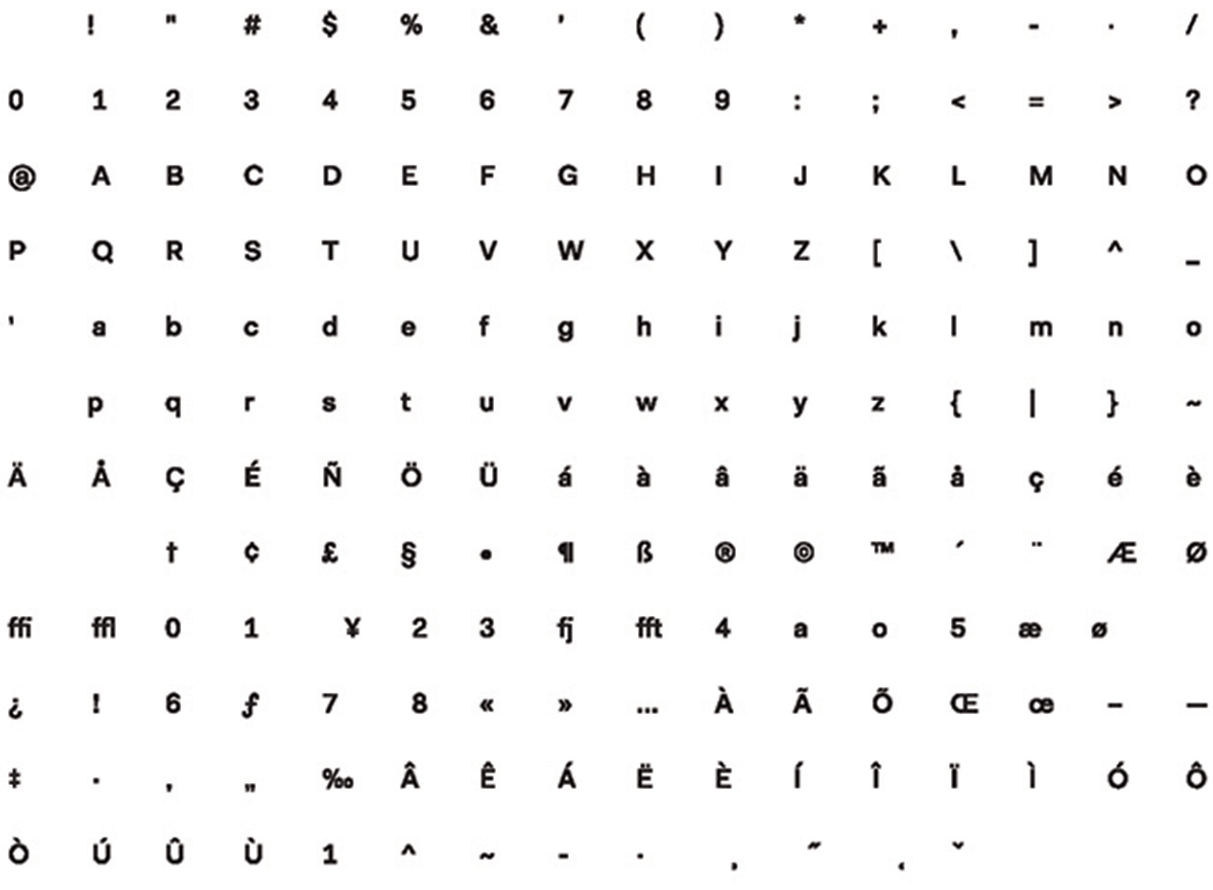
designingtype

Karen Cheng



Second Edition

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Designing Type

SECOND EDITION

Karen Cheng

Yale University Press

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CONTENTS

The author, Karen Cheng, at the University of Washington in Seattle. Photo by Rachel Hobart.

Introduction

My first experience in type was in graduate school, when I enrolled in a class on letter design taught by Heinz Schenker at the University of Cincinnati. Heinz was a graduate of the Basel School of Design, where his typography teachers were the Swiss designers Armin Hofmann and Emil Ruder. Basel was infamous for its rigorous and intensive program of design foundations. As documented by Manfred Maier in *Basic Principles of Design: The Foundation Program at the School of Design Basel, Switzerland* [1980], students spent months simply drawing lines before they were permitted to advance to letterforms. The philosophy of the program emphasized excellence in hand-driven craft; therefore, the curriculum also included calligraphy and letterpress printing.

Our class had no textbook. Heinz would stand at the chalkboard and draw each letter, describing the possible variations in old style, Didone, slab serif, and sans serif typefaces. He used no notes, his letters were beautiful, and he was never at a loss when questions were asked. We were expected to listen, to copy his drawings in our sketchbooks, and to subsequently draw our own letterforms in each of the main typestyles. For the final exam, each student had to exhibit four boards of painted letterforms. We used Pelican Plaka paint; the creation of the boards was sometimes referred to as "plaka-torture."

By the end of the course, I had contracted what designer Erik Spiekermann calls "Typomania." Educator and design critic Ellen Lupton describes Typomania in her introduction to Douglas Thomas's book, *Never Use Futura* [2017]:

"Introduced through the innocuous pages of a college textbook, typography will soon stalk you everywhere. You cease to find solace and sustenance at the supermarket; instead you puzzle over the diamond-shaped tittles that dot the i's of the Triscuit logo...

One day you step off the edge of the subway platform wondering whether the words 'STAND BEHIND THE YELLOW LINE' are set in Akzidenz Grotesk or Helvetica."

There are, perhaps, two major effects of Typomania. First, a desire to understand all the details of letterforms, so that you can better select, combine, and use type as a designer. The second is, of course, wanting to design your own typeface. This book attempts to address both of these needs.

The first chapter, *Design Process*, is expanded in this new edition to more fully describe the motivations and methods used to create a revival or original typeface. I have also included two case studies that show student type projects progressing from initial sketches to final drafts.

The second chapter, *Variables in Type Design*, provides a foundation for the activity of designing type. In this second edition I have expanded to discuss in greater detail how specific modifications to letters (i.e., changes in proportion, aperture, weight, and so on) affect the legibility, efficiency, and esthetics of a typeface.

