Reflection on Practice

The Martel type family

Submitted in partial fulfilment of the requirements for the Master of Arts in Typeface Design, University of Reading, 2008

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Design brief

Martel is a multi-script typeface family developed for use in contemporary Hindi newspapers. In recent years, newspapers have increasingly emphasised typeface choice as a key element of their overall brand. Appearance, robustness, and language support are all factors to be considered. In a design with more than one script, each component must work suitably alongside the others, as well as perform capably alone.

For its Regular font, Martel should include a seriffed Roman, small caps, and a Devanagari character set all equally suited to the setting of reader-friendly text. Two additional family members will assist: an Italic and a Bold. Both of these secondary faces are useful for calling attention to certain words or phrases, as well as for setting headlines of similar-size to the text.

The fonts in the Martel family shall be OpenType-formatted. Typographic features that are reasonably envisionable shall be included, and the fonts should perform as users would expect in current applications.

1. Introduction

This essay recounts my experiences over the first ten months on the MATD course and illustrates my primary achievement there to date: creating a multi-script typeface. I hope to offer readers insight into the process of typeface design and – more importantly – learning about typeface design.

Since the development of text faces that support both Latin and non-Latin scripts is one of the hallmarks of the course at Reading, this document pays particular attention to the progress of the Devanagari component of my typeface. However, mirroring the schedule of the programme, this reflection on the practice of designing my typeface will begin with the Latin.

2. Towards a new Latin text face

2.1 What makes this typeface different?

Over the course of the year, I had the opportunity to discuss my progress with a few designers not attached to the MATD course. During TYPO-Berlin 2008 , Henning Krause looked over my test sheets. He drew a box around the top right corner of one page with a mock newspaper layout. 'This is your typeface,' he said *(fig. 1)*. He was correct; the Martel typeface is intended for newspapers, makes use of simple, direct forms, and has high contrast between its different weights.


Sunday Edition | **The Newspaper**

rida could rerun primaries

Sen. Obama, the Democrat's likely presidential candidate, addressing another packed gymnasium earlier this campaign season.

upstate Pennsylvania. You could call the Levittown experience the could purchase in the mid-1950s for $8,990, with a down payment Olympic-size public pools and the Levittown Shop-a-Rama with its stores and soda fountains and its parking for six hundred cars. Last month as the epic struggle for the Democratic presidential nomination between Barack Obama and Hillary Clinton reached Pennsylvania I came to watch it through the prism of Levittown — its past and present. The dream is van-

Figure 1: Upper right-hand corner of one of Martel's test sheets, designed with a mock newspaper layout. Used from 5 April – 30 May 2008. Actual size.

These features alone, however, are not enough to delineate a new design; countless other typefaces already fill the same role. Analysing additional elements help separate Martel from the pack. For example, the design's tall x-height leaves little room for differences between uppercase, small cap, and lowercase letters. The Roman's serifs generally fall into two categories – large triangles at the ascender or x-height and wedges on the baseline and descenders. Martel's terminals are closely related – typically rounded on the outside and sheared at an angle inside. Developed as much for the Devanagari script as for Latin, Martel's stroke contrast keeps the textures of the two similar *(fig. 3)*. Other features include both scripts featuring slightly wide characters and similar rounded/sheared terminal-combinations, as well as complimentary stroke patterns and diagonal-stress axes.

2.2 Defining proportions

The Martel type family's dimensions grow from the Roman letters of the Regular weight. Since this was the part of the family where work began, it was necessary to establish certain parameters with it. Two of Martel's most characteristic features are its tall x-height and the diminutive capitals *(fig. 2)*. These place the emphasis of the design is on its lowercase letters, the most-used element of a typeface. Martel's large x-height also

Figure 2: On a 1000-unit grid, Martel's cap height is 720 units, the x-height 563, and the ascender height 854. Descender depth (not shown) is –250.

एयरपोर्ट को मात देगा नई

राष्ट्रमंडल खेलें शुरू कर दिया जाएग

दिल्ली के लोगों के लिए एक आधुनिक और तकनीकी रुप से विशिष्ट मैट्रो रेलों का ख्वाब देखने का वक्त अब खत्म हुआ, अब बारी इन पर इतराने की है. दुनिया की आधुनिकतम और सर्वश्रेष्ठ मेट्रो रेल परिवहन व्यवस्था अब भारत की राजधानी दिल्ली में है. इस 48 किलोमीटर के खुले और 13 किलोमीटर के भूमिगत रेल परिपथ और 59 स्टेशनों वाली महत्वाकांक्षी दिल्ली मट्रो रेल परियोजना पर कुल 10,571 करोड़ रूपए का खर्च आ रहा है.

अनुमानित ख़र्च का 64 प्रतिशत जापान सरकार, 28 प्रतिशत केन्द्र व राज्य सरकार और शेष परियोजना को ऋण द्वारा उपलब्ध कराया गया

पिछले दिनों एक ऐसा ही प्रतिनिधिमंडल पाकिस
स्तान का यह प्रतिनिधिमंडल आया तो था भारती
पर लौटा दिल्ली मैट्रो की वाह-वाह करते हुए. श्रीत
दिल्ली की मैट्रो को कोलंबो ले जाने के लिए
के जनसंपर्क अधिकारी अनुज दयाल कहते हैं,
और जो भी देश या शहर हम से सहयोग चाहते
करेंगे." दुनिया के इन तमाम देशों के अलावा
महानगर इसे अपने यहाँ ले जाना चाहते हैं. इस

Police

Fatal stabbing near minister's former home

The Ministry of Defence has agreed to pay almost £3m in damages to Iraqis who were tortured by UK troops in Basra in 2003, their solicitors say. Nine Iraqi men who were mistreated and the father of a man beaten to

Art

Emin work feared stolen from outside cathedral

An estimated 9.4 million motorists will have to pay more road tax under reforms aimed at punishing "gas-guzzling" vehicles, the government has admitted. Official estimates say vehicle excise duty will rise for 43%

Emergency serv

Terrified family from rocks in st

Israel's defence minis
of his country's re
against Iran if it feels
Ehud Barak, speaki
said Israel had "pro
that it won't hesitate

Figure 3: Another test sheet employing mock newspaper layouts. First used on 9 July 2008. Cropped. Actual size.

Figure 4: Martel's Latin and Devanagari glyphs employ opposite stress angles, each common to their scripts' traditional text faces.

helps make the identifying features of lowercase letters larger in smaller point sizes. It allows the counterforms room to be large, opening up the type (while Martel's x-height is quite large, the first drafts of the typeface gave it even *more* prominence, as may be seen in *figure 5*). The short uppercase helps improve letterfit, as well as eliminating the extra attention that capitals may draw to themselves in German typesetting.

2.3 Building up from sketches

The MATD course starts at a leisurely pace; the workload becomes steadily heavier over the course of the year. Before beginning with our proper typefaces, several weeks were filled with reading and making pencil sketches of type and letters. This was complemented by a series of talks from various lecturers, including James Mosley. After his slide presentations on Renaissance type casting began, I read Harry Carter's *A view of early typography up to about 1600*.[1] Along with *Counterpunch,* this focused my attention on the work of Hendrik van den Keere.[2]

At Gerard Unger's behest, I followed up my investigations into Van den Keere by looking at later baroque types – specifically at the work of Miklós Tótfalusi Kis and the Leipzig typefounders who acquired it. As I translated pencil sketches made while observing these letters into vector outlines, I attempted to open up the interiors a bit, as I felt that the 'a', for instance, would otherwise become too dark *(fig. 6)*. While my typeface eventually strayed away from this baroque origin, I tried to maintain a certain 'baroque sparkle', which I defined as a specific thick/thin contrast in the letters a and n, for example.

From the beginning, Martel's design made use of a diagonal, or oldstyle axis. Initially, this direction was adhered to because of the source material I observed during my sketching stage. However, as I came to define my brief (a multi-script Latin and Devanagari text face), I saw new advantages to this direction. Aside from my interest in the historical genre, I began to observe diagonal stress in many Devanagari text faces *(see page 37)*. While oldstyle Latins and Devanagari do not share the same axis, the oldstyle axis is a virtual flip of that used in Devanagari *(fig. 4)*.

2.4 'Adhesion' tests

There is a University of Reading manner of designing typefaces, well-documented in the writings of previous students. During this process, we were mainly guided by two instructors: Gerry Leonidas and Gerard Unger. The work begins with the Roman lowercase; specifically with the eight letters a d h e s i o n. Together, these letters allow the quick creation of a myriad of words, a task which tools like *adhesiontext.com* greatly simplify. With our dummy text, we create test sheets showing paragraphs in several point sizes (10pt, 12pt, 14pt, etc.). These are usually created in Adobe InDesign – which Gerry Leonidas once called as important to typeface design as FontLab. Looking at print-outs of letters in several point sizes of running text allows one to make accurate judgements as to which letters are not working at their intended size, which letter elements are not like the others, and how well the font's macro (text colour) and micro (individual letter pairs) spacing values have been defined.

