Beauty, Form and Function in Typography

Spiral splines in Typeface Design

Acase study of Manjari Malayalam typeface

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Abstract: Manjari typeface was an experiment to use spiral splines to define the curves of Malayalam glyphs. It was a milestone in the progression of script towards maximally rounded glyphs. The script has been evolving from its rectangular characteristics in the early days of metallic types to the circular characteristics of popular digital fonts. The design of curves in Manjari are theoretically based on the PhD thesis by Raph Levien - "From Spiral to Spline: Optimal Techniques in Interactive Curve Design". In this paper we present the design principles and aesthetic concepts behind this font. We will also discuss the popularity and adoption of Manjari in the digital as well as print media.

Keywords: **Malayalam, Script, Spirals, Opentype, Typeface, Digital Typography**

1 Introduction

Malayalam script, since its evolution from Brahmi[1] writing style through Vattezhuthu and Grantha[2] writing systems to the digital typefaces of modern era, has undergone a lot of changes. The noticeable aesthetic feature of contemporary script is its loops and curly strokes. Vertical symmetry for many letters like ക, ഞ, ഞ are a part of script's identity.

Manjari Malayalam typeface utilises spiral shapes to accentuate these features leading to its aesthetic acceptance. A sample of text rendered in Manjari typeface is shown in Figure 1. The use of spiral spline curves results in shapes that are extra smooth. The spiral smoothness of curves are complemented by rounded terminals which gives very soft feeling for the eyes. The rigidness of geometric fonts is completely avoided giving a good humanist identity. The curve perfection results in negative spaces that acquire beautiful leaf and drop shapes between the bowls and loops of the script.

2 Malayalam script

2.1 Ancient manuscripts and early printing

Samples of copper plate inscriptions and palm leaf manuscripts show that the letters were

bever perfect rounds, but rather rectangular or elongated curves. The sample indicating

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[1] https://en.wikipedia.org/wiki/Brahmi_script
[2] https://en.wikipedia.org/wiki/Grantha_alphabet

Figure 1: Text rendered in Manjari typeface

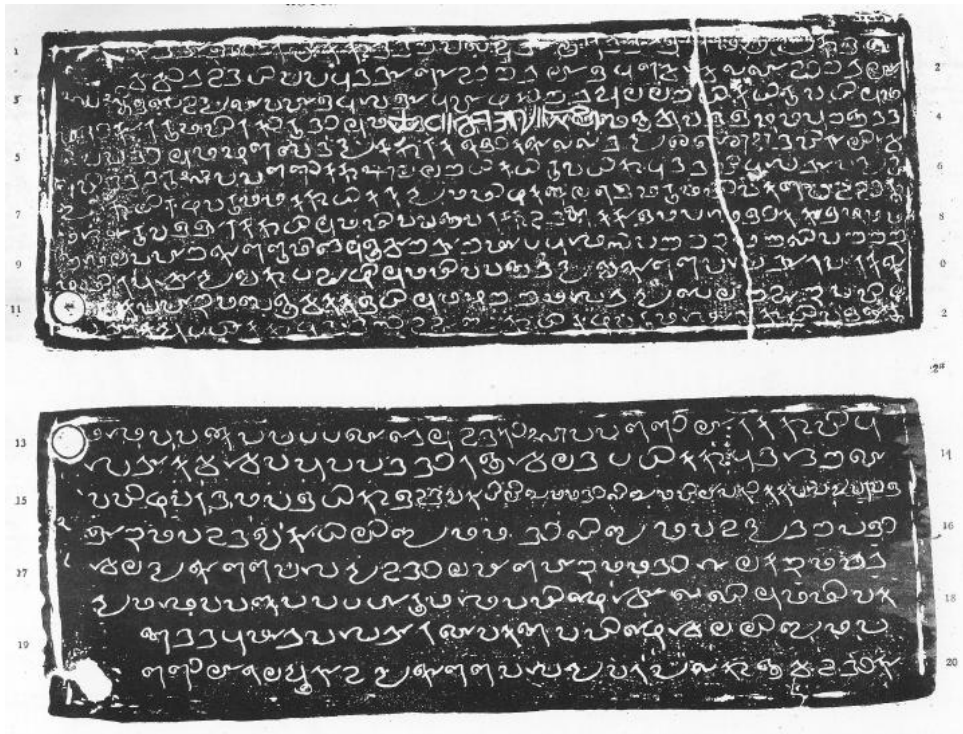this is shown in Figure 2. It is an inscription from Tharisappalli copper plates dating back to 849 AD.

