Invisible hands: tracing the origins and development of the Linotype Devanagari digital fonts

Journal of the Printing Historical Society

Fiona Ross, 'Invisible hands: tracing the origins and development of the Linotype Devanagari digital fonts'. *Journal of the Printing Historical Society*, Third series no. 2, 2021, pp. 111-153.

ACKNOWLEDGEMENTS

This article was written as part of the 'Women in Type' research project, hosted by the University of Reading and funded by the Leverhulme Trust, to whom I wish to express my gratitude for enabling this research. I also wish to express my sincere thanks to the support of all those named within the article, to my research colleague Alice Savoie, and to the Printing Historical Society, especially Paul Nash, for including my essay in this handsome publication.

Invisible hands: tracing the origins and development of the Linotype Devanagari digital fonts[1]

Fiona Ross

In the twenty-first century there is now greater recognition, at least in the field of textual communication, that scripts other than Latin are used by the majority of the world's population. One such script is Devanagari, a Brahmi-derived script employed by some 400 million users[2] for writing Hindi, Marathi, Rajasthani and Nepali as well as Sanskrit and other languages. Its typographical rendition in print through the use of movable metal type dates back to 1771 in Rome with the publication of the *Alphabetum Brammhanicum*,[3] whose rather crude letter-shapes were drawn by unnamed Indian converts. This was followed by initiatives in India, on continental Europe and in Britain, for example in the work of Charles Wilkins (1749–1836).[4]

The true authorship of typographical letterforms that have affected and continue to affect the quotidian reading experience in different scripts for innumerable people has proved time and again to be inaccurate or elusive – either unwittingly or deliberately – even into the digital era.[5] Yet historical enquiry has provided a deeper understanding of type-design and type-making processes and the realisation that the final visible result often relies on the concomitant activities of many hands.

Such activities include the frequently overlooked role of type-drawing offices during the twentieth century, which were often staffed principally by women, and which operated in concert with the rarely recorded decisions and actions of key participants that affected the design outcomes.[6] An insight into the multifarious contributions of seemingly invisible hands in the design process and the consequent impact on typographical history is afforded by tracing the origins and development of the Linotype Devanagari digital fonts that were published in the early 1980s, which continue to be familiar to many millions of readers in the twenty-first century.

1. This essay adopts the practice of using 'font' for a film or digital typeface, and 'fount' for a set of pieces of cast metal type.

2. See Vaibhav Singh, 'Devanagari type in the twentieth century: motivations, imperatives, technology and the design process', unpublished Ph.D. thesis, University of Reading, 2017, fig. 1.

3. Amaduzzi, Giovanni Christoforo, editor, *Alphabetum Brammhanicum seu indostanum universitatis Kasi* (Romae: Typis Sac. Congregationis de Propag. Fide, 1771).

4. See G. W. Shaw, 'Printing in Devanagari: the evolution of types in Devanagari script', *The Monotype recorder*, new series 2 (1980), p. 20; and B. S. Naik, *Typography of Devanagari* (3 volumes, Bombay: Directorate of Languages, 1971), p. 239.

5. See Fiona Ross, 'Two Bengali grammars – a typographic perspective', https://www.bl.uk/early-indian-printed-books/articles/two-bengali-grammars-a-typographic-perspective; and see below, p. 150.

6. See Alice Savoie, 'The women behind Times New Roman: the contribution of type drawing offices to twentieth century type-making', *Journal of design history* 33:3 (2020), pp. 209–224.

Fig. 1. *Javajī Dadajī Type Foundry, Marathi, Sanskrit, Hindi type catalogue* (Mumbai, 1967), front cover. Reduced from 137 × 224 mm. **NB** Unless otherwise noted, all images in this article are taken from originals in the Non-Latin Type Collection at the University of Reading.

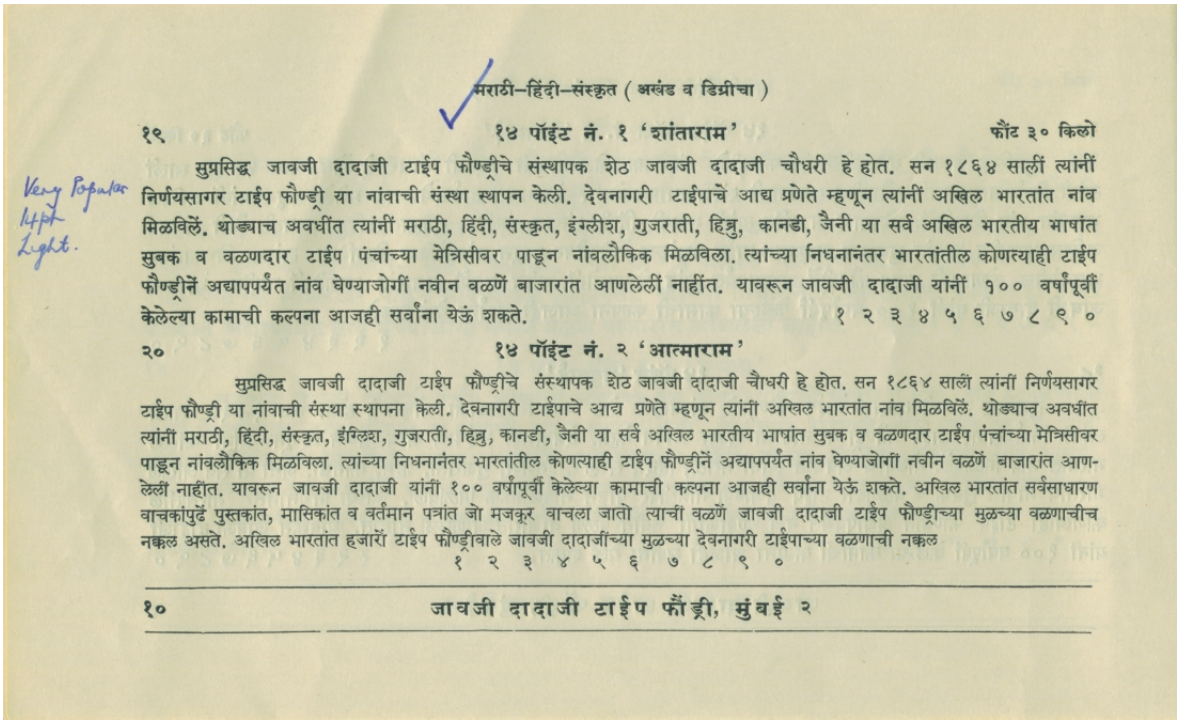
SETTING PRECEDENTS

The impetus to render languages in the Devanagari script through typographical means originated from evangelical and political forces external to South Asia, and may be seen in such eighteenth-century types as those of the Propaganda Fide and of Charles Wilkins. But its first truly successful translation into metal type was effected by an autochthonous Indian typefoundry, the Javajī Dadajī Type Foundry, established in Bombay in 1864,[7] and evinced through the works of its accompanying Nirnaya Sagar Press established in 1869 (Fig. 1 and 2). The Devanagari script required particular typesetting techniques to ensure an effective, readable textual outcome. It is known that the founts employed by the Nirnaya Sagar Press adopted the 'Degree' system of composition which utilised small components particularly for vowel-signs, so that some characters had to be made up of multiple smaller type-units (see Fig. 3). Unless carefully composed and locked up in the forme, the type had a tendency to become dislodged and move or drop out during printing. In 1963 the Nirnaya Sagar Devanagari typefaces are recorded to have comprised some 600 different type-units[8] to serve, as stated in the foundry's 1967 type-specimen, the needs of the Hindi, Marathi and Sanskrit languages, thereby occupying many type-cases for high-quality book work.[9]

7. This foundry continued beyond the founder Javajī Dadajī Choudhary's death in 1892; for further biographical information see Naik (1971, note 4), pp. 309–312. Although cast by the foundry, the types are usually referred to as Nirnaya Sagar types, a practice that is followed here.

8. '600 sorts' (Naik (1971, note 4), p. x). Naik later (pp. 341–342) gives the standard figures for the Degree system as approximately '400 sorts', and the Akhand system as over 600.

9. At considerable cost, as up to seven cases of type in one size would be needed; see Norman Ellis, 'Indian



मराठी–हिंदी–संस्कृत (अखंड व डिग्रीचा)

१९ १४ पॉइंट नं. १ 'शांताराम' फॉंट ३० किलो

Very Popular 14pt Light.

सुप्रसिद्ध जावजी दादाजी टाईप फौण्ड्रीचे संस्थापक शेठ जावजी दादाजी चौधरी हे होत. सन १८६४ सालीं त्यांनीं निर्णयसागर टाईप फौण्ड्री या नांवाची संस्था स्थापन केली. देवनागरी टाईपाचे आद्य प्रणेते म्हणून त्यांनीं अखिल भारतांत नांव मिळविलें. थोड्याच अवधींत त्यांनीं मराठी, हिंदी, संस्कृत, इंग्लीश, गुजराती, हिब्रु, कानडी, जैनी या सर्व अखिल भारतीय भाषांत सुबक व वळणदार टाईप पंचांच्या मेत्रिसीवर पाडून नांवलौकिक मिळविला. त्यांच्या निधनानंतर भारतांतील कोणत्याही टाईप फौण्ड्रीनें अद्यापपर्यंत नांव घेण्याजोगीं नवीन वळणें बाजारांत आणलेलीं नाहींत. यावरून जावजी दादाजी यांनीं १०० वर्षांपूर्वीं केलेल्या कामाची कल्पना आजही सर्वांना येऊं शकते. १ २ ३ ४ ५ ६ ७ ८ ९ ०

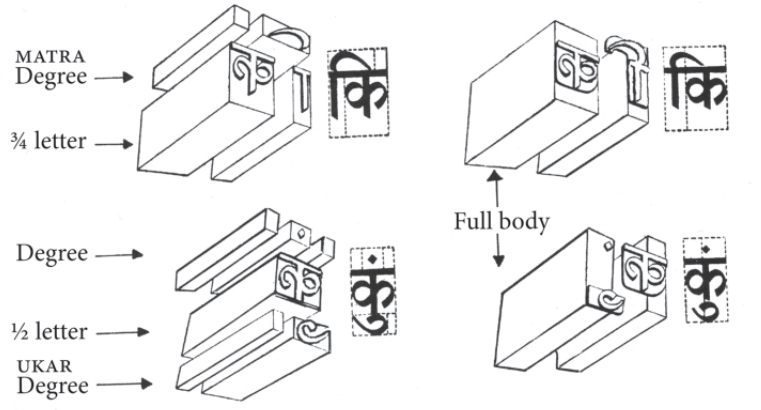
२० १४ पॉइंट नं. २ 'आत्माराम'

सुप्रसिद्ध जावजी दादाजी टाईप फौण्ड्रीचे संस्थापक शेठ जावजी दादाजी चौधरी हे होत. सन १८६४ सालीं त्यांनीं निर्णयसागर टाईप फौण्ड्री या नांवाची संस्था स्थापना केली. देवनागरी टाईपाचे आद्य प्रणेते म्हणून त्यांनीं अखिल भारतांत नांव मिळविलें. थोड्याच अवधींत त्यांनीं मराठी, हिंदी, संस्कृत, इंग्लिश, गुजराती, हिब्रु, कानडी, जैनी या सर्व अखिल भारतीय भाषांत सुबक व वळणदार टाईप पंचांच्या मेत्रिसीवर पाडून नांवलौकिक मिळविला. त्यांच्या निधनानंतर भारतांतील कोणत्याही टाईप फौण्ड्रीनें अद्यापपर्यंत नांव घेण्याजोगीं नवीन वळणें बाजारांत आणलेलीं नाहींत. यावरून जावजी दादाजी यांनीं १०० वर्षांपूर्वीं केलेल्या कामाची कल्पना आजही सर्वांना येऊं शकते. अखिल भारतांत सर्वसाधारण वाचकांपुढें पुस्तकांत, मासिकांत व वर्तमान पत्रांत जो मजकूर वाचला जातो त्याचीं वळणें जावजी दादाजी टाईप फौण्ड्रीच्या मुळच्या वळणाचीच नकल असते. अखिल भारतांत हजारों टाईप फौण्ड्रीवाले जावजी दादाजींच्या मुळच्या देवनागरी टाईपाच्या वळणाची नकल

१ २ ३ ४ ५ ६ ७ ८ ९ ०

१० जावजी दादाजी टाईप फौंड्री, मुंबई २

Above: **Fig. 2**. Annotated specimen of 'Very popular 14 point light', known as the Nirnaya Sagar typeface. *Javajī Dadajī Type Foundry, Marathi, Sanskrit, Hindi type catalogue* (Mumbai, 1967), p. 10. Reduced from 137 × 224 mm.



Left: **Fig. 3**. Degree (left) and Akhand (right) systems of composition (based on an illustration in B. S. Naik, *Typography of Devanagari* (Bombay: Directory of Languages, 1965)).

The alternative 'Akhand' system relied on kerned elements to allow characters to be assembled (see Fig. 3), but still required over 600 individual characters and character elements for Devanagari composition.[10] Neither system of composition was attainable for the mechanical typesetting which was introduced into colonial India for the Devanagari script in the 1930s. The 'inauguration of the Devanagari Monotype machine,' the result of a commercial undertaking involving the exertions of key figures across three continents, took place in Poona in 1932;[11] while the Devanagari

typography', *The Carey exhibition of printing and fine printing: the National Library, Calcutta* (edited by B. S. Kesavan, Calcutta: Government of India Press, 1955), p. 11.

10. See note 8.

11. See Vaibhav Singh's excellent account of its development: 'The first Indian-script typeface on the Monotype …', *Journal of the Printing Historical Society*, new series 29 (Winter 2018), pp. 37–70.

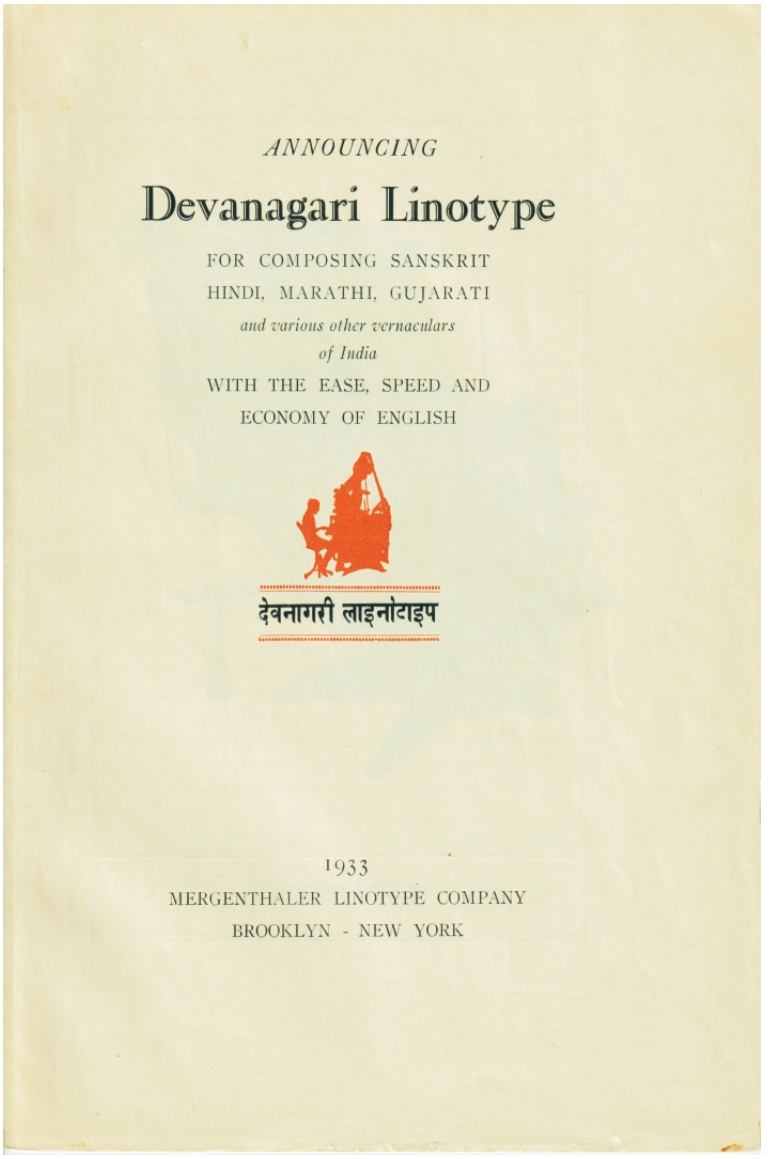


Fig. 4a. *Announcing Devanagari Linotype* (New York: Mergenthaler Linotype Company, 1933), front cover. Reduced from 265 × 193 mm.

Linotype machine – the product of another trans-continental enterprise[12] – was launched in Calcutta (now Kolkata) in 1933 (Fig. 4a and 4b). The Monotype machine,[13] developed by the Monotype Corporation in the UK, which employed a form of the Akhand system[14] was preferred over the Linotype for good quality work in the Devanagari script, yet it could not meet the exacting standards that Monotype set out:

> However ingenious a machine may be, whatever the speed it may attain in composition, quality in printing surface and facility of correction are essential features of its practical utility. No machine

12. Involving disparately-located Linotype companies: Linotype & Machinery Ltd, England; Linotype & Machinery Ltd branch offices in Calcutta and Bombay; Mergenthaler Linotype Company, USA. The Devanagari Linotype comprised a modified Linotype machine fitted with a Devanagari keyboard and channels of different sizes customised to compose Devanagari vowel-marks and special symbols.

13. The Monotype machine actually comprised two units, a keyboard and a caster; see F. G. E. Ross, *The printed Bengali character and its evolution* (Surrey: Curzon Press, 1999), pp. 162–163.

14. Introduced with the help of 'Sankerrao Date' (Shankar Ramchandra Date). See Gopal Krishna Modi, 'The Devanagari system of types', *7th conference, All India Type Founders Federation* (Calcutta: All India Type Founders Federation, 1982), p. 8.

Fig. 4b. Page showing the Linotype machine for Devanagari from *Announcing Devanagari Linotype* (New York: Mergenthaler Linotype Company, 1933). Reduced from 265 × 193 mm.

> that is devised to do what previously was done by hand can be looked upon as correct in principle or perfect in adaptation, unless it maintains equal quality and greatly increased quantity of production. In such a degree as the machine lowers the standards created by the slow evolution of manual methods, it must be pronounced a failure.[15]

Indeed, Monotype could not meet its criterion of producing Devanagari type that was indistinguishable from foundry type: the Monotype matrix-case for each typeface could only accommodate a maximum of 255 characters.[16] Furthermore, the character

15. 'The Lanston machine for casting and setting single type in perfectly spaced lines', cited in *The Monotype recorder* 39: 1 (1949), p. 16.