Over months of progression according to this method, certain patterns emerged in my workflow. Changes to individual letter widths would be made, allowing the character set to work together better. These

Figure 5, top to bottom: First version of Martel (November 2007), the current version (July 2008), and the current version laid over the first. On a 1000-unit grid, the first version's cap height is 680, and the x-height 606. The current version's cap height is 720, with an x-height of 563. Ascender height (854) did not change.

Figure 6, top to bottom: Sketch made while observing baroque letters from the C. Zincken foundry, Leipzig 1743,[3] shown at 50% actual size; first version of Martel (November 2007); the current version (July 2008).

1. Carter, Harry, *A view of early typography up to about 1600.* London: Hyphen Press (2002).

2. Smeijers, Fred, *Counterpunch.* London: Hyphen Press (1996).

3. *Atlas zur Geschichte der Schrift, Band 2.* Darmstadt: Technische Universität (2000).

Figure 7: In Martel's Roman, the most difficult design challenge was to find a uniform solution for the terminals. In the left-hand column, four attempts for the a, r, and s are illustrated. It was only after more terminaled-letters were added to the mix (right-hand column) that making a correct solution became possible: 'sheared' terminal, visible in the final two rows of the right-hand column. The bottom row of the right-hand column shows the current version of the typeface.

Figure 8: The top row shows the first and last versions of Martel, while the second row focuses on the serifs. The dotless i on the left is from the first Martel, the second from the last. In an overlay of the two (third image), one can see how the top terminal's triangular wedge was compressed slightly. The asymmetry of the bottom serifs switched as the design progressed. The final serifs are enlarged (right).

changes would then be re-evaluated. The same was the case for adjustments to the thickness of the thin strokes or the definition of the serifs. However, the aspect of the Roman's design that would require the most revision was the treatment of terminals, a long process illustrated in *figure 7*.

Throughout November and December, Gerry Leonidas encouraged us to spend as much time as possible refining the letters of the 'official' course test word *adhesion*. At the same time, Gerard Unger suggested we add more letters to our character set quickly. While these two pieces of advice may seem conflicting, they are not necessarily so. Much of a design's overall texture and spacing – as well as key relationships like the thick/thin contrast and the angle of the stress axis – may be nearly resolved with the *adhesion* characters. However, adding additional letters into a workflow may help solve other problems. For instance, seeing just how many letters in the lowercase have a certain variety of terminal (in Martel's case a c f j r y share one sort of terminal and the s z another) allowed me to develop the solution needed for them to each properly relate to one another.

While the forms of Martel's serifs were arrived at more arbitrarily than the terminals, they underwent changes as well. Martel's lowercase letters have two sorts of serifs: those on the tops – at the x-height or on the ascender – and those on the bottom – on the baseline and beneath the descenders *(fig. 8)*. The upper serifs are triangular and flag-like. The lower serifs are wedge serifs, and are asymmetrical. The left side of the lower serif has a steeper angle than the right. The general impression of these serifs, especially when viewed in larger point sizes, is that they are simple – perhaps even primitive. However, the directness of the serif treatment is rooted in the purpose of the typeface: small-sized newspaper printing. In tiny text sizes (like the words you are reading now), serifs become so small that fine modelling treatments appear no different from wedges like those used in Martel; depending on the printing quality employed, fine serifs may break apart all together. Martel's serifs were developed to avoid this problem. As for modelled serifs that may be appreciated in larger sizes only, Martel is not timid; its sharp, direct serifs are a clear feature of its DNA.

2.5 The Roman has three cases

After I had reached a certain level of satisfaction with the progress of Martel's lowercase letters, I moved on to other areas of the typeface. The next element I undertook were the small caps. Like many MATD students, I heeded advice from Gerry Leonidas and designed my small caps before moving on to the uppercase. Small caps and uppercase letters are – generally – related; small caps may have somewhat wider proportions than the uppercase, and their height is certainly shorter, but they otherwise do not often deviate significantly in their forms from uppercase letters.

It falls to reason that, when confronted with uppercase and small cap letters, a designer may just as easily begin with the uppercase. On this route, one may run into trouble in a few spots that are quite tight; the apexes in the small cap M are very narrow, for example. The amount of white space needed in a capital M is different. By following an 'uppercase' model when designing this small cap, the result could be too dark.

My overall typeface proportions only allow for 157 units of space between the x-height and the cap height, which does not leave much

Figure 9: Above, Martel's original small caps and uppercase letters. Below, the current version. Although the difference between Martel's x-height and cap height is not very high, Martel's small caps are taller than the lowercase letters. Their height is slightly lower than halfway between the x and cap heights.

Figure 10: Differences between the uppercase and small cap P and R. On the left are the capital P and R glyphs. The small cap versions are in the centre. To the right, the small cap P and R have been enlarged to cap height and laid over the uppercase P and R to illustrate the differences.

Figure 11: Left, the first E and F attempt. Middle, the current versions. Right, a current small cap E laid over the first version.

Figure 12: Martel's oldstyle figures share their height with the small caps, making them slightly larger than the lowercase letters. The lining figures are slightly shorter than the uppercase letters.

choice for the small caps. Since newspapers are documents often read in haste, it was important to me that my small caps be larger than my lowercase letters, so that they would each be easily distinguishable from one another. My small cap height is 612 units – 49 units above the x-height and 108 units below the cap height. This gives the small caps the appearance of being optically in between the height of the upper and lowercase letters *(fig. 9)*.

The stroke thickness of Martel's small caps is only four units more than that of the lowercase (115 vs. 111 UPM). This helps the small caps blend in to the overall colour of lowercase text. While capital letters typically begin words or sentences, small caps may occur in long sequences within a line, and should not appear darker or jarring in relation to the lowercase letters around them. Martel's uppercase letters have a stroke thickness of 121 UPM, making them not too much heavier than the small caps, but still slightly darker when they proceed lowercase letters.

While Martel's small caps and uppercase letters tend to use the same basic forms, there are a few exceptions, notably P and R *(fig. 10)*. Although small caps are by definition 'smaller' uppercase letters, in text setting they appear together more often with the lowercase, and it may be desirable to lowercase-ify them in order for these to work together better. In essence, ideal small caps create a third case that takes elements from each of the other two.

The initial drafts of Martel's small caps and uppercase contained two letters with a treatment that did not make its way into the current version: E and F *(fig. 11)*. The initial designs for these two letters included no serif on the middle arm, but rather a flared member. With this concept, I was trying to create commonality with Martel's serifs and terminals, but Gerard Unger found this too out of sync. 'Don't start a revolution with just two characters', he imparted.

2.6 Figures and currency symbols

Martel's Regular and Italic character sets contain four figure options:

- tabular lining figures,
- proportional lining figures,
- tabular oldstyle figures, and
- proportional oldstyle figures.

I began with the proportional oldstyle figures, which I believe is the option that should be used most often in text. The oldstyle figures share an alignment with Martel's small caps, making them slightly larger than the lowercase letters and eliminating the need for separate 'small cap figures'. Making the oldstyle figures small cap height also allowed their counterforms to be slightly larger and more open, improving their legibility *(fig. 12)*.

Designing lining figures after the oldstyle figures was not difficult. Many of the outlines could virtually be reused intact. The oldstyle and lining figures do both undergo minimal changes when re-spaced with tabular values, but mostly in obviously narrow figures like 1 or 7, or in the widest (e.g., 0, 4, 6, 8, 9).

Martel's figures are relatively independent from the forms used in the Roman upper and lowercase. Nevertheless, there are a few elements of element repetition – the terminal on the 3 and the 5, for instance, or the serif on the 7 *(fig. 13)*.

Figure 13: Although Martel's figure forms are somewhat independent of the upper and lowercase, there are a few similar elements employed.

Figure 14: At the far right, a table make use of proportional lining figures instead of the tabular option. The table to its left (with the shaded columns) looks much better due to the tabular figures and currency symbols.