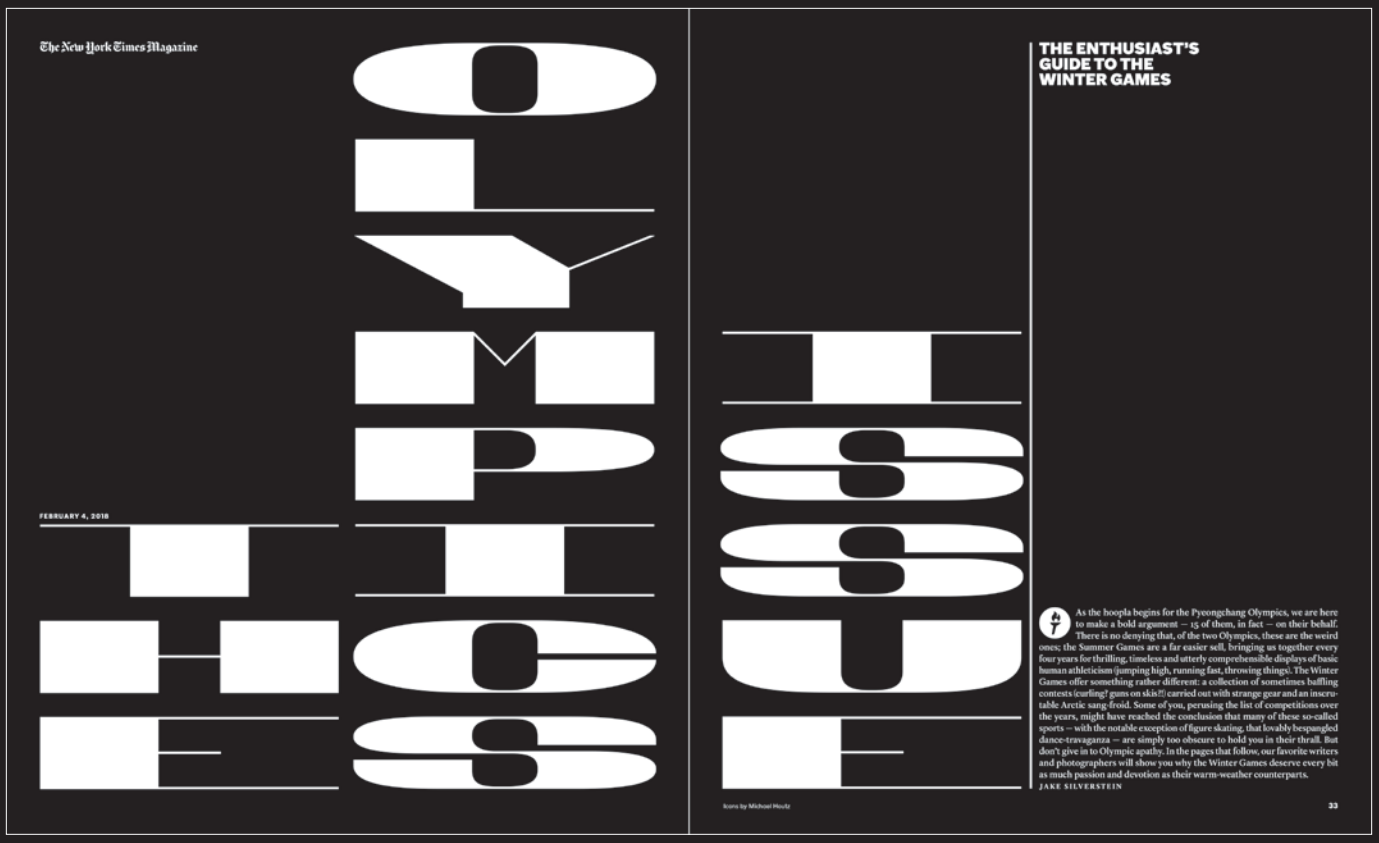
The third chapter, *Spacing*, has been moved forward to facilitate the best practice of "spacing as you go"—that is, determining the space for each character after it is drawn, rather than waiting until the end to space all glyphs. This section has also been expanded with new material.

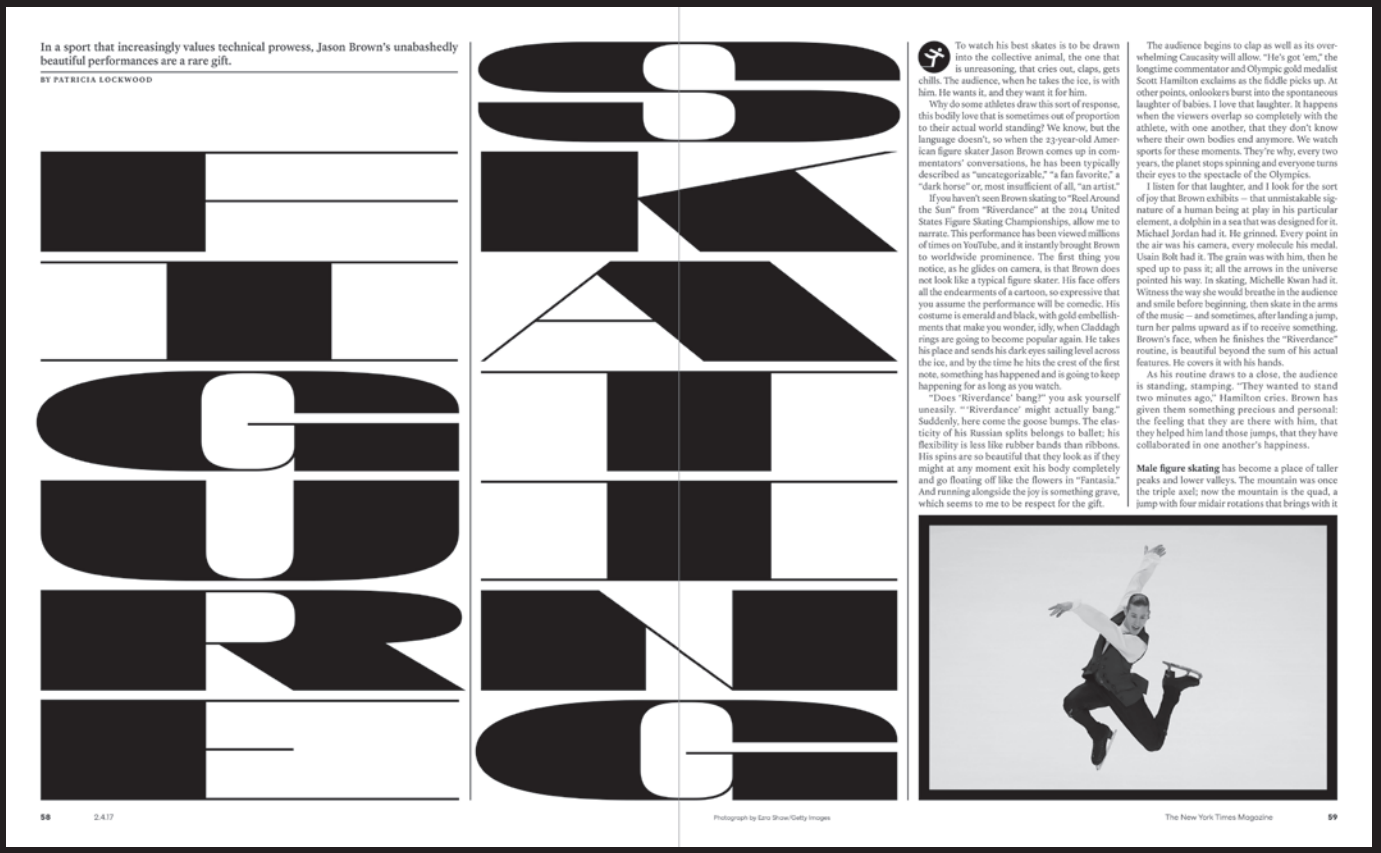
The remaining chapters divide a typeface into related subsets: capitals, lowercase letters, numbers, punctuation, and diacritical marks/special characters. In this second edition, I have placed serifs and sans serifs together rather than separating them into different sections. I hope this structure allows the relationships between these typestyles to be more easily seen and understood. The chapter on punctuation and symbols now includes several new glyphs: the hyphen and en/em dashes; parentheses, brackets and braces; the ampersand; and the now ubiquitous @ and hashtag/pound (#) signs.

The book closes with an appendix on type classification, and two new appendices: an overview of type design software, and a listing of all the typefaces shown in the book, along with their designers and type foundries. Note that the selected typefaces have expanded greatly from the first edition. While still emphasizing the classic text typefaces and typestyles, I have also included new, contemporary font families. In my opinion, analyzing the canonical typefaces that have endured—in some cases, for centuries—helps designers better understand the craft and logic that makes for effective type design. However, clearly there are new designers who are breaking new ground in the profession, and their contributions will lead (and have already led) to evolution and progress in the field. Not all of the typefaces shown here will satisfy every reader, but they have been chosen with care to represent a wide range of design possibilities.

1

DESIGN PROCESS





A custom mono-width font in one style (Bold and Wide) for vertically stacked headlines was created by A2-TYPE for *The New York Times Magazine*.

Motivations

The hardest part of designing a typeface might be the decision of whether or not to do it at all. The number of existing typefaces (estimated at around 300,000 individual fonts or 60,000 font families[1]) can be intimidating, especially for the novice designer.

