

Ashwini Phadke

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STRUCTURAL ANALYSIS OF
NIRNAY SAGAR TYPEFACE

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STRUCTURAL ANALYSIS OF
NIRNAY SAGAR TYPEFACE

GREAT PRIMER NO. 3

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SEMINAR PROJECT

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STRUCTURAL ANALYSIS OF NIRNAY SAGAR TYPEFACE
GREAT PRIMER NO. 3

Visual Communication
Seminar Project

Submitted in partial fulfillment of the requirements
for the Degree of Master of Design in
Visual Communication.

By
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91625004

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Co-Guide:
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Industrial Design Centre
Indian Institute of Technology, Bombay.
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APPROVAL SHEET

The Visual Communication Project entitled '**Structural Analysis of Nirnay Sagar Typeface**' by Ashwini Phadke is approved in partial fulfillment of the requirements for the Degree of Master of Design in Visual Communication.

Signature

Date

Guide

: *Manisha*

30 JUNE '93

Co-Guide

:

Internal Examiner

:

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Ashwini Phadke

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INTRODUCTION

INTRODUCTION

वेदशास्त्रपुराणेतिहासकाव्यान्यनेकशः ।
योग्यमूल्येन दास्यन्ते ग्रन्था निर्णयसागरे ॥

"Various literatures like vedas, shastras, epics historical and poetry books can be printed in various ways (frequently) in fair price."

This oath taken by Jaoji Dadaji Choudhari regarding the Nirnay Sagar Type Foundry seems appropriate.



जगजीतदाजी

NIRNAY SAGAR ERA

Jaoji Dadaji Choudhari (1839-1892) saka 1760 Founder of Nirnay Sagar Type Foundry.

1848 - He joined American Mission Type Foundry at the age of ten, employed in rubbing types. Worked for ten years

1859 -The press was taken over by Exchange Press now known as Times Of India.

1862 -After one and a half years joined Indu Prakash press as type caster

1862 -Oriental printing press,assigned work of type founding

1864 - Started his own type foundry.

1866 Indu Prakash type foundry was handed over to Jaoji

बडोदावरसल—हे पूर्वी अगदी गरीब स्थितीतील असतांही आपल्या बुद्धिचा-
र्याने, दृढउद्योगाने आणि मनमिळाऊ स्वभावाने फार मोठ्या योग्यतेस बटले. यांच्या
आगी व्यवहारज्ञान व विचारशक्ति इतकी उत्तम होती की, ते जे जे काम हाती घेत, ते ने
फार सवधगिरीने व काळजीपूर्वक करीत असत. हाताखालच्या लोकांस वागवून घे-
ण्याची यांची रीत वर्णनीय होती. दुष्ट काळाने हजारांचे मियरल जे जावजी शेट त्यांस
जगावून नाहींसे केले.

चिकित्सक—यांनी केवळ गरीब स्थितीत राहून आपल्या उद्योग, दृढनिश्चय व
चातुर्यबलावर लक्षाधीशामध्ये आपली गणना करली; मुंबई इलाख्यातील नव्हे, परंतु
आज हिंदुस्थानातील मुद्रणकलेस त्यांच्या ऊर्जित दशेस आपलें. शांतता, लोकनियता,
गंभीरपणा, सचोटी या गुणाविषयी मि० जावजींनी आपलें जगाकडून वर्णन करून घेतले
आहे. जावजींच्या मरणाने आज मुंबई इलाख्यातील छापखानेवाल्यांचे भूषणच गेले म्हण-
ण्यास हरकत नाही.

वांचे ग्याझेड—ह्यांस थोड्या दिवसांमागे मुंबईसरकाराने जस्टिस आर्चु पि पीस हा
नात्याचा किताब दिला. त्याचा उपभोग घेण्यास व तत्संबंधाने लोकांस उपयोगी पडण्यास ने
फार दिवस राहिले नाहींत. जावजी मेल्यामुळे मुद्रणकलेच्या धंद्यांतला एक मोठा खंडा व
खटपटी मनुष्य नाहींसा झाला आहे. ह्यांनी अनेक उपयुक्त संस्कृत, हिंदुस्थानी, मराठी
आणि गुजराती ग्रंथ प्रसिद्ध केले आहेत. ह्यांचा टैप पाडण्याचा आणि छापण्याचा कार-
खाना फार मोठा आहे.

सुधारक—आमच्या इकडे छापखान्यांस जी ऊर्जित दशा आली आहे, ती बऱ्याच
अंशाने यांच्या मेहनतीचे फळ होय. यांच्या आयुष्यकालांत विशेष लक्षांत ठेवण्यासारखी
गोष्ट म्हटली म्हणजे त्यांची मूळची स्थिति फार गरीबीची असून केवळ आपल्या उद्यो-
गाच्या व नेकीच्या बळावर ते इतक्या प्रसिद्धीस आले. आजपर्यंत त्यांच्या साक्षाने जे अ-
नेक संस्कृत मराठी ग्रंथांचे प्रकाशन झाले आहे, ते मनांत आणितां त्यांच्या हातून विद्या-
वृद्धीच्या प्रसारास किती मदत झाली आहे हे कोणासही दिसून येणारे आहे.

अरुणोदय—तीन रुपये दरमहा वेऊन दगडावर टैप घांशित बसणारे त्या वेळचे ते
पोर पुढे अशा योग्यतेस येईल, असे कोणाच्या स्वमांतही नव्हते. हे बुद्धीने लिखट
होते म्हणून छापखान्याच्या संघाच्या हरएक कामांत ते इतके प्रवीण झाले होते की या
इलाख्यांतल्या छापखान्यांचे मूळ पुरुष जे टामस ग्राहम त्यांनीही पुढे पुढे मि० जावजींच्या
पुढे हात ठेकले होते. त्यांची जरी इतकी भरभराट झाली तरी आरंभीच्या आपल्या बरो-

as stated in a note published in Indu Prakash (April 11, 1892)
Jaoji started his type foundry only after mastering the
art, learned from Thomas Graham (as acknowledged by
Ranoji Raoji Aru)

Jaoji was assisted in type cutting by Ranoji Raoji Aru.