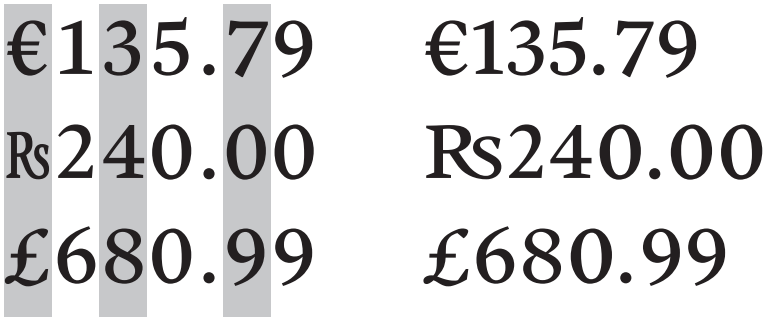
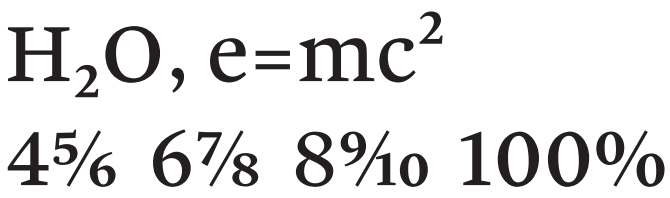


Figure 15: The top row shows Martel's figures as they appear when the subscript and superscript features are applied. The second row shows fractions built from numerator and denominator glyphs. These figures have the same size and proportions as the zeros in the percent symbol.



When designing currency symbols, I view them as additional figures. Just as Martel has four varieties of figures, there are four corresponding versions of each currency symbol *(fig. 14)*. Although it is not commonly available in most western fonts, Martel's character set includes rupee currency symbols (Rs). A ligature of an uppercase R and lowercase s, the rupee is a wide symbol. Nevertheless, Martel offers tabular versions anyway – for both the lining and the oldstyle figures (₨, ₨). The tabular lining rupee (₨) does not reach the tabular figure height; this is the compromise made to include the symbol within the tabular width.

Martel's superior and inferior numbers, as well as its numerators and denominators, all use the same small figures in a different vertical positions *(fig. 15)*. These smaller lining figures were arrived at by creating a multiple master font with a weight axis running from Martel Regular to Martel Heavy *(see pages 27–29)*. The figures along this axis were shrunk to 60% of their height, and 63% of their width. Multiple instances were then generated, and the shrunken figures from one with the best colour vis à vis the Roman text were selected.

2.7 Diacritics

Martel employs at least three different versions of each diacritical mark *(fig. 16)*. The lowercase versions sit relatively close to their base glyph. Martel's accents are bold and direct; the relationships with their characters is strengthened by proximity. The second version of the accent is for small caps. These tend to be vertically adjusted versions of the lowercase accents, while the third version – the uppercase accent – is wider and flatter. Several of the uppercase and small cap I diacritics use alternate, narrower forms than the standard variants used on wider letters.

éÉÉ

Figure 16: Martel's three accent varieties – lowercase, small caps, and uppercase.

2.8 Kerning and post-production

My kerning process began by analysing a series of words containing specific glyph pairings onscreen, making corrections where needed. The first pairs were lowercase. Afterwards, I examined uppercase–lowercase pairs, then all caps, figures, and punctuation were tuned. This was repeated for the small caps. Along the way, I created kerning classes for the glyphs I applied kerning to. Following this onscreen work, print outs of my test lines were made, was well as Leslie Cabarga's *Kern King* text.[4] These were closely examined, and corrections to errant pairs were made.

The post-production of my Regular font was undertaken in Windows with Microsoft's VOLT application. More details about the VOLT process may be found in the Devanagari chapter *(see pages 23–25)*.

The OpenType features written into Martel Regular for the Latin script include: small caps from lowercase letters, small caps from uppercase letters, ligatures, discretionary ligatures, case-sensitive punctuation, oldstyle figures, lining figures, tabular figures, superscripts, subscripts, numerators, and denominators.

4. Cabarga, Leslie, Kern King. Accessed on 20 July 2008 at www.logofontandlettering.com/kernking.html.

Figure 17: Above, a pencil sketch made while observing printed letters in a metal type catalogue from the Jawaji Dadaji foundry.[5] *Reproduced at 50% of actual size. Below, the current version of Martel (July 2008).*

3. Making a Devanagari, too

3.1 Only as good as the preliminary research

Before this project, I had little experience designing non-Latin scripts, and no familiarity with Indian languages or writing systems. How does one begin to undertake designing a Devanagari text face without such a foundation? I think that any method should begin with a lot of looking.

Our class was fortunate enough to arrive at Reading while the summer's non-Latin typeface design exhibition was on display in the typography department building. Divided between Indian and Arabic scripts, visiting this exhibition gave a digestible overview of the connection that India's writing systems have with one another. Witnessing this, combined with seeing the results of previous courses' graduates, also gave many of us a feeling of tangibility: yes, it is possible to accomplish a Latin and Non-Latin typeface within the confines of the course, even without previous exposure in the area.

While the first digital glyphs for my Latin were drawn in November, it was only in February that I began drawing Devanagari letters in FontLab. I used the previous three months to lay down the necessary groundwork. First – as with my Latin – I began by examining other typefaces, making pencil drawings of their letters. The non-Latin exhibition was of particular assistance here. Included in it was a 1967 catalogue from the Jawaji Dadaji type foundry in India, as well as samples of the Linotype Devanagari typeface. To become familiar with the individual letters and how they fit together in language, I also began writing out exercises from the book *Teach yourself beginner's Hindi script*.[6] In November, Fiona Ross – another of our instructors – conducted a workshop on North-Indian scripts. Following various templates she gave us, I made more drawings of Hindi letterforms, as well as some quick forays into writing Bengali and Gujarati letters.

My first essay, submitted in January, compared a number of Devanagari text faces on the market. Specifically, I analysed 13 typefaces. For the sake of categorization, I dived them into two groups: calligraphic and monolinear *(see Appendix 2)*. Each group had a 'standard' face to which all other types were chiefly compared. Linotype Devanagari acted as the calligraphic standard, and Linotype Rohini the monolinear. Although neither of these two families have been distributed by Linotype since the 1990s, in decades past they ranked among the most-used typefaces in Indian typesetting. Linotype Devanagari and its derivatives are still common in Hindi newspapers and magazines.

In May, I received a grant from the Alumni Study Travel Fund to travel to India and collect Hindi newspapers for my dissertation research. My experience there reinforced my hypothesis concerning the continued wide-spread use of Linotype Devanagari. There may not be a 'default' Devanagari face, in a manner comparable to Helvetica or Times New Roman. But Linotype Devanagari comes close, especially for newspapers and news-themed magazine setting.

3.2 Putting research into practice

By comparing the measurements and characteristics of common fonts for my essay, I was able to see where certain designers or manufacturers had diverged from the pack, as well as estimate what is commonly

5. Jawaji Dadaji type foundry, *Marathi, Sanskrit, Hindi type catalogue*. Bombay: Nirnya-Sagar Press (1967). From the Linotype–Paul work-file archives, held in the collections of the Department of Typography and Graphic Communication, University of Reading.

6. Snell, Rupert, *Teach yourself beginner's Hindi script*. London: Hodder Education (2003).

	Linotype Devanagari (Gate Seven OpenType version, Regular weight)	Martel	Monotype Devanagari (AAT version, Regular weight)
Body height (2048 UPM, unless otherwise noted)	1069 units	745 units (1000 UPM grid)	1277 units
Relative vertical proportions, superscripts	Less than half of body height	Slightly less than half of body height	Less than half of body height
Relative vertical proportions, subscripts	About a third of body height	About half of body height	Less than half of body height
Horizontal proportions	Normal, but tight (for newspaper setting)	Normal	Some characters have tight interior spaces
Horizontal or vertical conjuncts	Mostly horizontal	Mostly horizontal	Mostly vertical

Figure 18: Excerpt from a chart comparing measurements and features of various Devanagari typefaces, including Martel. To see the complete analysis, view Appendix 4 on page 41.

Figure 19: Martel over Linotype Devanagari; differences in form and spacing are visible.

Figure 20: The base glyph height of Martel Devanagari, as well as the height of things that occur 'above the baseline', and 'below the baseline'. In addition to the term 'base glyph height', 'base character height' is also used in this essay.

Figure 21: Martel's Latin and Devanagari glyphs employ opposite stress angles, each common to their scripts' traditional text faces.

expected from a text face *(see figure 18 and Appendix 4)*. I followed these basic proportional guidelines while drawing the Devanagari glyphs in my typeface *(see figure 19 and Appendix 3 for comparisons between Martel and Linotype Devanagari)*.

Martel's Devanagari glyphs have a base character height (the area between the baseline and the headline – the horizontal bar at the top of letters that binds words together) that is slightly lower than the Latin cap height. This allows strings of uppercase text, as well as the Latin figures, to integrate well into Devanagari text. Hindi documents – as well as those of other languages that use the Devanagari script – do not often include much Latin text in Devanagari text block, as foreign nouns are easily transliterated. Latin-script URLs and e-mail addresses are common, however. Devanagari does not have 'ascenders' and 'descenders' in the manner of the Latin script, but there are a number of above and below the base marks that may give a similar impression. Martel's above and below the base marks are about half the base glyph height. As a result, they overshoot the Latin ascenders and descenders considerably *(fig. 20)*. This means that when the Martel Regular font is used to set Devanagari text, more interline space is necessary than would be required for Latin-only text. On the other hand, Martel's 'big on the body' Devanagari glyphs are optically compatible with the Latin's. It is not necessary to resize text in one or the other, as is often the case when mixing separate Latin and Devanagari fonts together in a single text.