On one hand, there are those who believe that new typefaces are unnecessary. The designer Massimo Vignelli famously stated that his selection of six classic typefaces (Bodoni, Century, Futura, Garamond, Times Roman, and Helvetica) were sufficient for most design problems.[2] Other practitioners, such as Experimental Jetset, have made an entire career using just one of those designs: Helvetica. Perhaps the opposite point of view is best expressed by type designer and educator Cristóbal Henestrosa in *How to Create Typefaces, from Sketch to Screen* [2017]:

"What happens in other similar activities: why make a new song, or a new novel, or a new movie? Luckily there are people that make new attempts and the results are remarkable. We would have lost a great deal if no one had made rock music after the Beatles."

Clearly, there are many who agree with Henestrosa, as interest in type design—once an esoteric discipline—has steadily increased over time. In the past decade, in addition to the well-established programs at the University of Reading in the UK and KABK (Royal Academy of Fine Arts in the Netherlands) several new postgraduate courses in type design have opened in the United States, Europe, Mexico, and South America. Informal type design education is also expanding, as practitioners, educators, and design organizations develop both in-person and online workshops.

Much of the interest in type design is driven by advances in technology. The transformation of type from physical to digital, the evolution and distribution of font design software, the widespread adoption of web typography and the dominance of online reading has made the activity of type design both better known and more accessible than ever. Still, the core problem remains: Why design a new font?

The answers to this question range from the pragmatic to the poetic. On the practical end, many of the new fonts issued today are commissioned by corporate clients. For example, in the last two decades, Airbnb, Apple, Google, IBM, Intel, HP, Netflix, PayPal, Samsung, and YouTube have all invested in exclusive, custom typefaces. Developing a custom typeface can actually save money by eliminating the recurring font-licensing fees that would be paid to a foundry for an existing design. Additionally, a custom typeface can be better than an existing typeface, because it can be optimized to meet specific requirements, such as being legible in specialized user interfaces, or supporting multiple languages.

Of course, custom type design is not new; corporations have long invested in typefaces to solve unique problems. For example, AT&T commissioned two different typefaces for their printed telephone directories: Chauncey Griffith's Bell Gothic in 1938, and Matthew Carter's Bell Centennial in 1978. Signage is another case: Adrian Frutiger created Roissy (an early version of the humanist sans serif Frutiger) for use at the Charles de Gaulle Airport in Roissy, France. In the 1990s, Microsoft Corporation hired Matthew Carter to create the fonts Verdana and Georgia for low-resolution (72 dpi) digital screens. More recently, in 2014, Amazon worked with type foundry Dalton Maag to develop Bookerly, a custom font for Kindle devices and apps.

Traditionally, newspapers and magazines have also invested in custom typefaces—not only to address functional problems (such as text-setting economy) but also to appeal to specific readers. In the 1990s and early 2000s, the former design partners Jonathan Hoefler and Tobias Frere-Jones created a series of award-winning display and text faces for *Harper's Bazaar*, *Rolling Stone*, *Business Week*, *Newsweek*, and *Martha Stewart Living*. Today, these mass market periodicals are in decline, but smaller, independent magazines (such as *AnOther*, *It's Nice That*, and *Fantastic Man*) have surged, perhaps in part thanks to arresting, off-beat typography. Similarly, many of the newspapers that have survived the transition to a digital world make use of distinctive custom typefaces, such as those created by A2-TYPE for *The New York Times Magazine* (shown opposite), and Commercial Type's collection for *The Guardian*.

Of course, new type designs are not driven exclusively by marketing, technology, or functional concerns. The urge to create may be quite personal. Designer Rich Roat of the foundry House Industries felt a kind of "sensual attraction" to Carnival, a narrow slab serif revived from their collection of 1960s phototype alphabets. Kent Lew, the designer of the typeface Whitman, has a more conceptual line of inquiry, noting: "For me, ideas generally come from 'what if' scenarios. What if Joanna had been designed by W. A. Dwiggins, instead of by Eric Gill? What if Mozart had been a punch-cutter—rather than a composer?"

This lengthy and diverse list of examples points to perhaps an obvious truth: The motivation for a new typeface is no different from the creative impulse for any other kind of design project. One needs an audience with a problem—or, as said by designer and Pentagram partner Michael Bierut, "a patient: the sicker, the better." The nature of the problem drives the solution. A typeface for a soccer team will clearly need to be different from a typeface for a design museum.

1 From Thomas Phinney, CEO of FontLab, quora.com/How-many-fonts-are-there-in-the-world.

2 Vignelli, Massimo, "Typefaces: The Basic Ones," *The Vignelli Canon*, Baden: Lars Müller, 2010, pp. 68–79.

IBM Plex is the custom corporate typeface of IBM. Designed by a team of designers led by Mike Abbink, the typeface is based on the original IBM wordmark and IBM's Selectric typewriter's Italic 12. The family consists of a serif, sans serif, and mono (with italics) in eight weights; it is free and open source, covering 110 languages.

adhesion Suisse Int'l (Medium)

championed Suisse Int'l Condensed (Regular)

lorem ipsum dolor Suisse Int'l Mono (Thin)

hamburgevons Suisse Sign (Semi-Bold)

hamburgerfontsiv Suisse Works (Book)

handgloves Suisse Neue (Regular)

Suisse International is part of a superfamily designed by Ian Party of Swiss Typefaces. Suisse was originally intended to be a sans serif companion to Party's earlier typeface Romain (so named because the design referenced models for the Romain du Roi designed in 1690). The Romain typeface was retired in 2017, but Suisse has since expanded into other variants, including a slab serif and a classic serif as well as condensed and monospaced styles.

Neue was commissioned from Peter Biľak by Paula Scher of Pentagram for her rebranding of The New School in New York City. The all-capitals typeface comes in three different widths and a “random” style that mixes the different proportions together unpredictably.

ABCDEEFGHIJKLM
NOPQRSTUVWXYZ

abcdefghij
klmnopq
rstuvwxyz

“.,?!”

(1234567890)
fifi*$@#

clean · heavy · sans-serif

esso

everyday

Welcome to Esso, a typeface derived from the friendly signage of Esso service stations. The bold Esso logo beckoned drivers from the freeway with the promise of fast and high-quality fuel. Clean and reliable, Esso helps you deliver your ideas and messages—everyday.

Above, an initial sketch from a five-week student project. Four students (Molly Boyd, Rachel Hobart, Jamie Martin, and Lacey Verhalen) developed a typeface based on a vintage Esso sign (Esso is a brand name for Exxon Mobil). Additional type and spacing refinements by Koko Morrill. Posters designed by Lacey Verhalen.

Type Design Briefs

Any type design project—indeed, any design project—should be guided by a brief. As type designer Jean François Porchez notes, "I have great difficulty designing fonts without a function, a brief. I can't create new forms simply for the pleasure of those forms. In fact, it's more the reverse: the function or brief inspires me to search for new forms."

Writing a brief forces a designer to think strategically about what the typeface needs to accomplish. Designer Nadine Chadine of Monotype suggests that a type design brief should include at least six elements: the intended function of the typeface; the medium where the typeface will be used; the languages to be completed; the desired personality of the typeface; the type classification; and the structural/stylistic basis for the design (for example, a humanist calligraphic typeface with classic proportions).[3]

1_What is the intended function of the typeface?

2_In what media will it be used?

3_What languages are needed?

4_What personality should the typeface convey?

5_What design characteristics are needed?

6_What typographic style is desired?

In the case of typeface revivals, the brief is largely filled in. A typeface revival is a new digital translation or reinterpretation of a typeface previously created in another time with different technology (for example, metal type, wood type, or phototype).[4] Creating a revival—even a direct facsimile—is less straightforward than it sounds. Complete fonts of type (or clear printed specimens) may be difficult to find. Even when materials are available, they are often inconsistent. One still needs to determine which letterforms to select, and which letterforms to modify. This is complicated by the fact that historically, designers often had to compromise their preferred letter shapes to fit the limitations of typefounding and printing in their time. In the present, it can be hard to imagine what John Baskerville might have done had he owned an up-to-date MacBook, FontLab, and a 1200-dpi laser printer. Still, if one seeks to make a Baskerville revival, a basic design framework is in place. It will be a text face; it will likely be used for long-form reading (with perhaps some display potential); and it will be a transitional design with an upright axis and medium to high contrast.