Figure 2: Copper plate inscription in Vattezhuthu.

The first ever printed Malayalam book was Samkshepavedartham(Pianius, 1772), printed in Rome using movable types in 1772. Sample pages of the book is shown in Figure 3. The

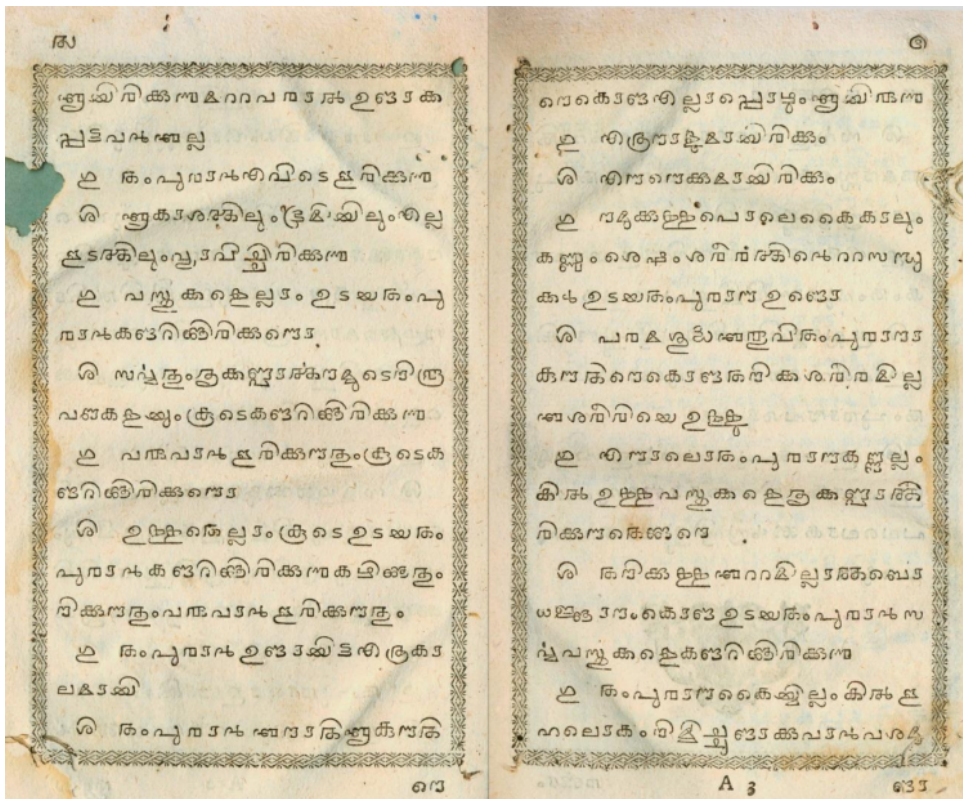script was characterized by rectangular features during the early days of printing.

Figure 3: Samkshepavedartham, 1772. This is the first ever book published in Malayalam with movable type. Rectangular nature of glyphs is noticeable.

Next remarkable event in history of Malayalam typefaces occurred when movable types were cast natively in Kerala, India during 1829 by an anglican missionary Benjamin Bailey(Cherian, 2006) for CMS Press, Kottayam, Kerala. These metal types were close to perfect round. The popularity of books from this press started to give uniform height proportions to the script. According to Gupthan Nair, Bailey's contributions as a typographer made the curvy style of the Malayalam script popular(Nair, 2001). See the most impactful output from the CMS Press Kottayam in Figure 4, a translation of the New Testament showing rounded nature of the script.

The acceptance of this style of roundness can be easily understood when a fine handwriting is often referred as 'അവൾക്ക നല്ല ഉരുണ്ട കയ്യക്ഷരമുണ്ട്' (She has a fine round shaped handwriting).

Figure 4: Malayalam New Testament. Printed in 1829 using types designed by Benjamin Bailey

സത്യംപോലെ

അനുഭവത്തിന്റെ അറിവാണ് സത്യം. അത് ഡൈഷണികമായ ഒരു സങ്കൽപമല്ല. മനസ്സും വാക്കും വസ്തുവും ചേർന്നാൽ സത്യമായി എന്നു പാശ്ചാത്യ ദർശനം.