The in and outstrokes of the Devanagari headline – as well as the main vertical stroke common in many letters – offers several possibilities to the designer. Martel's are cut at angle reminiscent of a pen-stroke, but the cut is not a clean one. Rather a trapezoidal detail is used to help create a more subtly-defined typographic wedge. The angle of headline's cut helps illustrate the stress pattern commonly used when writing Devanagari with a broad or reed pen. This stress angle is roughly a mirror image of that used when writing with an oldstyle axis in the Latin script *(fig. 21)*.

Although Martel is designed for newspapers – a task for which Linotype Devanagari was also conceived – Martel's characters are a bit more widely spaced than this 'standard' *(fig. 22)*. As Martel is a true multi-script typeface, it was important to allow text blocks set in Latin and Devanagari to achieve closely-related colour. One method used to prevent the Devanagari from appearing darker than the Latin was to make its letter spacing a bit more generous; hence its width.

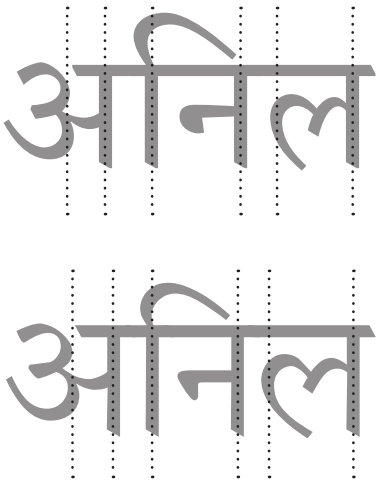


Figure 22: Rhythm differences between Martel (top) and Linotype Devanagari (bottom)

3.3 Operating systems, applications, typesetting, and realpolitik

While writing my essay, I set a sample text in each font analysed *(see Appendix 3)*. During this bit of Hindi typesetting, I first met with the difficulties of digital font support for Devanagari. Mac OS supports just one Devanagari font family, but Windows supports OpenType Devanagari fonts instead of AAT, so writing on that platform is much easier. Windows – and Microsoft's applications for it – make use of the Uniscribe text shaping engine, but Adobe's Windows applications do not. The text engine Adobe uses in its design applications does not fully support the substitution and positioning features required by Indic scripts. It is possible to create Devanagari text blocks in InDesign using the glyph palette, although this process is somewhat tedious. After my essay, all Devanagari texts I set would either be created in Word – exported in PDF format for placement in another application – or glyph by glyph in InDesign.

क, के, कु, कि, की

Figure 23: On the left is the Devanagari consonant Ka (क)*, followed by four instances in which its inherent vowel is changed to another sound by a vowel mark occurring above, below, to the left, or to the right of the glyph. The new syllables are then Ke* (के)*, Ku* (कु)*, Ki* (कि), and *Kii* (की).

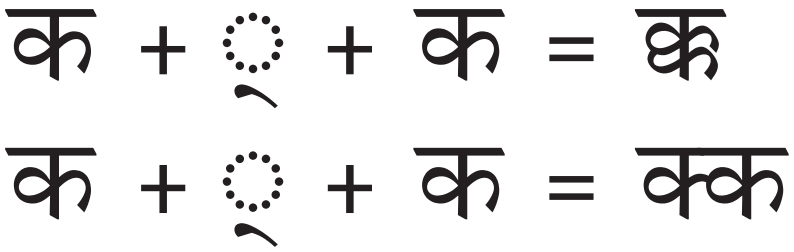


Figure 24: The Devanagari K and Ka sounds may join together to form a Kka cluster. This cluster may either be represented as a preformed conjunct (क्क)*, as is shown in the top row, or as the half form and full form combination shown at the bottom* (क्क).

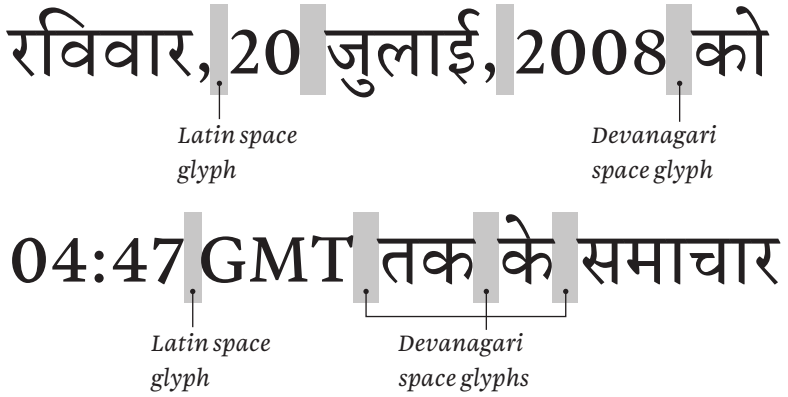


Figure 25: Martel makes use of two space glyphs. The default space (for Latin) is 200 units wide. The Devanagari's alternate space is 375 units wide.

Since I only brought my font into Microsoft's VOLT (Visual OpenType Layout Tool) during its post-production phase, my test documents during the design phase were created in InDesign using the 'hack' method mentioned above. It is interesting to note that – due to the lack of unified design application standards in the treatment of Indic text (Unicode encoded or not) – many of documents created by designers in India on a daily basis are produced via so-called hack methods, making file interchangeability difficult. There are work-around applications created by Indian software developers.

3.4 About the writing system

Devanagari is considered a 'complex script'. In comparison, Latin is a simple script. Complex scripts may include substitutions and repositionings that Latin's typographic features only begin to hint at. The basic unit of the Devanagari script is the syllable. Syllables may be vowels or consonants, but in addition to independent vowels, all Devanagari consonants have an inherent vowel sound of their own. This inherent vowel may be modified by marks that occur above, below, to the left, or to the right of the consonant *(fig. 23)*.

Consonants may also join with one another to form consonantal clusters. In the Devanagari script, these are represented by conjuncts. A bit like ligatures, conjuncts join multiple consonantal sounds together; only the vowel sound of the final consonant in the cluster remains intact. To produce this, all consonants in the conjunct but the last are represented by half forms.

In a Devanagari typeface, it would be impossible to create predawn conjunct glyphs for all possible clusters. Martel has 68 conjunct glyphs, but it could easily have hundreds mores. Where a conjunct glyph is not available, text engines like Uniscribe create conjuncts on the fly by substituting half forms for all but the last consonant in the cluster *(fig. 24)*.

A special substitution case is made for the र consonant (Ra). When this joins a consonantal cluster, it may take a form either above *or* below the base, depending on the order of the syllable's components *(fig. 26)*.

र + ◌् + क = र्क

क + ◌् + र = क्र

ट + ◌् + र = ट्र

Figure 26: The Ra consonant (र)*, when joined with another consonant in a cluster, may either shift to an above the base form, as it does in the first row above; merge together with the base glyph, as it does in the middle; or take a below the base form, as it does on the bottom. This is context-dependent.*

3.5 Design

The most valuable resource while designing Martel Devanagari was Fiona Ross. On a weekly basis, she would review test sheets, commenting on minor details and making suggestions of other typefaces or books to look at. Her critique methods rarely went deeper than this. However, it forced me to create my own practical methodology for learning about a foreign script.

During the design stage, I was working with separate fonts for my Latin and Devanagari character sets. It was only during post-production that they were merged together into a single file. After expanding my glyph repertoire past the most common vowels and consonants, two global changes were applied to the design. First, my Latin space glyph much too narrow for Devanagari, so I created a wider, alternate space (200 vs. 375 units, *see figure 25*). Second, I choose a new tactic for me E and Ai matras. In handwriting, these matras often have a "ball and stick" sort of form. My interpretation of this stroke directly related to the tail of my Latin lowercase y, a small nod to help both scripts feel part of the same typeface *(fig. 27)*.

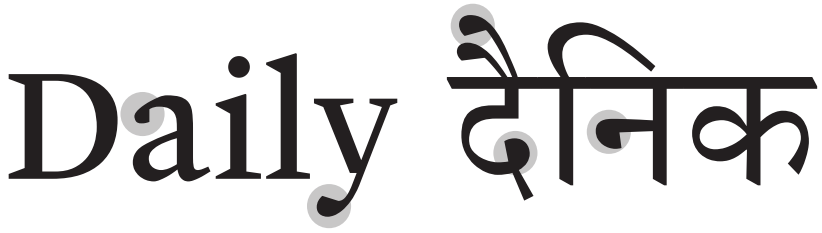


Figure 27: The sheared terminals in Martel's design help subtly bind the Latin and Devanagari together into one typeface. On the left, the sheared terminals on a and y are highlighted. These forms are repeated on the right in the Devanagari दै and न characters (Dai and Na).