If the revival is less of a direct copy and more of a personal interpretation, the design brief becomes more open-ended. Just as Jane Austen's 1816 novel *Emma* was transformed into the 1995 teen romantic comedy *Clueless*, designers might reimagine (or even satirize) a historical design. One example of this approach is James Edmondson's audacious Hobeaux typeface, created in homage to Hobo, a 1910 Morris Fuller Benton design long scorned by graphic designers as one of the "most hated fonts of all time." In describing his design process,[5] Edmondson recalls asking himself, "What does Hobo look like 100 years later?"—a question that led to a modern interpretation that is both serious and lunatic, especially in the extensive experimental variants (including Rococeaux, blood, snow, log, and chrome).

Alternatively, an even more open-ended approach to developing a typeface involves working from a much shorter bit of lettering—not a full typeface, but perhaps an illustrated treatment for a book title or a logotype (as shown on the opposite page). In this case, the existing letterforms have to point the way forward. For example, the initial prompt might contain the H and O, therefore establishing three main strokes in the upper case: the vertical stem thickness, the horizontal stroke thickness, and the maximum bowl thickness. Even if the H and O are not in the original prompt, similar letters (for example, the E and C) might provide these key measurements. The lowercase letters can then be drawn to fit the weights of upper case, with the numbers, punctuation, and symbols following. Conversely, if there are no capitals in the prompt, we can instead draw the lower case first, and then derive the upper case and numbers afterwards.

If there is no pre-existing work to build from at all, the type designer has complete freedom to set their own design brief. However, a lack of restrictions can be alarming; as noted by designer Charles Eames, "design depends on constraints." One way to narrow options is to define specific typographic variables to explore. This is the basis of designer and programmer Erik van Blokland's TypeCooker project.[6] The TypeCooker machine chooses randomly from lists of parameters (such as weight, contrast, stroke endings, width, contrast, construction) to generate an "assignment."

3 "A Type Design Brief: What Is in It, and Why Does It Matter?" *Smashing Magazine*, 2014, smashing-magazine.com/2014/02/a-type-design-brief-arabic-typography-calligraphy/.

4 There is a robust and ongoing debate about the ethics of typeface revivals. Some revivals are viewed as plagiarism—"knockoffs" motivated by profit. However, other revivals are considered historical preservation. See type designer John Downer's 2003 *Emigre* essay, "Call It What It Is" (emigre.com/Essays/Type/CallItWhatItIs).

5 Edmonson, James, "The Process of Hobeaux," 2015, ohnotype.co/blog/the-process-of-hobeaux.

6 See typecooker.com. You can also see the results of TypeCooker workshops/experiments on Instagram and Flickr (#typecooker).

Qashiko is a student type design project by Kaito Gengo. This one-quarter (three month) assignment is inspired by the *Typeface: Twin Cities* initiative organized by the Minnesota Design Institute (see *Metro Letters: A Typeface for the Twin Cities* by Deborah Littlejohn [2003]). The typeface reflects Kyoto, a city known as Japan's cultural capital for its Buddhist temples, Shinto shrines, and gardens. At left, initial sketches exploring the type concept; at right, the final specimen poster.

PATISSERIE

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
a b c d e f g h i j k l m n o p q r s t u v w x y z // (1234567890).,!?* “ ” ‘ ’ fi fl

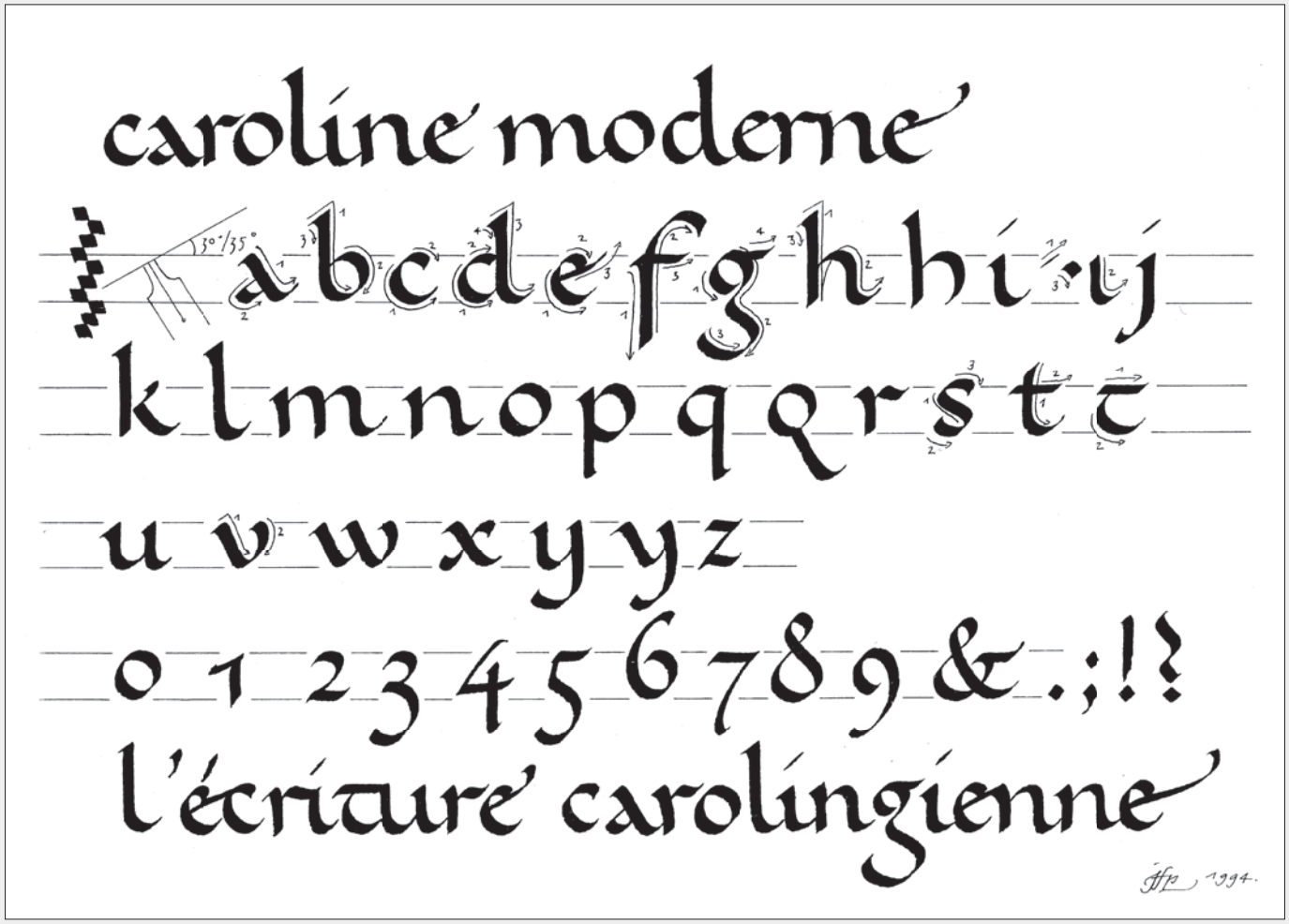
croissant
clafouti dariole
madeleines
beignets tart
chocolat nutmeg

A Patisserie is a French or Belgian bakery that specializes in pastries or sweets. This typeface was inspired by a street sign in the 16th arrondissement of Paris by five design students at the University of Washington in Seattle, Washington USA.

Patisserie is a unique typeface for all your delectable display needs.

