-Mesolithic France and Spain, C. 6000 BC.

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Silver partrait coin of 7th c. AD. Young age- King Vasisthiputra Pulumavi

Cemetery Inscription In later Brahmi (Box-headed) kanheri, Bombay 5-6 c. A.D.

Brahmi Inscription from PALE Pune District, Maharashtra 1st Century AD.

Courtesy Deccan College, Pune.

Inscription of Ikshwaku Raja Virpurush Dutta, Nagarjun Konda, 3rd c. AD. Andhra Pradesh

Silver coin of Yadawa Ruler Singhanadeva Devagiri, Maharashtra 13th c. A.D.

Courtesy Deccan College, Pune.

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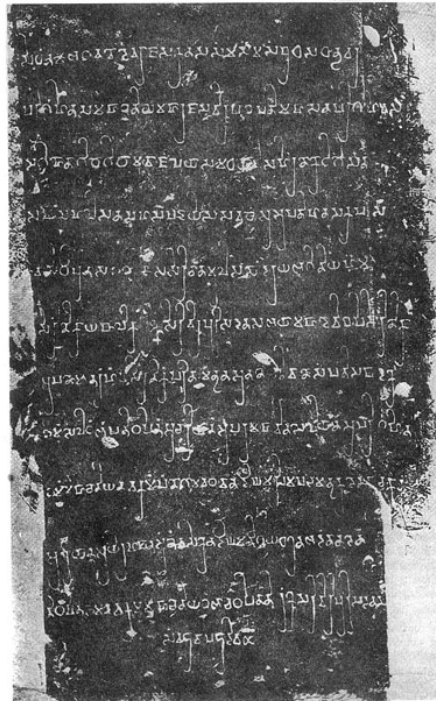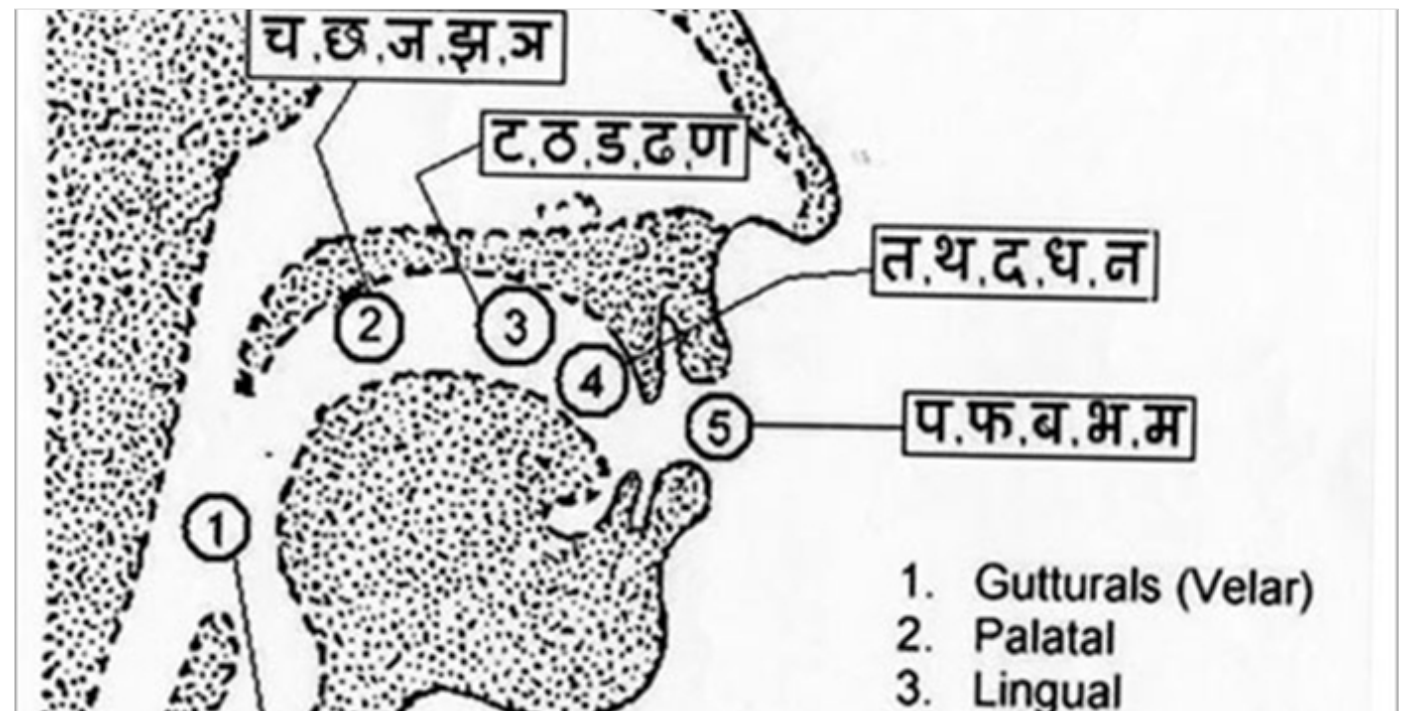https://dsource.in/resource/history-devanagari-letterforms/grammatic-tradition

## Grammatic Tradition

In India, Nataraj Shiva who is known for going into dance for acquiring a device to save the Vedas from being lost gave 14 aphorisms called Shivasootras. He delivered them by striking his trinklet (Damaru). In addition to this, Ganapati Atharna Sukta especially makes it clear that Ganapati is Bramha, Vishnu, Rudra, Indra, Wayu, Surya, Chandrama, Brahma-bhu-Bhuwah-Swaha and Aum.