സത്യത്തിന് ഒരു മുഖവും ഒരു നിർവചനവുമാണുള്ളത് എന്ന വിശ്വാസം തകർന്നടിഞ്ഞ ലോകത്താണു നാം ജീവിക്കുന്നത്. പൊതുജനാഭിപ്രായം രൂപപ്പെടുത്തുന്നതിൽ വസ്തുനിഷ്ഠ മായ സത്യങ്ങളെക്കാൾ സ്വാധീനമുള്ളത് ജനങ്ങളുടെ വികാര പരവും വിശ്വാസപരവുമായ താൽപര്യങ്ങൾക്കാണ് എന്ന അവ സ്ഥയെയാണ് സത്യാനന്തരത എന്നു വിശേഷിപ്പിക്കുന്നത്. ഇന്റർനെറ്റ് സാങ്കേതികവിദ്യ ഇതിനു വേഗം കൂട്ടി. വിർചൽ റിയാലിറ്റി സത്യമല്ല. സത്യംപോലെ ഒരു പ്രതീതിമണ്ഡലമാണ്.

സത്യംപോലെയുള്ള ലോകത്താണ് ഉത്തരാധുനികോത്തര ത(Post Post Modernism)യും വരുന്നത്. നിയമവ്യവസ്ഥയ്ക്കും സമൂഹഘടനകൾക്കുമപ്പുറത്തുള്ള സ്വാതന്ത്ര്യവും സാധ്യതക ളുമാണ് ഈ ലോകം വാഗ്ദാനം ചെയ്യുന്നത്; ആർക്കും ആരോ ടും കടപ്പാടും ധാർമികബാധ്യതയുമില്ലാത്താണ് ആ ലോക മെങ്കിലും.

ശരിവാദങ്ങളുടെ പ്രസക്തി എല്ലായിടവും എത്തിച്ചു എന്നതാ ണ് ഉത്തരാധുനികോത്തരതയുടെ പ്രാധാന്യം. എല്ലാ ആഖ്യാ നങ്ങൾക്കും ഇടം നൽകുന്നതിന്റെ പ്രസാദാത്മകത ഇതിനുണ്ട്.

സത്യാനന്തര സമൂഹത്തെയും ഉത്തരാധുനികോത്തരതയെയും കുറിച്ചുള്ള രണ്ടു പ്രബന്ധങ്ങൾ ഈ ലക്കത്തിലുണ്ട്.

പത്രാധിപർ

Figure 5: A sample malayalam rendering to illustrate a common typeface used in printing. Bhashaposhini, February 2018

2.2 Digital typefaces

Digital typefaces of Malayalam script introduced during 1990 that were popular in regular printing were mostly rounded. See Figure.5. The most popular unicode fonts since their release in the late 2000s, Rachana, Meera and Anjali continued to follow roundness as their glyph characteristic.

Manjari[3] typeface is designed by Santhosh Thottingal. Opentype engineering was done by Santhosh Thottingal and Kavya Manohar. This font was released in July 2016 and imme-diately gained wide popularity among Malayalam speakers. The curves in Manjari are de-signed to follow a spiral shaped path between its control points and the terminals are rounded.

The design principles behind Manjari typeface are discussed in the following section.

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[3]Available at https://smc.org.in/fonts/#manjari. The source code is published under open font license at https://gitlab.com/smc/manjari

3 Curve Interpolation by Spiral splines

Curves that passes through control points in a sequence can be termed interpolating splines. A good interpolating spline is a smooth curve that results from sparse control points. There are a huge variety of interpolating curves that include spiral splines, minimum energy curves, log aesthetic curves etc. As mentioned earlier, the nature of smooth interpolating splines have been studied by Ralph levien in his thesis, "From Spiral to Spline: Optimal Techniques in Interactive Curve Design"(Levien, 2009).

According to Levien, spiral spline interpolating curves have certain characteristics which make them particularly suitable for two dimensional curve fitting.

- **Roundness Property**: When spiral spline curves are used for interpolation, three data points on a circular path would yield that exact circle after interpolation.

- **Extensionality Property**: When a new control point is introduced on the interpolated spline between two points, the curve shape would be preserved.

