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Structural and Visual Aspects of Contemporary Typography – From Handwritten Calligraphy to Digitization and the Creation of Dynamic Variable Fonts

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Abstract

The article examines the role of the aesthetic characteristics of calligraphy in the creation of dynamic variable fonts in contemporary typography. By analyzing the visual approaches in the creation of a calligraphic work and comparing them with the possibilities provided by modern software tools for generating dynamically changing fonts, the process of creating new-generation fonts is traced. Particular attention is given to the analysis of significant examples from contemporary typography that use digital fonts in text design – from simplified sans serif, serif fonts, decorative scripts, and others. In recent years of the 21st century, a trend has developed in the creation of digital fonts that can proportionally change and deform based on width, weight, slant, style, texture, optical size, and other parameters. This variable function of Adobe's software programs is part of the OpenType features, called "Variable font," which enables greater flexibility in text design.

Keywords: variable font, calligraphy, digital font, OpenType feature.

1. Introduction

Calligraphy is a highly impactful art form, capable of evoking and creating emotional depth and space for the imagination. The leading visual approaches of calligraphy artists are always tied to a sense of harmony and balance, combining activity and dynamism with compositional silence and calmness, which is then conveyed to the viewer. Calligraphic works are powerful not only because of the meaning embedded in the written message, but also due to the high emotional intensity of their purely visual aesthetic qualities. The distinctive characteristic of calligraphy – merging meaningful messages with visual impulses conveyed through composition – goes beyond simple interpretation and immerses the viewer in complex, multidirectional associative and aesthetic-perceptual connections. The pursuit of a unified aesthetic whole in a calligraphic piece, along with its uniqueness, makes it a complete artistic work of undeniable aesthetic value.

Contemporary typography is filled with a wide variety of examples using digital fonts in text design – from simple grotesques and serif fonts to decorative scripts and more. In recent years, there has been a growing trend toward creating digital fonts that can change proportionally and deform based on width, weight, slant, style, texture, optical size, and other parameters. This variable function, supported by Adobe software and part of the OpenType format, is known as the

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Variable Font, and it allows for greater flexibility in text design. A variable font includes one or more axes, each providing specific variation between different design parameters. The format also allows for intermediate designs, either for the entire set of letters or for specific characters, offering finer control over the letterform's silhouette.

A variable font is one in which the equivalent of many individual fonts can be compactly packed into a single font file. It is done by defining variations within the font, forming a design space with one or multiple axes (e.g., weight, width, or optical size). Many font variants can then be represented by interpolating unknown values between known data points.

This new function opens exciting possibilities for fine-tuning the typographic palette and for new types of typography that can adapt to dynamic content, the reader's device, screen orientation, or even letter spacing.

Variable font technology is based on the OpenType 1.8 specification, introduced by Microsoft, Apple, Google, and Adobe in 2016. It is revolutionary in digital typography, being efficient and adaptive not only for designers but also for developers. Instead of having separate files for bold, italic, condensed, or extended styles, a variable font can seamlessly transition between these. This is achieved through "axes" that control various aspects of the font's appearance, such as weight, width, slant, optical size, etc.

A diagram (Fig. 01) illustrates a design space for a three-axis variable font with axes for weight, width, and optical size. The red glyph "a" at the center of the graphic represents the core or base design. Each green glyph represents the endpoints of the three axes, and the gray glyphs show transitional positions between these endpoints.

It's not necessary for every axis to affect all glyphs in a font, nor must each axis include a wide range of variations. Font designers can adjust the behavior of transitions along an axis to be gradual or abrupt – allowing the axis to act as a switch or provide discrete steps without intermediates. It is also possible to create axes affecting only one glyph (e.g., one that adjusts the tail length of the capital "Q") or axes that affect only a subset of glyphs with specific traits (e.g., an axis that shortens or upper lengths).