The Sun is the first representation of God in the Vedas praised by the Gayatri Mantra- his circular form permeate everywhere in the universe, so is the round end of the Damaru of Shiva. (Interwoven with the Gayatri Mantra in Devanagiri).

Understanding all the Suktas Late A.B. Walawalkar, who was drawn to this subject, established the Maheshwari technic of logical vowel-consonantal forms. The Damaru, as it strikes, gives 5 classes of sound- the Guttural, Palatal, Lingual, Dental and Labial. When you do a bi-section you get two and by tri-section of a circle, you get three. The crescents obtained by bi-section were assigned to Guttural and Labial and those obtained by tri-section were assigned to Palatal, Dental classes. Thus the Crescent script was designed by Ganesha.

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## Vowels and Consonants

The grouping of vowels and consonants is called Swaras and Vyanjanas respectively and is done according to the phonetic point of articulation.

**Vowels:**
Indian phonography is vowel dominant; each vowel is realizable in 3 scales Short, Long, Prolonged. All vowels can be pronounced in non-nasal and nasal modes. This means each vowel can have 18 realizations (three divisions on the position of the particular organ in the mouth while pronouncing that letter, and two divisions of nasal or non-nasal. Since each group is independent of the others, the total number of pronouncements comes to 18). Since it is not possible to record these differences and they must be remembered by listening to them properly, the Vedas were not written.

For representing all these differences there must be a provision to apply vowels hence there are Vowel-marks called Matras. There is only one three vowel combination that is Om.

**Consonants:**
All consonantal designs either touch or cross the vertibar; there are exceptions only in the design of letters such as GA, NA, SHA. These letters do not touch the vertibar. This is a graphic peculiarity to point to the fact that the writing is a Ganesh Vidya.

According to the tradition of the scribes of the Ganapati School, one scribe came to write copies text of Mahabharata for the author Vyasa Muni. Ganesha introduced vertibar of 'A' vowel. This feature is highlighted by Vyasa in Bhagwad Gita wherein Krishna says, 'I am the common factor of Aa kaar in all letters.' Thus this feature was added to all consonantal designs. After the vertibar is drawn predominantly the graphics become 'Dev-Lipi'.

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Genesis of Vowels.

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# Findings Origin from Vedas

Vedas came down generations by oral teaching from the teachers or father's mouth to the student or the son. The Vedic people had known no art of writing.

Vedic Brahmi Script:
The Brahmi script is a script evolved by the Vedic philologists after an inspection of sources of sound from Ganesh Vidhya and the causes of variations of sound. Brahmi was distinct and superior to all other scripts, perfect in phonetic arrangement and nasal signs. Each sign can be either a simple consonant or an inherent vowel. Brahmi (and all subsequent Brahmi-derived scripts) indicates the same consonant with a different vowel by drawing extra strokes, called matras, attached to the character. Ligatures are used to indicate consonant clusters.

The Brahmi continued to spread during Buddhist and Jaina though the Aa kaar was not present. But it became a permanent feature in the Bhagwat Gita which is called as 'Bharati Script'. The Bharati script began to evolve in Gupta period (4 to 6 century A.D.). The transition can be seen from the Brahmi script to the Bharati script to the Gupta script to Nagari script to Devanagari.



Example of strokes added to indicate different vowels following the consonants.



Formation of the merging vowels has been changed from left to right.

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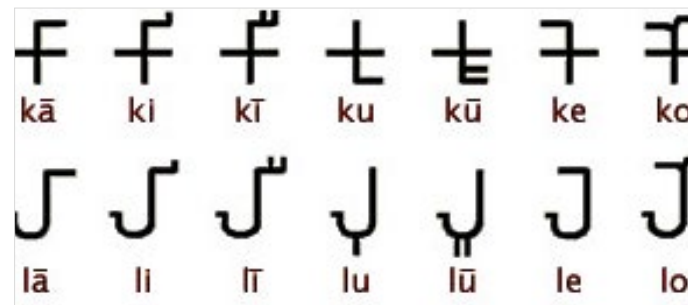https://dsource.in/resource/history-devanagari-letterforms/findings-origin-vedas

The basic Brahmi script.

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Inscription are developed from the original writing.

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# Experiments in Type-form

The National Institute of Design, India is developing type forms to facilitate mechanism and photographic reproduction in the major Indian languages. Today, Typefaces in most Indian scripts are same as those which are in existence when printing first commenced in India.

Traditional type designs are derived from forms created with a reed pen as in the case of Devanagari, Gujarati, Bengali etc. Variations in the size, width, and weight of individual typefaces are required for a variety of applications in newspapers, books, hoardings, press advertising, exhibitions, street signage and so forth. Yet the letterforms are restricted about three variations (normal, bold, italic). Hence even at a glance at any street hoarding or newspaper one can find sizes, quantity and variety in letterforms. Therefore, there is an urgent need to develop a more functional approach to the development of letterforms, suiting them to Indian needs.