Geometric continuity is an essential feature indicating the smoothness of interpolating curves. The basic property of connected curves is G^0 continuity, ie. curves touch at join points as shown in Figure 7. An interpolating curve of better smoothness has G^1 continuity, meaning the tangents on either sides of join points are essentially the same as shown in Figure 8.

A still higher order smoothness is offered by G^2 continuous curves, having a common center of curvature at the join points as shown in Figure 9. Spiral splines can be defined with G^2 continuity indicating very smooth variation in curvature.
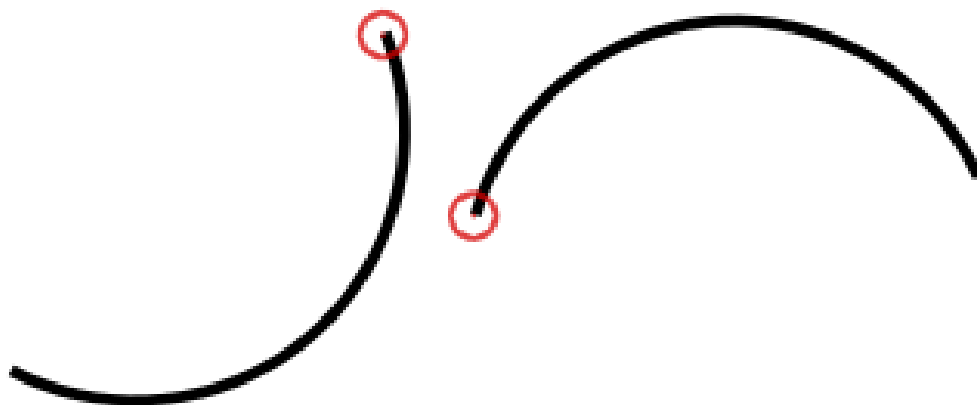

Figure 6: Disjoint curves. No continuity.

Figure 7: G^0 continuity. Curves will be continuous but there is visible stop point.

Figure 8: G^1 continuity. The tangents on either sides of join points are essentially the same. Curves will appear smooth. But there may be sudden changes in the path.

Levien proposes that *every curve segment in a two parameter, G^2 continuous interpolating spiral spline between adjacent control points can be cut from an Euler spiral subjecting to rotation, scaling, translation and mirror image transformations*. He calls Euler spiral as the generating curve for spiral splines. Euler spiral has a curvature that changes linearly with its curve length. See Figure 10 for a Euler spiral.

The Inconsolata monospace humanist latin font known for its clean lines and elegant design by Levien himself is based on this theory[4].
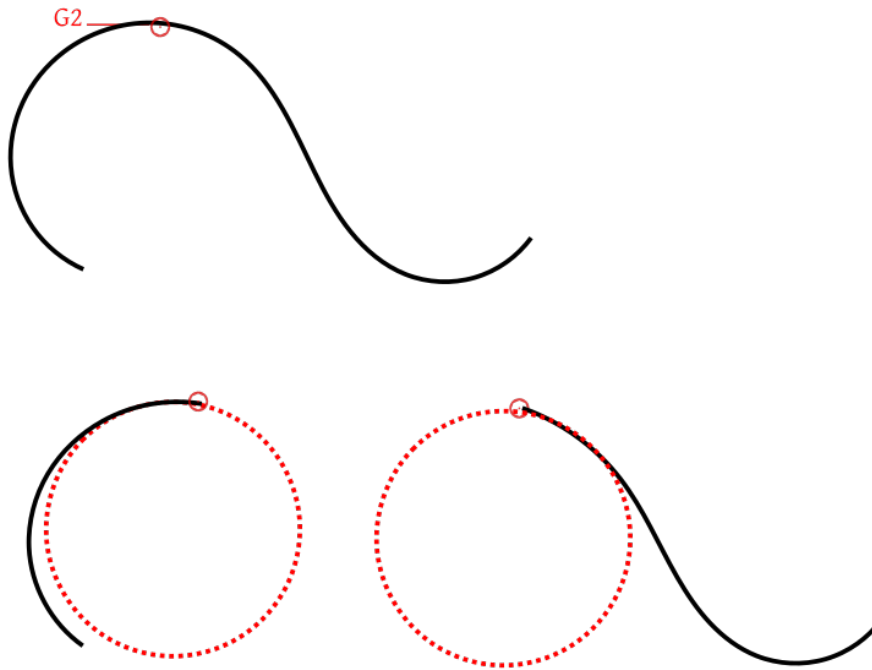
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[4] http://levien.com/type/myfonts/inconsolata.html