When using an axis that controls stroke weight, without affecting character width, font styles can range from ultra-thin to extra-bold (Fig. 02). An axis controlling width allows for condensed to very extended styles while maintaining letter proportions (Fig. 03). An axis for slant transforms upright styles into italics (Fig. 04). An axis controlling contrast between thick and thin parts of the letter allows for a palette with or without stroke contrast (Fig. 05). Serif axes can add or reduce serif prominence, enabling transitions from serif to sans-serif styles, even with adjustable serif lengths. Other axes can adjust x-height, improving small-letter readability, or modify capital height independently. Another axis could manage letter spacing – dynamically increasing or decreasing it. The optical size axis improves legibility at various sizes depending on the medium, whether digital or print (Fig. 06). For digital media, differences across web browsers may require size optimization for each channel. These are some of the key features of variable font axes.

There are also custom axes based on creative and experimental projects. These include detailed changes to the silhouette and character of letters. One example is an axis for roundness, morphing shapes from sharp angles to smooth curves. Another example involves adding or removing ink in places where natural ink buildup occurs when writing with a metal nib. This design element - known as an *ink trap* – helps letters appear visually balanced in small sizes. Ink traps are often used in glyphs with diagonal strokes. An ink trap axis can dynamically add or remove these features, improving legibility in small print sizes.

Other axes can toggle decorative elements, strokes, or flourishes – especially useful for script and ornamental fonts. In calligraphic fonts, an axis could modify stroke style – from delicate

monoline strokes to expressive brush textures. Axes can also alter the texture of calligraphic fonts – from refined and smooth to rough and bold lines. Additionally, an axis can adjust ascender and descender lengths of lowercase letters, compressing or expanding vertical spacing. These are just a few possibilities; many other axes arise from designer experimentation.

Practical applications of variable fonts can be found in web design, branding, print preparation, and enhancing accessibility for both designers and developers. In web design, variable fonts improve site performance by reducing the number of font files and allowing responsive typography. In branding, they ensure consistency and flexibility across different media and formats. Purchasing a variable font expands the potential for developing diverse brand visuals. In print design, especially at small sizes, selecting a variable font with an optical axis ensures legibility across different sizes.

This accessibility to fine-tune weight and size improves user readability, optimizes workflow and communication between designers and developers, and provides flexibility while maintaining consistent typography. It also enables innovative designs, such as animated typography. Variable fonts offer a modern, versatile approach to typography, giving designers more creative control and enhancing the user experience.

The efficiency of a single file reduces the number of necessary font files, simplifying asset management and decreasing webpage load times. Designers can fine-tune typography for any layout or context by adjusting parameters with precision. Variable font functionality is supported in most modern browsers and design software (e.g., Adobe CC, Figma).

Technical details in the OpenType variable font format include additional tables that support variable functionality. The main tables are:

fvar: Lists the variation axes and their ranges.

gvar: Contains glyph variations for each axis.

cvar: Manages variation of control values.

avar: Adjusts interpolation of axis values.

Variable fonts use interpolation to generate intermediate styles between defined masters. For example, a font may have light and bold masters, and interpolation can generate any weight in between. Designing smooth interpolation requires careful planning, especially for highly decorative elements. Smooth transitions in variable fonts are achieved through consistent design and interpolation across all masters.

2. Gerrit Noordzij

Gerrit Noordzij is one of the most influential figures in contemporary typography. His research in the field of form generation and the dynamics of letterforms is essential to the development of modern type design. In his foundational work *'The Stroke: Theory of Writing'* (2005), Noordzij examines letters not as static shapes, but as the result of the movement of a writing tool. He emphasizes that the shapes of characters arise from how the tool is manipulated in relation to the baseline and slant.

Central to Noordzij's theory is the concept of the *'stroke'* – the fundamental structural unit in the construction of a letter. The stroke is understood as the movement of the writing instrument, which defines not only the contour but also the rhythm and visual dynamics of the form. This approach shifts the traditional perception of typography by focusing on the process of creation, rather than merely the final graphic result.

One of Noordzij's most significant contributions is the so-called *Noordzij Cube* – a three-dimensional model describing the interrelations between the three main parameters of type: weight, width, and contrast (Fig. 07). The model presents these characteristics as interdependent and subject to continuous transformation, allowing for more flexible and adaptive type family design.