At NID, this design experiment is being conducted in Devanagari, Bengali, Tamil and other scripts. This experiment commenced in 1967 when Adrian Frutiger (designer of Univers Type Series) was invited by NID to start the type design activity at the Institute. The following work demonstrates the simplicity, order and standardization which have been made possible in the mode and basic construction of each letterform. The style allows for variation in width and weights. It facilitates typecasting as well as photo composing. The composition of these forms provides suitable grey areas that assist the legibility of individual letters even when reduced to a small type size.

The simplicity of forms and the structure of the new design are done keeping in mind the requirements of latest technology. This is an imminent need as India enters the new world.

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Letter 'ka' in different scripts of India.



Design process of Devanagari letterforms.
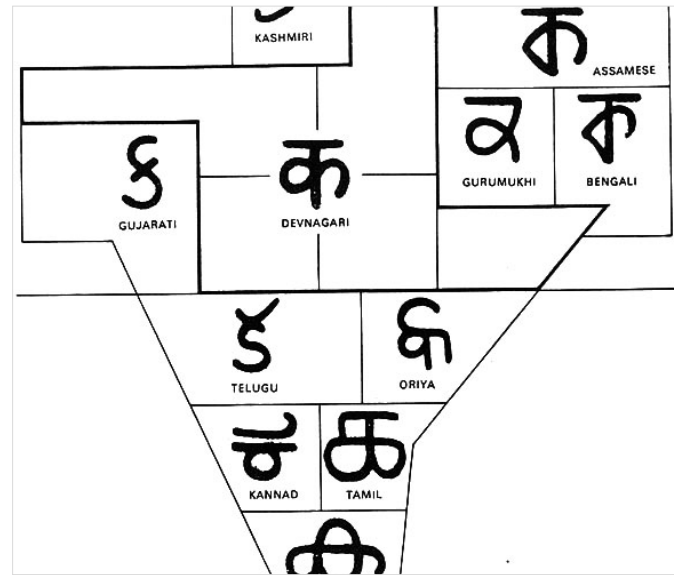


A system approach for different weights and widths.

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# Characteristics of Script

The form of writing in Devanagari did change over the centuries, but the base of the script was laid on firm foundations that all scripts of India have inherited from their ancient mother script.

The characteristics of Devanagari are as follows:

**Devanagari Needs No Spelling Arrangement:**
Spelling has been eliminated in Devanagari because every sound had been correctly analyzed and placed into its phonetic classification and the consonants and the vowels which have different functions have been assigned definite mode of behaviour. On the contrary, as a combination of letters is used in Roman script for sounds that have no signs, the need for spelling them artificially became necessary.

**Series Modulation by Vowel Signs:**
Devanagari and all scripts of the Brahmi family have distinctive graphemes for all vowels in order to join with the consonant's representative signs. These have been evolved along with the script.

**Differentiation for the Pronunciation of Vowels:**
As pronunciation was to be very accurately managed the Indian Grammarians made a differentiation between the signs for the short and long sounds of the same vowel. It will be seen that the vowels which are short, flourish to the left and their longer signs to the right. This is noticeable in Devanagari, Tamil, Malayalam and other scripts of South Indians who were very careful in preserving their traditions.

**The Vertical Line:**
In earlier Brahmi script the vertical line is absent; it shows the addition of the Aa matra to a consonant so that it could be fully pronounced and written.

In some letters, the vertical line is short and goes on the top of forms, because a full line cannot be drawn through. The vertical line is an essential part of any Devanagari letter and in this context the reference in Bhagavad Gita is remarkable. The vertical line is cancelled by a halant sign in the case of letters to represent the half pronounced phoneme. These half signs also help to form conjunct letters. The suggestion to make half letters from full letters by adding halant signs has been found helpful for pronunciation.

**The Top Line:**
The top line is an integral &essential feature of Devanagari orthography. The continuous top line is a later development. In old manuscripts, copper plates and inscriptions the top line was limited to the character only and did not join the next letter. The top line knits letters into distinct words. A gap indicates a separation of one word

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**Conjunct Formation of Consonants:**
Devanagari has evolved as a specialized script for highly developed languages like Sanskrit. Some reformers recommended the formation of conjunct letters with halant signs even in the case of letters with full vertical lines. For saving space the conjuncts in Devanagari were initially written vertically, but the Grammarians would not object to joining them lineally when half forms of letters with the full vertical line could be used by removing the vertical line. In the case of archaic letters, there is no other way than applying the halant sign, especially in case of composing with a machine like a typewriter.

**Diacritical and Special Marks:**
Devanagari script is said to be capable of expressing many varieties of sounds. Various signs for a variety of long and short vowels were made in the language. But since the signs vary from province to province, an effort in standardization is very essential. Affricated words which came to India through the contact of the Persians and the Arabs left a mark on Hindi and such sounds have been denoted in Devanagari by adding a point at the bottom nearer graphemes in Devanagari.

There also exist another set of vowels which have been added to expand the range of traditional Devanagari. The Europeans introduced some sounds which are pronounced with half-open articulation e.g. cap, gap top, all etc. and these are denoted in Devanagari by putting half-moon marks on the top of nearer grapheme.

**Direction from Left to Right:**
Perhaps all ancient scripts were first written from the right to left. Only the Hebrew, Arabic, Persian and Urdu continued with the old way, but Brahmi the mother script of Devanagari changed the direction of writing from left to right. In this respect, the Devanagari is somewhat nearer to the Roman script.