16. Lawrence Wallis, 'Monotype time check', *The Monotype recorder: one hundred years of type making* 1897–1997 (Redhill: Monotype Corporation, 1997), p. 4.

proportions were somewhat constrained by their necessary adaptation to the relative-unit system.[17] In a region where labour for hand-setting was not in short supply, the Monotype machine did, however, gain in popularity through the casting component of the machine, which was utilised extensively throughout the Indian subcontinent as a faster means of casting type into case for hand-composition.[18] By 1984 it was recorded that India possessed a greater number of Monotype hot-metal machines than any other country.[19]

The implementation of the Devanagari script on the Linotype composing machine, initiated in America by Hari G. Govil[20] approaching the Mergenthaler Linotype Company (MLCo), was heralded as facilitating speedy newspaper composition (and thus dissemination) that would ideally, for the Indian vernacular press, match that of the 'English dailies'.[21] However, the Linotype could employ neither the Degree nor the Akhand system and possessed no facility for kerning (allowing part of one character to overhang or interlock with another) – a distinctive handicap for most Indian scripts, particularly with regard to the representation of all the required vowel-sounds. Unlike the Monotype system that resulted in the casting of individual types, the line-casting system produced stable lines which could more-easily be arranged into pages for stereotyping (to make the curved plates for rotary printing favoured by the newspaper industry).[22] Yet the Linotype was severely constrained by its ninety-channel keyboard, which permitted only a limited set of matrices in the main magazine.[23] This limit of ninety characters per typeface could be augmented by a side-magazine of auxiliary characters, but the latter was expensive and slowed down the composing process – a factor antithetical to the exigencies of rapid newspaper production (see Fig. 5).[24]

17. See Ross (1999, note 13), pp. 163–164.

18. The Monotype-cast types wore more quickly due to the softer metal, and the kerns and interlocking parts prevalent in Indian-script composition suffered from the pressure exerted by the presses. According to David Saunders, Monotype's recommendations to strengthen the types by using '10% tin, 10% antimony, 80% lead' were often ignored by 'some printers in India'; see Ross (1999, note 13), pp. 177–178.

19. See Fiona Ross, 'From metal type to digital letterforms: a straightforward transition?' *Matrix* 9 (1989), pp. 128–136, at page 132; and John Randle 'The development of the Monotype machine', *Matrix* 4 (1984), pp. 42–53, at page 47.

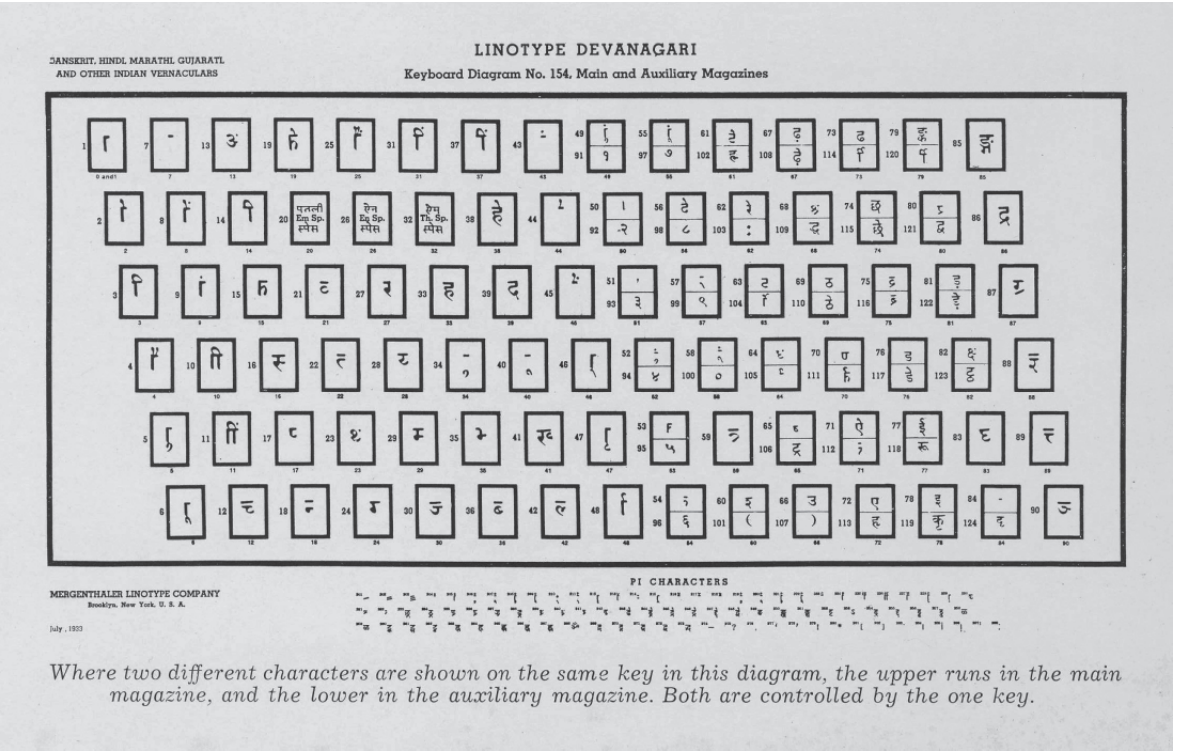
20. Hari G. Govil was a graduate of Benaras University who moved to America in 1920. Naik (1971, note 4), p. 401.

21. In 1916 it was stated that the Linotype 'class of machine, a machine that casts a slug or line of type from a line of previously assembled and justified matrices at a single operation of casting, is still the most important factor in newspaper printing throughout the world.' (J. A. Legros and J. C. Grant, *Typographical printing-surfaces: the technology and mechanism of their production* (London: Longmans Green and Co., 1916), p. 422). Here was meant English-language daily newspapers such as *The Hindu, The Indian express* and *The times of India*; see K. S. Vijayapaliah, *Introduction of Kannada on the typewriter, Linotype and Monotype* (Bangalore: Government Press, 1954), p. 3. See also Singh (2018, note 11), p. 38, note 6.

22. The robustness of Linotype-set matter was a significant advantage for printing Indian-script composition; see Ross (1999, note 13), pp. 137–138. In 1930s Bengal, printing the Bengal electoral rolls was also a key driver for implementing an Indian script on such equipment (*ibid.*, p. 148).

23. In addition, duplexed matrices meant that the Light and Bold characters had to be of the same width.

24. Hence the attention Linotype paid to keyboard revisions by *The times of India*'s Composing Room Superintendent, K. A. G. Krishnan, who was 'keeping record of all operator suggestions re placement of characters' to improve composing speeds by thirty percent (N. Balasubramanian to W. Tracy *et al.*, 14 October 1963, Tracy correspondence files, the Non-Latin Type Collection (hereafter referred to as 'NLTC'), University of Reading, file 25. A letter from W. Tracy to M. Parker confirms that three orders according to the new scheme, 'are to consist of 90-channel layout characters plus pi sorts [pi-characters] as specified. In no case is there any side magazine.' (31 August 1964, NLTC, file 25).



Where two different characters are shown on the same key in this diagram, the upper runs in the main magazine, and the lower in the auxiliary magazine. Both are controlled by the one key.

Fig. 5. Linotype Devanagari keyboard diagram from *Keyboard operation: Devanagari Linotype, for composing Sanskrit, Hindi, Marathi, Gujarati & other vernaculars of India* (New York: Mergenthaler Linotype Company, 1933). Courtesy of Vaibhav Singh. Reduced from 140 × 215 mm.

Nonetheless, the quality of the types and hand-composition at the Nirnaya Sagar Press was used as a benchmark by which to evaluate the unavoidably inferior composition afforded by hot-metal typesetting, as is clear from documents held in the Linotype archives variously situated in Britain and America.[25] Although Govil's initial sketches for Linotype Devanagari were, perhaps literally, drawn from or at least inspired by Nirnaya Sagar types, the sheer necessity of drastically reducing the customary foundry character-set required the deconstruction of many characters into separate components with which, in the linear setting of the Linotype, to construct alternative versions of the original type-forms.[26] Furthermore, the machine's inability to kern led Govil to adopt a radical approach to the treatment of the vowel-signs in order to approximate their gracefully-fitting Nirnaya Sagar counterparts.

Criticism of the resulting Linotype-set printed matter and mention of the superior aesthetics of the typefaces used by the Nirnaya Sagar Press repeatedly punctuate the inter-continental correspondence between the parties interested in the development of mechanical composition for the Devanagari script.[27] Linotype Devanagari, as the typeface was inevitably named, which in its hot-metal guise had two distinct styles, underwent a number of revisions over the

25. Principally at the University of Reading and the Smithsonian Institution, Washington.

26. Govil's system for splitting Devanagari characters for the Linotype is said to have been based on the work of Lokmanya Tilak. Naik (1971, note 4), p. 401.

27. For example, W. Tracy to A. C. Bridgman, 6 December 1963. NLTC (see note 24), file 25.

course of thirty years – one being a seemingly inexact adaptation of Nirnaya Sagar face number 369 in 1935[28] – thereby acknowledging the Linotype's visually awkward, if not inept, typographical representation of the script. Such numerous design iterations, pre- and post-Indian independence, demonstrate the company's constant efforts, in the hope of improving machine sales,[29] to produce readable Devanagari-script text within a challenging and changing competitive environment while hindered by the inherent technological limitations of hot-metal Linotype machinery.

DIFFERING DESIGNS AND APPROACHES

The Linotype company archives in both America and Britain hold copies of a printed type-specimen of a 1962 iteration of 'Linotype Devnagari [sic] 14pt' set along with the identical text composed with 'Nirnaya Sagar Type Face–Pica No. 1' and also 'Monotype Devnagari [sic] Pica' (see Fig. 6). This comparative setting of three versions of the same paragraph clearly illustrates the disparity between different composing systems and their consequent effects on the aesthetics and readability of the different type-designs.

The Monotype typeface (given the Monotype Series number 155), and notably its Akhand-style scheme of composition, was designed in the 1930s by Shankar Ramchandra Date (1898–1983), who visited England and the Monotype Drawing Office where the technical drawings were prepared and put into production.[30] According to the print-historian Bapurao S. Naik:

> Monotype Devanagari design in 12pt. (9 set) is based on Nirnaya Sagar Pica No. 1 and is not much distinguishable to the common reader. The larger versions 14 pt. and 16 pt. are the enlargements of 12 pt. design and have no relation to the original Nirnayasagar [sic] design of 14 p. Great Face. In all three cases the Monotype face is wider as compared to the height of the letters.

Naik continues to list a number of 'deficiencies inherent in the Monotype Devanagari currently in use'.[31] In comparison to the Nirnaya Sagar types, the sample of Monotype Devanagari shown in Fig. 6a reveals the differences in design – in the overall proportions, the wider spacing, and the smaller counter-sizes that serve to emphasise the vertical strokes – which produce a profoundly different texture on the page from that of its model. Some characters, like ह (ha) and ळ (ḷ), look oversized in relation to others; and the over-arching vowel-signs, particularly the 'double mātrā', are inconsistent in length. A few of the consonantal clusters, known as 'conjuncts', are set in a linear manner, rather than designed in

28. As Singh relates, this 14 point redesign was initiated by Kedarnath Chatterjee and drawn by an unnamed Bengali artist in Linotype's Calcutta office; the production drawings were prepared by Dorothy Arbogast and H. Meyer in MLCo's New York type-drawing office. The matrices were produced in England by Linotype & Machinery Limited. See Singh (2017, note 2) p. 167. Chatterjee was also involved in the redesign of the hot-metal Linotype Bengali with Siresh Chandra Majumdar; see Ross (1999, note 13), pp. 151–153. Majumdar was the owner of the Śrī Gouraṅga Press (and proprietor of the influential Bengali newspaper *Anandabazar patrika*) which 'produced the first book with text composed on the Devanagari Linotype in 1934' (Singh (2017, note 2), p. 157).

29. The drive for Linotype to improve on its Linotype Devanagari development, and its increasing engagement with Government departments and presses, was also propelled by knowledge that 'by 1965 the Constitution will oblige them to print a great deal of official matter in Hindi as well as English' (W. Tracy to M. Parker, 3 October 1963, NLTC (see note 24), file 25).

30. And drawn up by the women who staffed the Monotype Drawing Office as recorded by Dora Laing in the worklog notebook, '155 Devanagari' entry for 26 November 1931. Date oversaw from India the development of the Bolder Weight series 346 (Singh (2018, note 11), pp. 59–61).

31. Naik (1971, note 4), pp. 396–397. Vowel-sign revisions had been made since the original design with some characters added by the Monotype Drawing Office. A redesign and its popularity for both book and newspaper composition were noted by Balasubramanian to W. Tracy in 1969 (7 July 1969, NLTC (see note 24), file 25).

Nirnaysagar Type Face—Pica No. 1.
Three point leaded.

६. मुद्दलाची रक्कम किंवा त्यापैकीं शिल्लक राहिलेली रक्कम देणें झाली असेल आणि तारणाच्या संबंधांत कोणतीहि अंमलबजावणीविषयक उपाययोजना करण्यास असें तारण निकटपूर्ववर्ती कंडिकेअन्वयें पात्र झालें असेल तर, त्याबाबतींत, गहाण घेणाऱ्या इसमास, गहाण ठेवण्यांत आलेल्या मालमत्तेचा कबजा घेण्याचा व ती आपल्या ताब्यांत ठेवण्याचा हक्क असेल; आणि तसेंच त्यास अशी मालमत्ता कोणतीहि तक्रार न करतां धारण करण्याचा तसेंच तिचा उपयोग घेण्याचा व अशा मालमत्तेपासून मिळालेलें उत्पन्न व फायदे घेण्याचा हक्क असेल.

Monotype Devnagari Pica.
Three point leaded.

६. मुद्दलाची रक्कम किंवा त्यापैकीं शिल्लक राहिलेली रक्कम देणें झाली असेल आणि तारणाच्या संबंधांत कोणतीहि अंमलबजावणीविषयक उपाययोजना करण्यास असें तारण निकटपूर्ववर्ती कंडिकेन्वयें पात्र झालें असेल तर, त्याबाबतींत, गहाण घेणाऱ्या इसमास, गहाण ठेवण्यांत आलेल्या मालमत्तेचा कबजा घेण्याचा व ती आपल्या ताब्यांत ठेवण्याचा हक्क असेल; आणि तसेंच त्यास अशी मालमत्ता कोणतीहि तक्रार न करतां धारण करण्याचा तसेंच तिचा उपयोग घेण्याचा व अशा मालमत्तेपासून मिळालेलें उत्पन्न व फायदे घेण्याचा हक्क असेल. आणि या बाबतींत गहाण

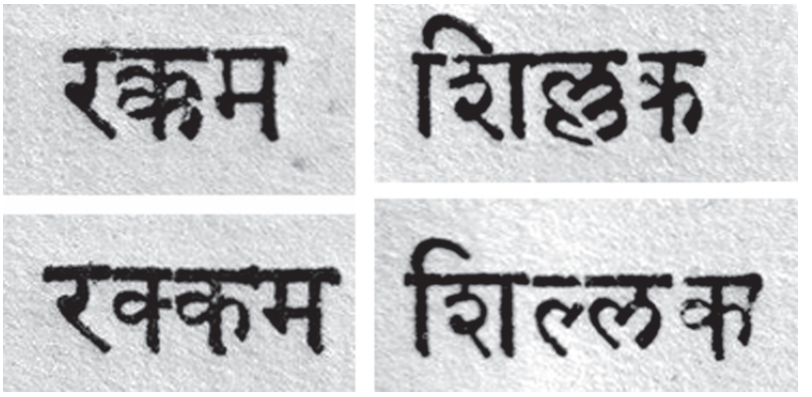
Linotype Devnagari 14 pt.

६. मुद्दलाची रक्कम किंवा त्यापैकीं शिल्लक राहिलेली रक्कम देणें झाली असेल आणि तारणाच्या संबंधांत कोणतीहि अंमलबजावणीविषयक उपाययोजना करण्यास असें तारण निकटपूर्ववर्ती कंडिकेन्वयें पात्र झालें असेल तर, त्याबाबतींत, गहाण घेणाऱ्या इसमास, गहाण ठेवण्यांत आलेल्या मालमत्तेचा कबजा घेण्याचा व ती आपल्या ताब्यांत ठेवण्याचा हक्क असेल; आणि तसेंच त्यास अशी मालमत्ता कोणतीहि तक्रार न करतां धारण करण्याचा तसेंच तिचा उपभोग घेण्याचा व अशा

Linotype Devnagari showing the reformed short 'i' as per Third Stage.

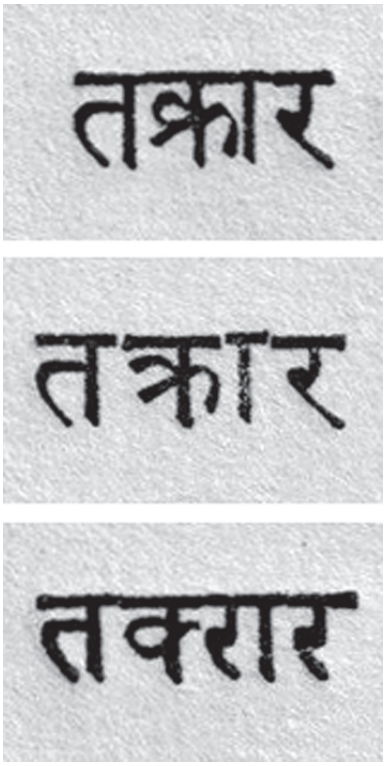
गिर्वाण, गिरगांव, गिरीधर, गिंडी, अगणित, आणि, पाणिनी, गणित, अघटित, टिटाघर, टिंब, टिटवी,

Fig. 6a. Type-specimen comparing Nirnaya Sagar, Monotype and Linotype (Vijapure) settings of Devanagari (1962). Linotype Archive. Actual size.



Right: **Fig. 6b**. Details from Fig. 6a showing the linear arrangement of conjuncts in the Monotype Devanagari (bottom) compared with the Nirnaya Sagar setting (top). Enlarged to 480 percent.

Below: **Fig. 6c**. Details from Fig. 6a comparing the conjunct kra in the Nirnaya Sagar (top), Monotype (centre) and Linotype (bottom) versions. Enlarged to 500 percent.



traditional fashion as a single typeform of vertically stacked consonants (see Fig. 6b). Curiously, one common conjunct, क्र (kra), has different shaping in all three typefaces (see Fig. 6c). The types, designed by Ranoji Raoji Aru,[32] in the Nirnaya Sagar paragraph do build some letterforms out of components but without the larger gaps between elements shown in the Monotype setting. The latter's fitting is not helped by the poorer alignment of the śirorekhā (the line which links the tops of most Devanagari characters), at least in this specimen, and the very wide inter-word spacing.