In the context of modern technologies, Noordzij's ideas prove particularly relevant in the development of variable fonts. In the article *'Variations on a Theme'* (Beier, 2019), it is explored how his principles of weight and contrast form the basis of variable axes that allow for smooth interpolation between different styles within a typographic system.

Noordzij emphasizes that even minor changes in the angle of slant or the pressure of the tool can result in significant visual changes in the character. These changes affect not only the shape but also the perception and readability of the text. This movement-focused, process-oriented, and hand-based approach lies at the heart of modern type design methods, which seek a productive dialogue between historical writing traditions and the capabilities of the digital environment.

Noordzij's theories have a profound impact not only on type design but also on the pedagogical methodology of teaching typography. As a longtime professor at the Royal Academy of Art in The Hague (KABK), he has shaped several generations of designers through his analytical and practical approach to writing and form-making. His method is based on a systematic study of the movement that generates form, rather than starting from fixed visual outcomes. This laid the foundation for the so-called *'Hague School'* of typographic education, known for its emphasis on calligraphy and letter construction.

Noordzij regards writing as a primary act, preceding graphic design and typography, meaning that each letter carries traces of the tool that formed it. This understanding allows for a deeper grasp of the visual differences between humanist and modern typographic styles, seeing them as results of different tools and movement angles – flat nib, quill, brush, engraving tool, etc.

In the digital context, Noordzij's approach is reflected in software environments such as RoboFont, Glyphs, and DrawBot, where type is treated not only as a visual object but also as the result of programmed movements and transformations. His concept of *'dynamic forms'*, which change in real time depending on context or platform, finds concrete application in the development of adaptive fonts for interface systems. Thus, despite its handwritten origins, Noordzij's theory is both traditional and visionary – offering a universal framework for analyzing and creating typographic forms in both analog and digital contexts.

3. TypeMedia

TypeMedia is a master's program at the Royal Academy of Art in The Hague, Netherlands. It is one of the most renowned type design programs in the world, offering in-depth study and creation of typefaces. The program specializes in the development of high-level type design and typography. Many of the graduate projects focus on the creation of type families that include one or more axes to optimize design processes and file formats.

4. Cosm by Benn Zorn

Cosm is a typeface family created in 2022 as a graduation project by German typographer and graphic designer Benn Zorn. The project is an experimental investigation into the interaction between analog and digital methods in the type design process, where drawing and

programming are used in parallel and treated equally as tools for shaping typographic structure (Fig. 08).

The initial concept focuses on visualizing psycho-emotional states – specifically anxiety and phobia – through letterform. The underlying hypothesis is that such states are underrepresented in contemporary type design and could be expressed through an unstable, non-traditional visual logic. In this context, the typeface aims to provoke an emotional response through formal deviations from standard typographic models.

Cosm includes several stylistic variants: a regular style with moderate geometrization, a sharply drawn and highly slanted italic with pronounced expressiveness, as well as additional stylistic variations inspired by the so-called abyssal aesthetic. This aesthetic is associated with visual qualities such as stickiness, mesh-like structure, organic fluidity, and fragmentation – forms that challenge conventional rationality in type design.

The creation process involves a generative approach, where coding is used not only as a tool for automation but also as an essential stage in the actual form-making. By using tools such as DrawBot and RoboFont, the author applies algorithmic principles, including Voronoi diagrams and other geometric transformations, to generate organic structures. These structures create visual tension and disrupt expected typographic rhythms, reinforcing a sense of destabilization and fluidity of form.

The project follows a repetitive process, in which drawing and programming alternate and mutually adjust each other, forming a dynamic cycle between intuitive and computational aesthetics. According to the author, this approach is *'a mixture of frustration and exhilaration'* that leads to an original result, disconnected from traditional historical or functional references.

Cosm questions the boundaries of the typographic system, demonstrating the potential for type to act as a mediator of psychological content. At the same time, the project showcases how contemporary design processes can integrate code as a creative tool, opening new directions for expression beyond established aesthetic and technical norms.