**Independent Grapheme exists for Pure Vowels and Consonants:**
Like the Roman script, Devanagari too has independent vowels. Every basic vowel has a different phonetic origin; each should reasonably have an independent grapheme. These vowels are given representative forms and these are used for modulation of consonants which are supposed to be pronounced with the help of vowels into a modulating series.

**Basic Arrangement of Phonemes is Phonetic:**
The Brahmi script has evolved from the studies in phonemics in which the Dravidians had specialized and hence is completely phonetic. There are some pronunciations imported from foreign languages and they are indicated by a dot at the bottom of the nearer phoneme. Half-open vowels imported from European tongues are indicated by a half-moon sign over a nearer phoneme

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Series Modulation by Vowel signs.



Differentiation for the pronunciation of vowels.



Manuscript style.

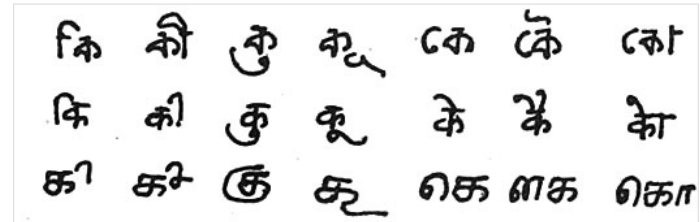Design Resource
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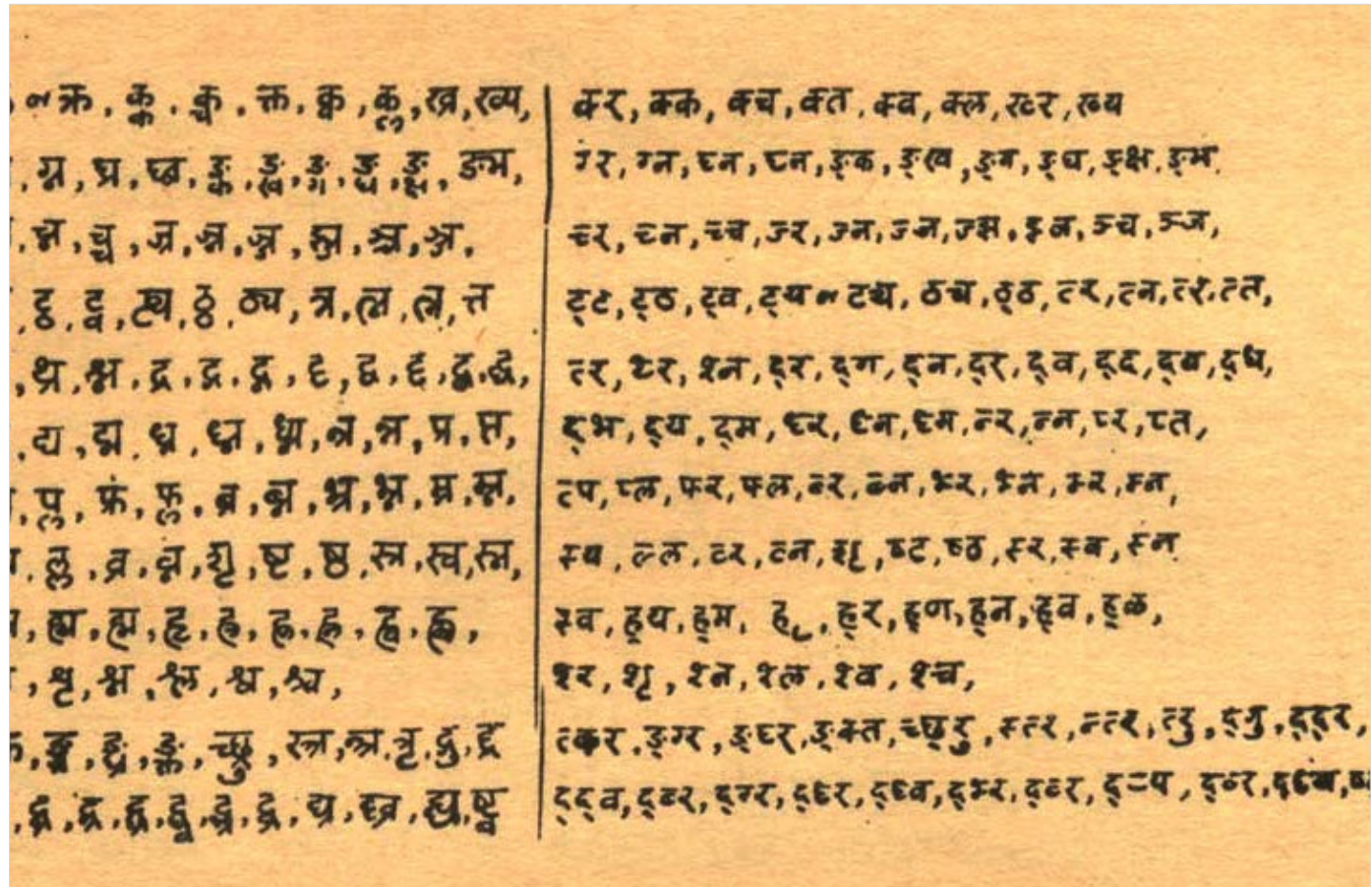https://dsource.in/resource/history-devanagari-letterforms/characteristics-script

Conjunct formation of 'Ra' letter.