Glyph ID	Unicode	Glyph name	Production name	Composition
791		DeThRa	uni0925094D0930	DeTha_DeVirama_DeRa
792		DeKhRa	uni0916094D0930	DeKha_DeVirama_DeRa
793		DeGRa	uni0917094D0930	DeGa_DeVirama_DeRa
794		DeSRa	uni0938094D0930	DeSa_DeVirama_DeRa
795		DeNRa	uni0928094D0930	DeNa_DeVirama_DeRa
796		DeBhRa	uni092D094D0930	DeBha_DeVirama_DeRa
797		DeYRa	uni092F094D0930	DeYa_DeVirama_DeRa
798		DeDRa	uni0926094D0930	DeDa_DeVirama_DeRa
799		DeTRa	uni0924094D0930	DeTa_DeVirama_DeRa
800		DeDhRa	uni0927094D0930	DeDha_DeVirama_DeRa
801		DeLRa	uni0932094D0930	DeLa_DeVirama_DeRa
802		DeShRa	uni0936094D0930	DeSha_DeVirama_DeRa
803		DeKSsRa	uni09150937094D0930	DeBeforeK_DeBeforeSs_DeVirama_DeRa
804		DeJRa	uni091C094D0930	DeJa_DeVirama_DeRa
805		DeQRa	uni0958094D0930	DeQa_DeVirama_DeRa

Figure 28: Excerpt from Martel Regular's encoding file showing the entries for 15 glyphs in the Devanagari character set. Since these glyphs are conjuncts, they have no Unicode values of their own.

Once I had drawn the all the glyphs of the Devanagari Unicode block, it became necessary to decide upon a definitive character set. I was still working with only a few dozen Devanagari glyphs; a font with Devanagari 1000 glyphs is certainly possible to envision, yet I knew that I would only be able to produce between 200 and 300 before the typeface submission date. I created an encoding file for my Regular font (with both the Latin and Devanagari glyph names) in Numbers, listing all glyphs in the order they should appear in the font, and – where available – their Unicode values. My total glyph count was near 1000, although slightly less than 300 of these were Devanagari *(fig. 28)*.

3.6 Post-Production in Microsoft VOLT

After merging my Latin and Devanagari glyphs into a single FontLab file, I created a few kerning classes and pairs for my Devanagari glyphs, but not nearly as many as for my Latin component. The next step was to generate a TrueType font and import this into a new VOLT project file. VOLT allows font developers to create the necessary GPOS and GSUB tables for the Uniscribe text processing engine. Both Windows Vista and Microsoft Office 2007 include a newer version of Uniscribe than Windows XP or previous Office suites. In order to guarantee backwards-compatibility, it was necessary to program the Devanagari OpenType features in my font twice, first using the older <deva> script tag, and then using the newer <dev2>, required for use in Vista and Office 2007.

I ran into a two difficulties in VOLT that I wish to document here. The first regards the <locl> feature. I used this to instruct Uniscribe to substitute Martel's default word space, punctuation, and figures with Devanagari-sized alternates. In applications, the space glyph substitutes when the script of the text changes to Devanagari. The space glyph also switches back to the Latin default once a Latin glyph enters the text. But the space does not resubstitute to the Devanagari alternate again until another Devanagari character appears.

The other substitutions in the <locl> feature are ignored, meaning that the punctuation or figures used are always the Latin 'defaults'. When setting just Latin or Devanagari text, this faulty substitution is not an issue. It is also less an issue in Nepali typesetting, which uses the Devanagari figures instead of the Latin ones, and little Latin punctuation. However, contemporary Hindi texts often use both Latin figures and Latin punctuation extensively.

For example, in the following text – वे वर्ष 1962 तक. दैनिक *(see also fig. 29)* – Uniscribe properly substitutes the space between the first two Devanagari words and between the second Devanagari word and 1962. The four figures in 1962 do not substitute. The space between 1962 and the Devanagari word following it is the default, Latin space – too narrow for this context. As the full stop between the last two Devanagari words does not substitute either, the space following it also used the default Latin space instead of the alternate Devanagari space.

The second problem deals with below the base mark positioning. Although this feature seems to be correctly written in the VOLT project, it does not seem to be processed by Uniscribe when text is generated. Since Devanagari makes use of many different sized marks below the base characters, unique positioning values for all combinations must be defined.

To date, I have produced three versions of Martel Regular for my typesetting purposes. The first version, submitted as part of my course-

वे वर्ष 1962 तक. दैनिक

वे वर्ष 1962 तक. दैनिक

Figure 29: Uniscribe and issues with multiple space glyphs. Above, a string of text rendering as intended. Below, the Devanagari space glyph does not substitute in for the default space glyph after the 2 or the full stop.

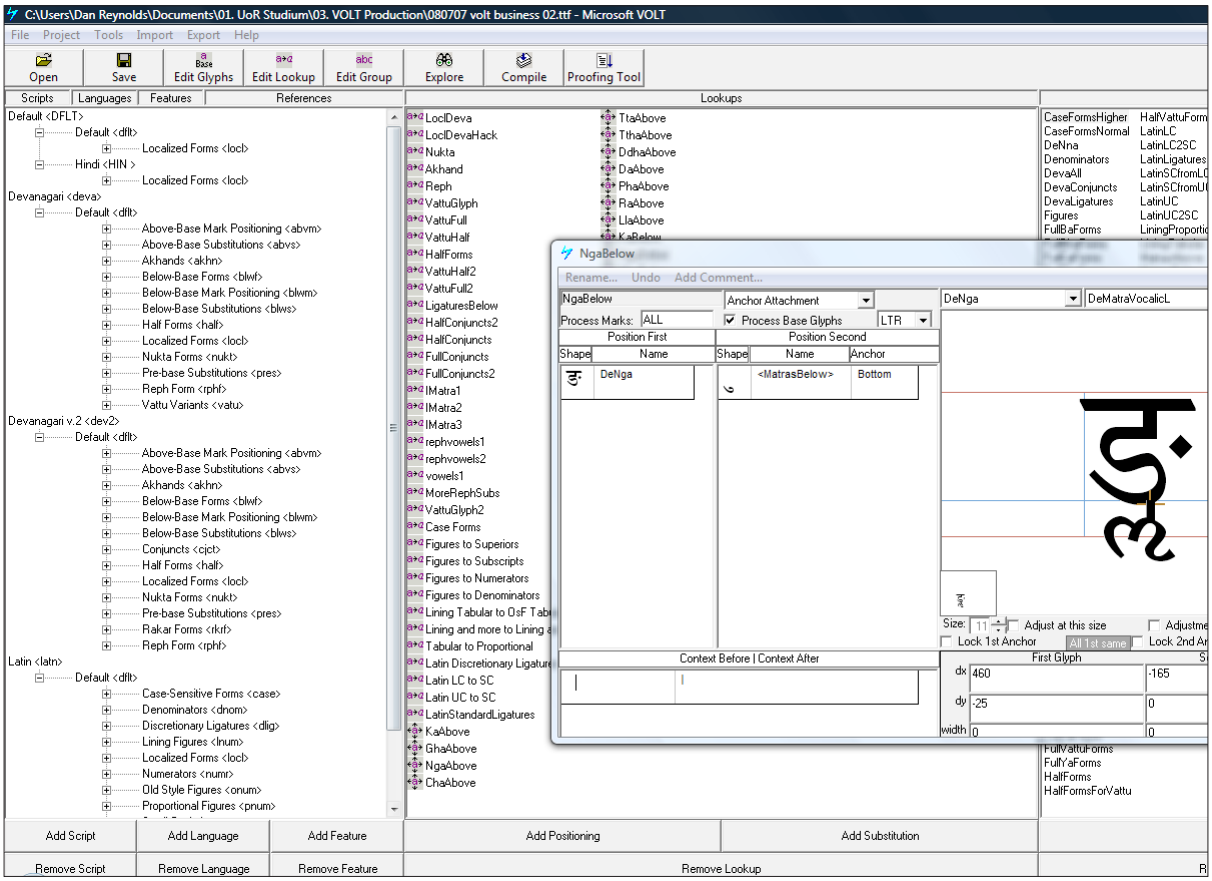


Figure 30: Screenshot from Microsoft VOLT, shown cropped at 50% of actual size. VOLT allows users to create glyph groups (right-most section of the screen), substitution and positioning features (centre of the screen), and define script and language support (left). The smaller window shows the below the base positioning feature for marks underneath the Devanagari Nga consonant (ङ).

work for assessment in Reading includes two space glyphs – each with a separate value – as is intended by the design. A second version, which I use to typeset documents in Word 2007, has made a compromise on the issue of multiple spaces: 300 units, instead of 200 for the Latin and 375 for the Devanagari. 300 is still wide enough for Devanagari, but it feels too wide for Latin. The third version of the font was generated directly from FontLab and not brought through VOLT. I use this font to typeset Devanagari strings in documents like this one, which was created with InDesign. Occasionally, the TrueType font published from VOLT will create unexpected errors with Devanagari text in InDesign.