< Cameron Coupe, Dana Golan, Eva Grate, Sahm Lee, and Jen Strong >

A one-quarter (three month) student typeface project by Cameron Coupe, Dana Golan, Eva Grate, Sahm Lee, and Jennifer Strong. Based on a Parisian sign documented in Louise Fili’s book, *Graphique de la Rue: The Signs of Paris* [2015].



Calligraphy is an essential component in the education of a type designer. Above, a model of Caroline minuscule script by designer and educator Jean François Porchez for Type Paris, an intensive five-week program in type design.

Type designer Laura Meseguer demonstrates the "inside-out" drawing method taught by Gerrit Noordzij at KABK in her essay "Ways of Sketching" published in *How to Create Typefaces: From Sketch to Screen* [2012], p. 41.

Drawing Letters

Many designers prefer to start with the lowercase letters, because they are more variable in their design than the upper case, and therefore carry more of the personality of the typeface. The type designer Matthew Carter is known to begin with the lowercase h and o, followed by the p, d, and v.[7] Veronika Burian and José Scaglione of TypeTogether note that they often begin their collaboration by exchanging several variants of the a, n, and o.

These initial letters form the building blocks for a test word—a text string that contains all the different forms (round, diagonal, square, etc.) in a Latin alphabet. Common test words include "hamburgefonstiv" and its variants: hamburgevons/hamburgefonts.

Gerry Leonidas, director of the graduate typeface program at the University of Reading in the UK, notes that he prefers the word "adhesion" as a test string.[8] In his view, it is helpful to have at least one of the b, q, d, p letters, because they determine a key attribute: how a round form connects to a vertical stem. He includes both the h and n, because those related letters show the ascender height and a branched form. Therefore, altogether, the word "adhesion" has four letters (d, h, n, o) to show the underlying rhythm and pattern of the proposed typeface, while also containing an a for personality. Leonidas believes that the lowercase a has distinct features, but is not as challenging or as individualistic as other letters (such as the g, for example). Leonidas further suggests avoiding diagonals (v, w, y, x) during this early stage in the design process, because they tend to be visually distinct—and because they have specific optical issues that are easier to address later, after the basic idea of the typeface is set.

Experienced type designers often draw their glyphs directly on the computer. However, in my opinion, design students generally achieve better results when they draw their letters by hand first—and use software later in the process. When drawing letters by hand, students can focus on creating the best possible shapes; they are not also navigating the digital tools and interface. Personally, I prefer working with pencil on vellum—the experience offers more tactile feedback than a plastic pen tip on a glass tablet. I think the resulting sketches are better as well. In design, the fidelity of a prototype should match the fidelity of the idea. When students first begin thinking about letters, their mental model of a glyph tends to be fuzzy. Hand-drawn sketches are more forgiving, allowing students to see several possible letter outlines. In contrast, digital drawings are precise—perhaps too precise. As type designer Nina Stössinger notes, "Paper is friendlier to the creative process than the screen. It supports vagueness and sketchiness better than computers do."

There are various methods for the drawing itself. In the pre-digital age, the only way to produce lettering was to directly draw it using some kind of writing implement: a pen, brush, marker, or even a chisel. Commercial artists and sign painters used these tools and others to create logos, mastheads, showcards, book covers, posters, and of course, signs. Although sign painting has largely been displaced by digital production, it is still quite possible and useful to try a variety of tools to write letters. Letters can be written with the preferred implement, then scanned to be used as guidelines for type.

In fact, students learning how to design type often start with broad-nib pen calligraphy to create an initial set of glyphs. The best letters are chosen from many sketches, and selected components—serifs, brackets, bowls, terminals, tails, branches—are used systematically throughout the typeface. This method achieves visual unity through structural logic. Viewers can see and sense that all glyphs are drawn in a similar way with the same tool.

One can also draw calligraphic letters without an actual ink pen or brush. Calligraphy is often demonstrated with a "double pencil"—two ordinary lead pencils bound together. (When trying this, be sure that the points are exactly level; the distance between them forms the "invisible nib.") Alternatively, in *The Stroke* [2006], author Gerrit Noordzij describes an "inside-out" drawing technique.[9] He uses a pencil to draw a zig-zag pattern of lines that approximate the width and direction of a calligraphic stroke. Noordzij's goal is to roughly sketch the overall proportion, contrast, weight, and positive/negative shapes of a letter—postponing the final character outline until it emerges on its own.

It takes quite a bit of practice to draw letters, and even award-winning type designers will admit that they are not skilled at free-hand drawing. Some recommend a combination of drafting and drawing—for example, sketching half of the O and rotating it to get the other side.[10] This technique improves the drawings of symmetrical letters, because some curves are easier to draw if you are right- or left-handed. Other designers map out key points that the letter outline needs to meet, creating a series of targets to aim for and connect. Grid paper can be helpful in the same way. I personally find that sketching a series of light "ghost" lines to rough out the general shape of character helps to discover the final outline.

When evaluating your letters, it's best to pin them up and view them from a distance; a change in scale can reveal inconsistencies that would otherwise be overlooked. Many designers also suggest viewing your drawings upside down and reversed, so that you can see and evaluate the glyphs as abstract shapes.

7 Wilkinson, Alec, "Man of Letters," *The New Yorker*, Vol. 81, No. 38, 2005.

8 Leonidas, Gerry, "The Origin of 'Adhesion'," 2013, leonidas.net/2013/04/03/the-origin-of-adhesion.

9 Noordzij, G., & Enneson, Peter. *The Stroke: Theory of Writing*. London: Hyphen Press, 2005.

10 Mirroring type is discouraged. Rotation is acceptable, because calligraphic direction is preserved. Mirroring (flipping horizontally or vertically) changes the angle of writing—thereby violating the logic of the form.

Above, Piquette, an example of a constructed typeface by design student Felix Wang, University of Washington. In this three-month project, students create a typeface based on a city or place; Piquette is inspired by the city of Detroit. Piquette Avenue is the location of the factory that first created and produced the Ford Model T automobile.

Constructing Letters

Perhaps the opposite of a humanist calligraphic approach is rational construction, where letters are drafted on a grid or built from geometric shapes. An early example of such a system is the 1692 Romain du Roi by punchcutter Philippe Granjean, a typeface constructed with circular segments on an eight-unit grid. The result was widely criticized; the letter drawings are still used today to illustrate the dangers of ignoring optical compensation. Still, the idea of a constructed, modular approach to type has persisted and been refined. For example, there is a wide range of constructed stencil typefaces, ranging from Architype Albers (1926–31) by the artist Josef Albers to Orientation (2015–18) by Sandrine Nugue for Commercial Type.

Granjean's Romain du Roi was driven by the ideals of the Age of Enlightenment. However, constructed type can simply be a pragmatic response to the need for mass reproduction. The engineers who created DIN 1451 (a 1930s typeface for the German standards organization Deutsches Institut für Normung) were concerned with performance, not philosophy; they wanted a typeface that anyone could draw with a compass, ruler, and grid. Similarly, the Lo-Res typefaces created by designer Zuzana Licko were creative solutions to the limitations of the early Macintosh. Her designs were restricted by a coarse pixel grid with only two binary options: black or white.

Many designers dislike constructed and grid-based typefaces for their inelegance—they can look clumsy and unrefined. However, others embrace their unique visual appeal. These types can have a kind of mechanical directness, and even an abstract beauty (such as in the highly simplified New Alphabet designed by Wim Crouwel, which used only horizontal lines). Type design and graphic design, like all of the arts, is a pluralistic discipline. Definitions of beauty, readability, legibility, and what is fashionable are highly subjective and change over time.

Emperor, Oakland, and Emigre were bitmap fonts created by Zuzana Licko in 1985 to accommodate low-resolution output devices. "Fifteen" indicates the number of pixels in the body.

Orientation is a stencil typeface created by Sandrine Nugue for signage at a student apartment building in Paris, France. The letterforms are abstracted in unexpected ways, resulting in a minimalist design that is unusually warm and playful.