## Anatomy of Letters

The Roman letters were categorized according to ascender, descender, serifs, counter, loop etc. But Devanagari letters till then had not been subjected to such a graphical analysis. One of the first attempts toward a graphical classification was done by S.V. Bhagwat (1961) in his thesis. Bhagwat's main insights on the graphical structure of Devanagari are enlightening.

Bhagwat groups on the basis of graphical similarity and then he goes on to define the guidelines for the same graphical elements of letters. The topmost lines are the Rafar line, followed by the Matra line and Headline. The Headline is also referred to as the Shirorekha. After the Shirorekha, the upper mean line and lower mean line are indicated. The upper mean line denotes the point from which the actual letter starts and the lower mean line is marked where the distinguishing characteristics of the letters come to an end. These lines are followed by the Baseline, which is where the complete letter ends and the lower Matras begin. The lowermost line is the Rukar line where the lowest portion of the Rukar ends. His new contribution to the vocabulary of graphic elements of Devanagari is the term Loop, which is used to describe top of the letter.

Bapurao Naik also attempted a graphical grouping titled Graphical classification of Devanagari Varnas of letters. Naik graphically organizes Devanagari letters into five groups based on the position of the Kana or Verti-bar.

Creating a vocabulary for Devanagari was done by Mukund Gokhale, it was first published in 1975-76. Gokhale uses the body paradigm to describe the various portions of the letters. The lines defined by him are: Urdha-varekha, Shirorekha, Skandhrekha, Nabhirekha, Janurekha, Padrekha, and Talrekha. Regarding the proportion of the letters, Gokhale uses the stroke thickness (thickness of pen stroke) as a base unit. Four strokes for upper Matras, eight strokes for main character and four strokes for bottom Matras are necessary. A total of sixteen units of strokes can be considered as primary height of the letter. Bapurao Naik also specifies this unit of heights, six strokes for upper Matra, twelfth strokes for main character and again six-unit for bottom Matras in a total of twenty-four units.

The description of the various parts of Devanagari letters by Gokhale is called Cartographic description of Devanagari in his article.

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Bhagwat's groups based on graphical similarity.


Naik's graphical classification of Devanagari varanas.


Terminology defined by Gokhale.

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Bhagwat's figure for graphical elements in Devanagari letterforms.



Gokhale's division of letters using body paradigm.

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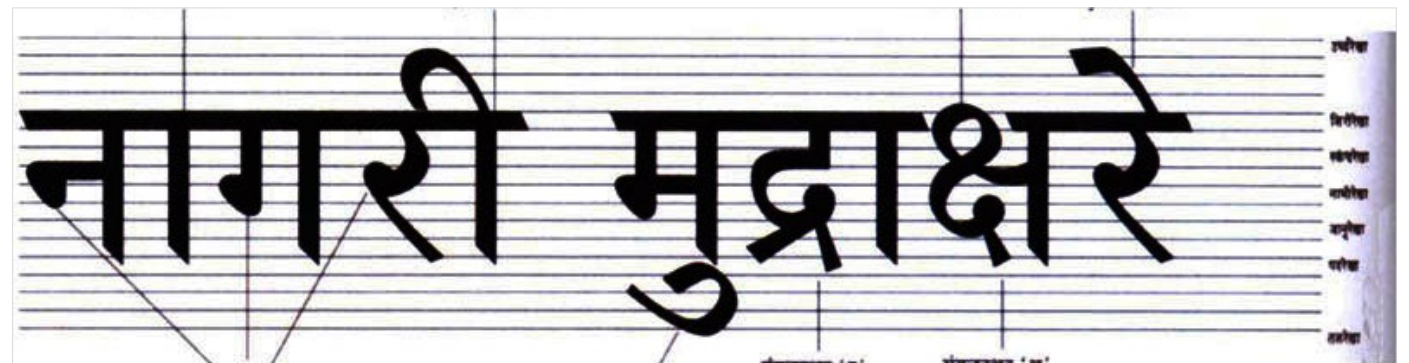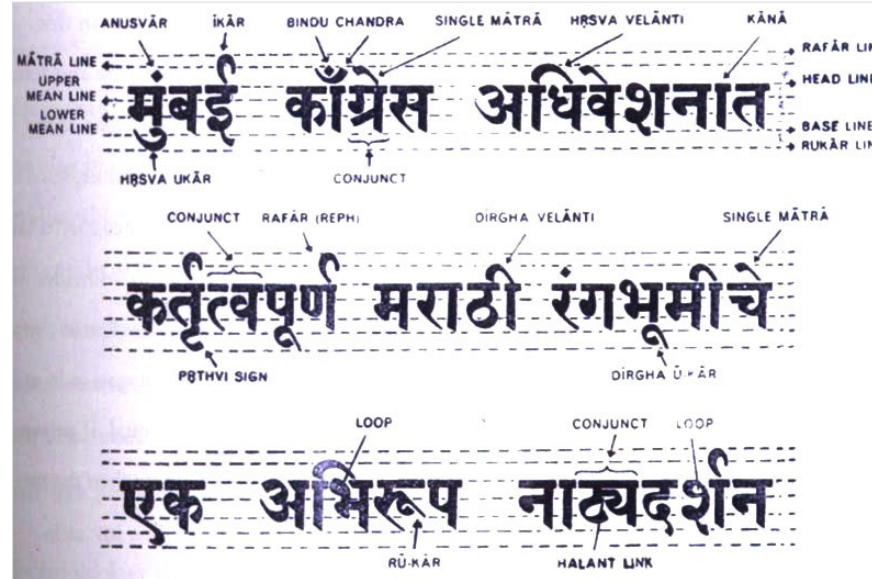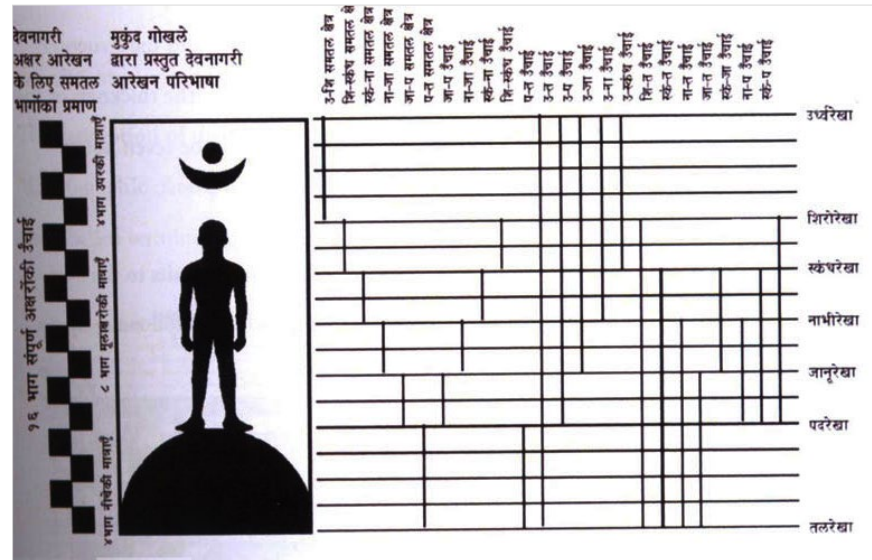https://dsource.in/resource/history-devanagari-letterforms/letterforms-typewriter