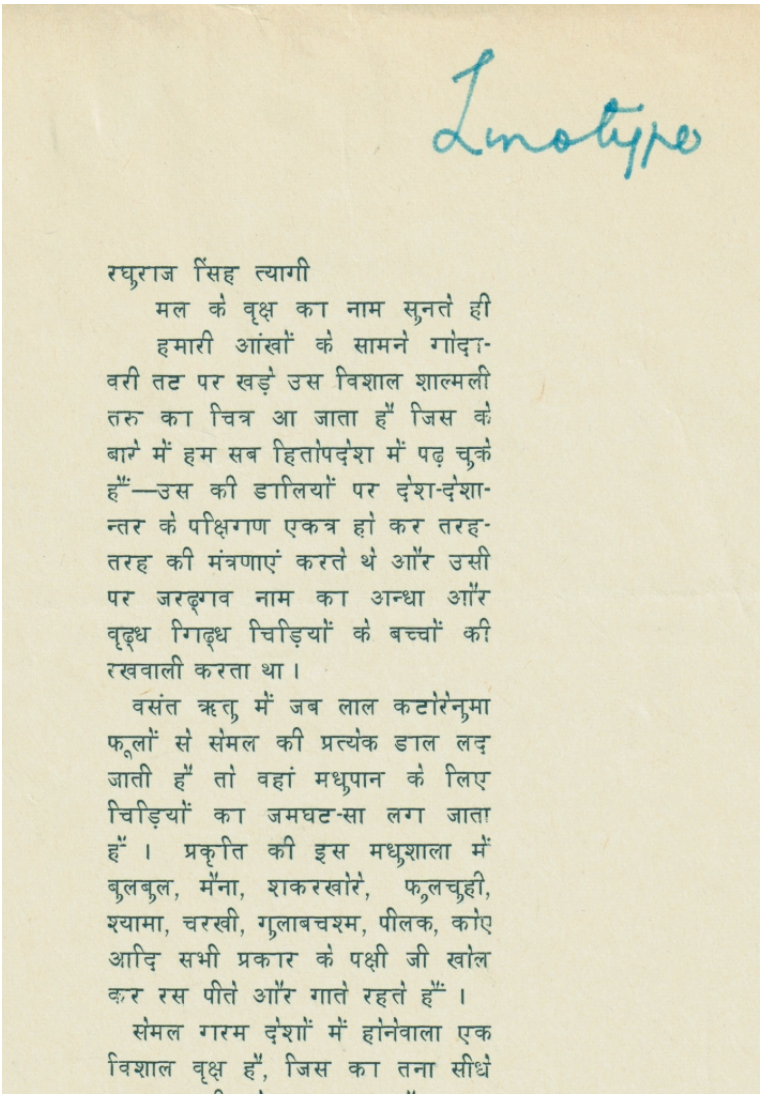
The Linotype-set paragraph is even more divorced from the preferred foundry type. The repeated criticisms of Linotype Devanagari, that impelled so many design iterations, remained unresolved even thirty years after its debut. As already indicated, the problems related chiefly to the use of common, often ill-fitting, components to mitigate the limitations of the character-set, and to non-kerning vowel-signs. This setting, however, does illustrate the long-standing efforts by B. S. Naik to improve on the aesthetics of Linotype Devanagari by means of the Vijapure scheme, which was 'essentially concerned with the angle of the Mātrā characters'[32a] and their positioning. It unquestionably shows some improvements in the linear composition of Devanagari over its standard Linotype counterpart (Fig. 7), albeit by utilising a larger array of characters than was available on the ninety-channel system. However, as the sample reveals, it still provided text with a somewhat broken appearance in comparison to the Nirnaya Sagar setting – even with an additional line added 'showing the reformed sort "i"'.[33]

It is also evident from this specimen and the constant correspondence over two decades between Walter Tracy, Manager of Typeface Development at Linotype & Machinery Ltd (L&M), Nataraja Balasubramanian, Manager in India of L&M's Bombay office, and Mike Parker, Director of Typographic Development at

32. See Naik (1971, note 4), pp. 310–314.

32a. See *Ibid.*, p. 407.

33. See *Ibid.*, pp. 329–333, passim. The Linotype correspondence files show that the implementation of the Vijapure scheme on the Linotype, named after Ganesh Pandurang Vijapure who devised it, and espoused by Naik, was constantly beset with obstacles. Furthermore, Jeevan


Linotype

रघुराज सिंह त्यागी

मल के वृक्ष का नाम सुनते ही हमारी आंखों के सामने गोदावरी तट पर खड़े उस विशाल शाल्मली तरु का चित्र आ जाता है जिस के बारे में हम सब हितोपदेश में पढ़ चुके हैं—उस की डालियों पर देश-देशान्तर के पक्षिगण एकत्र हो कर तरह-तरह की मंत्रणाएं करते थे और उसी पर जरद्गव नाम का अन्धा और वृद्ध गिद्ध चिड़ियों के बच्चों की रखवाली करता था।

वसंत ऋतु में जब लाल कटोरेनुमा फूलों से सेमल की प्रत्येक डाल लद जाती है तो वहां मधुपान के लिए चिड़ियों का जमघट-सा लग जाता है। प्रकृति की इस मधुशाला में बुलबुल, मैना, शकरखोरे, फूलचुही, श्यामा, चरखी, गुलाबचश्म, पीलक, कोए आदि सभी प्रकार के पक्षी जी खोल कर रस पीते और गाते रहते हैं।

सेमल गरम देशों में होनेवाला एक विशाल वृक्ष है, जिस का तना सीधे

Fig. 7. Detail of a specimen of standard Linotype Devanagari hot-metal composition, 10 September 1963. Actual size.

MLCo, that the company group was keeping a close eye on the competition. Monotype, even for newspaper composition,[34] was not Linotype's only competitor: Intertype (a New York-based company which manufactured line-casting machines and created 'new' types for them) was a key rival in the area, whose matrices were able to function in Linotype machines. In comparing designs, Tracy believed that even with matter composed according to *The times of India* ninety-channel scheme, as shown in Fig. 7, 'the Linotype type face is widely acknowledged to be the better of the two'[35] – a belief compounded upon having sight of Intertype's 10 point Devanagari design. The L&M Calcutta office had succeeded in obtaining a specimen of Intertype's 10 point trial fount for *The*

Nayak of the Government of India's Central Hindi Directorate telephoned L&M Calcutta, concerned that Naik's character-revisions represented 'an attempt "to smuggle" Marathi convention into Hindi' (A. C. Bridgman to W. Tracy, 16 November 1963). In 1971, Tracy stated 'The Vijapure scheme does not exist in reality – because not all of the intended characters were made and we never received a keyboard layout' (telex from Tracy to H. Moss, 12 February 1971). By 1973 G. P. Vijapure had died and the 'promoters of the scheme' were 'not as active as before' (N. Balasubramanian to B. Saunders, 30 November 1973, NLTC (see note 24), file 25).

34. In the context of newspaper setting, the more fragile surface of matter cast on the Monotype machine was often used as a means of deflecting criticism of the Linotype Devanagari founts. Balasubramanian to A. H. Walker, 27 June 1974, NLTC (see note 24), file 25A.

35. W. Tracy to Parker, 3 October 1963, NLTC (see note 24), file 25. With the exception of some vowel-signs, this was perhaps a debateable assessment when comparing the 14 point designs.

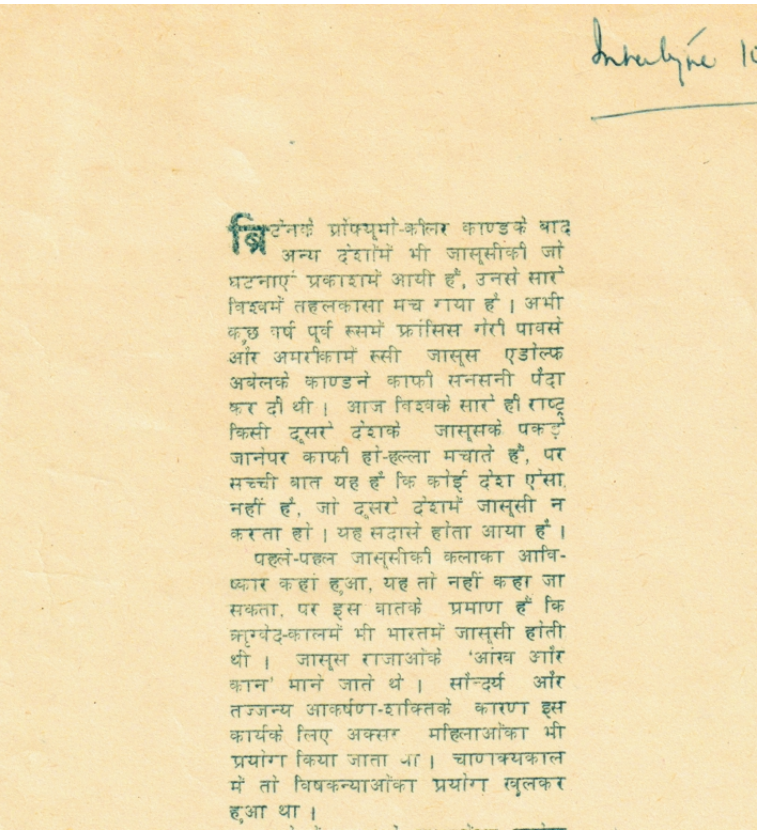


Fig. 8. Detail of a specimen setting in 10 point Intertype Devanagari, 15 October 1963. Detail. Actual size.

times of India, a Linotype customer, and noted in a communication to the London office 'the Intertype 10-pt is felt to be a flop. Matras [vowel-signs] are lost and lots of characters doubling [jamming] in the magazine channels'.[36]

In addition to the known defects of line-casting for Devanagari, the Intertype 10 point specimen (Fig. 8) shows many problems, particularly inconsistent spacing and some character malformations; yet the type-size was a great advantage over the Linotype 14 point due to the chronic shortage of newsprint paper during this time and well into the 1970s. The Linotype company, for economic and technical reasons, never met the repeated requests to produce smaller sizes of Devanagari in metal (although Linotype was reported to allow more characters per line than Intertype Devanagari, which 'would lead to a considerable saving of space').[37] Thus, upon yet another request in June 1974, when considerations of adapting Devanagari for photocomposition came into the equation, Balasubramanian (known as Bala), reported that the India office was selling Linotype machines to US specifications with Intertype matrices.[38]

36. Extract of a letter from A. C. Bridgman to E. T. Martin sent to W. Tracy, 14 October 1963, NLTC (see note 24), file 25.

37. A. C. Bridgman to W. Tracy, 17 September 1963, NLTC (see note 24), file 25.

38. N. Balasubramanian to A. H. Walker, 9 July 1974, NLTC (see note 24), file 25. The reference to US specifications was probably to machines with moulds set to Anglo-American type-height (0.918 inches) (D. Wood to F. Ross, e-mail, 21 August 2021).

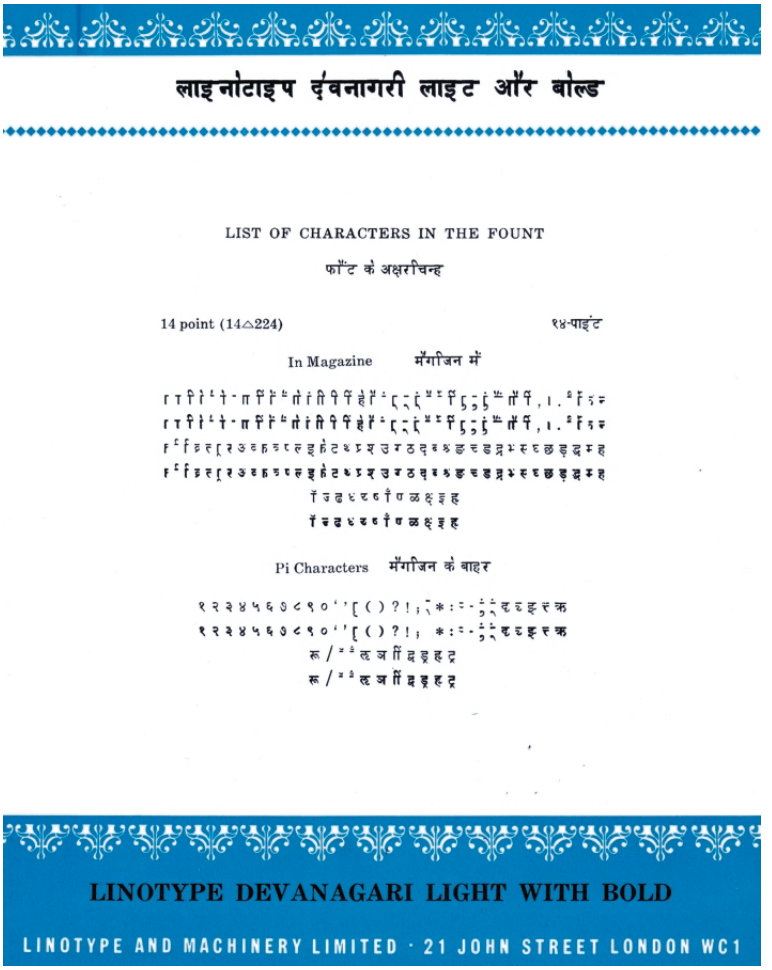


Fig. 9. 'LIST OF CHARACTERS IN THE FOUNT' from a specimen of hot-metal *Linotype Devanagari light with bold* (London: Linotype and Machinery, [*ca* 1968]). Reduced from 230 × 161 mm.

ADAPTATIONS FOR PHOTOCOMPOSITION

Despite what Linotype would have considered the rather lacklustre sales of 'Devanagari Linotype' machines, the naturally wide dissemination of printed matter composed in an increasing number of Indian scripts on the Linotype ultimately redefined what was to become acceptable as legible typography in the Indian sub-Continent (see Fig. 9 and 10). Notwithstanding its visible impact on textual composition, the Linotype was considered for some years by many in India to be 'as essential as the Typewriter for a progressive nation. Its necessity is … being felt by Printers in General and Newspaper Offices in particular'.[39] The customary typographical representation of some scripts by the line-caster was more profoundly affected than others, Bengali being a case in point.[40] However, aside from economic drivers and the natural antipathy,

39. Vijayapaliah (1954, note 21), p. 2.

40. See Ross (1989, note 19), pp. 129–133.

Fig. 10. Specimen of 14 point from *Linotype Devanagari light with bold* (London: Linotype and Machinery, [*ca* 1968]). Reduced from 230 × 161 mm.

particularly pre-independence, in some quarters to acquiring any equipment designated as British, there was an acknowledgement that new typesetting practices coupled with the mechanization of printing could widen dissemination of information to the reading public.[41] Readers became accustomed to a new orthography, often endorsed by script reforms that seemed designed to accommodate adaptations of scripts to mechanized typesetting.[42] To today's readers, after decades of reading text set with the looser-fitting hot-metal faces of Monotype and Linotype, the Nirnaya Sagar hand-composition shown in Fig. 6 may appear a little dense.

It has been noted that the customary practice of typefounding companies was to copy existing 'successful' designs when converting a typeface from one technology to another.[43] Yet the Linotype company group, conscious of the poor aesthetics of its hot-metal Devanagari types, looked again to the Nirnaya Sagar typefaces for

41. Reportedly, P. K. Roy of *The times of India* expressed the opinion 'that the public would accept almost anything which was offered and … emphasised that speed and facility of production was the main factor' (A. C. Bridgman to F. A. Trice (L&M, London), 16 September 1963, NLTC (see note 24), file 25).

42. See Singh (2017, note 2), pp. 189–191.

43. See Ross (1999, note 13), pp. 193–194.

its adaptation of the script for photocomposition. Thus in 1974, Balasubramanian was pleased to quote Walter Tracy's 'heartening news'[44] in a letter to H. B. Kansal, Deputy Secretary to the Ministry of Home Affairs in the Government of India:

> In regard to type design, the Devanagari we are creating for VIP[45] will be similar in type to the Nirnaya Sagar foundry type, with correct traditional matras (no fear of them breaking away in film-setting!). In addition, we shall try to proportion the stroke weights and the inner white areas so that the type will be legible not only at 10 point but 8 point also, because we are aware of the need for economies in printing costs. … and we will try to make the new faces as effective at 24 point as in the text sizes.[46]

Type-specimens produced by the Nirnaya Sagar Press thus formed the starting point for the design of a new Linotype Devanagari typeface in the 1970s that was to be undertaken under Walter Tracy's supervision; Tracy had established the Department of Typographic Development at Linotype Paul Ltd (London) in 1974, which focused on fonts for photocomposition.[47] An immediate concern, which generated much correspondence between Tracy and Balasubramanian, was defining the character-set – a concern that remains a key initial consideration for typographical development projects.[48] Potential users were contacted to help define a character-set that would meet the needs of both Hindi and Marathi. In particular, the joint Managing Directors of *The daily tej*, Viswa Bandhu Gupta and Prem Bandh Gupta, were consulted for Hindi language coverage; later a number of Government officials, including Kansal, as well as book-publishers, were approached for wider language coverage.[49] The Devanagari character-set could now be re-evaluated and expanded from the hot-metal limitations for the V-I-P photo-typesetter; however, there was no longer any possibility of setting additional 'pi characters' (which had been an available, but cumbersome, Linotype hot-metal practice; see Fig.

44. N. Balasubramanian to W. Tracy, 9 July 1974, NLTC (see note 24), file 25.

45. The Linofilm V-I-P (Variable Input Photo-typesetter) produced in 1970. See L. W. Wallis, *A concise chronology of typesetting developments*, 1886–1986 (London: Wykyn de Worde Society in association with Lund Humphries, 1988), p. 42. There had been enquiries to implement Indian script on the Linotron 505 machine but its failure to kern and the knowledge that the failure to do so in the case of Linotype hot-metal was 'deplored', negated such a development (W. Tracy to M. Parker, 30 November 1971, NLTC (see note 24), file 25A).

46. W. Tracy to N. Balasubramanian, 2 July 1974, and quoted in a letter from N. Balasubramanian to H. B. Kansal, New Delhi, 28 October 1974, NLTC (see note 24), files 25A and 25 respectively.

47. Later called Linotype-Hell Ltd, and finally Linotype Ltd. Meanwhile, 'in the decade 1970–80, there was upheaval in independent India against foreign owned businesses/companies. That was the time, September 1977, when Linotype Associates India Private Limited was formed with all Indian Directors and … N Balasubramanian appointed Managing Director. This Company overtook the hot-metal business and operations of L&M Branches, becoming authorised representative of Linotype-Paul Limited with sole distributorship and marketing rights for their electro-mechanical and electronic photo-typesetting equipment' (WhatsApp message, K. K. Singh to F. Ross, 27 May 2021).

48. See Fiona Ross, 'Non-Latin scripts: key issues in type design' *Non-Latin scripts: from metal to digital type* (edited by Fiona Ross and Vaibhav Singh, London: St Bride Library, 2012), pp. 125–153, at page 130.

49. They were also consulted regarding hyphenation logic (N. Balasubramanian to W. Tracy, 2 February 1973, 10 December 1973; and N. Balasubramanian to Kansal, 21 November 1974, NLTC (see note 24), file 25A).