5. Furya

Furya is a variable font inspired by 1950s car lettering and the calligraphic model Civilité. The font includes a single variable axis that simultaneously affects several parameters – weight, slant, and letter construction. It is designed along three primary axes that differ in weight, angle, and formal structure (Fig. 9).

The variable axis, tentatively called the *'speedometer'*, ranges from 45 to -45 degrees and enables a smooth transition from a back-slanted, heavy style, through an upright, lighter form in the middle, to a forward-slanted and once again heavy style at the other extreme. This coordinate system synchronizes the transformation of all visual characteristics, creating a sense of motion and speed within the typographic composition itself.

6. Grima

The Grima Font Family is a contemporary display font based on the concept of *'Unispace'* – a new genre in type design inspired by both unicase and monospaced fonts, published by Fontfabric. The family includes five fonts with fixed darkness, expanding width, and a variable version for more fine-tuned control over widths (Fig. 10).

The axis responsible for the font's width offers a spectrum ranging from narrow to very wide, while preserving the proportional characteristics of the letterforms. This allows for a rich set

of variations expressed through dynamic shifts in weight and width, making the typeface suitable both for headlines and texts across different visual contexts.

The letterforms feature short ascenders and descenders, designed to ensure compactness and allow for text lines of uniform height but varying width. Each character has a unique skeleton, carefully crafted to fill the type body and space as densely as possible. The even spacing between characters, combined with their detailed shapes, creates harmony and a unified stylistic appearance in composition.

The Grima Font Family was created by type designer Todor Georgiev, part of the Letter Collective team. The typeface was developed as a result of an exploration into complex forms, guided by a fruitful idea to create a decorative lettering font where readability ranks third – after challenge and innovation.

Based on pencil sketches influenced by writing with a broad nib and featuring very fine calligraphic details, the font was designed to fill the gap in unconventional Bulgarian typefaces.

7. Gwen

Gwen is a typeface that blends modernity with geometric elegance. With its variable axes, it is particularly well-suited for projects requiring diverse visual impact, such as adaptive headlines or extended blocks of text. Gwen is distinguished by its delicate variations in stroke thickness and angle, which give it a unique character. The distinctive sharpening and elongation of the serifs, combined with the shifting weight of the rounded strokes, contribute to an impression of bold elegance and lightness.

The type family, created and published by Fontfabric, includes seven weights. The complete type system consists of two subfamilies: a highly distinctive Display serif family, which reveals its full potential and beauty at large sizes, and a more refined Text version, suitable for smaller sizes. The variable font combines the best of both variants and provides unique flexibility, allowing for seamless transitions across all weights and between the Text and Display styles simultaneously.

In this case, the axes are combined. The first axis adjusts the weight of the strokes without affecting the width of the characters. The second axis alters the details of the serifs – in one direction, they become more rounded, suitable for text (print) usage, while in the other, they become sharper and more decorative, ideal for display purposes (Fig. 11).

The font supports extended Latin and Cyrillic character sets, and its primary purpose is editorial use, though it can also be effectively applied to headlines, posters, packaging, and more.

8. Drumnik

Drumnik is a typeface family developed by Fontfabric Studio, drawing its inspiration from the traditions of Cyrillic script, specifically from the calligraphic practices of the Old Bulgarian literary canon. The typeface is designed as a variable typographic system, in which control axes allow tracking the transformation of forms between different stylistic states. This approach broadens the possibilities for dynamic typographic usage depending on the context and functional needs (Fig. 12).

The conceptual foundation of Drumnik is based on in-depth typographic research, including an analysis of historical styles such as Ustav (Cyrillic uncial) and Vyaz (a decorative, highly ornamental script from the late Middle Ages). The influences from these sources are not direct quotations but rather interpretations adapted to the contemporary visual environment. As

a result, the design incorporates distinctive structural features – pronounced contrast between primary and secondary strokes, expanded horizontal proportions, unique terminal shapes, and ornamented connections between elements.

At a later stage of development, elements from classical serif typefaces were integrated into the font, resulting in the creation of a hybrid typographic structure. This synthesis of historical reference and modern legibility seeks to achieve a balance between cultural identity and functional adaptability.