## Letterforms for Typewriter

The idea of writing mechanically was patented on 7th July 1714 by Henry Mil; the first experimental gadget was made by a French man Xavier Progin in 1833. Random conversions in Devanagari came to market from time to time, but the most important models were the Nagari Lekhan Yantra by V. M. Atre and the Mistra - Hindi typewriter by Olympia.

The orthography of a script for typewriter is decided by the popular acceptance of common grapheme that fully represents the pronunciations of the language. There are huge numbers of joint letters and it is not possible to include them on keyboard of a conventional machine. So the literacy societies and the Government tried to simplify the Devanagari script, the simple form being named Bal-bodh.

This simplified Devanagari can be fully adapted to the conventional standard typewriter. The orthography of the letterforms in the simplified Devanagari script.

**Spacing:**
The typewriter's roller moves over an equally towards left; the unit distance of such movement is termed as 'spacing'. The size of the typeface is called 'Pica', when a roller moves by 10 spaces per linear inch and it is called 'Elite' when it moves by 12 spaces per linear inch thus it varies in various sizes.

**Motion:**
The distance by which the roller is lifted, when a shift key is pressed is termed as 'motion'.

**Dead Offset keys:**
This mechanism influences the joining marks of Matras and the design of consonants.

**The Rational solution (Phonetic Keyboard):**
The committee report (1957) gave a very useful principle namely, 'Put the most frequent letters on the most propitious positions.' So the keyboard consists of 'most propitious positions', 'most effort region' and 'most difficult region', all within the 'blind typing range' and the rest in the 'optical typing range'. And these letterforms are categorized into 3 graphic groups on the basis of Vertibar positions, as per Ganesh-Vidhya analysis (Mid bar group, Topbar group, End bar group). So we can assign mathematical values to them and give differential values to places on the shift and unshift positions.

**Grouping and Regional assignment:**
High frequency (Home positions), Medium frequency (Middle region), Low frequency (Outer region), shift position.

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**Classification of characters:**
The following classes are signs for the compositions of simplified (Bal-bodh) Devanagari grapheme which can print in all types of texts in Hindi, Marathi and Sanskrit.

Vertibar signs, End vertibar signs, Matras-cum-vertibar, Mid vertibar signs, Top vertibar signs-Unclassified signs, Numericals, Punctuation and others.

**Institute of Typographic Research (ITR) Keyboard Layout:**
ITR differentiates between Phonetics and Phonology. Phonetics is the term used by linguists in pronunciations as they exist in spoken languages. Phonology is a science of sounds that are classified according to organs of speech as per Vedas. ITR follows Phonological grouping of sounds together with positional value as well as the propitious use of frequency of occurrence of characters. Considering unshift and shift positions keyboard models can provide 106, 112,118, 120 and 126 characters or their double, about 106 characters are common in all and a few additional characters are provided as per capacity.

Unshift positions of the Home row carries high frequent characters, their shift position carries phonetically nearer character; in addition, the central zone carries more frequent characters than those which are at extremes.