Figure 9: G^2 continuous curves, having a common center of curvature at the join points. The Spiro library in Inkscape generates G^2 curves and the same is used for Manjari typeface.
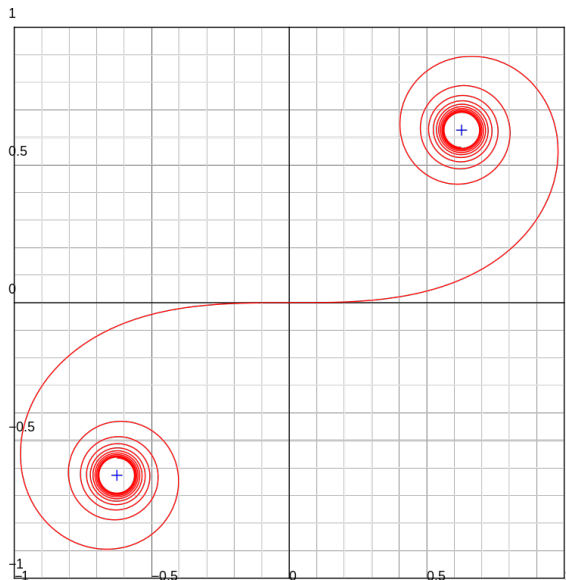

Figure 10: Euler Spiral, defined by the linear relationship between curvature and arclength, was first proposed as a problem of elasticity by James Bernoulli, then solved accurately by Leonhard Euler

4 Design process

The design of Manjari typeface was done using free software tools in GNU/Linux operating system. The drawing was done in Inkscape using the Spiro tool[5], which implements the optimal curve generation technique outlined by Raph Levien. Figures 11, 12, 13 and 14 illustrates the process.
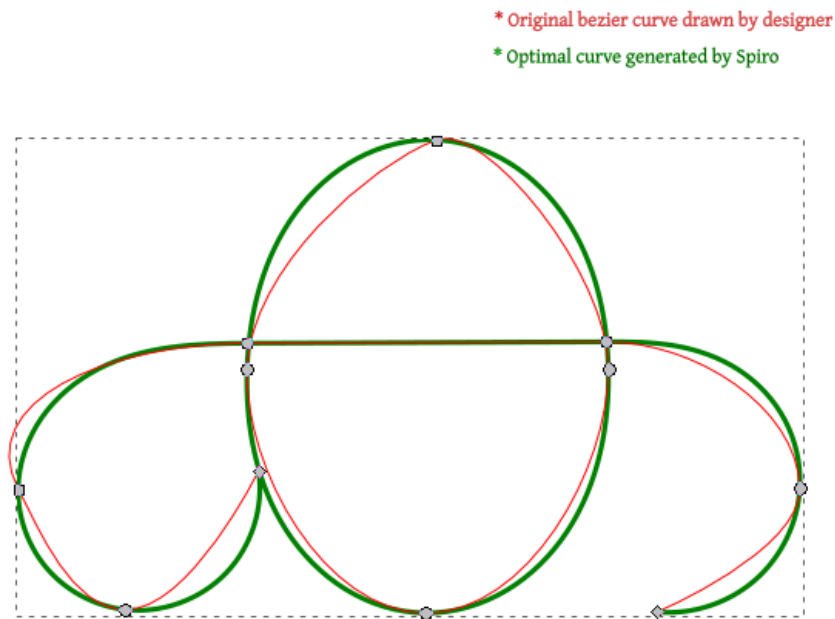

Figure 11: Designer defines the control points. Spiro tool interpolates the optimal spiral curve between them. Designer adjusts the nodes till desired glyph shape is achieved.