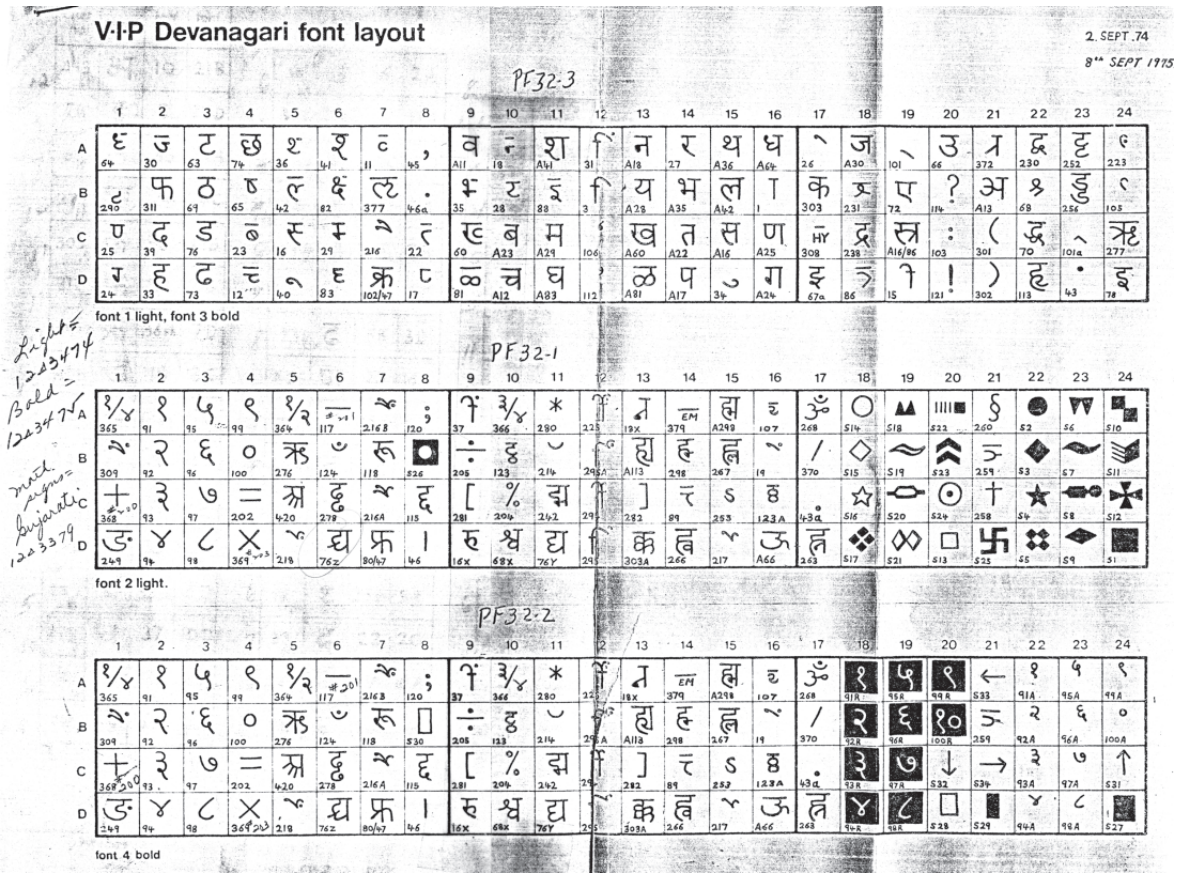


Fig. 11. Annotated Linofilm V-I-P Devanagari font layout diagram (1974–1975). Reduced from 275 × 350 mm.

5 and 9). Tracy was to underline this point on more than one occasion, writing to Balasubramanian on 2 November 1973:

> The important thing, then, is the establishment of a list of characters to be made in the light and bold which can safely be regarded as standard for Hindi and Marathi for all customers. I emphasize 'standard' because all prices and, indeed, the manufacture itself can only be undertaken on the basis of standard procedures; customers cannot be allowed to vary the array of characters on the fonts, because this will mean the making of fresh master negative plates – an expensive and lengthy business.[50]

The V-I-P film fonts offered ninety-six characters in each film strip; the Devanagari was to follow the model already developed for Gujarati on this photo-typesetter and occupy four film strips to achieve a sufficient complement of characters in two weights. Fonts 1 and 2 would contain the light face, and fonts 3 and 4 the bold. However, sections of fonts 2 and 4 differed, as these contained characters, such as mathematical signs and superior figures, in a 'common weight' that could be used with either type style,

50. W. Tracy to Balasubramanian, 2 November 1973. Another unwelcome expense was the then high rate of customs duty into India of '110% on anything connected with electronics or computers' (N. Balasubramanian to W. Tracy, 28 May 1973, NLTC (see note 24), file 25A).

Fig. 12. The British Type Drawing Office, Altrincham (a posed and touched-up photograph from *The L&M news* 16:3 (December 1952–January 1953), p. 40).

which Tracy deemed would be 'very useful for newspaper and commercial printing'.[51] The character-set possible with the V-I-P was still limited, relative to foundry type, and required the use of components to build some characters. Therefore, various, at first provisional, font-schemes were devised – whose characters were mapped as closely as possible onto the Gujarati scheme[52] – to determine the Devanagari character-sets and font-layouts in order to proceed with the artwork for the new typeface design (see Fig. 11).

ESTABLISHING NEW STANDARDS

The new Linotype Devanagari design was to be developed by utilising the existing hot-metal drawings, copies of which Tracy requested from MLCo's New York Drawing Office, for their size and weight but revised to be similar in style to Nirnaya Sagar type. The use of film instead of metal type afforded the possibility of overlapping character-elements which meant that even the śirorekhā (connecting-line) could now appear seamless. Kerning was also possible: right and left kerns were achieved by offsetting all characters to the left, as suggested by Mike Parker, who agreed that the 'Linotype face should be improved for fit and shape and must be revised to include kerns'.[53] Furthermore, Parker and Tracy were keen to explore the possibilities of positioning 'the matras' (vowel-signs) using the Latin 'accent-centring procedure'.[54]

It was expected that the British Type Drawing Office, then situated in Altrincham (Fig. 12), would undertake the new artwork,

51. W. Tracy to N. Balasubramanian, 21 August 1975, NLTC (see note 24), file 25A.

52. This was done in an attempt to simplify font-manufacture and programming (see W. Tracy to N. Balasubramanian, 1 July 1974 and 16 October 1974, NLTC (see note 24), file 25A, and p. 136 below.

53. Telex, M. Parker to W. Tracy, 6 December 1971, NLTC (see note 24), file 25A. In the history of the Linotype Devanagari development, this offset was to have consequences in transferring to later digital technologies.

54. The accent-centring routine used software to place the centre of each accent centrally over or under the measured width of the host characters. Since mātrās (floating vowel-signs that had zero width and so

whereas font manufacture would be undertaken by MLCo in Plain View, Long Island, USA. Mike Parker summarised clearly the exacting standards required in the design and production processes for the V-I-P, which required meticulous artwork from the Type Drawing Office:

> Our tolerances in making fonts for the V-I-P are measured in ten thousandths of an inch. The fonts themselves are made on rather elaborate cameras which would require artwork to a fixed scale, properly registered. The drawing size is approximately ten inches square for each character. We use back-lighted originals – clear characters surrounded by red or black.[55]

However, on 25 June 1974, upon receiving from India an urgent order for V-I-P equipment, and with letter-drawing resources in England unavailable to tackle Devanagari characters (probably due to commitments to Linotype's more successful Arabic ventures) Tracy sought permission from Mike Parker for the British type-designer Matthew Carter to take on the work.[56] Carter already possessed experience with designing typefaces for scripts other than Latin, namely Greek and Hebrew;[57] most importantly, he possessed the skills to design typeforms for both hot-metal technology and photocomposition. With good models from Nirnaya Sagar provided by Tracy,[58] Carter was tasked with first producing trial characters in light and bold weights, which would be reduced photographically to simulate different type-sizes and sent to India for approval. It was anticipated that he could then complete the artwork in nine months.[59]

The decidedly positive responses to Carter's trial Devanagari designs (Fig. 13) were communicated enthusiastically by Balasubramanian via cablegram from India on 18 March 1975, stating that a 'better version does not exist superb', with which Tracy concurred.[60] The resulting new design for photocomposition was delivered in 1976 at first with 'experimental fonts' to *The times of India*.[61] Like the hot-metal typeface the new design was named Linotype Devanagari, but showed huge improvements over its predecessor and commendably little affinity to the hot-metal designs. Its typographical development had, however, not been a completely smooth enterprise: Linotype's client *The daily tej* was troubled by character-alignment problems,[62] which were particularly prominent in Devanagari due to its śirorekhā; the accent-placement routine needed to be revised for special instances; some characters failed to appear when keyed; and new or replacement characters had to be added to the fonts, much to the displeasure

functioned as accents) usually needed to be placed to the right-hand side of most characters, the drawings of the mātrās needed to be offset horizontally to achieve this.

55. M. Parker to W. Reed, 7 January 1972, NLTC (see note 24), file 25A.

56. Telex from W. Tracy to M. Parker, 25 June 1974, NLTC (see note 24), file 25A. Parker believed Carter to be their best designer (cited from 1970 correspondence in Helena Lekka, 'Linotype's design of new Greek typefaces for photocomposition in the Greek printing market, 1970–1980', unpublished PhD thesis, University of Reading, 2017, p. 109).

57. See Lekka (2017, note 56) p. 109.

58. In discussion with the author (Ross) in September 2018, Matthew Carter stated that it was Nirnaya Sagar specimens in Naik's book (the single advance copy rather than the published three-volume set) that had been used as models, although Tracy did obtain a full specimen-book from the press's foundry, as shown in Fig. 1.

59. Linotype-Paul Ltd, internal memorandum, W. Tracy to R. Caesar, 26 July 1974, NLTC (see note 24), file 25A.

60. 'I really do think this is the best Devanagari design I have seen' (W. Tracy to M. Parker, 20 March 1974, NLTC (see note 24), file 25A). On completion of the Bold, Balasubramanian confirmed the same response from clients (29 May 1975, NLTC, file V-I-P).

61. In-house memorandum, W. Tracy to E. Vesey 28 May 1976, NLTC (see note 24), file 25A.

62. T. V. Krishnamurthy, L&M Bombay, to W. Tracy, 20 June 1977, NLTC (see note 24), file 25A. Carter describes how at Plainview a 'granite-based fixed focus camera in the grid department' was used, which should have ensured correct alignment (e-mail to Ross, 17 April 2021).

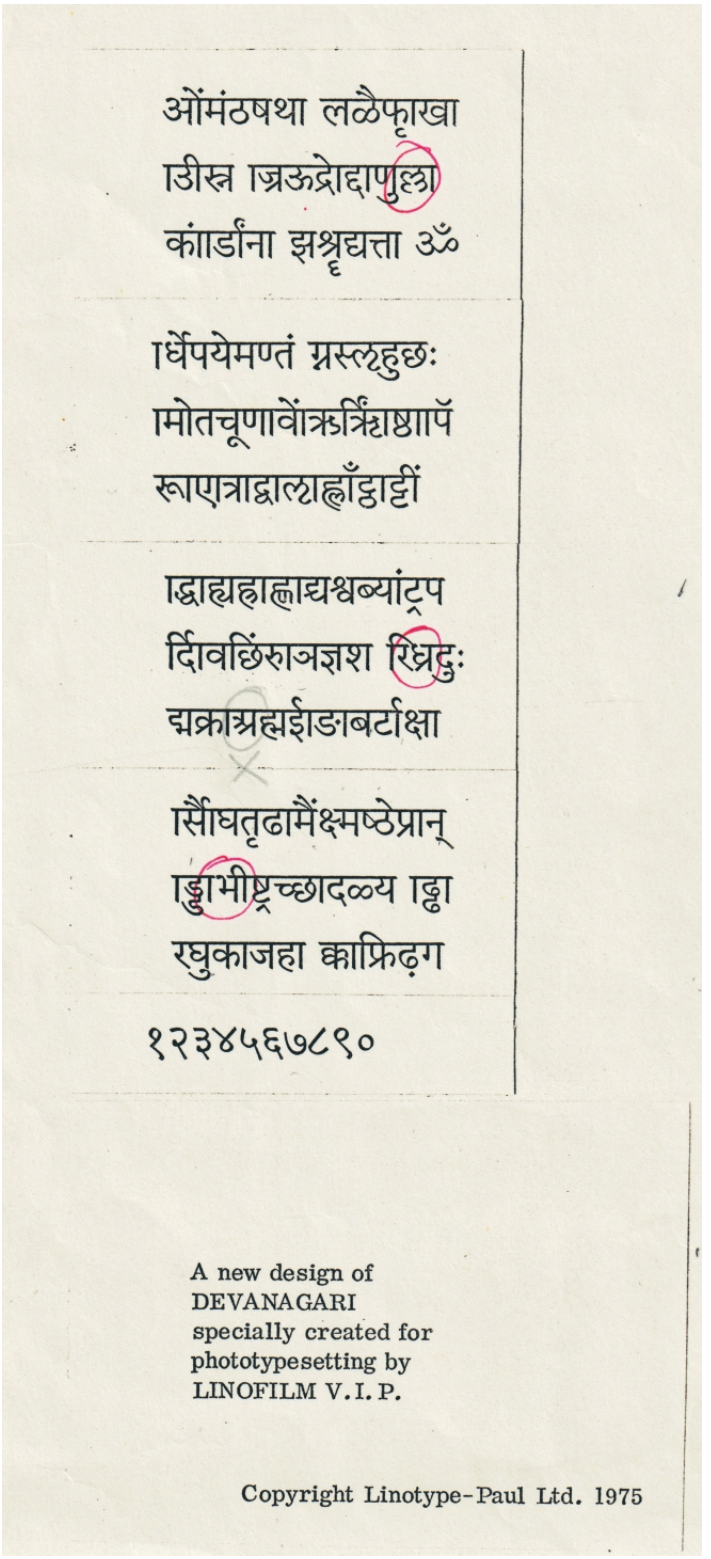
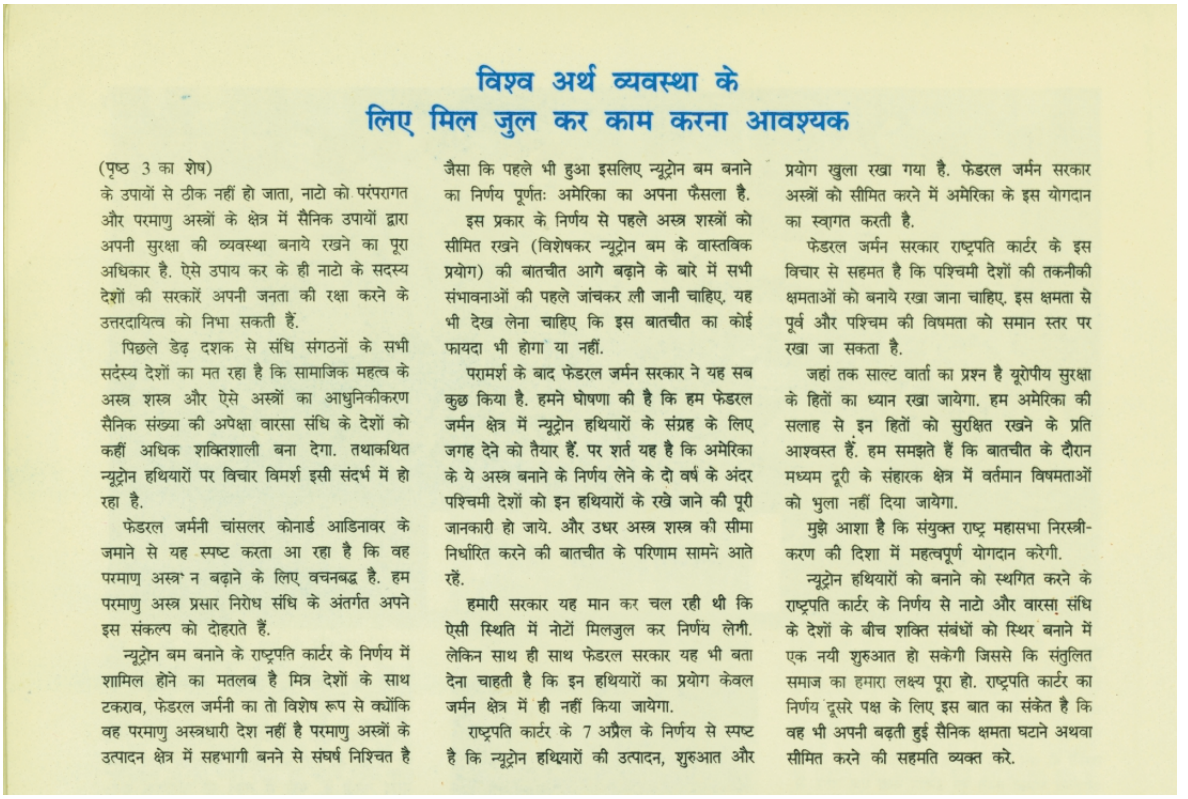


Fig. 13. Detail of an annotated photocopy of a trial of 'A new Linotype Devanagari typeface by Matthew Carter for LinofilmV-I-P typesetter' (Linotype-Paul, 1975). Reduced to 80 percent. The characters would never occur in the sequences shown. The second and third characters encircled in red, probably by Walter Tracy, show forms that Balasubramanian requested be changed to accord with script reform strictures (see p. 149 and note 119 below). The other encircled characters show forms more suitable to Sanskrit; their use was discontinued by Linotype and other typefounders.



विश्व अर्थ व्यवस्था के लिए मिल जुल कर काम करना आवश्यक

(पृष्ठ 3 का शेष)
के उपायों से ठीक नहीं हो जाता, नाटो को परंपरागत और परमाणु अस्त्रों के क्षेत्र में सैनिक उपायों द्वारा अपनी सुरक्षा की व्यवस्था बनाये रखने का पूरा अधिकार है. ऐसे उपाय कर के ही नाटो के सदस्य देशों की सरकारें अपनी जनता की रक्षा करने के उत्तरदायित्व को निभा सकती हैं.

पिछले डेढ़ दशक से संधि संगठनों के सभी सदस्य देशों का मत रहा है कि सामाजिक महत्व के अस्त्र शस्त्र और ऐसे अस्त्रों का आधुनिकीकरण सैनिक संख्या की अपेक्षा वारसा संधि के देशों को कहीं अधिक शक्तिशाली बना देगा. तथाकथित न्यूट्रोन हथियारों पर विचार विमर्श इसी संदर्भ में हो रहा है.

फेडरल जर्मनी चांसलर कोनार्ड आडिनावर के जमाने से यह स्पष्ट करता आ रहा है कि वह परमाणु अस्त्र न बढ़ाने के लिए वचनबद्ध है. हम परमाणु अस्त्र प्रसार निरोध संधि के अंतर्गत अपने इस संकल्प को दोहराते हैं.

न्यूट्रोन बम बनाने के राष्ट्रपति कार्टर के निर्णय में शामिल होने का मतलब है मित्र देशों के साथ टकराव, फेडरल जर्मनी का तो विशेष रूप से क्योंकि वह परमाणु अस्त्रधारी देश नहीं है परमाणु अस्त्रों के उत्पादन क्षेत्र में सहभागी बनने से संघर्ष निश्चित है जैसा कि पहले भी हुआ इसलिए न्यूट्रोन बम बनाने का निर्णय पूर्णतः अमेरिका का अपना फैसला है.

इस प्रकार के निर्णय से पहले अस्त्र शस्त्रों को सीमित रखने (विशेषकर न्यूट्रोन बम के वास्तविक प्रयोग) की बातचीत आगे बढ़ाने के बारे में सभी संभावनाओं की पहले जांचकर ली जानी चाहिए. यह भी देख लेना चाहिए कि इस बातचीत का कोई फायदा भी होगा या नहीं.

परामर्श के बाद फेडरल जर्मन सरकार ने यह सब कुछ किया है. हमने घोषणा की है कि हम फेडरल जर्मन क्षेत्र में न्यूट्रोन हथियारों के संग्रह के लिए जगह देने को तैयार हैं. पर शर्त यह है कि अमेरिका के ये अस्त्र बनाने के निर्णय लेने के दो वर्ष के अंदर पश्चिमी देशों को इन हथियारों के रखे जाने की पूरी जानकारी हो जाये. और उधर अस्त्र शस्त्र की सीमा निर्धारित करने की बातचीत के परिणाम सामने आते रहें.

हमारी सरकार यह मान कर चल रही थी कि ऐसी स्थिति में नोटों मिलजुल कर निर्णय लेगी. लेकिन साथ ही साथ फेडरल सरकार यह भी बता देना चाहती है कि इन हथियारों का प्रयोग केवल जर्मन क्षेत्र में ही नहीं किया जायेगा.