• Top Row - Signs, Numerical etc.
• Touch Zone - Blind Typing Region
• Upper Row - Labials, Semi vowels
• Home Row - Dentals, Gutturals, Sibilants
• Bottom Row - Vowels, Lingual's, Matras

ITR provides maximum required about 400 characters and keyboard is designed with unshift, shift and control position with ligature routine. Scripts so far covered by ITR are Devanagari, Gujarati, Bengali, Oriya, Telugu, Kannada, Malayalam, Tamil, Simhala and Thai.
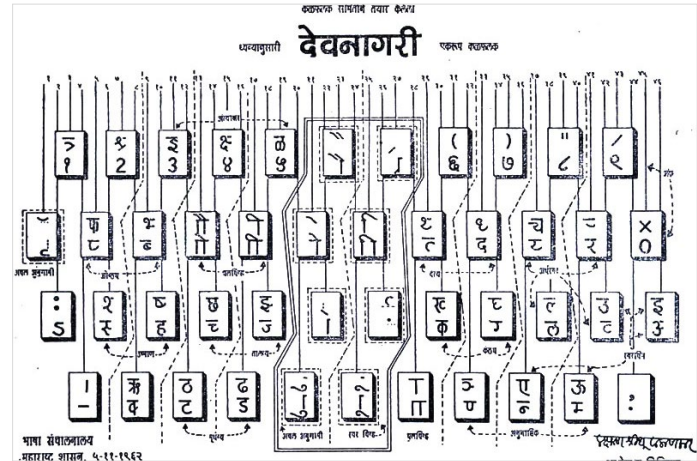
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Typewriter keyboard circulated by the Government of Maharashtra in 1962.


The figure show effort value for normal position and upper for shift position.


Devanagari Typewriter keyboard in 1963.


Final layout of the Typewriter keyboard for Devanagari, Hindi, Marathi (1965).

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## Digital Typefaces

The art director of ITR, M. W. Gokhale provided a stimulated digital font catalogue on print. The sample text used in the ITR font catalogue is the quick brown fox suggested by Wakankar and created by Pandit (1968).

A type catalogue published by them in 1972 contains 21 typefaces and text samples are provided in 10,12,16,18, and 24 points; whereas some display typefaces samples are provided in 30,36,48 and 72 points. M. W. Gokhale arranges font alphabetically (Aabha, Aakansha, Abhishek, Ajinkya, Ajit, Akshar etc.)

CDAC provides 109 fonts most of them are available in normal, bold and italics. The CDAC font catalogue is arranged randomly for the samples; where an alphabetical arrangement, in the end, suggests the usage scenario for the font (DV-Dhruv, DV- Kishor, DV- Alankar etc.).

They also provide the purpose-based grouping of fonts. The classes are as follows:

• Body Text - Books, Magazines, Newspaper, Advertisements, Greetings, Directories, etc.
• Headline - Books, Magazines, Newspaper, Advertisements.
• Display - Posters and Signboards, Hoarding, LED display, TV/Video.

And the further study was proposed by R. K. Joshi (2005).

The proposed categorization of fonts are as follows:
• Fonts Based on Indian Historical Landmarks - such as Brahmi letters, Gupta letters, Peshwa letters etc.
• Computer Technology Font - Dot-matrix, Digital fonts using formats such as postscript, true type, open type.
• Calligraphy Fonts - Handwriting based, calligraphic style of script
• Decorative Fonts - Fancy decorative, pattern-based, form-based, cursive calligraphy

Need of Variety of Typefaces:
Scripts and letterforms are important aspects of Languages. Typefaces are not mere chunks of text or information; they have a personality of their own. They communicate not just with the content they carry but also with their form. They convey a specific message and a typographer should make sure that they convey the appropriate message. Designer should consider the user group such as children, adults, students, men, women etc. and purpose of designing like advertisements, publishing, identity etc.

Devanagari or any Indian scripts are no doubt very readable, but careful observation is needed regarding symmetry, structure, point sizes and alignment in them. The new technology of lettering and composing where a designer can create different sizes and dimensions should meet the need of typeface design and variety in them as per

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the purpose.