The project supports extended Latin and multiple stylistic sets, making it applicable across a wide range of visual and communicative contexts. The ability to interpolate across various axes (weight, contrast, style) positions Drumnik as a contemporary tool for adaptive typographic design, including in digital environments.

The development of Drumnik can be seen in parallel with broader trends in the renewal of Cyrillic graphic culture through the use of variable fonts and technologically assisted methodologies. In this sense, the typeface represents not just an aesthetic creation but part of a deliberate process of typographic reform aimed at providing new tools for cultural and linguistic representation in contemporary visual design.

9. Transforma

Transforma is a typeface family released by Fontfabric, skillfully combining an elegant sans-serif typeface, a smooth handwritten script, and a third hybrid style – *'The Mix'*, in which all elements blend into a visually harmonious whole (Fig. 13).

The serif component of Transforma is designed with wider proportions, ensuring excellent legibility even at small sizes. The inclusion of ink traps and vertical cuts gives it a contemporary and technological feel. The ExtraBlack version increases contrast and introduces experimental letterforms such as 'a,' 'f,' and 'g', offering an innovative reinterpretation of classical typographic elements.

The handwritten style captures the natural rhythm of handwriting, creating a lively, emotional, and engaging appearance that brings a sense of human warmth to the composition.

Enter The Mix – the creative direction where the geometric precision of the sans-serif and the organic softness of the script merge seamlessly, proving that contrasting forms can coexist and balance within a unified typographic system.

With its flexible structure and multi-style character, Transforma is suitable for a wide range of applications. The clarity and functionality of the sans-serif make it ideal for web design, mobile interfaces, navigation systems, and corporate communication, where readability is a priority. The handwritten style adds emotion and personality, making it perfect for packaging, advertising, invitations, magazines, and fashion branding. Meanwhile, The Mix is a great choice for editorial design, headlines, posters, and brand identities seeking a creative and modern visual language.

This typographic family, Transforma, offers both visual contrast and coherence, enabling designers to build rich, multi-layered compositions within a single font system.

10. Sofia Sans

Sofia Sans is a typeface that combines minimalism and flexibility, created and released by the Lettersoup studio. Thanks to its variable axes, Sofia Sans allows for fine-tuning of weight, width, and slant, making it particularly suitable for both digital platforms and print materials. The

typeface maintains its clean aesthetic and elegant design regardless of the context in which it is used (Fig. 14).

Sofia Sans was specifically developed to meet the needs of the tourist wayfinding system in Bulgaria. It supports both the Bulgarian form of Cyrillic and extended Latin, enabling full usability in multilingual environments. The type family is built according to the OpenType standard, including a rich set of features – small caps, various numeral styles, arrows, circled numbers, and more – further enhancing its functionality and versatility.

Visually, Sofia Sans impresses with its harmonious balance between geometric structure and humanist touches. The letterforms are stable and well-structured, which contributes to excellent legibility even at small sizes. At the same time, slightly rounded corners and occasional bouncing off the baseline in certain styles give the typeface an informal and approachable feel, softening the rigidity of its minimalist design.

This makes it especially suitable for wayfinding systems, public environments, web and mobile applications, where clarity, a friendly tone, and visual consistency are essential.

11. Shantell Sans

Shantell Sans is a modern handwritten font created by artist Shantell Martin in collaboration with Google Fonts. The typeface reflects her unique style – free, playful, and artistic, with references to handwriting and contemporary calligraphy. What's particularly interesting in the development of this typeface is the use of four variable axes: width, casualness, bounce, and spacing. Two of these – casualness and baseline bounce – convey a loose and unpretentious appearance of the text. The way the letters bounce off the baseline creates a sense of motion, lightness, and dynamism, which further enhances the informal character of the typeface (Fig. 15).

12. Segmenta

The Segmenta type family, developed by the Type Department, is an excellent example of the application of variable typography principles in contemporary design. Specifically, Segmenta A is designed as a decorative display font, intended for use in headlines, posters, advertising materials, and other visually impactful contexts. It includes 18 predefined styles, showcasing a variety of combinations across three primary typographic parameters: weight, width, and italic angle (Fig. 16).