Since 2017, I have been working to revive Jan van Krimpen's typeface Romanée using printed specimens, archival drawings, smoke proofs, and (of course) guesswork. The result is a single-style typeface that currently covers upper- and lowercase letters, a limited set of diacritics, two stylistic alternates, basic punctuation, and numerals.

Jan van Krimpen (1892–1958) was a Dutch type designer, calligrapher, and graphic designer who worked for the renowned Dutch printing house Enschedé. In 1928, Enschedé asked Van Krimpen to revive a pair of upright and italic types from their archives: Kleine Text Romein [Roman] No. 2 and Kleine Text Curcyf [Cursive/Italic] No. 2. The design of these two types is credited to the seventeenth-century punchcutter Christoffel van Dijck.

Unfortunately, the actual metal type of Kleine Text Romein No. 2 was melted down in the eighteenth century (during the "dark age" of printing in the Netherlands). Therefore, the roman design was documented only in printed specimens. However, Van Krimpen disapproved of revivals anyway (he criticized them as "neither flesh nor fish") and instead sought to create a new roman of matching color and proportion to pair with Van Dijck's existing italic.

In collaboration with Enschedé's punchcutter Paul Helmuth Rädisch, Van Krimpen's effort became Romanée, a crisp, modern serif now regarded as one of the finest types designed by Van Krimpen. As it happens, the modernized character of Romanée failed to fulfill the initial brief; it was not considered a successful match for the existing Kleine Text Curcyf No. 2. Twenty years after the release of Romanée Roman, Van Krimpen began to design the more upright Romanée Italic.

Despite widespread admiration for Romanée, few digital revivals are publicly available. Fred Smeijers and Peter Matthias Noordzij at TEFF (The Enschedé Font Foundry) digitized Romanée in 1995, but their typeface was not released owing to differences in vision over the design of the italic. Designer Holger Königsdorfer also worked on a revival of Romanée during his graduate studies in type design at the Royal Academy of Art (KABK) in The Hague. Holger's revival was released in 2019 as "LD Renommée" by the Lazydogs Type Foundry (see below).

LD Renommée
Paulus Centurioni, et militibus:
Nisi hi in navi manserint

Type design by Holger Königsdorfer, The Lazydogs Type Foundry.

For my own revival of Romanée, I worked from six sources:

1_A 1993 reprint of Van Dijck's type specimen of Kleine Text Romein No. 2 from *Proef van Letteren* (which reproduces the Enschedé type specimens of 1768 and 1773);

2_Scans of 1928 Romanée drawings (lower case at 12 pt and upper case at 7.5 pt) by Van Krimpen from the North Holland Archive;

3_A 1929 specimen booklet set in 14 pt Romanée bound in Volume 7 of *The Fleuron*, a British journal of typography and book arts published by the Fleuron Society in London in 1923–1930;

4_An undated set (likely 1930) of Romanée smoke proofs (possibly at 14 pt and 16 pt) by Van Krimpen and punchcutter Paul Helmuth Rädisch from the North Holland Archive;

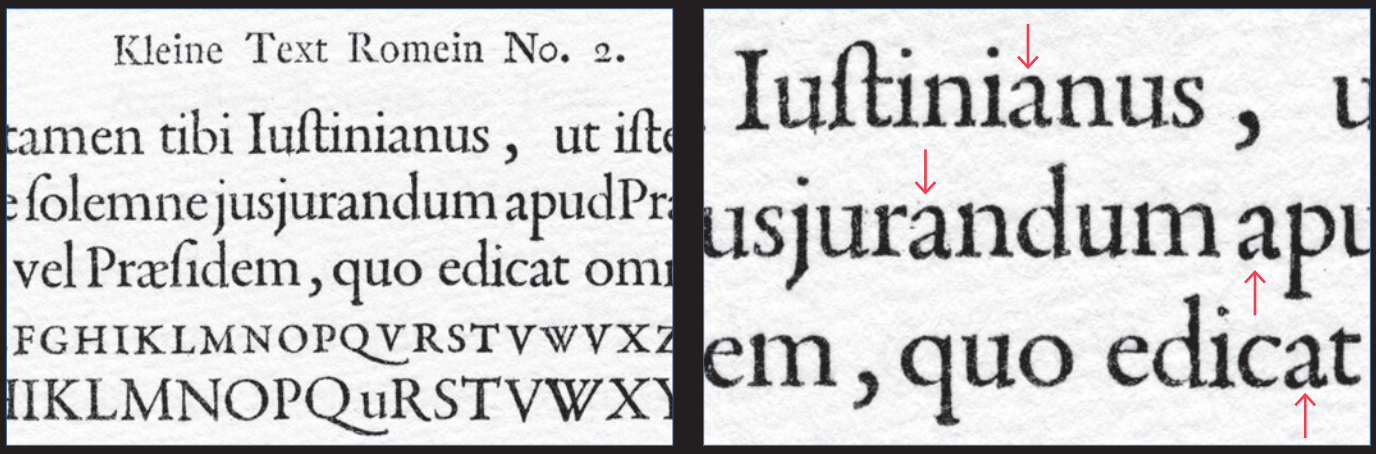
5_A 1931 Enschedé printing of Homer's *Odyssey* set in 16 pt Romanée;

6_A 1978 printing of *Typefoundries in the Netherlands* set in 16 pt, 14 pt, 12 pt, and 10 pt Romanée.

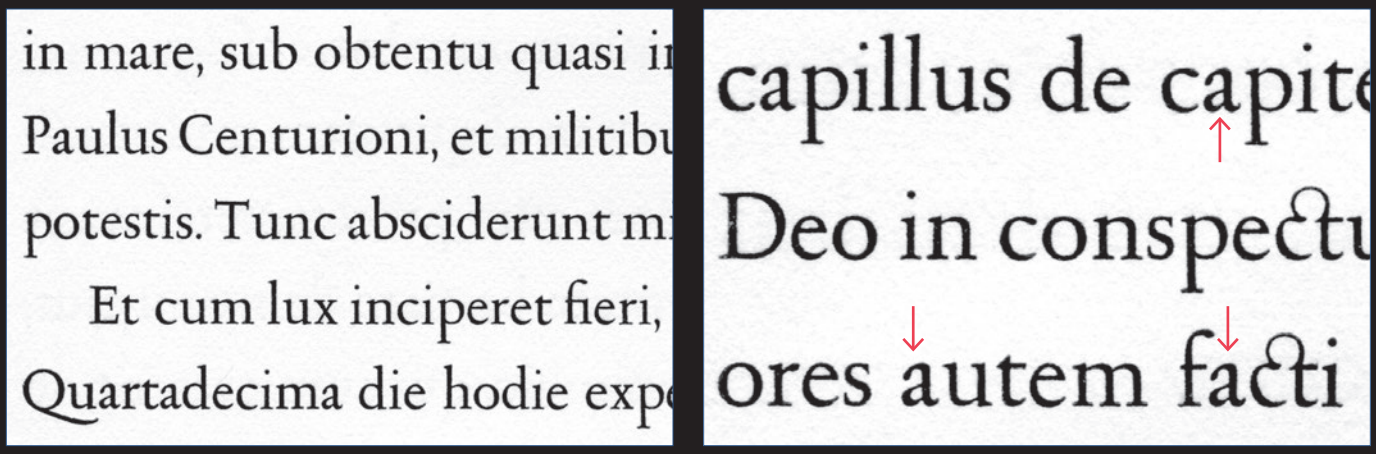
In examining these materials, I was immediately confronted by significant design differences between each source. After an extended research effort, I decided that the initial 1928 drawings (the second source in the list above) and 1929 printed specimen from *The Fleuron* (the third source listed above) likely reflected early design ideas that were later revised, resulting in the more refined type used in the 1931 *Odyssey* (the fifth source listed above) and the 1978 *Typefoundries in the Netherlands* (the sixth and last source listed above).