Jaojis types were universally acclaimed all over and were in
demand in many foreign countries where they are still in use.
1868 - Undertook printing of Almanac prepared by Vithal

Sakharam Agnihotri. It was a twelve page format in type.
1719 - Composed Panchang Saka in the types specially cut
by him, which was later printed in 1869.

Nirnay Sagar Press was started with only one press Super
Royal hand press.

Frist book printed was the Garud Puran (sanskrit).

Fig. 36. A page from the Biography of Jaoji Dadaji set in 8 pt.
degree face cut by Aru

OBJECTIVE

The beauty of Nirnay Sagar Typefaces lie in its design and in the technical mastery of punch cutting the types.

The excellence in the characters has made Nirnay Sagar Typefaces the model for most of the currently used typefaces. These types were universally acclaimed and were in demand in many foreign countries where they are still in use.

A lot of work has been carried out in studying and analysing the Nirnay Sagar typefaces.

The aim is to find out the detailing of design of the characters that made them classical.

NIRNAY SAGAR TYPEFACE

1

8 Point Marathi

विज्ञान शाप की वरदान : तसे पाहिले तर हा प्रश्नच होऊ शकत नाही. एके काळी स्वभावतःच गति-शाल असलेला हा मानवमाणी निसर्गादी कचेतरी जमवून घेऊन आपला जगत होता. त्यातच समाधान मुंबई काँग्रेस अधिवेशनांत कर्तृत्वपूर्ण मराठी रंगभूमीचे एक अभिरूप नाट्यदर्शन घडविण्यांत आले. ०००

2

8 Point Marathi black

मीतीच्या भावनेने स्वरक्षणासाठी उपाय शोधण्याला माणसाला प्रवृत्त केले. “स्वरक्षणाची ही गरज” विज्ञानशास्त्राची आदिमाता आहे. मुंबई काँग्रेस अधिवेशनांत कर्तृत्वपूर्ण मराठी रंगभूमीचे एक अभिरूप नाट्यदर्शन घडविण्यांत आले. १२३४५६७८ ०००

3

Long Primer (338)

निर्णयसागर हे महाराष्ट्रमुद्रणकेलेचे, महाराष्ट्रवाङ्मयाचे एक मूषण आहे. हे मूषणावह स्थान कायम राखण्याचे कार्य शेट तुकाराम जावजी ह्यांनी फारच उत्कृष्ट रितीने पार पाडले. मुंबई काँग्रेस अधिवेशनांत कर्तृत्वपूर्ण मराठी रंगभूमीचे एक अभिरूप नाट्यदर्शन घडविण्यांत आले.

4

Pica No. 1 (334)

टाईप तयार करण्याच्या कामांत मुंबईस जावजी दादाजी व गणपत कृष्णाजी या दोघांनीच नांव मिळविले. (केसरी—१२-४-९२) मुंबई काँग्रेस अधिवेशनांत कर्तृत्वपूर्ण मराठी रंगभूमीचे एक अभिरूप नाट्यदर्शन घडविण्यांत आले. ०००

5

Pica Black No. 1 (332)

गौतमबुद्ध हा विहार प्रांताचा राजा शुद्धोदन ह्याचा एकुलता एक पुत्र होता. मुंबई काँग्रेस अधिवेशनांत कर्तृत्वपूर्ण मराठी रंगभूमीचे एक अभिरूप नाट्यदर्शन घडविण्यांत आले. १२३४५६ ०००

6

Pica Black No. 2 (333)

निर्णयसागर छापखान्याचे मालक कैलासवासी जावजी दादाजी हे आपल्या उद्योगाने व श्रमाने भरभराटीस आले होते. मुंबई काँग्रेस अधिवेशनांत कर्तृत्वपूर्ण मराठी रंगभूमीचे एक अभिरूप नाट्यदर्शन घडविण्यांत आले. ०००

7

Pica Italic (384)

मुंबई काँग्रेस अधिवेशनांत कर्तृत्वपूर्ण मराठी रंगभूमीचे एक अभिरूप नाट्यदर्शन घडविण्यांत आले. १२३४५६७८९० ०००

8

English No. 1

एका श्रीमंत गृहस्थाने आपल्या खजिन्यावर पाहारा करण्यास एक शिपाई ठेविला, मुंबई काँग्रेस अधिवेशनांत कर्तृत्वपूर्ण मराठी रंगभूमीचे एक अभिरूप नाट्यदर्शन घडविण्यांत आले. १२३४५६७८९ ०००

9

New Face 12 Point English No. 1

विश्वशांतीचे कटे पुरस्कर्ते होते आणि तिचा प्रसार करण्यासाठीच जणु त्यांचा अवतार होता. मुंबई काँग्रेस अधिवेशनांत कर्तृत्वपूर्ण मराठी रंगभूमीचे एक अभिरूप नाट्यदर्शन घडविण्यांत आले. १२३४५६७८९ ०००

NIRNAY SAGAR TYPEFACES

Nirnay Sagar Typefaces are known for there elegant and efficient devnagari typefonts.

In its twenty seven years of its existence Jaoji Dadaji type Foundry issued:

Tweleve Marathi fonts,

Fifteen Gujarathi fonts,

Fourty fonts of English headline types.

Nine typesetting machines were working in foundry. The press had printed and published

193 Sanskrit ,

228 Marathi titles of its own.

The press and foundry together had 250 workers. Raoji Ranoji Aru produced several Devnagari type fonts which still remain unsurpassed.