# D'source

Digital Learning Environment for Design - www.dsource.in
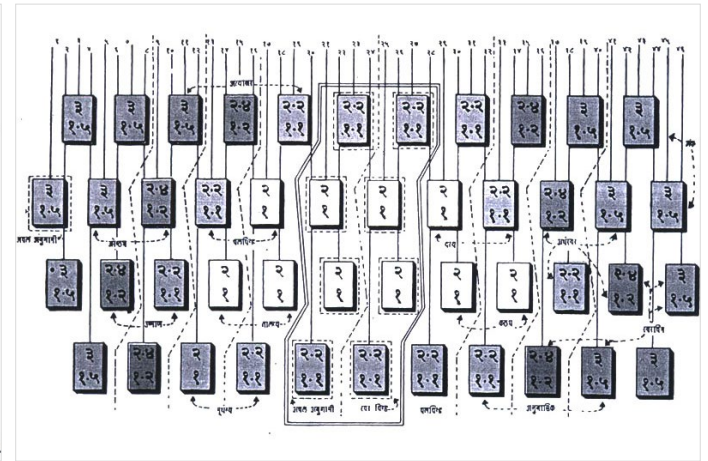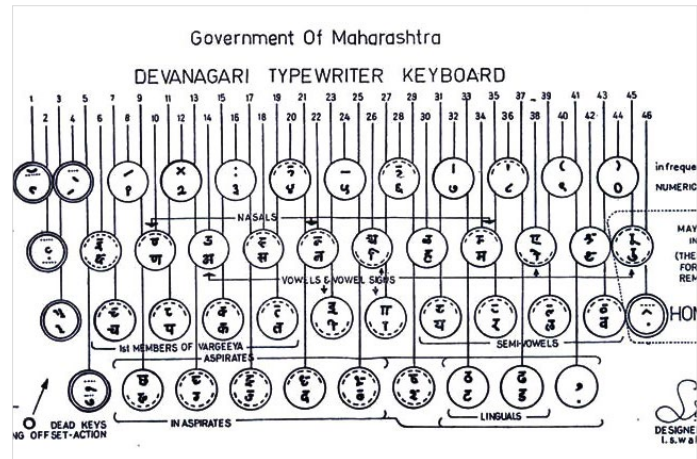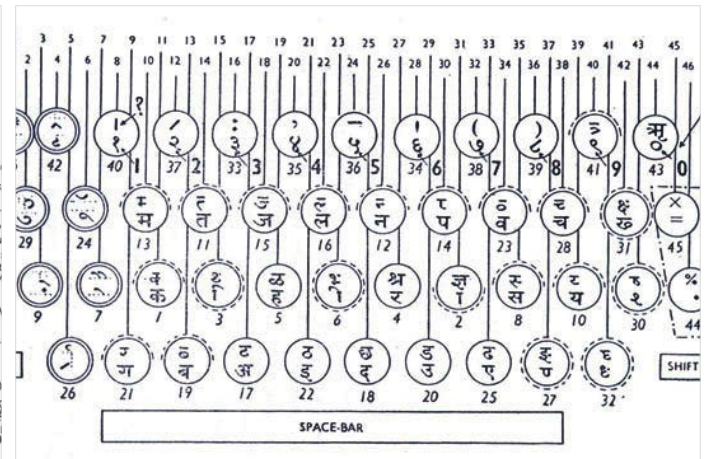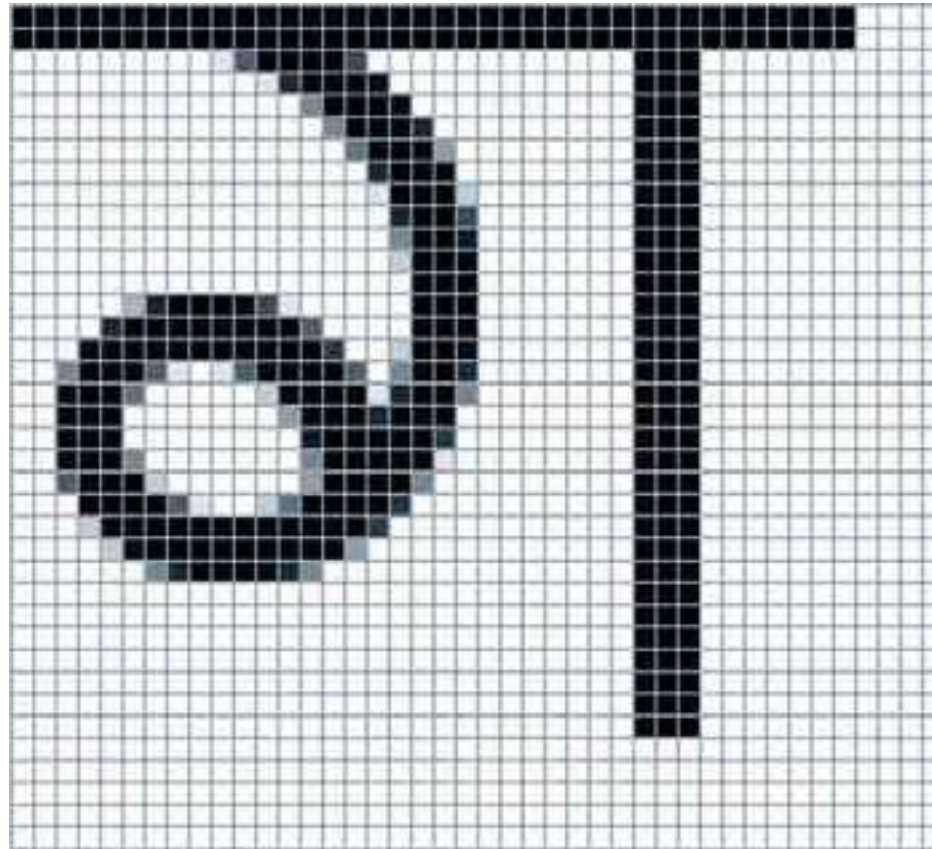
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**Source:**
https://dsource.in/resource/history-devanagari-letterforms/links

1. Introduction
2. Picto-Phonetic Script
3. Grammatic Tradition
4. Vowels and Consonants
5. Findings Origin from Vedas
6. Experiments in Type-form
7. Characteristics of Script
8. Anatomy of Letters
9. Letterforms for Typewriter
10. Digital Typefaces
11. Links
12. Contact Details

## Links

**Link:**

http://www.designindia.net/desciplines/type-design

**References:**

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• Wakankar L.S. (1966) Devanagari characteristics and mechanisation, The commercial printing press ltd., Bombay.

• Naik Bapurao S. (1971) Typography of Devanagari. Directorate Government Printing and Stationery, Bombay.

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## Contact Details

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