राष्ट्रपति कार्टर के 7 अप्रैल के निर्णय से स्पष्ट है कि न्यूट्रोन हथियारों की उत्पादन, शुरुआत और प्रयोग खुला रखा गया है. फेडरल जर्मन सरकार अस्त्रों को सीमित करने में अमेरिका के इस योगदान का स्वागत करती है.

फेडरल जर्मन सरकार राष्ट्रपति कार्टर के इस विचार से सहमत है कि पश्चिमी देशों की तकनीकी क्षमताओं को बनाये रखा जाना चाहिए. इस क्षमता से पूर्व और पश्चिम की विषमता को समान स्तर पर रखा जा सकता है.

जहां तक साल्ट वार्ता का प्रश्न है यूरोपीय सुरक्षा के हितों का ध्यान रखा जायेगा. हम अमेरिका की सलाह से इन हितों को सुरक्षित रखने के प्रति आश्वस्त हैं. हम समझते हैं कि बातचीत के दौरान मध्यम दूरी के संहारक क्षेत्र में वर्तमान विषमताओं को भुला नहीं दिया जायेगा.

मुझे आशा है कि संयुक्त राष्ट्र महासभा निरस्त्रीकरण की दिशा में महत्वपूर्ण योगदान करेगी.

न्यूट्रोन हथियारों को बनाने को स्थगित करने के राष्ट्रपति कार्टर के निर्णय से नाटो और वारसा संधि के देशों के बीच शक्ति संबंधों को स्थिर बनाने में एक नयी शुरुआत हो सकेगी जिससे कि संतुलित समाज का हमारा लक्ष्य पूरा हो. राष्ट्रपति कार्टर का निर्णय दूसरे पक्ष के लिए इस बात का संकेत है कि वह भी अपनी बढ़ती हुई सैनिक क्षमता घटाने अथवा सीमित करने की सहमति व्यक्त करे.

Fig. 14. Article showing Linotype Devanagari for V-I-P in use, for the dropped-head title and text of *जर्मन समाचार* (German Samāchār). From *The bulletin of the German Embassy* (4 May 1978), p. 12.

of Tracy,[63] who was revising Devanagari font-layouts, at Linotype's cost, right up to his retirement in October 1977.[64]

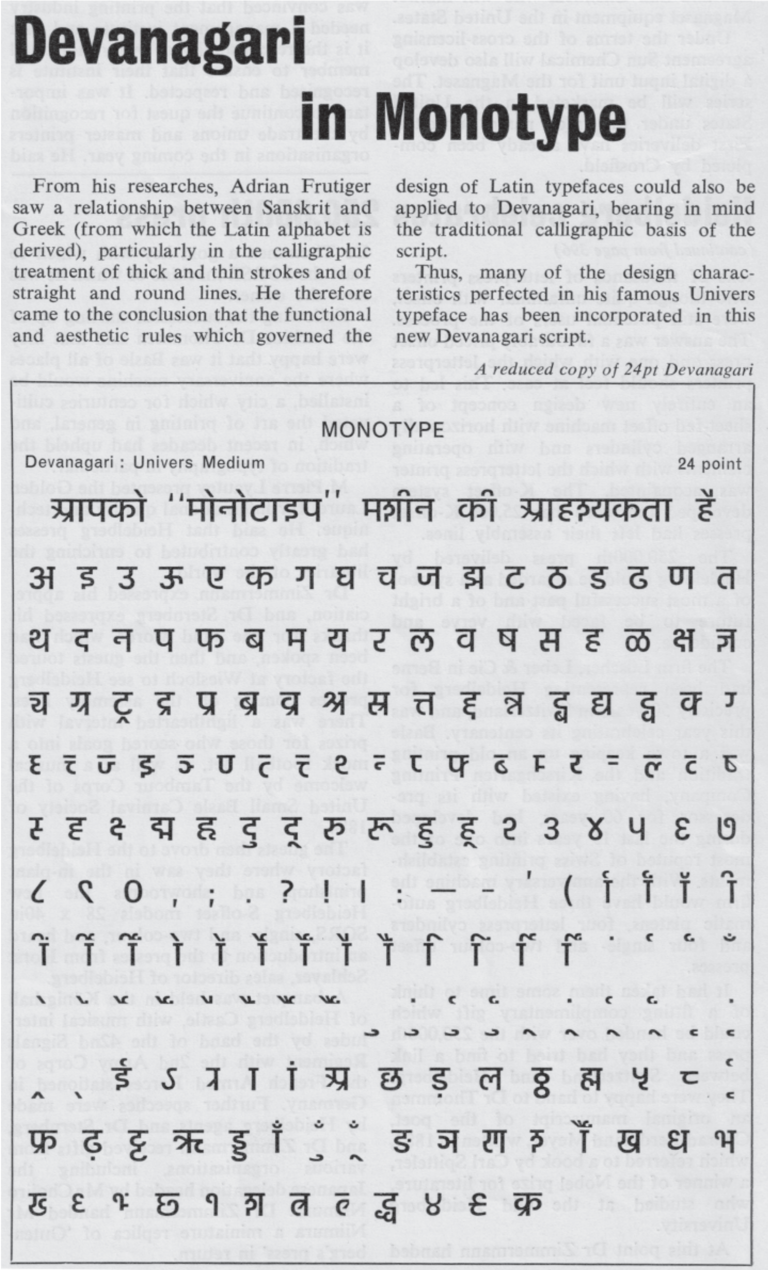
Regrettably, there is little extant material output of V-I-P Linotype Devanagari, particularly of the final version. Fig. 14, taken from the *जर्मन समाचार* (German Samāchār),[65] clearly demonstrates the benefits of kerning, especially with regard to the arching vowel-signs, which aids the flow of the script and visibly increases the readability of texts. Some character-combinations do appear disjointed on account of the continued use of common components owing to character-set restrictions; and the accent-placement routine provided a few problems, as shown in this iteration in which the 'accent' (mātrā) should sit above the central vertical stroke of some frequently-occurring characters. Recent research by the author reveals that the latter problem was rectified by software programmers in Cheltenham in 1977, although there is no extant example of this corrected feature in use.

Crucial to the design, however, is the stroke-modulation that accords with Indian penmanship, which has the pen cut in the reverse direction to that used for the Latin script (Fig. 15). It is worth noting that such adherence to the Devanagari script tradition

63. See W. Tracy to N. Balasubramanian 18 July 1975, NLTC (see note 24), file 25A.

64. Telex from W. Tracy to LAI Bombay, 25 October 1977, NLTC (see note 24), file 25A.

65. *The bulletin of the German Embassy* (New Delhi) (4 May 1978). The lack of extant examples of text set in V-I-P Devanagari may be accounted for by correspondence regarding *The daily tej*: T. V. Krishnamurthy (LAI Bombay) wrote to Vesey, 'Hindi on V-I-P is not used at all. The keyboard operators are too slow. … The need to change fonts for character selection is slowing them down and giving rise to errors' (29 December 1977, NLTC (see note 24), file 25A).



Devanagari in Monotype

From his researches, Adrian Frutiger saw a relationship between Sanskrit and Greek (from which the Latin alphabet is derived), particularly in the calligraphic treatment of thick and thin strokes and of straight and round lines. He therefore came to the conclusion that the functional and aesthetic rules which governed the design of Latin typefaces could also be applied to Devanagari, bearing in mind the traditional calligraphic basis of the script.

Thus, many of the design characteristics perfected in his famous Univers typeface has been incorporated in this new Devanagari script.

A reduced copy of 24pt Devanagari

MONOTYPE

Devanagari : Univers Medium 24 point

आपको "मोनोटाइप" मशीन की आवश्यकता है

अ इ उ ऊ ए क ग घ च ज झ ट ठ ड ढ ण त

थ द न प फ ब म य र ल व ष स ह ळ क्ष ज्ञ

Above: **Fig. 15**. The Indian broad-nib pen and the stroke modulation it produces in writing the character क (ka). Courtesy of N. Kshetrimayum.

Left: **Fig. 16**. Detail of a clipping collected by Walter Tracy. NLTC, file 25. 'Devanagari in Monotype' (on Adrian Frutiger and Mahendra Patel's new typeface), *Printing world* (15 November 1973), p. 399. Reduced from 210 × 125 mm.

was not followed in a new Devanagari design being undertaken at this time for Monotype, which was a collaborative work by the renowned Swiss type-designer Adrian Frutiger and the highly-regarded Indian calligrapher, Mahendra Patel (Fig. 16). Linotype was aware of this design – Frutiger had previously offered it to Linotype – but Tracy had in any event 'wondered if this departure from tradition is acceptable',[66] stating 'I think we should resist to

66. W. Tracy to M. Parker, 9 August 1968, in which he wrote 'We are all scarred for life by the Vijapure scheme' (NLTC (see note 24), file 25).

the death any request for Helvetica Devanagari' and concluded that 'it is better to give customers a design they know'.[67] Carter's Devanagari cannot be regarded merely as a revival of a Nirnaya Sagar typeface; rather it comprises the skilful re-imagining by a professional designer of a traditional typeface design for the new era of photocomposition.

CONTINUATION AND INNOVATION: ENTERING THE DIGITAL ERA

This development of Linotype Devanagari for the V-I-P laid the foundation for the design of the revised and greatly-expanded digital version, given the same name, whose typeforms first appeared in the Indian press in the early 1980s, and which are recognisably present in many of today's popular publications. Research was instrumental in designing Linotype Devanagari, and underpinned all the designs undertaken in the 1980s by the letter-drawing studio, then relocated to Linotype's new British headquarters in Cheltenham.

By late 1978 discussions were taking place, primarily at Linotype-Paul's London office in Kingsbury, about adapting Indian scripts to the new Linotron 202, a 'high-speed digital CRT typesetter';[68] Devanagari and Bengali were the first to be considered. A memorandum of 5 December 1978, composed by Anthony Bisley, Walter Tracy's successor, to Martin Boothman, then Managing Director of Linotype-Paul Ltd, concerning Devanagari stated:

> Miss Ross[69] has prepared, after thorough examination, a paper on this subject along with other comments we have received from India over a period of time from the existing installations that have been in operation.
>
> I have discussed this with Matthew Carter and I think it would be suitable for him to re-design the typeface and re-draw it. There are some 360 characters to be redrawn, and amalgamated; for this version of the [Linotron] 202, we will have whole conjuncts and will not be using the VIP method of bringing characters together to make conjuncts.
>
> The cost of this at the standard UK price is £12.00 per drawing. Taking into consideration the amount of work involved, Matthew Carter has said his price would be £4,000, overall. We cannot of course, afford this amount.
>
> I would suggest, therefore, that we do this in the [letter-drawing] Studio and employ Matthew Carter as a Consultant during the period of re-drawing the typeface.[70]

Bisley's suggestion was approved. However, Bisley's term at Linotype was short, and in direct consequence of his management all

67. W. Tracy to M. Parker, 30 December 1971, NLTC (see note 24), file 25A.

68. Jonathan Seybold, 'The Linotron 202: better than anybody anticipated!', *The Seybold report* 7:21 (17 July 1978), pp. 1–16, at page 1.

69. The author, who had joined Linotype initially as a Research Assistant in September 1978, having a background in languages that included Sanskrit.

70. Linotype-Paul Ltd in-house memorandum, A. J. Bisley to Martin Boothman, 5 December 1978, NLTC (see note 24), file 202.

but one of the letter-drawers, Lesley Sewell, had resigned – which therefore negated the plan for the London letter-drawing studio to take up the work. At this time Sewell was already occupied with the re-design of the P&O shipping company's branding by Walter Tracy, who had remained active as an external designer and as an occasional consultant. Furthermore, the success of the Linotron 202 typesetter[71] had encouraged the renowned Bengali publishing house and long-standing Linotype customer, Ananda Bazar Patrika (ABP), to place an order with Linotype to transition from hot-metal typesetting – bypassing filmsetting – directly to digital photocomposition for its Bengali and English language publications. It was established that ABP, as well as other customers, would require Devanagari fonts, but the Bengali type development for the 202 had to take precedence.[72] The intention, therefore, was for Sewell, upon completing other work, to embark upon the Bengali design; however, since the Linotype hot-metal rendition of the Bengali script was even poorer than that for Devanagari, it was evident that a complete redesign was required rather than a conversion of the old design to the new technology.[73]

Furthermore, it was clear that a new approach to typeface design and methods of composition, and consequently to the entire typographical development of Indian scripts by Linotype, was urgently needed. In Ross's view, this approach should be based on the Indian phonological writing-system as well as on Indian penmanship, which would be crucial to the development of digital fonts for Devanagari and other Brahmi-derived scripts.[74] The proposal for such a radical development formed part of the document prepared by Ross, to which Bisley had referred in his memorandum, entitled 'An introduction to Indian scripts for photocomposition',[75] several iterations of which were further developed in conjunction with other Linotype colleagues, principally Dr Mike Fellows. In July 1979 Ross sent a copy of the proposed plan (with the shorter title 'Indian scripts for photocomposition') to Matthew Carter alongside information about another interim but consequential development for Hindi composition, with a covering-letter saying:

> Please find enclosed a copy of the keyboard layout and character list of Hindi for the Linoterm [filmsetter]. The character numbers are those of the VIP font, since it is proposed to use your drawings, subject to your agreement.
>
> The aim of this scheme for setting Devanagari is to produce an efficient low-cost machine, which is capable of setting Hindi without lowering the quality of output already achieved by the VIP; in fact, we hope to make some improvements.[76]

71. See Seybold (1978, note 67), pp. 1 and 3–15

72. Ananda Bazar Patrika Ltd in Calcutta, formerly the Śrī Gouraṅga Press which had produced the first book set with the hot-metal Linotype Devanagari, although principally a Bengali-language publishing house was the first customer for the Linotype Devanagari digital fonts (see above, note 28).

73. The redesign was undertaken by the former Linotype employee and experienced freelance type-designer Tim Holloway, in collaboration with Fiona Ross, who consulted with ABP and Dr Tarapada Mukherjee, lecturer in Bengali at the School of Oriental Studies, London University.

74. This became more pertinent with an order for further scripts from Ramnath Goenka for *Indian express* newspapers; Goenka was impressed with the Linotron 202 typesetter and particularly with the quality of the Bengali type design, which he regretted they did not need. See below, p. 148 and note 117.

75. F. Ross, Linotype-Paul Ltd in-house document: 'An introduction to Indian scripts for photocomposition', 15 December 1978, NLTC (see note 24), file 202.

76. F. Ross to M. Carter, 27 July 1979. NLTC (see note 24), folder of 'Carter papers'.

The development and implementation of the Devanagari script on the Linoterm in 1979, according to a new scheme devised by Ross at the instigation of Balasubramanian, formed a stepping-stone on the way to developing the revised and expanded Linotype design for digital photocomposition. The letter to Carter notes: 'I am sure you are aware of the problems our department has been having for quite some time now',[77] referring to the lack of studio staff which necessitated Carter, who was still residing in England at the time, to take up the revised and extended artwork that required immediate attention. Carter, already a renowned type-designer proved to be remarkably open to revisions proposed – after consultations with Linotype colleagues in India – by Ross, a Sanskrit postgraduate.[78] At one of their earliest meetings Carter had queried the necessity to improve Devanagari type design given the often poor quality of newsprint paper in India during this period; however, he acquiesced to Ross's counter argument that the poor quality of the newsprint meant that type-designs needed to be optimized to improve legibility.

Carter's new artwork for Linoterm Devanagari Light and Bold was despatched for font production to Bruce Lehnert, Manager of Font Engineering at MLCo in Plain View, in November 1979 with a letter explaining:

> Enclosed are drawings and the paperwork for these faces. Some of the drawings are replacements for existing ones, some are special 'Linoterm only' forms, and some are for completely new characters. …
>
> The replacement drawings are … revisions of existing letter-forms that Fiona Ross prefers for reasons of legibility, and in the case of these 27 characters the existing friskets[79] (as already used for V-I-P Devanagari) should be scrapped and the replacements used for all future Devanagari fonts on all machines.[80]

The Linoterm keyboard and its layout were significant (see Fig. 17). There was still a one-to-one correspondence between a font cell (a character or character-component, referred to as a 'sort' by the designers) and a keyboard code, the number of which was limited to seventy-five per font; thus, Devanagari Linoterm had a limited set of 150 characters over two fonts, which necessitated the continued use of components known as 'half-forms' to build most conjuncts. However, the keyboard layout was closer to that of a typewriter than Walter Tracy had been able to achieve with the V-I-P;[81] and it was logically arranged with half-forms occupying the same position in font 2 as their full forms in font 1, excepting the most frequent which retained a font 1 position. A small number

77. *Ibid.*

78. See Phyllis Hoffman, 'Matthew Carter: reflects on type design', thesis, Rochester Institute of Technology, 1999 (accessed from https://scholarworks.rit.edu/theses/3850), pp. 155–158.

79. Negatives of the drawn characters – in this case, photographically produced. See Fig. 22.

80. M. Carter to B. Lehnert, 29 November 1979, NLTC (see note 24), folder of 'Carter papers'.

81. See W. Tracy to N. Balasubramanian, 29 February 1972, NLTC (see note 24), file 25A.

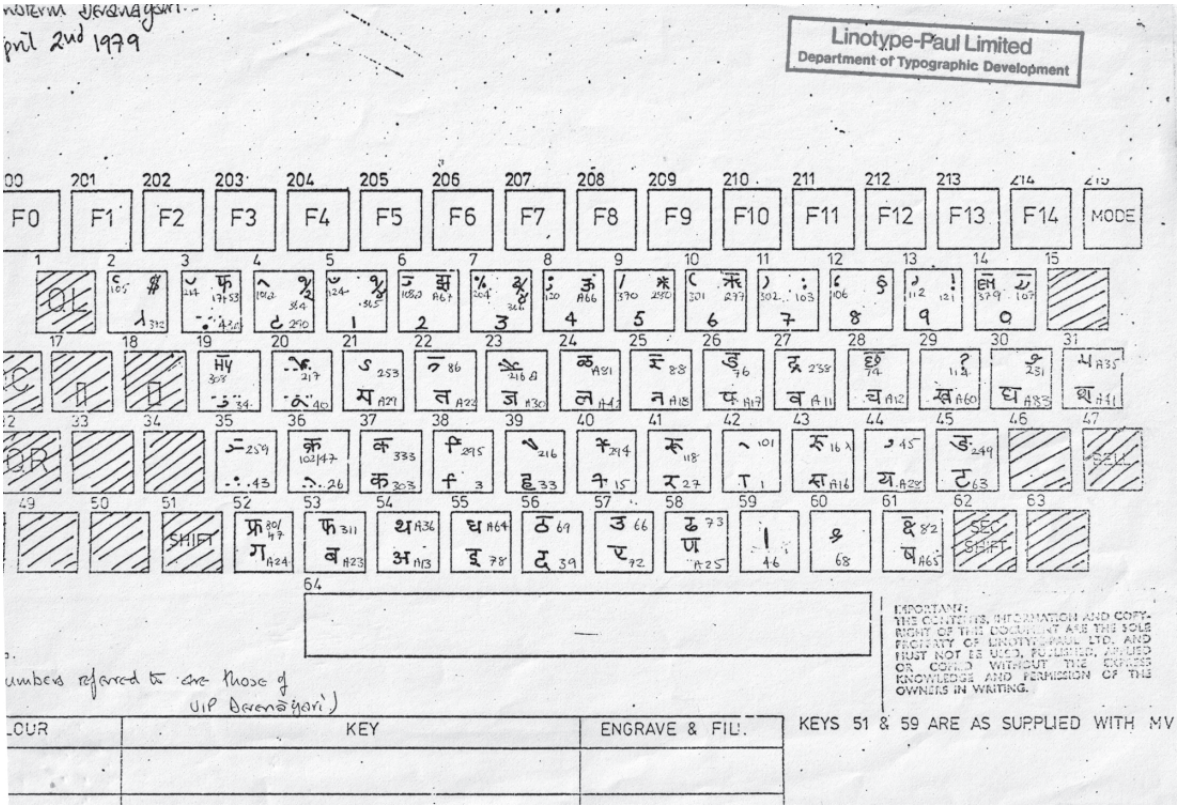


Fig. 17. Linoterm Devanagari keyboard-layout diagram by F. Ross for Linotype-Paul (1979). Reduced to 60 percent.

of common ligatures (including conjuncts) – such as क्र, फ्र, रु and रू – were included in the fonts and were accessible through the keyboard and, as Ross noted:

> Some ligatures appear on the character list which are not to be found on the keytops. These only number 8 and will be placed in relatively 'logical' positions on font 2. Their positions will be memorised by the operator. Since English will be engraved on the front of the keys, I [Ross] felt that these ligatures could at least be engraved on the sides to avoid any problems. Bala, however, was adamant that this was unnecessary; it was he who first wanted to put Devanagari on the Linoterm.[82]

Thus, true to all Devanagari keyboards developed to-date, the nature of the keyboard governed not just the font-layout but the character-repertoire and therefore the artwork. In other words, the keyboard was central to the development of the typeface design. Consequently, irrespective of staffing problems within the Department of Typographic Development, until the Linotron 202 keyboarding procedures for Devanagari were determined the design work – of creating integral conjuncts[83] – could not begin. It was

82. F. Ross to M. Carter, 27 July 1979, NLTC (see note 24), folder of 'Carter papers'.

83. See Bisley (1978, note 70).

to be at this stage that software and, therefore, the invisible hands of programmers contributed to the type-design process for Indian scripts.