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[5]Spiro library. Spiro is a toolkit for curve design, especially font design, created by Raph Levien. It is integrated with Inkscape and Fontforge. http://www.levien.com/spiro/
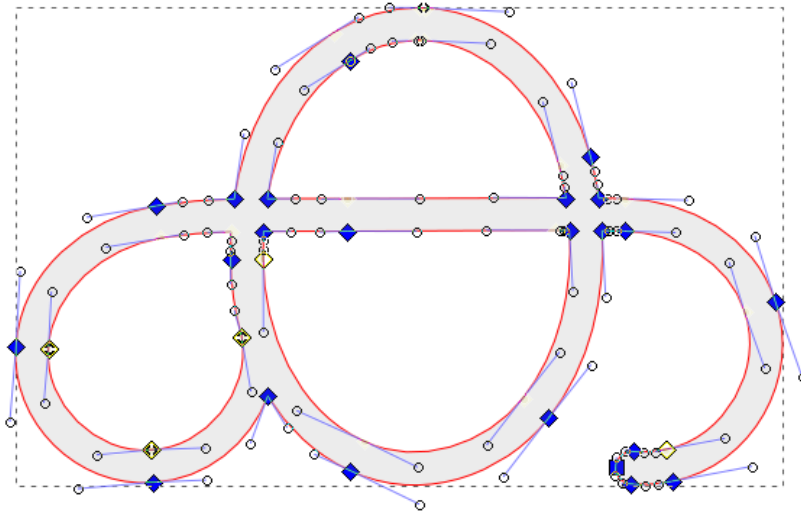
Figure 12: The stroke is converted to bezier path with desired stroke width by Spiro library in Inkscape. Now this is the draft of cubic bezier outline of glyph
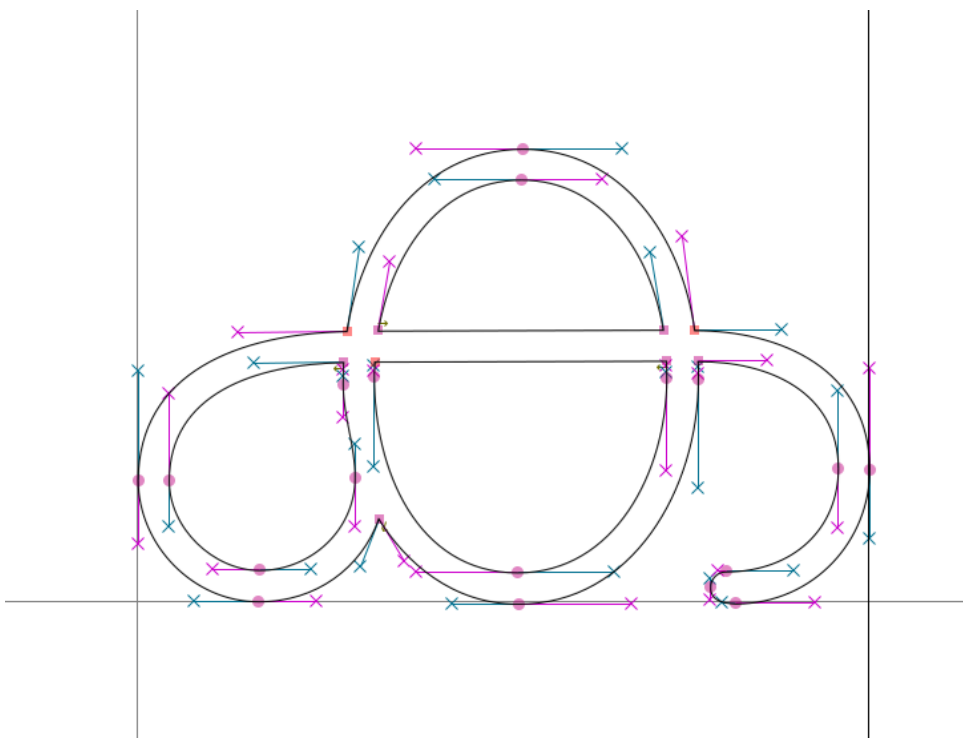

Figure 13: A font editor simplifies and clean up the nodes, defines glyph name, bearings.
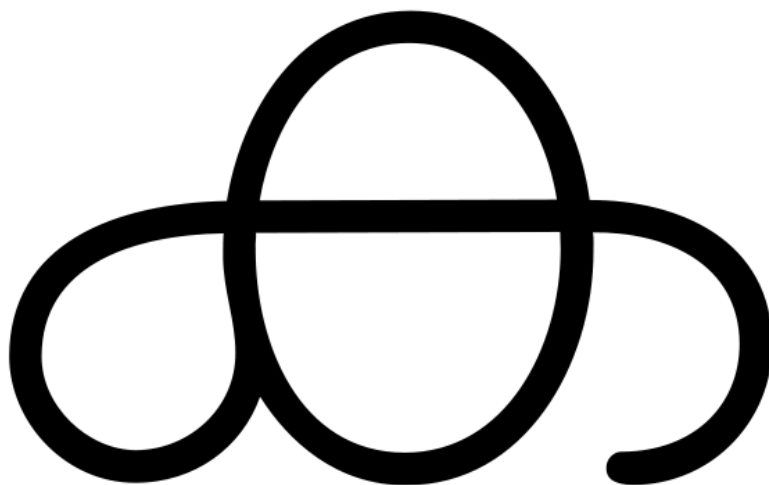
Figure 14: Final glyph