Book/Text faces issued by the Nirnay Sagar Type Foundry.

1. Marathi.

2. Marathi black

3. Long Primer (338)

4. Pica No.1 (334)

5. Pica black No. 1 (332)

6. Pica Black No. 2 (333)

7. Pica Italic (384)

10

Great Primer No. 1 (325)

थोडें नुकसान झालें तरी होवो पण खरा सरळपणा राहो असे ते वागत.
मुंबई काँग्रेस अधिवेशनांत कर्तृत्वपूर्ण मराठी रंगभूमीचे एक अभिरूप
नाट्यदर्शन घडविण्यांत आले. १ २ ३ ४ ५ ६ ७ ८ ९ ० ०००

11

Great Primer Black No. 1 (323)

रचिवर्मा चित्रकले, वर्णशलाकांस जावजी शेट ॥ १ ॥
मुंबई काँग्रेस अधिवेशनांत कर्तृत्वपूर्ण मराठी रंगभूमीचे
एक अभिरूप नाट्यदर्शन घडविण्यांत आले. १ २ ३
४ ५ ६ ०००

12

Great Primer Black No. 2 (324)

लोकांनी आपणांस चांगलें म्हणावें, आपली वाहवा व्हावी, अशी
साहजिकच इच्छा असते.... मुंबई काँग्रेस अधिवेशनांत कर्तृत्वपूर्ण
मराठी रंगभूमीचे एक अभिरूप नाट्यदर्शन घडविण्यांत आले.

13

Great Primer No. 3 (327)

‘वाद्रायणसंबंध’ हा शब्द अनेकदां येतो. ज्या गोष्टींचा संबंध मुळीच
नसतो, त्या गोष्टींचा संबंध.... मुंबई काँग्रेस अधिवेशनांत कर्तृत्वपूर्ण
मराठी रंगभूमीचे एक अभिरूप नाट्यदर्शन घडविण्यांत आले. १ २ ३

14

Great Primer Black No. 3 (469)

मुंबई काँग्रेस अधिवेशनांत कर्तृत्वपूर्ण मराठी रंगभूमीचे एक
अभिरूप नाट्यदर्शन घडविण्यांत आले. १ २ ३ ४ ५ ०००

15

One-Nick Great Primer (322)

मुंबई काँग्रेस अधिवेशनांत कर्तृत्वपूर्ण मराठी रंगभूमीचे
एक अभिरूप नाट्यदर्शन घडविण्यांत आले. १ २ ३ ४
५ ६ ७ ८ ९ ० ०००

16

One-Nick Great Primer Black No. 2 (321)

मुंबई काँग्रेस अधिवेशनांत कर्तृत्वपूर्ण मराठी रंग-
भूमीचे एक अभिरूप नाट्यदर्शन घडविण्यांत आले.

8. English No. 1

9. New Face 12 pt. English No. 1

10. Great Primer No. 1(325)

11. Great Primer Black No 1 (323)

12. Great Primer No 2 (324)

13. Great Primer No. 3 (327)

14. Great Primer Black No. 3 (469)

15. One Nick Great Primer (322)

16. One Nick Great Primer Black No. 2 (321)

The typeface used for analysis is Great Primer No. 3(327)

अ	फ	क	कु	क्षु	कू	कृ	क्य	पृ	स्त	१
इ	ब	ख	खु	खु	खू	कृ	हृ	स	स्थ	२
उ	भ	ग	गु	खु	खू	कृ	ळ	म	स	३
ऊ	म	घ	घु	खु	खू	कृ	तृ	प्र	स्म	४
ऋ	य	ङ	ङु	खु	खू	कृ	त्य	पु	स्य	५
ॠ	र	च	चु	खु	खू	कृ	त्त	फु	स्य	६
लृ	ल	छ	छु	खु	खू	कृ	त्र	फ	स्व	७
ॡ	व	ज	जु	खु	खू	कृ	ब	फु	ह	८
ॢ	श	झ	झु	खु	खू	कृ	त	वृ	ह	९
ॣ	ष	ञ	ञु	खु	खू	कृ	थ	ब	ह	०
ए	स	ट	टु	खु	खू	कृ	ध	भ	ह	.
।	ह	थ	थु	खु	खू	कृ	द	भ	ह	,
ि	ळ	द	दु	खु	खू	कृ	द	भृ	ह	;
क	क्ष	न	नु	खु	खू	कृ	द	भृ	ह	:
ख	श	प	पु	खु	खू	कृ	द	भृ	ह	-
ग		फ	फु	खु	खू	कृ	द	भृ	ह	(
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ङ		भ	भु	खु	खू	कृ	द	भृ	ह	?
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[illegible]

ANALYSIS

ANALYSIS

The typeface used for analysis is Great Primer No. 3(327)
The characters from an existing contact print negative of the Great Primer No. 3. are enlarged to 2.6 cm 'x' height for greater clarity in analysis .

The analysis done to study the details in design include

- structural analysis
- joinery analysis
- width analysis
- analytical study of characters
- width and height ratio of the characters
- width and stroke thickness ratio
- height and stroke thickness ratio of the font.

‘बादरायणसंबंध’ हा शब्द अनेकदां येतो. ज्या गोष्टींचा संबंध मुळीच नसतो, त्या गोष्टींचा संबंध....मुंबई काँग्रेस अधिवेशनात कर्तृत्वपूर्ण मराठी रंगभूमीचे एक अभिरूप नाट्यदर्शन घडविण्यांत आले. १ २ ३

STRUCTURAL ANALYSIS

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Groping of form similar characters. The structural analysis concluded at 20 main classifications.

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ट ट व्य ह

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JOINERY ANALYSIS

A single character is a combination of primary strokes like horizontal, vertical, diagonal, curve.