With that settled, I set about tracing Van Krimpen's later letters as faithfully as possible, but still encountered issues that were difficult to resolve. For example, the lowercase a in Romanée has a distinctive tadpole-like terminal shape. In early specimens, this shape is exaggerated and a bit clumsy; however, in the later prints, the shape is almost too subtle—it can disappear under fattening ink spread. Additionally, some letters (such as the o, s, w, and y) were sized oddly.

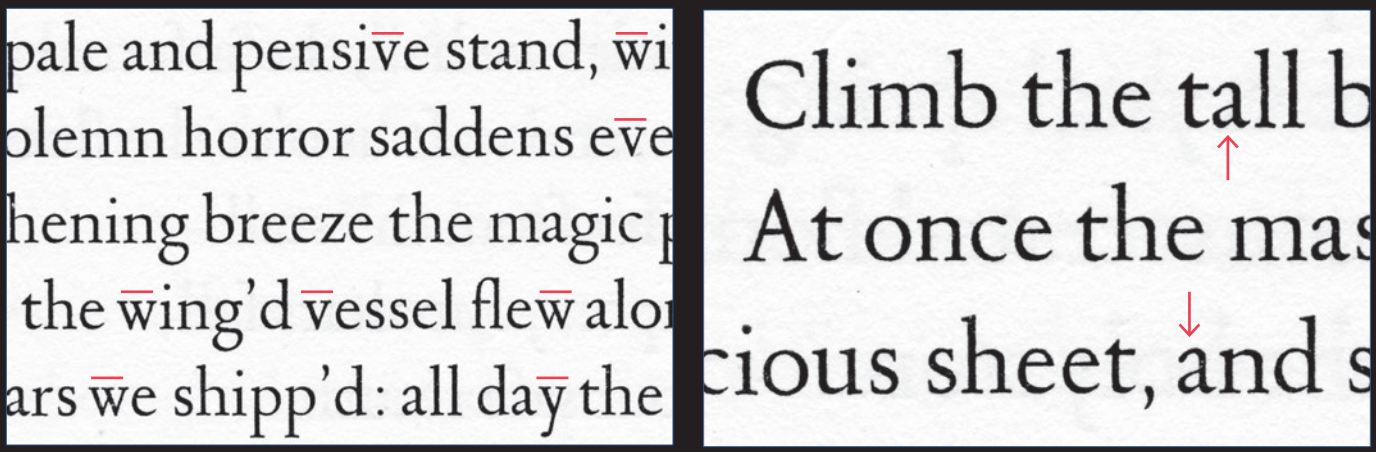
I could correct these errors, but I worried that Van Krimpen was driven by a rationale that I had failed to perceive. Also, I personally thought that Van Krimpen's serif cupping was somewhat too subtle—perhaps even indecisive. However, incorporating more obvious calligraphic pen motion seemed like a violation of Van Krimpen's ghost. Perhaps what makes Romanée so charming is precisely this struggle and tension between the mechanical and the calligraphic.



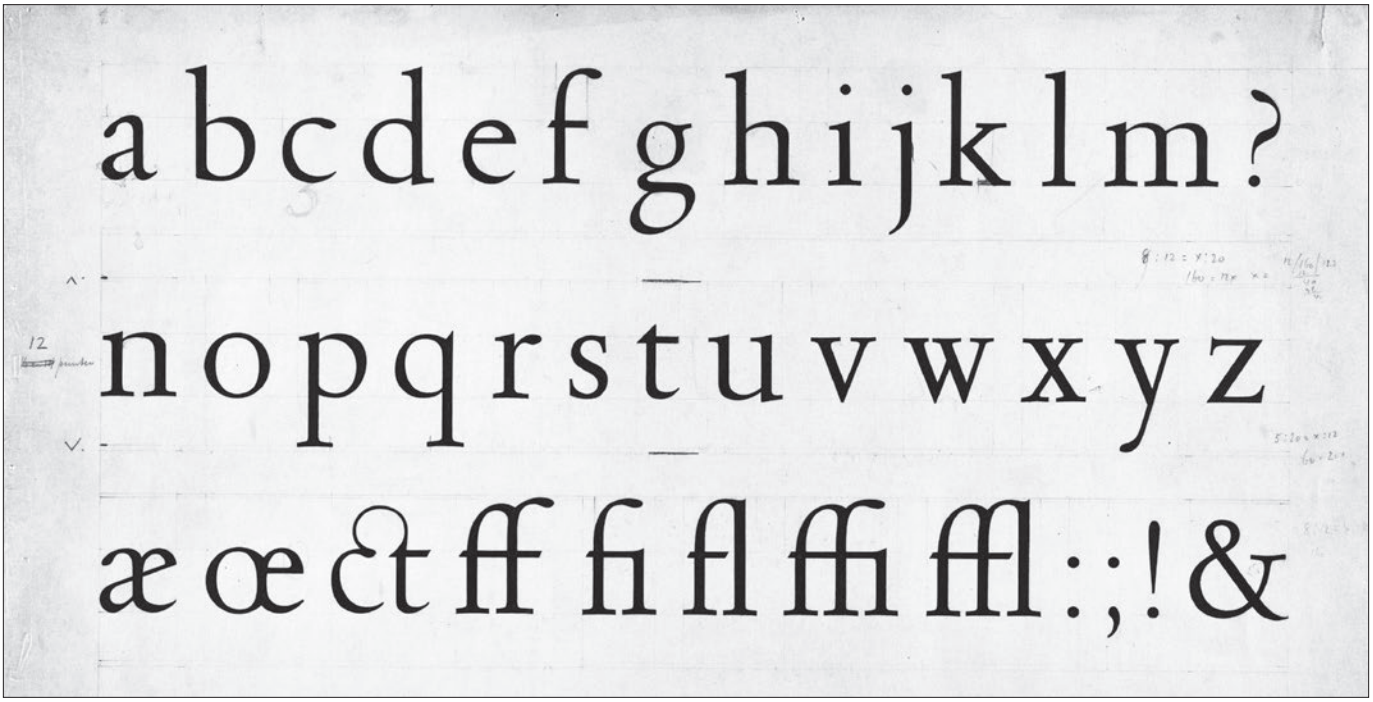
Above, the seminal source: Kleine Text Romein No. 2—the original van Dijck typeface that Van Krimpen was asked to revive for the printing house of Enschedé.
This scan is from the 1993 reprint of the Enschedé specimens of 1768 and 1773. Note the relatively wide lowercase a.



Above, source #3: a scan from the 1929 specimen booklet of 14 pt Romanée bound in Volume 7 of *The Fleuron*.
The Fleuron's reviewers admired the s but criticized the arch of the r. The spacing of the type is uneven; note the lowercase a is narrower than in Kleine.



Above, source #5, a scan from the 1931 printing of Homer's *The Odyssey* set in 16 pt Romanée.
The lowercase a has been refined from earlier designs; it is wider with a more open aperture. However, the w is small (in comparison to the lowercase o).
The v and y may also be somewhat on the small side.



Above, source #2: Van Krimpen's own drawings for Romanée's lower case at 12 pt from 1928. Image from the North Holland Archive.
This is likely an early draft; the printed specimens of Romanée deviate significantly from these drawings (in particular, the lowercase g is quite changed).

Romanée PT
(First draft)

The calligraphic turn of the e needs to be more evident—it's a bit too "smoothed out."
Beak serif on the s doesn't match original drawing.