These three variable axes not only cover the traditional dimensions of type but also enable continuous interpolation between values. Furthermore, the inclusion of an italic angle axis, which controls the slant of the letters, allows for extremely nuanced typographic expression – for example, when creating dynamic layouts or adapting to a specific linguistic context (especially in languages where italics carry different semantic or visual functions). The width axis, on the other hand, is especially useful in responsive web design, where text space is limited or varies depending on screen size and device orientation.

13. Conclusion

The dynamic development of typographic approaches in recent years is a result of both the rapid evolution of digital technologies and the shift in visual thinking, along with enhanced ability to influence and direct viewer perception. As the field expands with endless possibilities for aesthetic transformation and creative interpretation, a new emphasis is also emerging on the functionality and social relevance of typography in today's visual communication landscape.

Acknowledgements

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Appendix

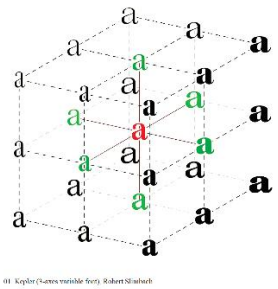


Figure 01

Figure 02

Figure 03

Figure 04

Figure 05

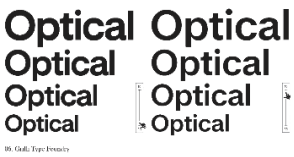
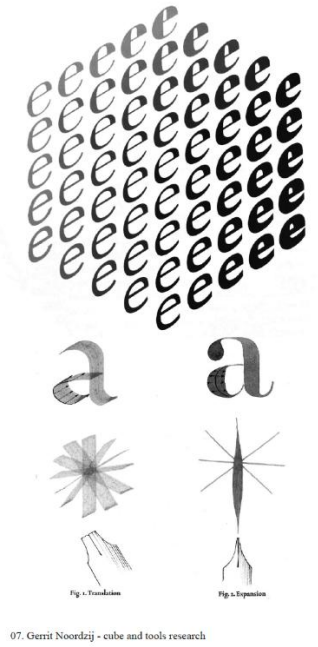


Figure 06



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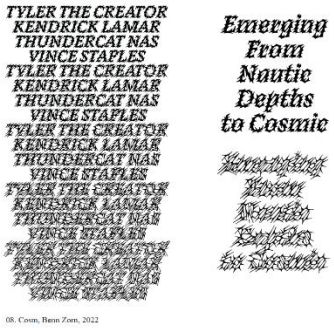


Figure 08

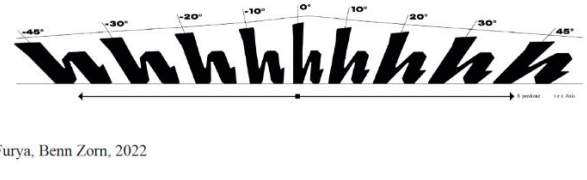


Figure 09

10. Grima, Todor Georgiev

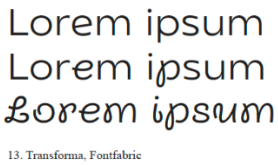
Figure 10

11. Gwen, Fontfabric

Figure 11

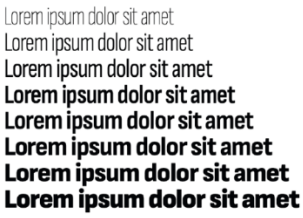
12. Drumnik, Fontfabric

Figure 12



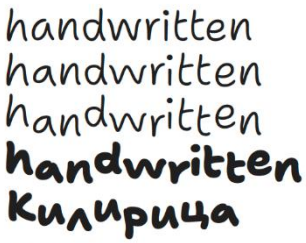
13. Transforma, Fontfabric

Figure 13



14. Sofia Sans, Lettersoup

Figure 14



15. Shantell Sans, ArrowType

Figure 15

16. Segmenta, Kobuzan

Figure 16


C O A S