Manjari is an equal thickness typeface. So, bold and thin variants are prepared by just varying the stroke width in Inkscape, while stroke is controlled by the curves from Spiro. The outline terminals were set to use round shapes, that complements the smoothness in outlines.

The typeface also has a matching Latin character set which follows the same design principles.

5 Specimen

 മഞ്ജരി
Manjari Malayalam font

An experiment to present the curly Malayalam script using spiral splines based curve design. The rounded terminal font gives a unique and fresh approach for Malayalam typeface design.

Designed by: Santhosh Thottingal

ഇലഞ്ഞിപ്പൂമണമൊഴുകിവരുന്നു
ഇന്ദ്രിയങ്ങളിലതു പടരുന്നു
പകൽക്കിനാവിൻ പനിനീർമഴയിൽ
പണ്ടെനിന്മുഖം പകർന്നുകന്നു

അ ആ ഇ ഈ ഉ ഊ ഋ എ ഏ ഒ
ക ഖ ഗ ഘ ങ ച ഛ ജ ഝ ഞ
ട ഠ ഡ ഢ ണ ത ഥ ദ ധ ന
പ ഫ ബ ഭ മ യ ര ല വ ശ ഷ സ
ഹ ള ഴ റ ൻ ർ ൽ ൾ ർ ൺ ൿ
ക്ര പ്ര യ്ക്ക ത്തു ഗ്ന ന്ദ ണ്ണ പ്പ ൻറ
ള്ള വ ന്ത ന്മ ല്ല ത്ര ശ്ര ഞ്ച ക്ഷ ത്മ

അനുരാഗലോലഗാത്രി
അനുരാഗലോലഗാത്രി
അനുരാഗലോലഗാത്രി

മഴ
തത്ത

പെയ്യി
ത്തു
റണ്ടും
സ്ത്രീ

ഇവിടെയുണ്ട് ഞാൻ എന്നറിയിക്കുവാൻ
മധുരമായൊരു കുവൽമതി
ഇവിടെയുണ്ടായിരുന്ന ഞാനെന്നതി-
ന്നൊരുവെറും രുവൽ താഴെയിട്ടാൽമതി
ഇനിയുമുണ്ടാകുമെന്നതിൻ സാക്ഷ്യമായ്
അടയിരുന്നതിൻ ചൂടുമാത്രംമതി
ഇതിലുമേറെ ലളിതമായെങ്ങനെ
കിളികളാവിഷ്കരിക്കുന്നു ജീവനെ?

ഭാഷയ്ക്ക് വാമൊഴിയെന്നും വരമൊഴിയെന്നും രണ്ടു വകഭേദങ്ങൾ എന്നാണ് ഭാഷാവിദ്യാർത്ഥികളുടെ ആദ്യപാഠങ്ങളിലൊന്ന്. വാകൊണ്ടു മൊഴിയുന്നത് വാമൊഴി. വരച്ചുകാട്ടുന്നത് വരമൊഴി. കമ്പ്യൂട്ടറിന്റെ സഹായത്തോടെ ഭാഷയ്ക്ക് ലഭിക്കുന്ന അധികമാനത്തെയാണ് ഇവിടെ തിരമൊഴി എന്ന പദംകൊണ്ട് വിവക്ഷിക്കുന്നത്. തിരയിൽ കാണാവുന്നതും എഴുതാവുന്നതും വായിക്കാവുന്നതുമായ മൊഴി എന്നോ തിരപോലെ അസ്ഥിരവും രൂപാന്തരസാധ്യതകളുള്ളതുമായ