As for the below the base mark positioning, each of these fonts now has the most important marks where I would like them to fall when they appear under the most important glyphs, in order to best approximate proper Hindi typesetting. This work-around solution is not the best, but it is satisfactory for the moment.

Figure 31: The top row shows Martel Regular while the bottom shows the evolution of Martel Heavy. Left, the Martel Heavy's first draft; right, the current version. The primary difference between the two versions is character width – the current version's letters are just 90% the width of the original's.

Figure 32: The left-hand column shows Martel Regular; the right-hand column shows heavier variants. Top, a hand-drawn 'text bold' design. Middle, the current Martel Bold – an instance generated from a Multiple Master font created from the current Martel Regular and Martel Heavy (bottom).

4. Widths and thickness

4.1 The Unger Method

Around the same time that I began with my Latin small caps and Devanagari, I also turned my attention to Martel's bold. At Gerard Unger's suggestion, I did not start this process by drawing a 'proper' bold. Rather, I drew much blacker letters that would eventually become Martel's Heavy weight. The current Martel Bold would later be interpolated from a Multiple Master font including Martel's Regular and Heavy glyphs *(fig. 33)*.

I drew these first heavy letters according to a procedure widely referred to as 'the Unger method.' This tactic – well documented in the writing of previous MATD students – allows for the quick creation of bolder letters from a regular by expanding the left and right edges of each stem outward *(fig. 34)*. After this initial drafting, there is a high degree of correction that must be applied to the letterforms before a true companion face for the roman may be arrived at *(fig. 31)*.

adhesion
adhesion
adhesion

Figure 33: Martel's Regular, Bold, and Heavy weights.

Figure 34: On the left, the Unger Method is illustrated. Via simple expansion of the stems, bolder letters may quickly be generated; pictured are n glyphs from Martel Regular and the first draft of Martel Heavy. On the right, the n's from the current versions of Martel Regular, Bold, and Heavy overlay each other.

Aside from my first heavy letters being wider than my Roman, their x-height was taller and the overshoots were larger. Since the width of counterforms and space between the letters decreased from my Roman to my Heavy, it was difficult to judge the optimal Heavy stem thickness, as well as the proper widths for each character. As a result, my initial Heavy's proportions were too wide.

4.2 Using Multiple Masters

Unhappy with what I saw as too 'generic' a Heavy to lead to a satisfactory bold, I set out to draw a new alphabet of 'text bold' letters – an alphabet that would function better together when set amongst a string of Roman text *(fig. 32)*. These did not agree with Gerard Unger in the least. At his suggestion, I went back to my Heavy design, and condensed all of its letters to 90% of their widths. I took this character set and – together with Martel Roman's glyphs – created a Multiple Master font with a single weight axis leading from my Roman to my Heavy.

I generated a number of instances from this. To my surprise, the middle range of these instances contained letterforms that were almost identical to my 'text bold' letters. The chief difference was in the spacing; my MM instances had slightly wider – and better – space between the letters. The 550-instance of this font became Martel Bold. Before the current ver-

adhesion **adhesion**
adhesion **adhesion**

Figure 35: The top row shows Martel Condensed Regular and Condensed Heavy. The bottom row shows Martel Regular and Heavy. The Condensed Heavy is currently too heavy compared with the Condensed Regular.

sion was generated, the serifs of Martel Heavy became more slab-like. As a result, Martel Bold's serifs are at a point halfway between the Regular's wedges and the Heavy's slab serifs.

Lining figures, basic punctuation, and several accented-letters were added to Martel Heavy before the 'final' Bold was generated for the MATD's typeface submission deadline. I did not submit the Martel Heavy font itself, as I believe this falls just outside the text confines of the brief I defined. Martel Bold, although a less 'finished' than Martel Regular or Martel Italic, still functions adequately as an emphasis face for text and in short headlines. Like Martel Regular and Martel Italic, kerning classes were created before the font was submitted, and careful kerning was applied.

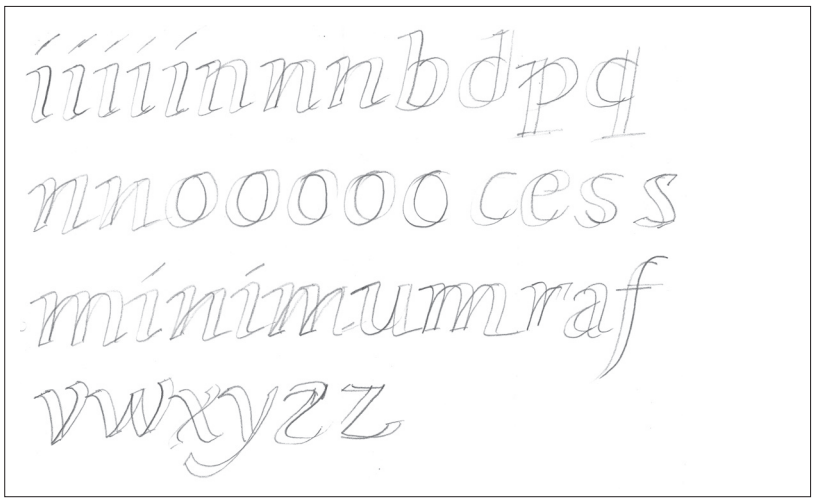
4.3 Creating condensed headline variants

Soon after I had working Heavy letters, Gerard Unger further encouraged me to condense them. In short order, I arrived at a Condensed Heavy, whose letterforms were approximately 80% of the Heavy's widths *(fig. 35)*. These glyphs required much less overshoot, and some horizontal strokes also required thinning. After the creation of the Condensed Heavy, both my Heavy and Condensed Heavy fonts' glyphs would be tested and edited in tandem.

Figure 36: On the left, n's from Martel Regular and Martel Heavy are illustrated. The two n's on the right are from Martel's Condensed Regular and Condensed Heavy. As may be seen, the Condensed Heavy does not have the proper relationship with the Condensed Regular – especially visible when shown next to Martel Regular and Heavy.

I followed up the Condensed Heavy with a Condensed Roman. In tests with my two Romans, it eventually became clear that the Condensed Heavy was too narrow to be useful in text sizes. Moreover, it was too condensed in comparison with my Condensed Roman, which is only 85% of the Regular. Work on both of these condensed weights was put on the back burner, as neither was part of my brief, and each was more suitable for display and headline use, which is not a particular focus point of our course.

Figure 37: First sketches for Martel Italic, made during Victor Gaultney's italic workshop. Shown at 50% of actual size.



adhesion *adhesion*
adhesion *adhesion*

Figure 38: Left, Martel Roman. The first version of Martel Italic is at the top right, and the current version underneath.

Figure 39: In Martel Italic's lowercase, serifs at the x-height and baseline switch to 'calligraphic' in and outstrokes.

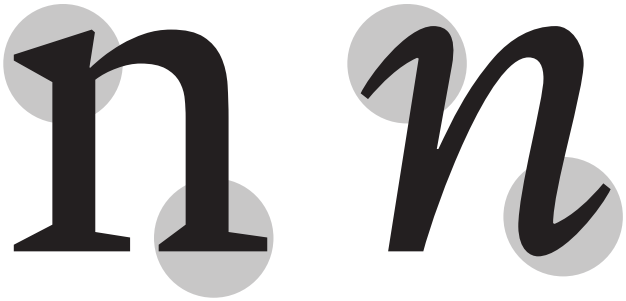
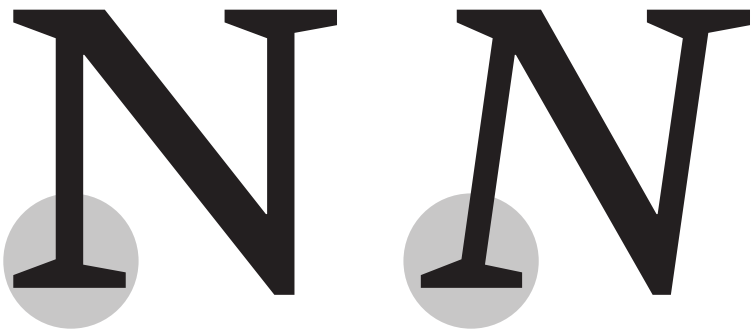


Figure 40: Martel Italic's uppercase letters are taken from the Roman, slanted 9° and then condensed to 90% of their width. The serif's have been corrected, so that their vertical elements remain straight – like the Roman – and not slanted.