The characters are classified in to different groups according to the manner its strokes are formed. Devnagari characters have a horizontal top line called 'Shirorekha' (common stroke in all the characters)

The joinery analysis concludes in 19 classifications (as seen in the following charts.)

JOINERY ANALYSIS

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WIDTH ANALYSIS

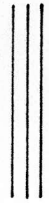
Characters are classified according to the width of the characters (measuring the horizontal space needed for individual characters)

This in turn renders each character proportionately to the form legible in perception.

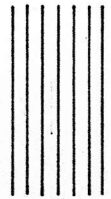
Width analysis is done by taking the 'x' height of the character 2.6 cm.

The font is thereby categorised under 25 set widths.

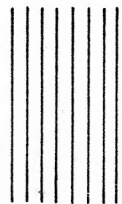
WIDTH ANALYSIS



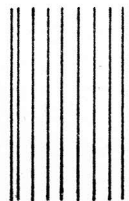
0.4 cm



1.2 cm

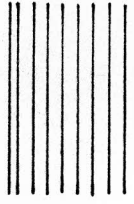


1.4 cm



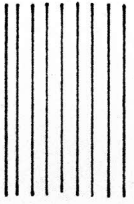
1.45 cm





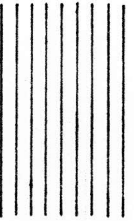
1.5 cm

ब न



1.55 cm

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1.6 cm

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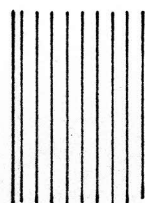
ध म य



1.6 cm

घ

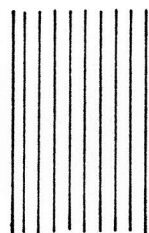
ङ



1.7 cm

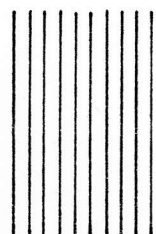
ठ

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1.75 cm

ह



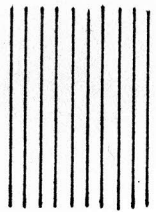
1.8 cm

ए

ण

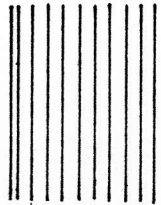
द

स



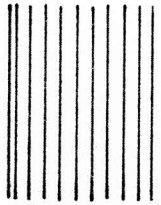
1.8 cm

ज न



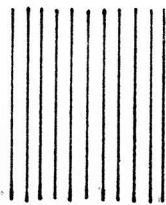
1.9 cm

अ उ च छ श



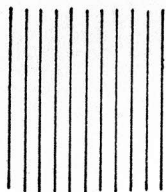
1.95 cm

ल



2.0 cm

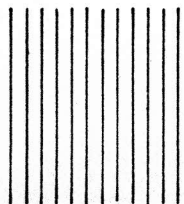
ड ञ फ क्ष



2.1 cm

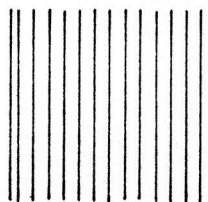
क

क



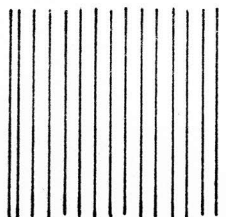
2.2 cm

ख



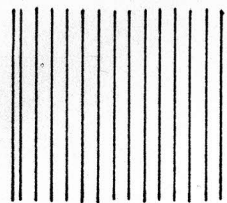
2.7 cm

ल

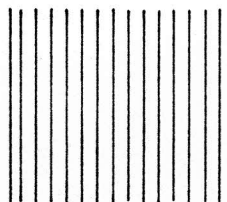


2.5 cm

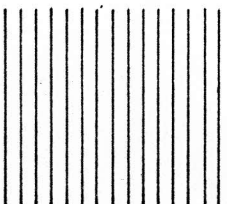
ल



2.7 cm

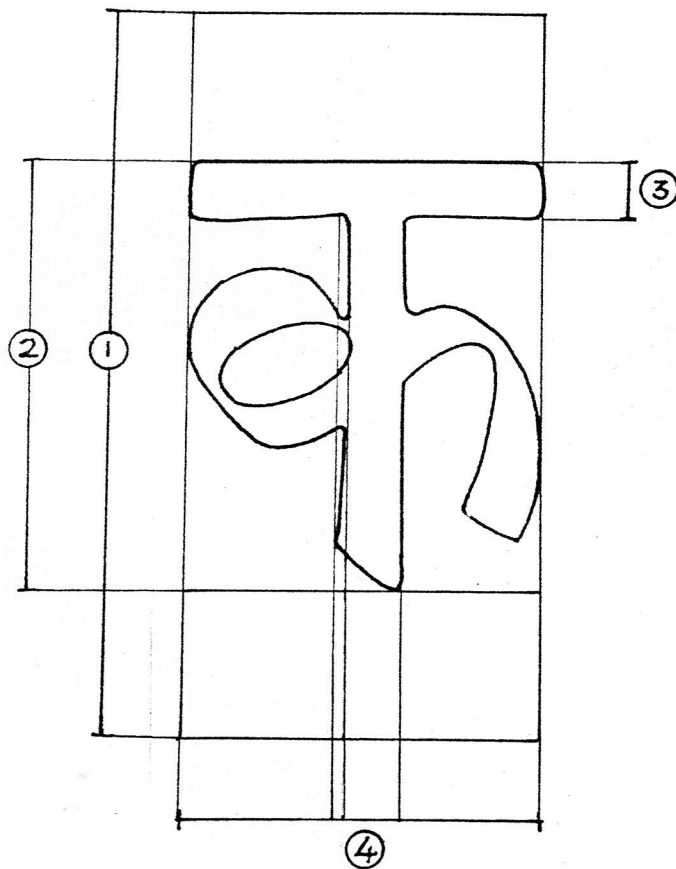


2.75 cm



3.0 cm





ANALYTICAL STUDY

- ① The 'x' height of the character is taken as 2.6 cm.
- ② The body height ie. Incorporating the ascender 'Matrarekha', 'x' height and the descender 'Rukarrekha' is 4.5 cm.