ന്നതും വായിക്കാവുന്നതുമായ മൊഴി എന്നോ തിരപോലെ അസ്ഥിരവും രൂപാന്തരസാധ്യതക ള്ളതുമായ മൊഴി എന്നോ തിരയാവുന്ന മൊഴി എന്നോ ഒക്കെ ഈ പദത്തിന് നിഷ്പത്തി പറയാം. ഇംഗ്ലീഷിൽ Hypertext എന്ന പദം കൊണ്ട് അർത്ഥമാക്കുന്നത് മലയാളത്തിൽ തിരമൊഴി എന്ന പദംകൊണ്ട് ഏറെക്കുറെ സാധിക്കാമെന്നു വിചാരിക്കുന്നു. ഭാഷയുടെ പരിണാമ ചരിത്രം സാങ്കേതിക വിദ്യയുടെ പരിണാമ ചരിത്രം കൂടിയാണ്. വാമൊഴിയിൽ

Designed in Regular, Thin, Bold style variants. Includes Latin glyphs. OFL licensed free font. Not released yet

Figure 15: A one page specimen of Manjari typeface

6 Popularity

Manjari has gained wide popularity in web as well as in print media since in release in July 2016. There are magazines and news portals which use Manjari as a major typeface. Internet memes widely use Manjari. A few samples are shown in Figures 16, 17 and 18.

Figure 16: A page from 'Eureka', Illustrated fortnightly for Children. It uses Manjari for body and titles
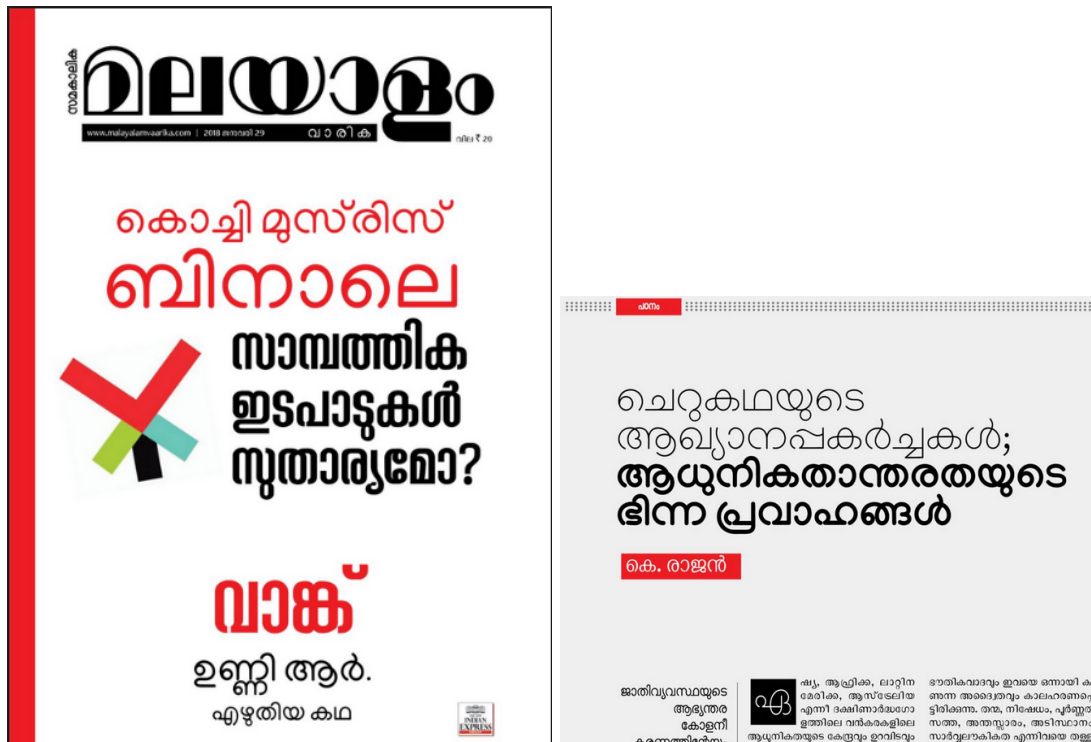
Figure 17: 'Samakalika Malayalam', Illustrated weekly uses Majari for titles and blurbs

Figure 18: An internet meme using Manjari

7 Conclusion

We discussed the principles and the process followed in the design of Manjari typeface. We also discussed how the optimum spiral curve design outlined by Levien is used in the process, which we believe is one of the main factor behind the wide popularity of the typeface in Malayalam.

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