5. The typeface's Italic

I began work on Martel Italic at the end of the second term, during Victor Gaultney's italic workshop. In his exercise, we printed out samples of our lowercase Roman letters, which had been artificially slanted. Taping two pencils together, we drew new cursive letterforms over top of these, using both interrupted and non-interrupted strokes *(fig. 37)*.

When I moved into FontLab, my first Italic lowercase letterforms were mostly non-interrupting, and created along a somewhat Granjonesque model *(fig. 39)*. They appeared rather narrower than Martel's Roman lowercase, and were lighter. The chosen slope was nine degrees, although I quickly realised that not all letter elements could hold to this.

After input from Christian Schwartz at TYPO-Berlin, I made two changes to my Italic lowercase. First, the bottoms of the letters – where the stroke changed its direction – were flattened, eliminating their angle. The proportion of the lowercase was also discernibly widened. Both of these suggestions were implemented to 'de-prettify' the typeface and make it more appropriate for newspaper setting *(fig. 38)*.

The Italic's uppercase letters, figures, punctuation, and special characters were mostly taken from the Roman, slanted nine degrees, and condensed to 90% of their width *(fig. 40)*.

6. Conclusion

When I began Martel nine months ago, imagining the typeface family in its current state as unthinkable. Initial struggles with the first Latin lowercase test letters created a sort of tunnel vision, beyond which it was difficult to imagine. Martel's progress as a typeface – and my own development as a designer and as a student – have been immensely gratifying. Even at this point in the design's process, it is quite a surprise to me that the family functions well enough in text that I am able to set documents like this one with it.

While Martel has grown beyond what I could have imagined at its start, the end of the project still feels almost as far away as it did in October. Before the family may be called complete – at the very least – the Italic and the Devanagari components with have to join the Latin in offering multiple weights.

This typeface was my first exposure to an Indic script. While simple Hindi documents may already be typeset with Martel, hundreds of additional glyphs must be added to the character set before it may meet an average computer user's expectations or daily needs.

The greatest lesson that I learned over the period of working on Martel's design has been the practice of creating my own methodology for script and typographic investigation. During future stages of the project, successes that may be added onto of this achievement will be possible because of the practices and experiences described in this document.

7. Appendices

7.1 Appendix 1: On the name 'Martel'

Having previously released two small display type families whose names began with the letter M, I decided to stick wit the 13th letter of the alphabet when I came to Reading. For months, my typeface's working title was *Macellarius* – Latin for butcher. I had chosen this word chosen at random from a Latin dictionary. Since five syllables may be a bit long for a typeface name, I eventually shorted it to Martel, thus naming my project after the eighth century Frankish ruler. Texts about Charles Martel – *Carolus Martellus,* or simply 'the Hammer' – may be found in this typeface's specimen booklet in a number of languages.

7.2 Appendix 2: Devanagari typefaces compared in essay

‘Calligraphic’ fonts (plus Martel)

अनिल कुंबले नहीं खेल	Linotype Devanagari
अनिल कुंबले नहीं खेल	Martel
अनिल कुंबले नहीं खेल	Arial Unicode (glyphs from Monotype Devanagari)
अनिल कुंबले नहीं खेल	Monotype’s WorldType Devanagari
अनिल कुंबले नहीं खेल	Surekh
अनिल कुंबले नहीं खेल	Akshar Unicode
अनिल कुंबले नहीं खेल	Sanskrit 2003
अनिल कुंबले नहीं खेल	Jana Hindi Sans

Linotype Rohini

अनिल कुंबले नहीं खेल

Yogesh

अनिल कुंबले नहीं खेल

Akhil HE

अनिल कुंबले नहीं खेल

Gargi

अनिल कुंबले नहीं खेल

Shree-Dev

अनिल कुंबले नहीं खेल

Mangal (Windows Vista version)

अनिल कुंबले नहीं खेल

Linotype Devanagari 16/19.2 pt.

भारत ने अपने पहले दिन के स्कोर में 23 रन और जोड़े और एक विकेट गँवाया. खेल समाप्त होने के समय भारत ने चार विकेट के नुकसान पर 133 रन बना लिए थे. राहुल द्रविड़ 38 और युवराज सिंह छह रन बनाकर खेल रहे थे. भारत ने दूसरे दिन अपना एकमात्र विकेट सौरव गांगुली के रूप में गँवाया. वे अपने कल के 51 रन के स्कोर में केवल आठ रन ही और जोड़ पाए और एलेन वाइज़ की गेंद पर मिडविकेट पर ब्लीजार्ड के हाथों कैच हुए. भारत ने इस मैच में टॉस जीतकर पहले बल्लेबाजी करने का फैसला किया था. मैच के पहले दिन भी वर्षा ने खेल में बाधा डाली थी. ऐसा अनुमान है कि शनिवार को मैच के तीसरे और अंतिम दिन भी वर्षा हो सकती है.

Martel 10/15 pt.

भारत ने अपने पहले दिन के स्कोर में 23 रन और जोड़े और एक विकेट गँवाया. खेल समाप्त होने के समय भारत ने चार विकेट के नुकसान पर 133 रन बना लिए थे. राहुल थ्रविड़ 38 और युवराज सिंह छह रन बनाकर खेल रहे थे. भारत ने दूसरे दिन अपना एकमाघ्र विकेट सौरव गांगुली के रूप में गँवाया. वे अपने कल के 51 रन के स्कोर में केवल आठ रन ही और जोड़ पाए और एलेन वाइज़ की गेंद पर मिडविकेट पर ब्लीजार्ड के हाथों कैच हुए. भारत ने इस मैच में टॉस जीतकर पहले बल्लेबाजी करने का फैसला किया था. मैच के पहले दिन भी वर्षा ने खेल में बाधा डाली थी. ऐसा अनुमान है कि शनिवार को मैच के तीसरे और अंतिम दिन भी वर्षा हो सकती है.

The above text is a cricket article from the BBC Hindi website – http://www.bbc.co.uk/hindi/sport/story/2007/12/071221_cricket_india.shtml. Accessed Friday 21 December 2007.

7.4 *Appendix 4: Font comparison chart from essay*

	Linotype Devanagari (Gate Seven OpenType version, Regular weight)	Martel	Monotype Devanagari (AAT version, Regular weight)
Body height (2048 UPM, unless otherwise noted)	1069 units	745 units (1000 UPM grid)	1277 units
Relative vertical proportions, superscripts	Less than half of body height	Slightly less than half of body height	Less than half of body height
Relative vertical proportions, subscripts	About a third of body height	About half of body height	Less than half of body height
Horizontal proportions	Normal, but tight (for newspaper setting)	Normal	Some characters have tight interior spaces
Horizontal or vertical conjuncts	Mostly horizontal	Mostly horizontal	Mostly vertical
Vertical conjunct depth compared with body height	About half the body height e.g., –487 units for the 'De_Dd_Dd_Ya' glyph	Less than half the body height, e.g., –328 units for the 'DeDdDda' glyph	Quite deep, e.g., –729 units for the 'ngakadeva' glyph.
Vowel signs: joining or disconnected	Disconnected	Disconnected	Disconnected (but Arial Unicode's join)
Counters: open or closed	Closed	Closed	Closed
Headline thickness (2048 UPM, unless otherwise noted)	115 units	81 units (1000 UPM grid)	142 units
Vertical stem width (2048 UPM, unless otherwise noted)	123 units	95 units (1000 UPM grid)	158 units
Horizontal stroke endings	Cut off at an angle reminiscent of a pen-made terminal	Trapezoidal form reminiscent of a pen-made terminal	Cut off at a 90-degree angle
Vertical stem endings	Cut off at an angle reminiscent of a pen-made terminal	Trapezoidal form reminiscent of a pen-made terminal	Trapezoidal form reminiscent of a pen-made terminal
Stroke modulation	Scribal	Scribal	Scribal
Overall colour	Even colour	Even colour	Even colour
Stress	Diagonal	Diagonal	Diagonal
Spacing/character fit	Optically balanced	Balanced, but wider than Linotype Devanagari	Optically balanced
Latin or Devanagari numerals	Both, default is Latin	Both, default is Latin	Both, default is Latin; Arial Unicode's Latin numerals are Arial, Monotype Devanagari's are not
Latin alignment/ compatibility	No Latin glyph component; the Latin numerals and the rupee symbol are quite pen-based	Full glyph component for European languages using the Latin script, designed harmoniously and simultaneously by the same designer	No Latin component; Arial Unicode's Devanagari glyphs are Monotype Devanagari with minor differences; Monotype Devanagari does not match Arial in terms of forms