- ③ Stroke thickness,
Horizontal stroke thickness is 0.3 cm

Being a calligraphic typeface ie. thick and thin stroke.
The maximum stroke thickness at curves is 0.4 cm and the minimum stroke thickness is 0.2 cm.

- ④ Vertical stroke thickness At the place where the vertical stroke is attached to the top line 'shirorekha' the stroke thickness is 0.3 cm.

At the bottom free end of the vertical stroke the stroke thickness is 0.4 cm.

The right side perpendicular to the top line and the stroke thickens on the left side of the stroke.

In order to define the weight of the typeface the following criterias were considered

1. height of the character
2. weight of the character
3. stroke thickness (average 0.3 cm)
4. Height and width ratio
5. Stroke thickness to weight ratio
6. Stroke thickness to height ratio.

The analytical study is done to research into the proportions of the individual characters.

To find out the ratio of width relationship of vertical and horizontal stroke thickness with the set width and the 'x' height respectively. The above is very minutely considered in the Nirnay Sagar Fonts.

ANALYTICAL STUDY

Tabulation chart according to the approx. 'x' height 2.6 cm

No.	Character	Height of the letter	Width of the letter	Height of the letter : Width of the letter	Stroke thickness : Height of the letter	Stroke thickness : Width of the letter
1	अ	2.5	1.9	1: 0.7	1: 8.3	1: 6.3
2	इ	3.0	1.6	1: 0.5	1: 10.0	1: 5.3
3	उ	2.4	1.9	1: 0.7	1: 8.0	1: 6.3
4	ऊ	2.4	1.9	1: 0.7	1: 8.0	1: 6.3
5	ऋ	2.5	1.2	1: 1.2	1: 8.3	1: 9.3
6	ॠ	2.6	3.0	1: 1.1	1: 8.6	1: 10.0
7	ल	2.5	2.7	1: 1.0	1: 8.3	1: 9.0
8	ॡ	2.8	2.5	1: 0.9	1: 9.3	1: 8.5
9	ए	3.0	1.8	1: 0.6	1: 10.0	1: 6.0
10	।	2.6	0.4	1: 0.1	1: 8.6	1: 1.3
11	क	2.6	2.1	1: 0.8	1: 8.6	1: 7.0
12	ख	2.6	2.2	1: 0.8	1: 8.6	1: 7.3
13	ग	2.6	1.6	1: 0.6	1: 8.0	1: 5.3
14	घ	2.6	1.6	1: 0.6	1: 8.6	1: 5.5
15	ङ	2.2	2.0	1: 0.9	1: 7.3	1: 6.6
16	च	2.6	1.9	1: 0.7	1: 8.6	1: 6.3
17	छ	2.3	1.9	1: 0.8	1: 7.6	1: 6.3
18	ज	2.6	1.8	1: 0.7	1: 8.6	1: 6.1

No.	Character	Height of the letter	Width of the letter	Height of the letter : Width of the letter	Stroke thickness : Height of the letter	Stroke thickness : Width of the letter
19	झ	2.6	1.6	1 : 0.6	1: 8.6	1 : 5.3
20	ञ	2.6	2.0	1: 0.7	1: 8.6	1: 6.6
21	ट	2.2	1.6	1: 0.7	1: 7.3	1: 5.3
22	ठ	2.4	1.7	1: 0.7	1: 8.0	1: 5.6
23	ड	2.2	1.6	1: 0.7	1: 7.3	1: 5.5
24	ढ	2.3	1.5	1: 0.6	1: 7.6	1: 5.1
25	ण	2.5	1.8	1: 0.7	1: 8.3	1: 6.0
26	त	2.6	1.5	1: 0.5	1: 8.6	1: 5.1
27	थ	2.6	1.6	1: 0.6	1: 8.6	1: 5.3
28	द	2.8	1.8	1: 0.6	1: 9.3	1: 6.0
29	ध	2.6	1.6	1: 0.6	1: 8.6	1: 5.3
30	न	2.6	1.5	1: 0.5	1: 8.6	1: 5.0
31	प	2.5	1.2	1: 0.4	1: 8.3	1: 4.0
32	फ	2.6	2.0	1: 0.7	1: 8.6	1: 6.6
33	ब	2.5	1.5	1: 0.6	1: 8.3	1: 5.0
34	भ	2.5	1.7	1: 0.6	1: 8.3	1: 5.6
35	म	2.6	1.6	1: 0.6	1: 8.6	1: 5.3
36	य	2.6	1.6	1: 0.6	1: 8.6	1: 5.3
37	र	2.6	1.5	1: 0.5	1: 8.6	1: 5.6
38	ल	2.4	1.9	1: 0.8	1: 8.0	1: 6.4