As noted above, the development of V-I-P Devanagari was linked to the V-I-P Gujarati layout, in order to use the Gujarati programme because 'the programmers are far too busy to prepare a special one'.[84] This injunction by Tracy refers principally to the hyphenation logic, but the first foray into photocomposition for Linotype Devanagari was also constrained because its realisation could not involve the use of software to select contextual forms.[85] Character selection logic had been essential to the implementation of Arabic on the V-I–P typesetter which, in turn, inspired and was crucial to the new scheme for the digital development of Indian scripts proposed in a memorandum by Ross to Bisley, and which asked: 'Has a programmer been appointed or found within the organisation who will be looking after this project?'[86] Grounded in research – and facilitated by the emerging digital technologies of the period and the concomitant eagerness of programmers to devise new solutions to problems that had previously hindered mechanised composition of Indian scripts – the 'Phonetic Keyboard' (see Fig. 18) devised by Ross with Mike Fellows in 1978 emerged as the core component of the new scheme.

One document outlining the proposed scheme explains:

> In the past conjuncts have been formed for typesetting purposes by means of combining half forms – the half forms being engraved on the keytops. This has proved unsatisfactory since it not only necessitates the appearance of additional forms on the keyboard, which are hard to distinguish, but also tends to produce distorted forms of characters. In digitised photocomposition there is no need to employ this method since we are able to store a great number of characters in the font which do not necessarily appear on the keyboard.[87]

In this scheme, access to conjuncts was afforded by the introduction of the 'Conjunct' key on the keyboard, which set in motion the character-selection routine specific to the typeface.

The Phonetic Keyboard was revolutionary for its time since, in effect, it demanded an act of faith by its developers (Linotype) and the earliest users, to believe that, for the first time, hundreds of characters were part of the font but were not visible on the keyboard; and that this system would enable the 'keyboard operator to touch-type phonetically'.[88]

However, the Phonetic Keyboard was not strictly phonetic. Newspaper owners formed the majority of Linotype's customers,

84. W. Tracy to N. Balasubramanian, 3 December 1974, NLTC (see note 24), file 25A.

85. This use of software, although contemplated, had not been afforded to V-I-P Devanagari. W. Tracy noted in 1974 that the sales quotation to the customer, *The daily tej*, 'now includes a justifying keyboard for correction. This prevents the use of a look-up programme, and means that all the characters must be found directly from the keyboard' (W. Tracy to N. Balasubramanian, 27 March 1974, NLTC (see note 24), file 25A).

86. In-house memorandum, F. Ross to A. Bisley, 15 December 1978, NLTC (see note 24), file 202. Linotype UK was arguably the only company at the time to have a team of software engineers solely devoted to supporting non-Latin scripts.

87. F. Ross, 'Indian scripts for photocomposition', unpublished in-house document, 12 July 1979, NLTC (see note 24), file 202, p. [2].

88. *Ibid.*

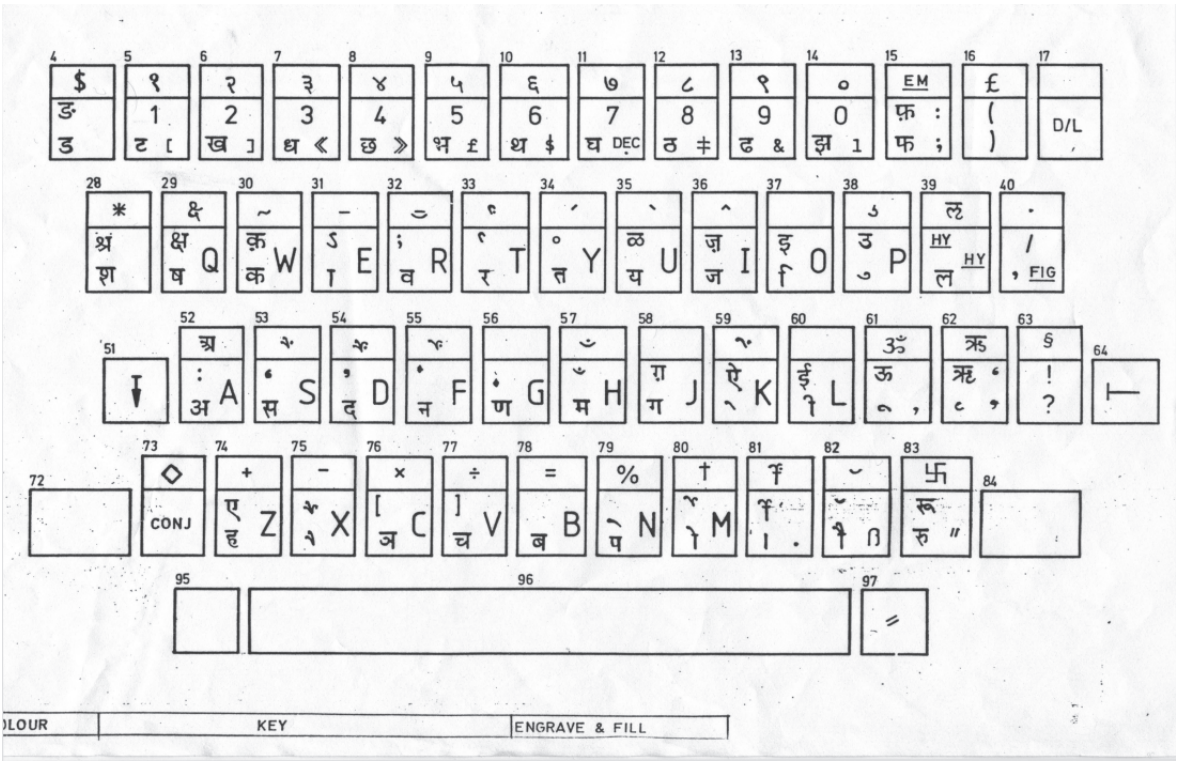


Fig. 18. Phonetic Keyboard layout diagram, with the conjunct key 'CONJ' bottom left (*ca* 1979). Reduced to 60 percent.

for whom keying speeds were vitally important, and so the keyboard continued to allow compositors to key vowel-signs in the sequence to which they were accustomed.[89] This feature prevented the great number of mistakes that would otherwise have occurred in transitioning to a purely phonetic scheme, and avoided the necessity of making experienced compositors redundant.

The Phonetic Keyboard was also cost-efficient because, although it relied on the use of Linotype's proprietary software, it could be implemented on standard keyboard hardware – the 'objective' being 'an efficient keyboard which is simple to use and fast to operate and yet can handle all the complexities of the Indian languages'.[90] Thus, in continuance of Balasubramanian's edict that 'we [Linotype] strongly believe in the right of man to express himself in the best typographical form',[91] no attempt was made to patent it. Moreover, in embracing new technology, Linotype was not wedded to the notion of maintaining backwards compatibility with previous technologies for existing customers who wished to 'go digital'.[92] It can be said that the Phonetic Keyboard, was the tool that from the early 1980s transformed the visible appearance of Indian-script typography.[93] Its implementation provided unprecedented freedom

89. Vowel-signs were keyed in visual sequence; for example, for the word हिन्दी (hindi), the first character in the keying sequence would be the kerning vowel-sign 'i' although it is pronounced after the second character 'h'. In current practice, the vowel-signs are re-ordered so the 'h' is keyed first.

90. Ross (1979, note 87). For further details see Ross (1999, note 13), pp. 216–222.

91. 'Points for meeting with Home Ministry June 1974 – Devanagari', by N. Balasubramanian, in a letter to A. Walker, 27 June 1974, NLTC (see note 24), file 25.

92. See Fiona Ross, 'An approach to non-Latin type design', *Language culture type* (edited by J. Berry, New York: Association Typographique Internationale, 2002), p. 70.

93. The publishing house Ananda Bazar Patrika (ABP) was the first to endorse the keyboard, which was

in developing new character-sets and in conceiving new design practices, thereby providing the incentive and opportunity to achieve higher typographical standards, which, in turn, depended on the activities that took place both within and outwith Linotype's UK drawing-office.

NEW HANDS, NEW PROCESSES

It was at first calculated in 1979 that the new digital Devanagari fonts would require 283 glyphs (digital characters or character elements) in each weight of Light and Bold and, although Matthew Carter was willing and able to undertake a greater number of the required Devanagari revisions and additional drawings than originally envisaged, it was evidently imperative to re-staff the letter-drawing studio. Following the Typographic Department's relocation to Cheltenham in 1980, contrary to Linotype's customary practice, and encountering Tracy's disapproval, it was decided to hire university graduates rather than school-leavers.[94] The staff recruited over the next twelve months had backgrounds in fine art, calligraphy and cartography. Although by then the letter-drawing office only undertook non-Latin designs[95] (namely, Arabic, South Asian, Thai and Ethiopic scripts), the test for applying to join the Studio was to draw freehand a copy of the Times Europa 'S' designed by Walter Tracy – as Georgina Surman, who was to undertake the majority of the Devanagari extension work, recalled in an interview on 14 November 2019.[96]

Serendipity played a part in Surman's recruitment in the early 1980s: despite graduating with a BA in Fine Art, she joined Linotype to work in the Accounts Department at the Cheltenham office. There she was spotted for her 'arty' dress sense by Terry Byrne, Manager of Font Services, to whom the Department of Typographic Development reported in the absence of a replacement for Bisley. Others were to join the Studio briefly but by 1983 – the year when the digital Linotype Devanagari fonts were being implemented in newspaper offices in India – the staff had stabilised to those depicted in Fig. 19. The team, which is how the Department staff saw themselves, was divided between those described as letter-drawers, who worked in the Studio, and those involved in research and development. This team, with one exception, worked together for over a decade.[97] It was by no means a conscious decision to hire principally women. However, most of the men who applied for positions appeared to lack the necessary commitment to working on the typographical development of non-Latin scripts (which required many months of training through practical experience).

instrumental in confirming its acceptability since Bengali conjuncts often bear scant resemblance to the consonants from which they are derived. As ABP also required Devanagari, at their suggestion, due to the nature of the Phonetic Keyboard, theirs was the first three-script keyboard, bearing Bengali, Devanagari and Latin.

94. The Department then comprised only Fiona Ross and Lesley Sewell; Ross reluctantly took on the running of the drawing office in 1980.

95. The Department of Typographic R & D was keen to shake off the previously used term 'exotic', which was inappropriate for scripts used widely outside Europe, and because it would occasion offensive comments and attitudes towards the all-female staff of the Department. The term 'non-Latin' was considered at Linotype to be a technical term that would counter the dominance of Latin as the default software and approach to type-design and font production.

96. G. Surman interviewed by Alice Savoie, 14 November 2019. Lettering, Printing and Graphic Design Collections, Department of Typography & Graphic Communication, University of Reading.

97. Sarah Morley, a University of Reading graduate, while enjoying the work as a researcher mainly employed on Arabic type development, left as she recognised there was no route for promotion. Ross, who was Head of Typographic Development, was only made manager in 1985, several years after fulfilling this role and was the first female manager at Linotype UK.

Fig. 19. Photograph (by Brian Donnan) of the Department of Typographic Development letter-drawing studio and research staff, 1983. *Left to right:* Georgina Surman, Lesley Sewell, Sarah Morley, Gillian Robertson (later Barret), Ros Coates, Fiona Ross and Donna Yandle.

.

The research which lay behind the implementation of Devanagari on the Linotron 202 (conducted in parallel with a study of the history of Bengali type)[98] was based on the desire to 'arrest the degradation of Indian typeforms imposed by the introduction of hot-metal typesetting practices'; and the premise that 'to appreciate how the printed forms had arrived at their current shapes, it was essential to view them from an historical perspective and to assess whether factors influencing their design were still pertinent in the digital era'.[99] Consequently, the notion that research underpinned best practice was fostered throughout the Department's time at the Cheltenham Linotype headquarters. Regular seminars on Indian orthography for both the letter-drawers and the research assistants were therefore introduced by Ross in recognition that a thorough understanding of Brahmi-derived scripts, such as Devanagari and Bengali, was highly beneficial to the execution of their digital typographical representations. Staff were encouraged to visit the libraries of SOAS and St Bride in order to seek out pertinent information under guidance. Furthermore, the small in-house library that Walter Tracy had started was expanded to include further information on relevant scripts and exemplars of good typographical practice, a selection of which was acquired through Linotype Associates India Private Ltd (LAI), headed then by Balasubramanian

98. This research was conducted by Ross (forming the basis of a PhD in Indian palaeography at SOAS), which culminated in the first Bengali digital fonts – Linotype Bengali – first published in ABP's eponymous newspaper in 1982 (shown in Fig. 29).

99. Ross (2002, note 92), pp. 65 and 70.

Fig. 20. Photograph of N. Balasubramanian (right) welcoming the President of India, Shri Sanjeev Reddy, to the Linotype office located in Delhi, 1977. From the Ramnathan family archive courtesy of Kala, Dhananjay and Rohini Ramnathan.

with whom the Department continued a close relationship over the years (Fig. 20).[100]

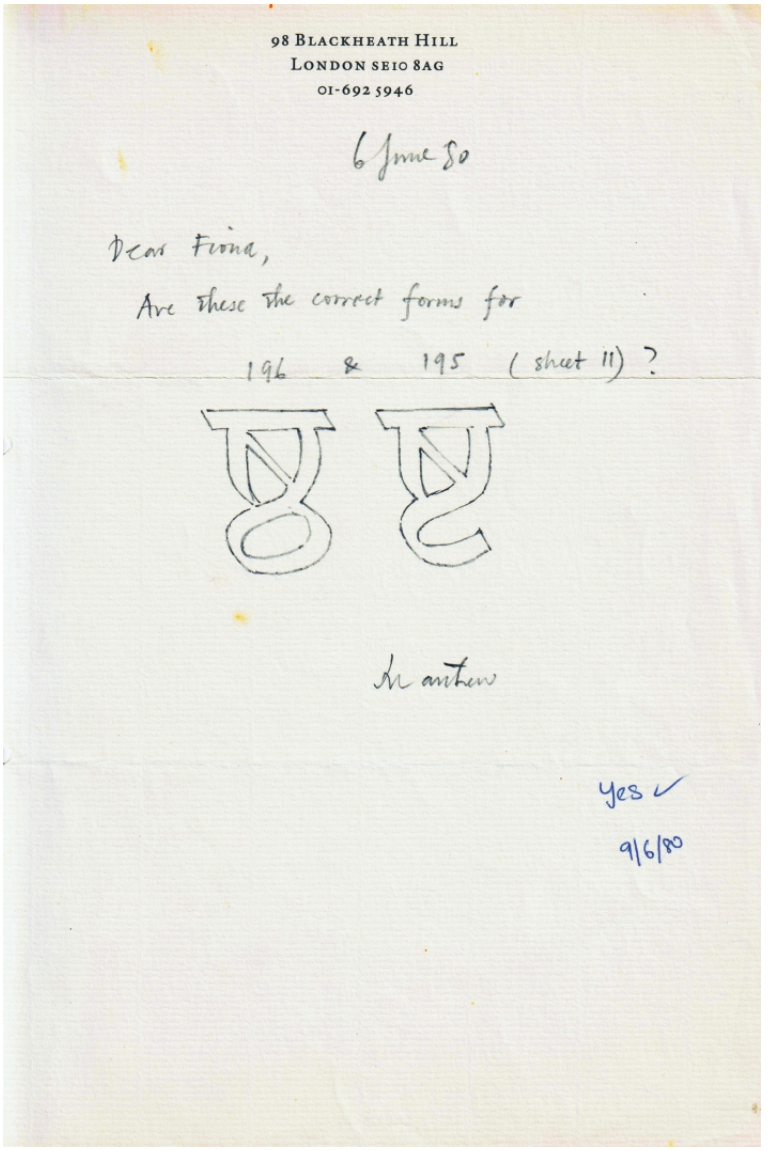
In the 2019 interview, Georgina Surman confirmed that 'a strong research component' formed part of the design process which, often informed by script primers that illustrated correct stroke-sequences in character formation, was initiated by drafting characters specified by Ross on tracing paper, which would then be scrutinized and amended when appropriate before being drawn-up as finished artwork. However, the design process for the Devanagari digital type development was somewhat unusual in two regards. Firstly, although the design required over 200 additional original characters and a small number of revisions (not '360 redrawn' as Bisley had inaccurately stated),[101] the base characters had already been designed and published; and while staff were in the process of being recruited and trained, Carter had already undertaken revisions for the Linoterm and was continuing to add a considerable number for the Linotron 202 implementation (see Fig. 21).[102] Secondly, and more importantly, the artwork was at a size specific to Matthew Carter's work, a size which had not been employed in Linotype-Paul Ltd's letter-drawing office by Walter Tracy.

Hitherto, the medium for new Linotype designs in the London letter-drawing studio had tended to be pencil drawings of 'finished artwork' within a drawing-area approximately 12 inches high, on paper from which a hand-cut negative, a frisket, would be cut from Rubylith masking film – a process at which Sewell excelled, and

100. Nataraja Balasubramanian died at the age of 56 on 23 January 1982; his son, Balasubramanian Ramnathan (known as Ramnath), took on the role of Managing Director of the LAI in February 1982 (e-mail from Dhananjay Ramnathan to Ross, 5 June 2021).

101. Bisley (1978, note 70).

102. Documentation from Carter lists some 171 characters in the Light weight and 173 in the Bold (28 July 1980, NLTC (see note 24), folder of 'Carter papers'). Presumably money saved on salaries for non-existent staff helped pay for Carter's artwork.