	Monotype's WorldType Devanagari	Surekh (CDAC-GIST OpenType version, Normal weight)	Akshar Unicode (Regular weight)
Body height (2048 UPM, unless otherwise noted)	No access to the font file	1416 units	1220 units
Relative vertical proportions, superscripts	A little more than one third of body height	About half of body height	About half of body height
Relative vertical proportions, subscripts	About a third of body height	About a third of body height	About a third of body height
Horizontal proportions	Some glyphs are very wide	Normal	Condensed
Horizontal or vertical conjuncts	Mostly horizontal	Vertical	Vertical
Vertical conjunct depth compared with body height	n/a	Not very deep, e.g., –401 units for the 'dvletternga_ dvsignvirama_dvletterkh' glyph	Not very deep, e.g., –364 units for the 'ud1084' glyph
Vowel signs: joining or disconnected	Joining	Disconnected	Joining
Counters: open or closed	Open	Closed	Closed
Headline thickness (2048 UPM, unless otherwise noted)	n/a	155 units	115 units
Vertical stem width (2048 UPM, unless otherwise noted)	n/a	155 units	135 units
Horizontal stroke endings	Cut off at a 90-degree angle	Cut off at an angle reminiscent of a pen-made terminal	Cut off at an angle reminiscent of a pen-made terminal
Vertical stem endings	Trapezoidal form reminiscent of a pen-made terminal	Cut off at an angle reminiscent of a pen-made terminal	Cut off at an angle reminiscent of a pen-made terminal
Stroke modulation	Scribal modulation, but with low contrast	Scribal	Scribal
Overall colour	Divergent width patterns	Even colour	Colour uneven
Stress	Diagonal	Diagonal	Diagonal
Spacing/character fit	Optically balanced	Wide	Tight, with some problem pairs
Latin or Devanagari numerals	n/a	Both, default is Latin	Both, default is Latin
Latin alignment/ compatibility	Designed to work with Univers	Latin upper and lowercase similar to Times New Roman	Latin glyph component is similar in design to Arial

	Sanskrit 2003 (Regular weight)	Jana Hindi Sans (Regular weight)	Linotype Rohini (Gate Seven OpenType version, Regular weight)
Body height (2048 UPM, unless otherwise noted)	1325 units	1459 units	975 units
Relative vertical proportions, superscripts	About half of body height	Less than half of body height	About half of body height
Relative vertical proportions, subscripts	Between a third and half of body height	Almost half the body height	Less than half of body height
Horizontal proportions	Normal	Very wide and open	Normal
Horizontal or vertical conjuncts	Mostly horizontal	Horizontal	Mostly horizontal
Vertical conjunct depth compared with body height			Over half the body height, e.g., –530 in the 'Ng_K_Ss_Va' glyph
Vowel signs: joining or disconnected	Disconnected	Joining	Joining
Counters: open or closed	Closed	Closed	Closed
Headline thickness (2048 UPM, unless otherwise noted)	156 units	128 units	103 units
Vertical stem width (2048 UPM, unless otherwise noted)	186 units	104 units	113 units
Horizontal stroke endings	Cut off at a 90-degree angle	Cut off at an angle reminiscent of a pen-made terminal	Cut off at a 90-degree angle
Vertical stem endings	Rounded-off trapezoid, reminiscent of pen-made terminals	Cut off at an angle reminiscent of a pen-made terminal	Cut off at a 90-degree angle
Stroke modulation	Scribal	Scribal, with rather high contrast	Monolinear
Overall colour	Even colour	Light on the page, with prominent word spaces	Even colour
Stress	Diagonal	Diagonal	Horizontal, with some diagonal movement
Spacing/character fit	Some pairs may be too tight	Loose spacing	Optically balanced
Latin or Devanagari numerals	Both, default is Latin	Both, default is Latin	Both, default is Latin
Latin alignment/ compatibility	Latin glyph component is from URW's Palladio, a Palatino clone	No Latin glyph component	No Latin glyph component

	Yogesh (CDAC-GIST OpenType version, Normal weight)	Akhil HE	Gargi (Medium weight)
Body height (2048 UPM, unless otherwise noted)	1430 units	1030 units	622 units (1000 UPM grid)
Relative vertical proportions, superscripts	Less than half of body height	Less than half of body height	Slightly less than a third of body height
Relative vertical proportions, subscripts	Less than half of body height	Less than half of body height	Slightly less than a third the body height
Horizontal proportions	Normal	Condensed	Normal
Horizontal or vertical conjuncts	Vertical	Horizontal	Vertical
Vertical conjunct depth compared with body height	Less than a third of body height, e.g., –397 for the 'dvletternga_dvsignvirama_ dvletterga' glyph		Less than a quarter of body height, e.g., –162 units for the 'uni0939_uni094D_uni0932' glyph
Vowel signs: joining or disconnected	Joining	Joining	Joining
Counters: open or closed	Open	Open	Open
Headline thickness (2048 UPM, unless otherwise noted)	111 units	110 units	74 units (1000 UPM grid)
Vertical stem width (2048 UPM, unless otherwise noted)	146 units	124 units	73 units (1000 UPM grid)
Horizontal stroke endings	Cut off at a 90-degree angle	Cut off at a 90-degree angle	Cut off at a 90-degree angle
Vertical stem endings	Cut off at a 90-degree angle	Cut off at a 90-degree angle	Cut off at a 90-degree angle
Stroke modulation	Monolinear, with some flared strokes	Monolinear	Monolinear
Overall colour	Even colour, word spaces are nice and tight	Dense and compact	Dense colour
Stress	Horizontal, with some diagonal flair	No stress	No stress
Spacing/character fit	Optically balanced	Tight	Tight
Latin or Devanagari numerals	Both, default is Latin	Both, default is Latin	Both, default is Latin
Latin alignment/ compatibility	Latin glyph component is similar in design to Helvetica	Latin upper and lowercase glyphs are a condensed sans serif design	Latin glyph component is similar in design to Helvetica

	Shree-Dev-001 (Non-encoded version, Regular weight)	Mangal (Vista version)	Mangal (pre-Vista)
Body height (2048 UPM, unless otherwise noted)	500 units (1000 UPM grid)	1320 units	1320 units
Relative vertical proportions, superscripts	Half of body height	Less than half the base glyph height	Less than half the base glyph height
Relative vertical proportions, subscripts	Half of body height	About half the base glyph height	About half the base glyph height
Horizontal proportions	Very round	Wide	Wide
Horizontal or vertical conjuncts	Mostly horizontal	Mostly horizontal	Mostly horizontal
Vertical conjunct depth compared with body height		A quarter of body height, e.g., –323 units in 'glyph342'	About a quarter of body height, e.g., –382 units in glyph 'u0951'
Vowel signs: joining or disconnected	Disconnected	Joining	Joining
Counters: open or closed	Closed	Most counters close	Open
Headline thickness (2048 UPM, unless otherwise noted)	50 units (1000 UPM grid)	160 units	160 units
Vertical stem width (2048 UPM, unless otherwise noted)	48 units (1000 UPM grid)	176 units	176 units
Horizontal stroke endings	Cut off at a 90-degree angle	Cut off at a 90-degree angle	Cut off at a 90-degree angle
Vertical stem endings	Cut off at a 90-degree angle	Cut off at a 90-degree angle	Cut off at a 90-degree angle
Stroke modulation	Monolinear	Monolinear, but with some pen-reminiscent elements	Constructed
Overall colour	Colour uneven	Even colour	Even colour
Stress	No stress	Horizontal, with some diagonal movement	No stress
Spacing/character fit	Tight	Wide, but optically balanced	Wide, but optically balanced
Latin or Devanagari numerals	Devanagari only	Both, default is Latin	Both, default is Latin
Latin alignment/ compatibility	No Latin glyph component	Latin upper and lowercase glyphs are a sans serif design	No Latin glyph component

8. Bibliography

Cabarga, Leslie, Kern King. Accessed on 20 July 2008 at http://www.logofontandlettering.com/kernking.html.

Carter, Harry, *A view of early typography up to about 1600.* London: Hyphen Press (2002).

Jawaji Dadaji type foundry, *Marathi, Sanskrit, Hindi type catalogue.* Bombay: Nirnaya-Sagar Press (1967).

Linotype–Paul work-file archives in the collection of the Department of Typography and Graphic Communication, University of Reading.

Smeijers, Fred, *Counterpunch.* London: Hyphen Press (1996).

Snell, Rupert, *Teach yourself beginner's Hindi script*. London: Hodder Education (2003).

TU Darmstadt, *Atlas zur Geschichte der Schrift, Band 2*. Darmstadt: Technische Universität (2000).

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