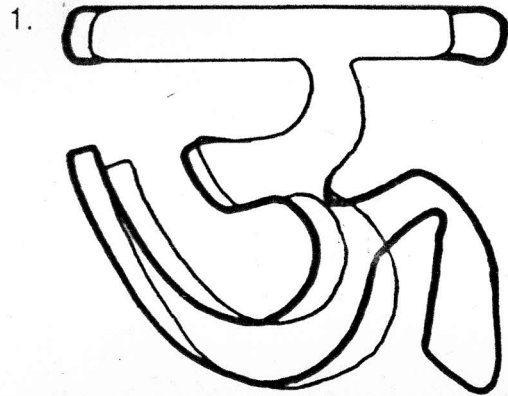
No.	Character	Height of the letter	Width of the letter	Height of the letter: Width of the letter	Stroke thickness: Height of the letter	Stroke thickness: Width of the letter
39	व	2.6	1.4	1: 0.5	1: 8.6	1: 4.8
40	श	2.6	1.9	1: 0.7	1: 8.6	1: 6.3
41	ष	2.6	1.4	1: 0.5	1: 8.6	1: 4.6
42	स	2.6	1.8	1: 0.6	1: 8.6	1: 6.0
43	ह	2.9	1.7	1: 0.6	1: 9.6	1: 5.8
44	ळ	2.1	2.1	1: 1.0	1: 7.0	1: 7.0
45	क्ष	3.0	2.0	1: 0.6	1: 10.0	1: 6.6
46	ज्ञ	3.0	1.8	1: 0.6	1: 10.0	1: 6.1

The analytical study is done to research into the proportions of the individual characters.

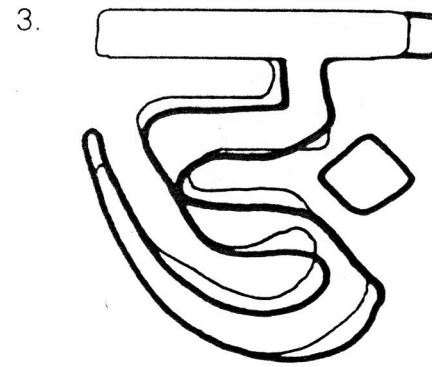
To find out the ratio of width relationship of vertical and horizontal stroke thickness with the set width and the 'x' height respectively. The above is very minutely considered in the Nirnay Sagar Fonts.

Minute form detailing in similar structure characters.

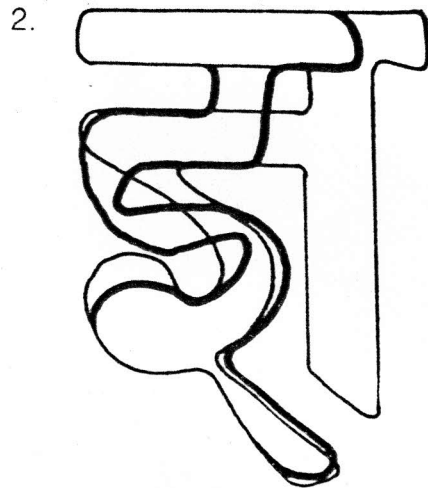
Similar structured characters are compared to study the subtle changes in their individual forms.



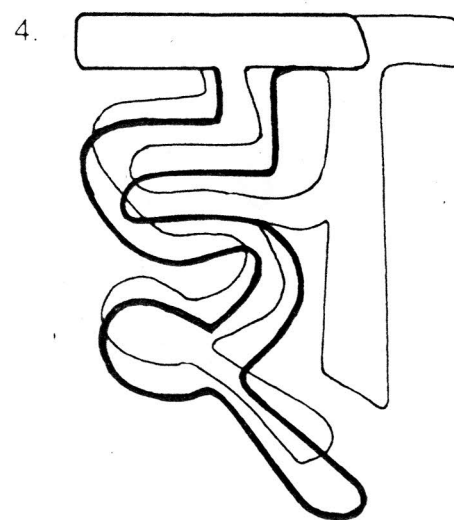
- Due to the supplementary end stroke (॒) of (क॒) the lower curvilinear stroke of the main body is shifted to the left.
- The end point of the lower curvilinear stroke of (क॒) is extended upward to balance the supplementary stroke.
- horizontal top line of the character (क॒) is longer than (क) to support the extended character.



- The lower curve of (ख॒) is shifted below to incorporate the dot in the character.
- To balance the dot the end stroke is extended upward and ends in a tapering point rather than blunt edge as in (ख)
- The upper vertical and curvilinear stroke (ख॒) is joined at a diagonal (slant) to incorporate the dot.

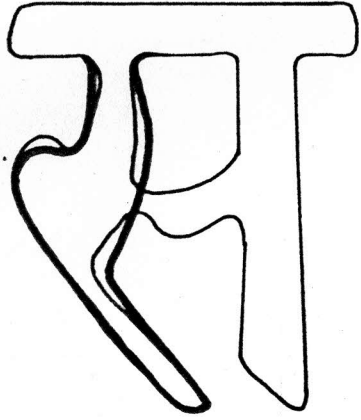


- Due to the horizontal stroke (॒) of (झ॒) which is parallel to the top line, the curvilinear stroke joins the horizontal stroke at a diagonal angle.
- The lower curvilinear stroke is shifted to the left and the node which joins the curvilinear and the diagonal stroke in (झ॒) is shifted upwards to fit in the pre-set 'x' height.



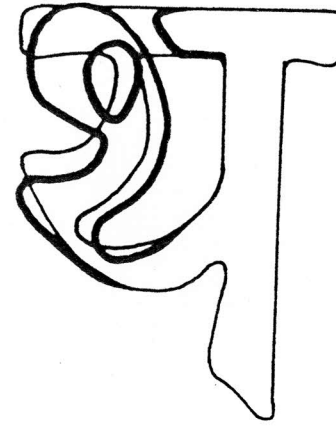
- The character 'झ॒' is smaller than the character (झ) because of the vertical stroke in the character (झ॒)
- (झ॒) being a vowel and a singular letter can extend below 'x' height. But (झ) being a consonant has to limit itself to the 'x' height.
 - To balance the vertical stroke that ends only to the 'x' height.

5.