98 Blackheath Hill
London SE10 8AG
01-692 5946

6 June 80

Dear Fiona,

Are these the correct forms for

196 & 195 (sheet 11) ?

Yes ✓
9/6/80

Fig. 21. Letter in pencil from Matthew Carter to Fiona Ross regarding the shaping of new Devanagari typeforms (Ross's response in blue biro), 6 June 1980. Reduced from 300 × 210 mm.

which was followed for the Linotype Bengali digital fonts drawn by Tim Holloway:[103]

> The drawings and friskets were register-punched and aligned with a transparent background drawing-mask by means of a pin-bar in order to ensure perfect character fit – a particularly essential requirement for joining scripts. Each typestyle would have its own drawing mask produced by the Department showing the baseline, the kerning area and the size of the typesetting window along with vertical lines spaced according to the relative unit-width system employed. Earlier typefaces would have different drawing-masks for the different master sizes.[104]

103. These friskets were digitised at Stempel AG (Frankfurt, Germany), as were Sanskrit Devanagari additions at a later date.

104. Fiona Ross, 'The Linotype non-Latin collection, University of Reading', *Non-Latin typefaces: at St Bride Library, London and Department of Typography & Graphic Communication, University of Reading* (edited by R. Banham and F. Ross, London: St Bride Library, 2008), p. 34.

Fig. 22a and **22b**. A phototype 'frisket', positive and reverse, for a Linotype Devanagari character-shape that fell out of use (as circled in pencil in Fig. 13). Reduced from 164 × 214 mm (overall frisket dimentions).

However, Carter's Devanagari drawing-size related to a particular camera that was situated at MLCo in Long Island, named in one piece of correspondence as the 'Brown camera'.[105] The fact that the artwork followed Mike Parker's practice at Mergenthaler of using 'black on-white inked-in right-reading drawings' and was produced on 'Cronaflex mylar drafting film'[106] measuring approximately 9 inches, indicates that the friskets (Fig. 22a and 22b) were made by photographic means with this camera and overseen by Bruce Lehnert . This process greatly accelerated font-production times.

105. M. Carter to M. Parker, 9 June 1975, NLTC (see note 24), folder of 'Carter papers'. Contrary to former information, Carter stated it was not specifically built to cater for his art-work (discussion with Ross, September 2018).

106. E-mail from M. Carter to F. Ross, 17 April 2021. Carter recalls that 'the capitals of Snell Roundhand, which was made in this way, are about 5.5. inches high'.

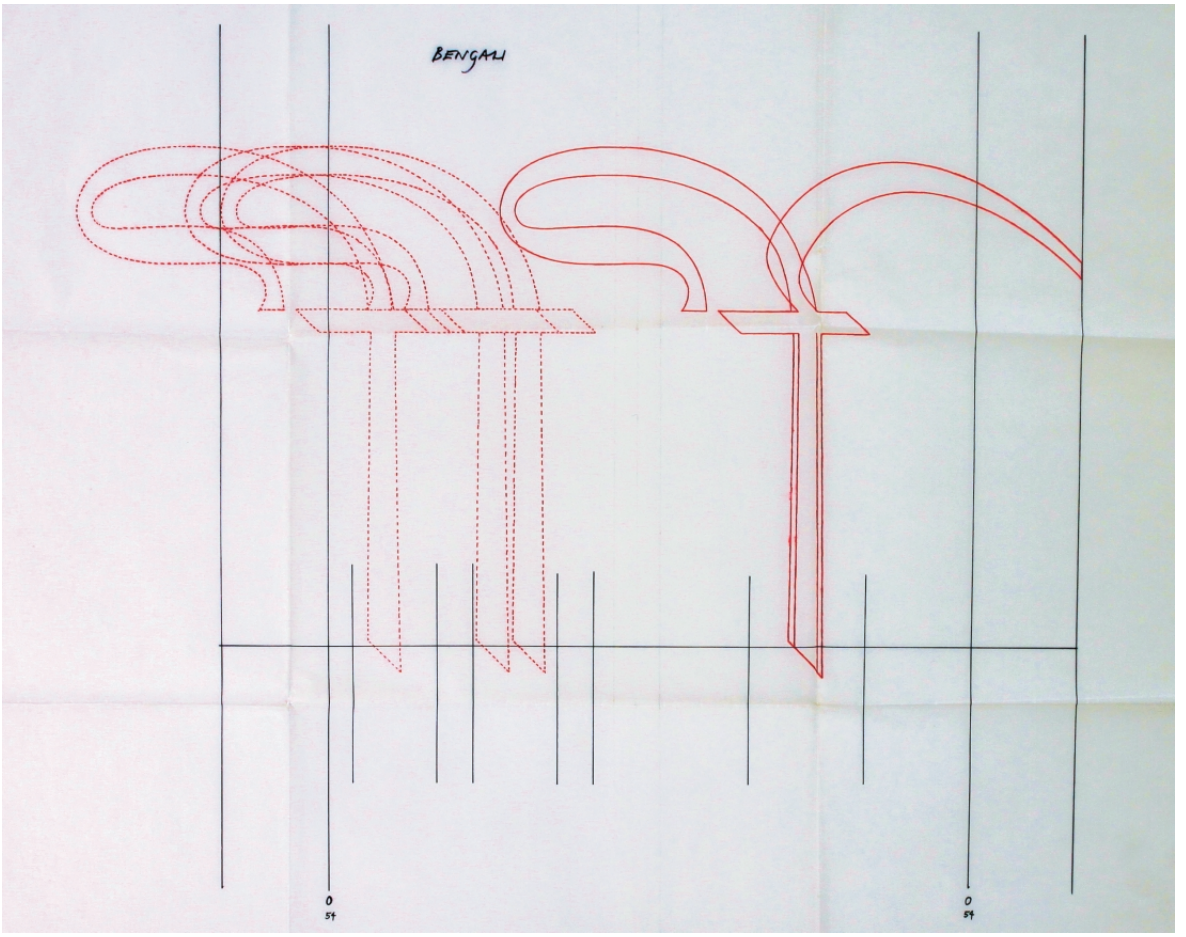


Fig. 23. Drawing templates for kerning vowel-signs utilising available horizontal offsets for digital type in Bengali by Tim Holloway (*ca* 1978). Reduced from 410 × 586 mm.

For determining character widths, the Devanagari artwork was originally drawn to the relative-unit system of eighteen units to the em-square; however, aided by software development and experience gained from the ongoing work on digital Bengali, it became clear that to achieve the desired precision in the fitting of vowel-signs and other marks it was imperative that all artwork adopt the more refined fifty-four-unit system.[107] Trials by Holloway for Bengali composition, and in the Studio for Devanagari, demanded from the software-support team the possibility to kern (in increments of up to nine units) in both directions (see Fig. 23) – finally laying to rest the ghost of Linotype's hot-metal practices. Furthermore, it was imperative for the software to enable superscripts and subscripts to be positioned according to different x–y co-ordinates as necessary – an earlier V-I-P restriction had been that of having either 'high' or 'low' accents. In practice this meant that in the Devanagari fonts, for example, the two superscripts – the ◌ॅ (ekar)

107. See A. Savoie, *International cross-currents in typeface design: France, Britain and the USA in the phototype-setting era*, unpublished PhD thesis, University of Reading, 2014, pp. 216–217 and 233–237. The even more flexible system of 1000 units was available and was adopted in Post-Script font-production in the late 1980s; see F. Ross, *The printed Bengali character and its evolution* (2nd revised edition, Kolkata: Sishu Sahitya Samsad, 2009), p. 222.

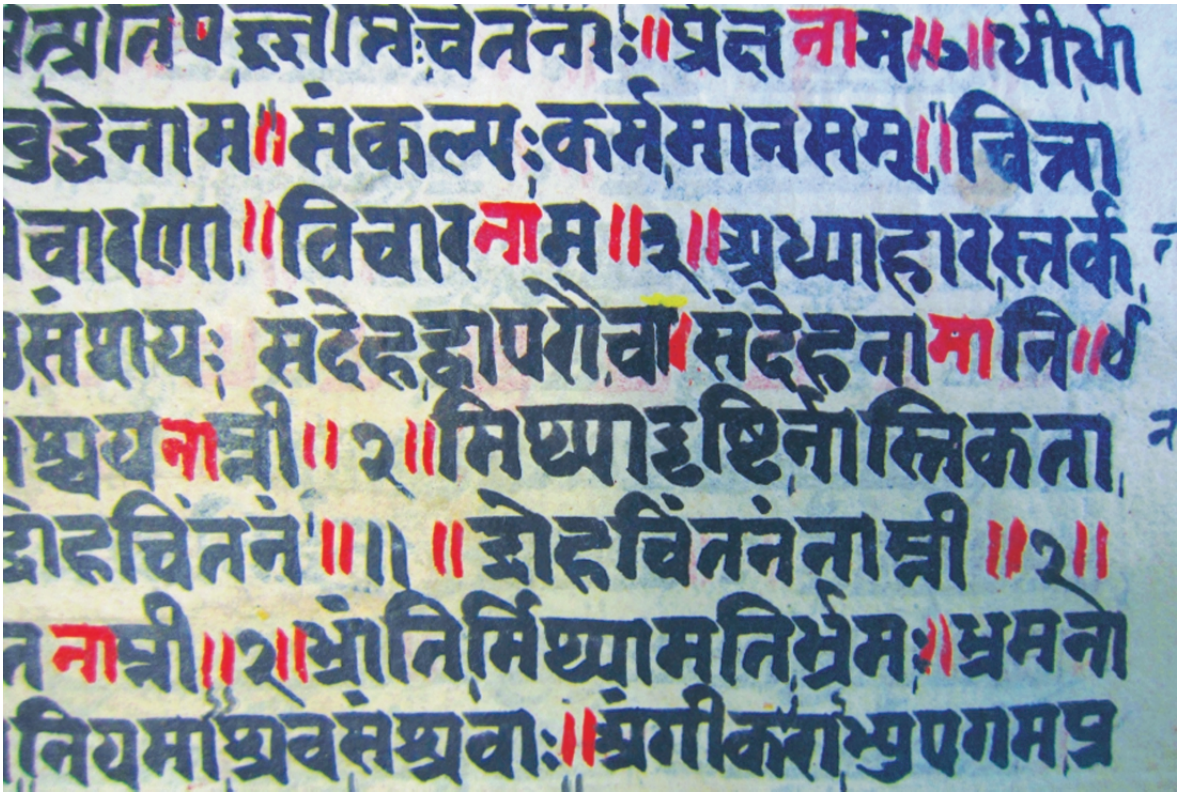
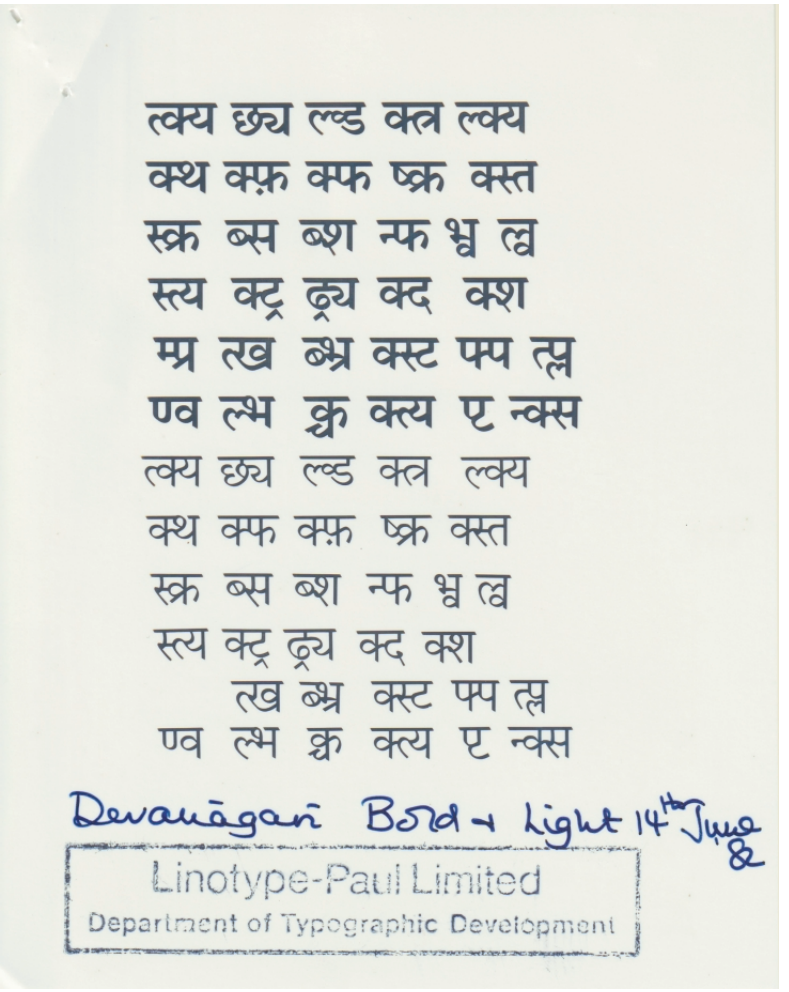


Fig. 24. Enlarged detail of the Amara-Simha manuscript (*ca* 1800). SOAS Library, MS 44425. Reproduced courtesy of SOAS, University of London.

and the ˙ (anusvara) – could adopt different positions as found in manuscript practice (see Fig. 24). As Mike Fellows was to remark, 'it is all about fonts and the software. If you don't have both … you cannot achieve fine typography'.[108]

Further improvements were introduced to the Devanagari design, which after April 1982 was undertaken in the Cheltenham letter-drawing studio headed by Georgina Surman, and which at that time included Hellie Fuller. Photographic reductions (Fig. 25) of new or revised artwork were periodically sent to Carter for review until he decided such reviews were no longer necessary, particularly as he was not overly familiar with the script. Furthermore, there was growing self-confidence in the Department's design and font-development skills, which had benefited from Carter's initial assistance, and which were supported by Linotype's software engineers – and by Balasubramanian and K. K. Singh in India, who were in close touch with their customers whose requirements and feedback were relayed to Cheltenham. Consequently, the additions and revisions to Linotype Devanagari, comprising the design of fully-formed conjuncts and the reshaping of ill-proportioned hot-metal legacy forms, under Ross's supervision became points of

108. Mike Fellows interviewed by Fiona Ross and Alice Savoie, 16 June 2020. Follow-up questions 20 July and 20 August 2020. Lettering, Printing and Graphic Design Collections, Department of Typography & Graphic Communication, University of Reading.



Left: **Fig. 25**. Photographic reduction of new conjunct trials by G. Surman for Linotype Devanagari digital types sent to M. Carter (1982). Actual size.

Below: **Fig. 26**. Drawings of the type-form 'chva'. *Top:* For Linotype Devanagari, by M. Carter (*ca* 1975). *Bottom:* Revised design for the digital fount, by the Linotype letter-drawing studio (*ca* 1983). Ink on drafting film. Cropped and reduced to 36 percent.

reflection and discussion between colleagues rather than merely instructions handed down to the letter-drawers as had been the case under Walter Tracy's management. In other words, Georgina Surman and those working with her were able to make design decisions rather than simply execute orders, which marked a significant change in letter-drawing office practice for the British branch of Linotype (see Fig. 26).

Mike Fellows noted that 'probably the most significant change at that time was having the type-developers of the Type Drawing Office or the Type Department in the same building as software development and, as time went on, this became a more critical, close association'.[109] Within the Typographic Department itself, the R & D staff were responsible for numerous inter-related tasks which, aside from working with programmers (specifically Mike Fellows and Ishmail Parekh) on software specifications, included

109. Mike Fellows, follow-up questions to interview, 20 August 2020 (see note 108).

Right: **Fig. 27**. Section of a Linotype Devanagari conjunct table showing keying sequences to set conjuncts using the Phonetic Keyboard (*ca* 1982). Such tables are commonly used in schoolbooks to teach children the Devanagari script. Reduced to 65 percent (margins cropped).

क+क=क्क	क+व=क्व	ख+व=ख्व
क+ख=क्ख	क+व+य=क्व्य	ख+श=ख्श
क+च=क्च	क+श=क्श	ग+ग=ग्ग
क+ज=क्ज	क+ष=क्ष	ग+घ=ग्घ
क+ट=क्ट	क्ष+म=क्ष्म	ग+ज=ग्ज
क+ण=क्ण	क्ष+य=क्ष्य	ग+ण=ग्ण
क+त= क्त	क्ष+व=क्ष्व	ग+द=ग्द
क+त+य=क्त्य	क+स=क्स	ग+ध=ग्ध
क+त+र=क्त्र	क+स+ट=क्स्ट	ग+ध+य=ग्ध्य
क+त+व=क्त्व	क+स+ड=क्स्ड	ग+ध+व=ग्ध्व
क+थ=क्थ	क+स+त=क्स्त	ग+न=ग्न
क+द=क्द	क+स+प+र= क्स्प्र	ग+न+य=ग्न्य
क+न=क्न	क+स+प+ल=	ग+ब=ग्ब
क+प=क्प	क्स्प्ल	ग+भ=ग्भ
क+प=क्प्र	ख+ख=ख्ख	ग+भ+य=ग्भ्य
क+फ=क्फ	ख+त=ख्त	ग+म=ग्म
क+म=क्म	ख+न=ख्न	ग+य=ग्य
क+य=क्य	ख+म=ख्म	ग+र=ग्र
क+र=क्र	ख+य=ख्य	ग+र+य=ग्र्य
क+ल=क्ल	ख+र=ख्र	ग+ल=ग्ल

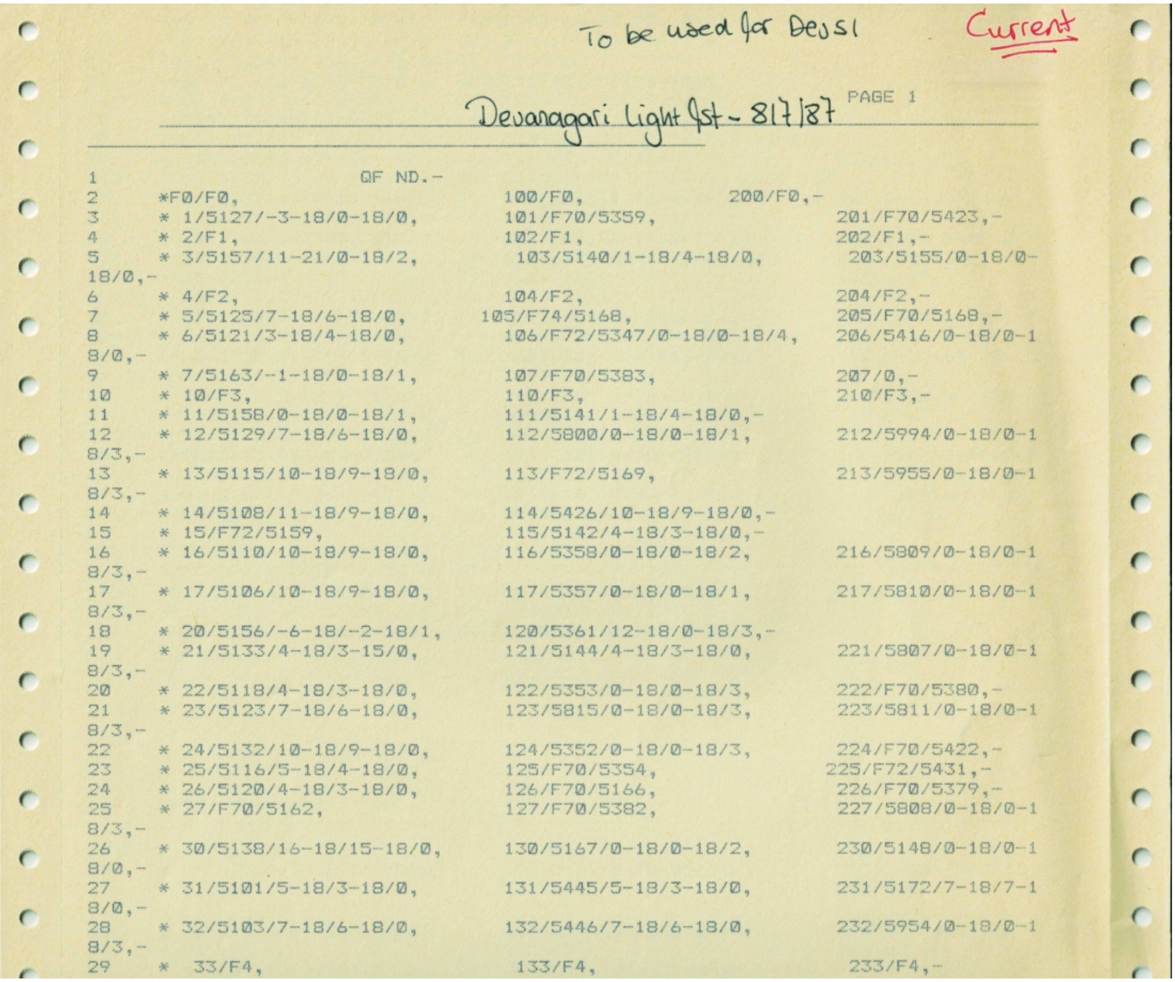
Opposite: **Fig. 28**. Section of a Linotype Devanagari FST (Font Selection Table) print-out showing keyboard character encoding, 'accent' (mark) positioning, and hyphenation logic-codes (1987). Reduced to 60 percent.

defining character-repertoires, font-specifications, keyboard-layouts, character-encodings, contextual ligature information tables (known as 'contextual look-up tables') and, as a legacy of Bisley's hasty departure, supervising keytop-engravings.[110] Ros Coates, a core member of the R & D staff, commented in 2020 on feeling part of the team:

> From what I can remember, a large part of my role involved testing the fonts for problems and if encountered, I would inform the programmers until the whole software/font package worked as it should before release. I certainly felt part of a strong team where everyone contributed to achieving the same goal.[111]

110. Immediately prior to his departure, in the full knowledge that he was leaving, Bisley arranged for the Department, whose staff only comprised Ross and Sewell, to take on many additional tasks, such as specifying and supervising the character engravings on keytops.