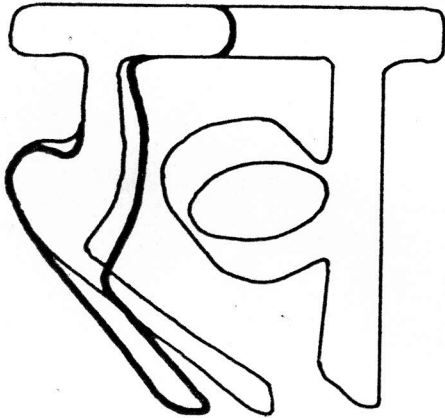
- (स) having a supplement vertical stroke the (र) form in (स) is thinner to retain optimum counter space in relation to the width of the letter.
- To balance in this detail the node in (स) is shifted upward.

7.



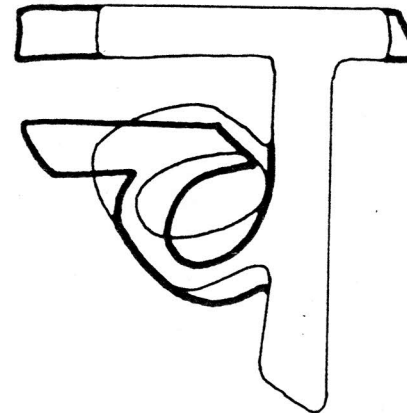
- The upper curve of (श) is shifted below to incorporate the starting small loop
- The upper curvilinear vertical stroke is shifted below and therefore joins the curvilinear horizontal stroke at a thinner width than (य)
- The starting loop of (श) takes the place of the horizontal top line.

6.



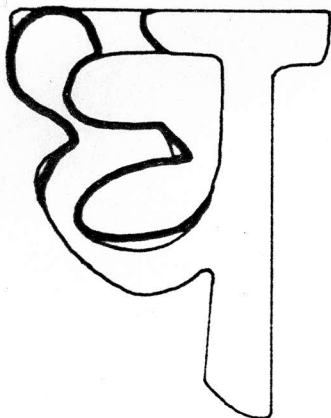
- The (र) form in (ख) is thinner from the right side to incorporate the (व) form.
- In order to bind both the elements together in (ख) the diagonal end stroke of (र) in (ख) gets closer to the (व) form.
- The node joining the curvilinear stroke and the diagonal stroke in (स) flattens to counter with the change in the angle.

8.



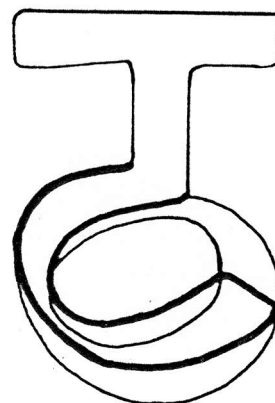
- The angle of the curvilinear stroke in (च) is bend lower than (व) a. To retain the legible counter form and b. To balance the horizontal stroke.

9.



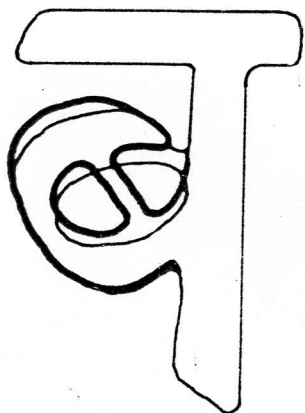
- a. Since the counter space of (घ) is not joined to the top line 'shirorekha' it visibly gives a larger counter than (घ), rendering the form of the (घ) character weak.
- b. To counteract this the lower curvilinear stroke of (घ) is shifted slightly upward.

11.



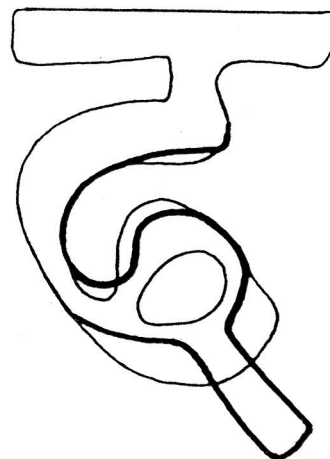
- a. The lower curvilinear stroke of (घ) takes a dipped lower curve to open the closed counter of the total form of the character (घ).

10.



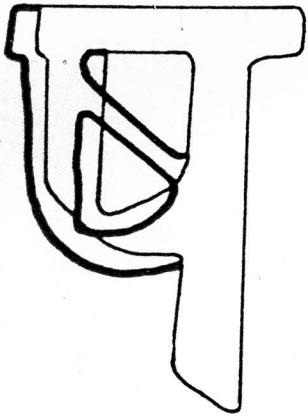
- a. The curvilinear stroke in (घ) is shifted upward to balance the diagonal stroke in the closed curvilinear stroke.
- b. The top of the curvilinear stroke is not attached to the vertical stroke, for open counter space.
- c. This retains the optimum counter space for legibility of the character, and avoids the ink blotching when printed.

12.

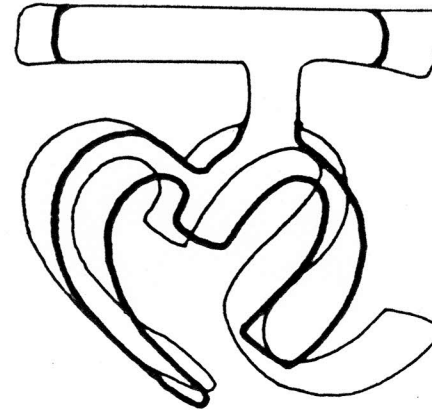


- a. To accommodate the additional (ॡ) form in the character (घ) the upper curvilinear stroke is slightly shifted upwards.
- b. The outer edge of the lower loop of (घ) is shifted inside to balance the counter form.

13.

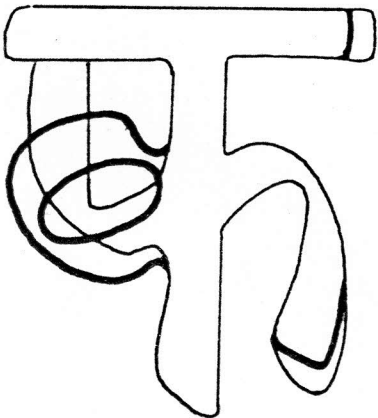


- a. The curvilinear stroke in (ॐ) is opened out from the left and bottom side of the character to attain the optimum counter space
- b. Joinery of the diagonal stroke in (ॐ) are thinned inside to achieve legibility and counter ink deposition.

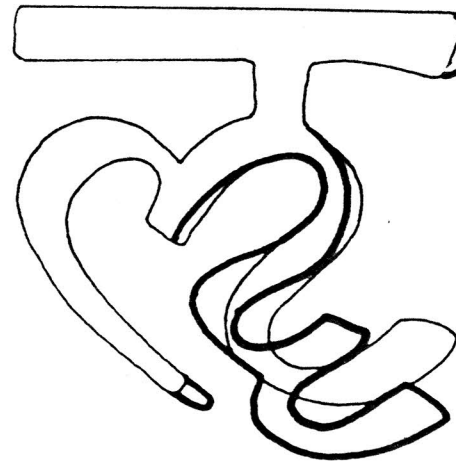


- a. The lower body of the character (ॐ) is shifted to the left to accomodate the extended curvilinear end stroke and thus retain the balance of the total form.

14

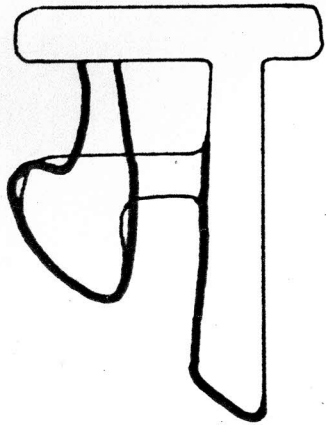


- a. The left side of (ॐ) is vertical closed form, this is balanced by extending the right stroke lower and end in a tapering slant.



- a. The end stroke of (ॐ) has two curvilinear strokes. To fit the character in the specified width the first of the two end curvilinear strokes (ॐ) is shifted to the left .
- b. The starting curvilinear stroke (ॐ) of the character (ॐ) is shifted below, to balance the two end curvilinear strokes.

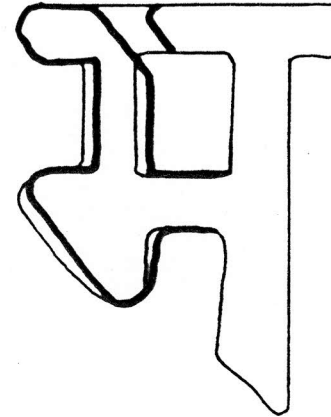
17.



The small nodule which makes the loop of (श) and (ष) lie in the same spot.

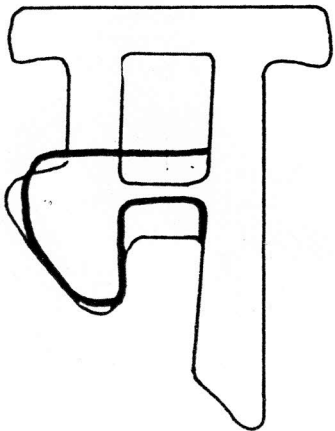
- a. The nodule of (श) is slightly thinned inward to attain an open counter space and to balance the visible weight of the nodule.

19.



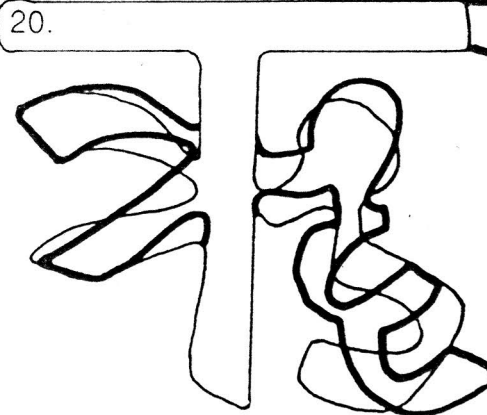
- a. To counteract the opened form in (श) the vertical stroke is shifted inside.

18.



- a. The lower horizontal stroke of (ष) is shifted below to open the counter space as it is enclosed by two horizontal and vertical strokes.
- b. To avoid ink blotch the angle of the nodule is slanted in (ष).

20.



- a. To accomodate the larger extention (ॡ) the nodule form on the right is shifted upward.
- b. To accomodate this change in form the left strokes (ॡ) are slanted downward and the joining point is shifted upwards.

CONCLUSION

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In the structural similar characters subtle changes are seen in individual strokes forming the characters considering the balance and the legibility of the characters.

To avoid extra ink deposition in the niches of the characters, the strokes slightly taper inside at the joineries.

The strokes are redefined outwardly to increase the counter space in closed counter character and vice versa.

The end of the vertical stroke is thickened at the lower edge to counter the visible weight of the continuous top line 'shirorekha'.

REFERENCES

1. Bobst Graphic Hass Unica ; BG Types special issue,
Nov 10 Sept 1980.
2. Kulkarni P.B.; Biography of Jaoji Dadaji Chaudhari
Nirnay Sagar Akshar Sadhana.
3. Lele Manisha; Concepts of primitives in major Indian
languages, Seminar project. Batch 1987- 89
3. Naik Baburao; Typography of Devnagari.
4. Nirnay Sagar negatives - Great Primer No.3.
5. Prakash Rajeev; Designing a bold typeface in
Devnagari along with its promotional material, V.C.
project III

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