111. E-mail from R. Coates to F. Ross, 11 March 2020.



To be used for Devs1 Current

Devanagari Light fst – 8/7/87 PAGE 1

```
1                     QF NO.-
2    *F0/F0,                        100/F0,             200/F0,-
3    * 1/5127/-3-18/0-18/0,         101/F70/5359,                 201/F70/5423,-
4    * 2/F1,                        102/F1,                       202/F1,-
5    * 3/5157/11-21/0-18/2,          103/5140/1-18/4-18/0,         203/5155/0-18/0-
18/0,-
6    * 4/F2,                        104/F2,                       204/F2,-
7    * 5/5125/7-18/6-18/0,        105/F74/5168,                   205/F70/5168,-
8    * 6/5121/3-18/4-18/0,          106/F72/5347/0-18/0-18/4,     206/5416/0-18/0-1
8/0,-
9    * 7/5163/-1-18/0-18/1,         107/F70/5383,                 207/0,-
10   * 10/F3,                       110/F3,                       210/F3,-
11   * 11/5158/0-18/0-18/1,         111/5141/1-18/4-18/0,-
12   * 12/5129/7-18/6-18/0,         112/5800/0-18/0-18/1,         212/5994/0-18/0-1
8/3,-
13   * 13/5115/10-18/9-18/0,        113/F72/5169,                 213/5955/0-18/0-1
8/3,-
14   * 14/5108/11-18/9-18/0,        114/5426/10-18/9-18/0,-
15   * 15/F72/5159,                 115/5142/4-18/3-18/0,-
16   * 16/5110/10-18/9-18/0,        116/5358/0-18/0-18/2,         216/5809/0-18/0-1
8/3,-
17   * 17/5106/10-18/9-18/0,        117/5357/0-18/0-18/1,         217/5810/0-18/0-1
8/3,-
18   * 20/5156/-6-18/-2-18/1,       120/5361/12-18/0-18/3,-
19   * 21/5133/4-18/3-15/0,         121/5144/4-18/3-18/0,         221/5807/0-18/0-1
8/3,-
20   * 22/5118/4-18/3-18/0,         122/5353/0-18/0-18/3,         222/F70/5380,-
21   * 23/5123/7-18/6-18/0,         123/5815/0-18/0-18/3,         223/5811/0-18/0-1
8/3,-
22   * 24/5132/10-18/9-18/0,        124/5352/0-18/0-18/3,         224/F70/5422,-
23   * 25/5116/5-18/4-18/0,         125/F70/5354,                225/F72/5431,-
24   * 26/5120/4-18/3-18/0,         126/F70/5166,                 226/F70/5379,-
25   * 27/F70/5162,                 127/F70/5382,                 227/5808/0-18/0-1
8/3,-
26   * 30/5138/16-18/15-18/0,       130/5167/0-18/0-18/2,         230/5148/0-18/0-1
8/0,-
27   * 31/5101/5-18/3-18/0,         131/5445/5-18/3-18/0,         231/5172/7-18/7-1
8/0,-
28   * 32/5103/7-18/6-18/0,         132/5446/7-18/6-18/0,         232/5954/0-18/0-1
8/3,-
29   *  33/F4,                       133/F4,                       233/F4,-
```

The character-encodings and contextual look-up tables (conjunct tables, see Fig. 27)[112] were effected for the Linotron 202 by Font Selection Tables (FSTs), determined for each weight by Ross and Coates and recorded on punched paper-tape. Fellows has described FSTs as the technical framework needed to allow the digital setting of Indian scripts; they not only enabled type-developers to specify links between keyboard inputs and font-elements, but also allowed them to define co-ordinates for subscript and superscript positioning, hyphenation logic, and any contextual spacing or kerning.[113] Once the digitized Devanagari fonts were received on floppy disc from MLCo, the software programme (subsequently developed as the All-India programme) and FSTs were loaded onto the Linotron 202 by means of its paper-tape reader; font and software testing could then begin, as well as the setting of type-specimens to be sent to LAI for feedback (see Fig. 28).

112. Conjunct tables were specified in the FSTs by a list of character strings (utilising character-numbers) that, when combined, would result in a specifically-designed conjunct, also specified in the FST. The use of the 'conjunct' key on the keyboard preceding the specified combinations would drive the software program to select the correct conjunct for setting. Conjunct tables formed part of the routine testing of fonts, and the typeset results were sent to LAI and clients for reference. See Fig. 27 and 28.

113. E-mail from M. Fellows to F. Ross, 2 August 2021.

Initially, much of the testing and typesetting was done almost blind, or rather by using a Latin-script Visual Display Unit, until Coates was able to undertake, with great skill, the less urgent but nonetheless important task of designing Devanagari screen-character-shapes that were limited by the 12 × 9 dot-matrix configuration of the then front-end unit of the typesetter called the MVP Editing Terminal.[114] The Linotron 202 produced typeset copy in galley form on photo-sensitized paper that was processed in a darkroom.[115] The test results and type-specimens were scrutinized for any errors in design, software, encodings, vowel-sign positioning, alignment and so forth, by all those who had had a hand in Linotype Devanagari's creation and development. The creation of the digital Linotype Devanagari – as a trans-continental enterprise, underpinned by collaboration and co-operation between participants who embraced innovation both in the process and the technology – set the pattern for future South Asian-script in-house type-design and development.

RECEPTION

By October 1983 the Linotype Devanagari fonts were in use in India, and a report of a visit to *The Indian express* (IE) offices in Delhi and Bombay states that the operators were 'touch typing at some speed and seemed happy with the keying procedures'.[116] The report also describes the conflicting responses to the new Devanagari designs from two IE editors. Prabhash Joshi, the Delhi editor, was unused to foundry type-forms – 'some of the conjuncts he totally misread but insisted on his authority' – and wished to use half-forms, not realizing how this might affect the quality of the design. Krishna Kumar Singh, Systems Manager of Linotype India Delhi, considered such an intervention to be a retrogressive step not to be contemplated, particularly as Ramnath Goenka, the newspaper proprietor had chosen to purchase Linotype equipment on account of the quality of the typeface design achieved for Bengali.[117] On the other hand, Mrs V. Pendse-Naik, the Marathi editor

114. Wallis (1988, note 45), p. 54. This was the same unit that had been used to drive the V-I-P and the Linoterm, so that customers upgrading to the Linotron 202 could use the same terminal but with new software. Later versions of Apple keyboards, rehoused by Linotype as, for example, Linokey II, utilised the Phonetic Keyboard for South Asian scripts.

115. This process was relatively costly, and devices such as the line-printer LP82 were devised at Linotype for proofing Indian scripts.

116. F. Ross, 'India visit report' unpublished Linotype in-house document, 2 December 1983 (author's copy), p. 1. At a later visit to *The times of India* offices (the only newspaper to transition from V-I-P to the Phonetic Keyboard), the editor reported that keying speeds had improved by forty percent in one week and thus he did not need to make any redundancies. A policy of the leading Keralan newspaper *Malayala manorama* was never to 'make anyone redundant' (*Ibid.*, p. 14).

117. *Ibid.*, p. 3.

of *Lokaprabha* at the IE Bombay offices, declared the conjuncts to be 'correct' and was happy to report an increase in readership since introducing the Linotype Devanagari digital design.[118]

Pendse-Naik requested that more Marathi conjuncts be created in pursuance of IE's policy of not using half-forms, or the 'halant sign' (which deleted the inherent vowel), in setting the often-needed transliteration of loan-words and foreign names that formed unusual consonantal clusters. Fortunately, the Phonetic Keyboard, which allowed flexible links between keys and characters in the font, meant that it was possible to add to the character-set after equipment had been installed without affecting the keyboard hardware, something which had not been possible with earlier Linotype technologies. The use of customised Font Selection Tables (FSTs) permitted the character-set to vary according to language requirements; separate FSTs were created for Hindi, Marathi and Rajasthani composition, and some were tailored to specific customer requirements. Over time, the Linotype Devanagari character-set exceeded 300 glyphs as conjuncts for neologisms and transliterations were added. Sanskrit and Vedic forms were also added to the fonts as they were updated for new generations of Linotype typesetting equipment. In the course of each transition to a new technology, and to take advantage of any technological developments, the design was re-evaluated and digital outlines reviewed and refined by the Typographic Department; yet the Linotype Devanagari typeface, propelled by Linotype proprietary software, retained its identity – even for the first iteration of PostScript fonts in 1988, which required a temporary reduction in the character-set.

The typeface design, taking its cues from Nirnaya Sagar types developed by the Javajī Dadajī Type Foundry but with less stroke-contrast and revised proportions, took pains to follow Indian penmanship, and in its digital iteration achieved a stroke-fluency with kerned forms akin to manuscript lettering. Many conjuncts could be more compact than their V-I-P renditions, and also benefited from precision in mātrā positioning. However, the characters ख (Kha), ध (Dha) and भ (Bha) in their digital format continued to show signs of script-reform strictures, which Balasubramanian insisted to Tracy were a government requirement (at least for ध and भ).[119] Although deliberately compact in width to achieve economies of space for newspaper setting, the Linotype Devanagari digital fonts achieved an aesthetic and legibility that had not been available to mainstream printers for forty years. Mike Fellows, in his later position as Marketing Director, reported that Linotype's Indian-script digital fonts and reliable, high-quality typesetters had

118. *Ibid.*, p. 20.

119. N. Balasubramanian to W. Tracy, 31 July 1975, NLTC (see note 24), file 25A. The 'looped' nature of these forms was reduced by Ross in the subsequent Rohini, Adobe Devanagari and Murty Hindi typefaces.

Fig. 29. List of South Asian digital Linotype faces. Detail from the first page of a loose-leaf type-specimen (Linotype-Hell Ltd, [*ca* 1990]). Reduced to 80 percent.

given the company a ninety percent share of the Indian vernacular newspaper market in the last two decades of the twentieth century, the Devanagari fonts having the largest readership (see Fig. 29).[120]

It had long been a company policy of Linotype not to name designers of typefaces upon their release unless the designers were famous. Thus, it was possibly only at the publication of the 1983 photograph of Department staff in 2008 that those at the core of Linotype's non-Latin digital font development became publicly visible, were named, and revealed to comprise an all-female team.[121] The work of the Typographic Department during this time was respected by those in other interested departments and particularly by colleagues overseas.[122] Mike Fellows in a 2020 interview recalled that 'Martin Boothman [Managing Director] appreciated and was interested in what was being done, I think, and understood that this was ground-breaking stuff, which a lot of people wouldn't have understood'.[123] Such respect was not naturally accorded to the Department by other Linotype staff, many of whom were unaware of the reception to its typographical exertions. As Fellows said, '80 percent of the company had no idea what was going on'.[124] It was apparent at the time that the sales representatives located in Cheltenham tended to see fonts merely as peripheral to machine sales, an understandable tendency since they only received commission on the latter. Surman recalled the lack of respect even from some senior managers connected with the Department. Referring to one man under whose management the Department was placed for a period of time she stated: 'Fiona [Ross] pushed for us

120. Although Fellows' report might sound like a marketing statement, the point he was underlining was that the fonts could not have occupied such a large market share at this time had it not been for the reliability and quality of Linotype's typesetters.

121. The photograph was originally published in *Linotype express* (Cheltenham: Linotype Ltd, 1983, p. 3), but was reprinted in Banham and Ross (2008, note 104, p. 36). See also Fig. 19.

122. Including Linotype's Middle East Liaison Office (MELO), situated first in Beirut and then in Nicosia, Cyprus, which requested assistance in obtaining Arabic of the same quality as that they had observed in the Bengali and Devanagari fonts. The technologies at that time meant that type-design and type-making could not be carried out independently.

123. M. Fellows interview (see note 108).

124. *Ibid.*

to get better wages but … he didn't regard us as anything other than, you know, the girls who draw stuff in that room'.[125] That it was women who were at the heart of the enterprise did not seem to be the issue. The Head of Personnel in 1983, when discussing a pay-rise for the drawing-office staff with Ross, who had stressed the importance of the type work, declared that the Personnel Department would not 'be held to ransom by tuppeny-ha'penny artists'.[126]

Ros Coates, who had undertaken clerical work prior to joining Linotype, was herself not displeased with her salary and felt she received recognition for her skills. However, she succinctly described the situation that applied to the entire Department: 'I don't recall any one moment when I questioned whether I was being underpaid against my male colleagues. Perhaps this was to do with being the only person assigned to my specific role and therefore there was no direct comparison available'.[127] Surman, who was concerned about over-specialisation and disliked working in an office, however, stayed for over ten years honing her creative design skills and making decisions that went far beyond those expected of a 'letter-drawer', to the benefit of innumerable readers. Ambition was not a strong point for Surman or Ross, who were particularly invested in the work itself, but it was evident that there was no clear career progression for Department staff within the company.[128] The Department expanded significantly when in 1988 it was granted a license by Adobe Inc. to use their tools for PostScript font production and became a key group in the newly-founded Special Projects team headed by Fellows. However, Linotype Ltd closed its offices in 1996, and the Linotype Devanagari fonts were no longer legitimately available for purchase for over twenty-five years.

LEGACY

At its publication in 1983, the Linotype Devanagari digital typeface made a significant contribution – building on its earlier counterparts – to the visible representation of South Asian languages (potentially more than 120 different languages). Unfortunately, its use as the principal display and text typeface in national newspapers did not spark a renaissance in Devanagari type-design. On the contrary, with the development of accessible and affordable font-making tools, the typeface became, like its sister Linotype Bengali, increasingly subject to piracy – at the hands of publishers as well as typefounders, who were secure in the knowledge that Linotype would not prosecute.

Evidence of such piracy is immediately discernible in many publications that make use of cloned forms of the Linotype Devanagari

125. G. Surman interview (see note 96).

126. M. Fellows interview (see note 108).

127. E-mail from R. Coates to F. Ross, 11 March 2020.

128. See interviews of M. Fellows and G. Surman (notes 96 and 108).

font: these exhibit inconsistent design-traits through poor digital outlines; an evidently limited character-set, necessitating the re-adoption of ill-fitting half-forms indicative of hot-metal, and, to a limited extent, film composition; and poor layout-software that contributes to poor fitting (spacing and mātrā positioning).[128] The many examples of poor typographical practices visible in fonts masquerading as Linotype Devanagari illustrate how imitation rarely produces more than a superficial resemblance to the original fonts and their embedded attributes, and only serves to impair readability. Recent years, however, show encouraging signs of the emergence of original, high-quality Devanagari designs. Furthermore, in 2019, the company Monotype Imaging, which had acquired Linotype in 2006, re-released the Linotype Devanagari fonts in five weights in OpenType format, and with added contextual forms, particularly variable length vowel-signs.[129] And, inevitably, with more hands involved in the process.[130]

As a case-study in type-design and font-development, that of the Linotype Devanagari digital fonts is perhaps an outlier since the factors, and actors, influencing its conception and gestation can be traced over an unusually extensive period and through a fair number of design iterations. Yet, documenting the digital typeface's origins and development assists in countering the impression, often given in historical accounts, that type-design is customarily a solitary occupation undertaken by one acclaimed individual. Especially for South Asian scripts, most typeface designs – which can only be useful to a community when manufactured as working fonts – emerge from a collaborative enterprise informed and executed by different contributors in answer to specific typographical needs. It hardly needs stating that it is not possible to acknowledge the entire multiplicity of contributors to the design and font-development process, some of whom may have unknowingly influenced design decisions, nor to note all the multifarious activities that helped form the final typographical outcomes.

Such a case-study also illustrates the value of researching archival resources, eliciting oral accounts from eyewitnesses and analysing material outputs. The result is a more accurate and nuanced history of typographical developments which assists in recognising the value of contributions from often-overlooked participants in the creative process, such as the design work of women in the letter-drawing studio, advice from overseas colleagues, and innovative work by software and research and development pioneers.

The creation and production of the digital Linotype Devanagari fonts (Fig. 30) was the result of international collaboration; and

128. M. Fellows remarked that an 'aspect of Linotype's quality … was consistency of design throughout a typeface' (follow-up questions to interview, 20 July 2020, note 108).

129. First introduced for Adobe Devanagari by Holloway and Ross, produced by John Hudson; see Ross (2009, note 110), pp. 223 and 224.

130. Lisa Timpe and Gunnar Vilhjálmsson were the designers employed by Monotype Imaging Inc. (which acquired Linotype GmbH and thus its fonts in 2006) to revive the typeface for publication in OpenType format under Ross's consultancy.

Fig. 30. Linotype Devanagari type-specimen (Linotype-Hell Ltd, [*ca* 1990]). Reduced from 296 × 210 mm.

those engaged in the development were keenly aware that they were not only collaborating with their immediate colleagues but with unseen hands across the centuries, stretching back to the days of Nirnaya Sagar, to help provide a better reading-experience for millions across the globe. Inevitably, many hands continue to remain invisible.