Branches of the n and h are too flat; shape is awkward and indecisive

Romanée PT
(Second draft)

Foot serif heavier; serifs heavier overall

Weight improved on the e; beak serif redrawn on the s

Improved branch shape

At this juncture, I was grateful for advice from the type designer David Jonathan Ross, who encouraged me to better define the goals of this revival. Did I want the type to feel as if it were still cut in metal, or did I want to bring Romanée into the digital era? Designer Fred Smeijers also kindly reviewed my work. After pointing out a few issues with size and spacing (some of which I had dutifully copied from the original Romanée), Mr. Smeijers asked, “How much allowance is there to pull it a bit more into our days with our technical possibilities? Can you make it better and still let it be Romanée?” This is the approach of designer Bram de Does for his typeface Trinité, which was inspired by both Romanée as well as Garamond.

In addition to David and Fred, I would like to thank Karen Cheng, my advisor; Jason Deweintz of the Greenboathouse Press, who very kindly helped me with gathering materials; and type designer Holger Königsdorfer, who generously shared his thoughts on his own revival of Romanée during his graduate studies at KABK. Designer Christian Schwartz from the type foundry Commercial Type also gave me much valuable insight and encouragement.

Above, designer Peiran Tan. Photo by Isaac Jaeger.

Romanée PT
aæbcdefghijklmnoòpqrstuüvwxyz—.,?!”123456789&o
ABCDEFGHIJKLMNOPQRSTUVWXYZ

Hamburgfontsiv—adhesion Quartadecima die hodie While the wing’d vessel flew along the tide; Our oars

Romanée PT
(Current draft)

During three months of 2019, as part of a sophomore-level design studio course, our four-person group worked to design a single-weight typeface based on a hand-painted sign in the Art Building at the University of Washington in Seattle. We chose this sign because we were attracted to the unusual diagonal R and the P. Even though these letters are distinctive, the overall personality of the typeface is simple and straightforward—plain but not boring.

The original hand-painted sign; sign painter unknown.
The sign directs delivery drivers to the main office of the Art Building.

We started the project by photographing the sign and tracing its letters. Our first step was to draw the OHoh and 01, with the goal of determining the stroke weights for the upper and lower case, as well as the numbers. It was surprisingly difficult to get all the glyphs to match in weight; even a difference of half a millimeter can make a letter too dark (we were drawing our capitals at 86.5 mm high, or about 3.4 inches). After several rounds of revisions, we set stroke measurements that we thought were correct.

Unfortunately, we realized (after drawing the entire lower case) that our lowercase letters were too light in comparison to the upper case. During our initial drawing phase, we would pin up our letters on a wall and view them from a distance to check their density. Naturally, we organized the letters into test words to see how the design was evolving. However, we made the mistake of making only all-lowercase and all-uppercase words. This resulted in each case looking fairly even individually, but when we put capitals and lower case together in text, we could see that the capitals were noticeably darker—too dark.

We researched similar sans serifs to try to better understand the problem. The weights of our lowercase stems ranged between 77% to 85% of the upper case, but the ratios of other bold sans-serif fonts were far less (89% to 97%). After we redrew the lower case, the new stem weights increased to 92% to 96% of the upper case.

Ratio of lowercase to uppercase stroke widths
Sample set of three bold sans-serif fonts:

	Univers 65-Bold	Roboto Bold	Helvetica Bold
Vertical stroke width	93%	97%	93%
Horizontal stroke width	89%	97%	93%
Maximum bowl width	92%	95%	96%
Diagonal stroke width	93%	91%	96%

Ratio of lowercase to uppercase stroke widths
Workroom Sans initially and after revision:

	Initial lower case	Revised lower case
Vertical stroke width	85%	96%
Horizontal stroke width	86%	92%
Maximum bowl width	85%	94%
Diagonal stroke width	77%	92%

Workroom Sans
(First draft)

OHoh

Our initial draft of the lowercase letters.
Unfortunately, the lower case is noticeably lighter than the capitals.

Workroom Sans
(Second draft)

OHoh

The capitals are the same as in the first draft (shown at left),
but the lowercase letters are now bolder for a better match.

MARKER
PEN
notebook
PAPER
x-acto
YERBA mate
TACK
vellum
LATE nights

WORKROOM SANS

Inspired by a loading dock sign hanging in the Art Building at the University of Washington, Workroom Sans is a strong, humanist typeface formed through the fortitude of its designers. Simultaneously universal and personal, this sans serif has a distinctive character.

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
a b c d e f g h i j k l m n o p q r s t u v w x y z 0 1 2 3 4 5 6 7 8 9 - – — . , “ ”

A key issue in our typeface was the combination letters: the R, P/p, B/b, q, and d. In the beginning, we tried to trace the P and R exactly as they appeared on the original hand-painted sign (although we did clean them up with consistent stroke widths, etc.). However, it was surprisingly difficult to design a matching B (see below). The B with an angular waist seemed too Art Nouveau (we wanted a less "fancy" and more neutral typeface).

Emulating the distinctive diagonal shape in the lower case was also challenging. We tried to give the branched glyphs (n, h, m, r, u) "thrust" shapes to mirror the P and R. Similarly, we moved the bowl weights to asymmetrical positions in the b, p, d, q. As we did this, we began to realize that we could take the design in many different directions. For example, we could make it more humanist (like Gill Sans) or even create a "spurless" sans (like Dax).

In the end, we decided that the angular R and P (and our odd angular B) were simply too distinct. In text settings, these capitals jumped out and drew attention to themselves—they didn't want to "play nicely" with other letters. We wanted our typeface personality to be more straightforward; these letters felt too quirky, even cutesy.

To address this problem, we experimented with "dialing down" the diagonal emphasis in different ways. For example, we left the R with some diagonal stress, because we thought its interior point was important to preserve. However, we modified the bowls of the P and B to be more horizontal, and tried various kinds of gaps (to match the disconnected R). Not all of the gaps were successful—in particular, the angled gaps (see below) seemed "neither here nor there." In the lower case, we reduced the thrust in bowls and branches; we also straightened the crossbar of the e.

In our final solution, we decided to relate the P and B by giving both of the glyphs a vertical gap between the bowl and the stem (the diagonal cut was too strange, in our opinion). We then opted to unify the R and K by giving both of them pointed junctions. The diagonal curves are now less extreme, which helps the R fit with other letters more comfortably.

A different design problem involved the stroke endings of open letters. In the original sign, the ends of the C and S were sliced at different angles. We felt these angles were both too different and too extreme. Therefore, we reduced the slope of the cuts and tried to unify the angles. The new endings are not identical, but we think they feel more consistent. For unity, we carried similar angles over in the lowercase a, c, e, f, g, j, s, t, and y.

We are still working on the typeface, which we decided to name "Workroom Sans" after the many hours we have spent in the studio refining glyphs. We do have alternates for some letters (we have both a double-story and single-story a and g). We now realize that we should make a text version (our current design works better at display size; at small type sizes, some of the details are lost). Of course, the typeface would also be more useful if we made a family that has more weights, as well as an italic. Three months is clearly not enough time to make a typeface, but it is a start.

Workroom Sans
(Initial sketches)

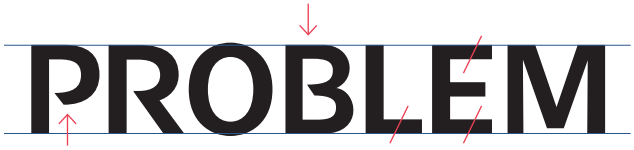
First drawing from the original sign

Bowls slightly rounded; disconnected P

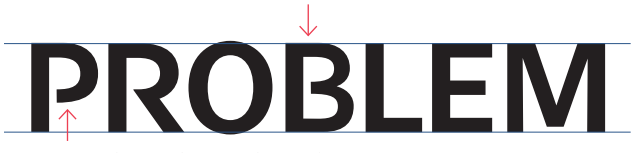
An early attempt to match the B to the shape of the P and R

To match the P, the h and b are drawn asymmetrically; the e crossbar is diagonal

Workroom Sans
(Intermediate explorations)



Bowls of the P, R, and B are redrawn (but still point slightly downward).
Note the diagonal cuts on the P and B; should ends of the L and E also be cut?



A variation with vertical cuts on the P and B.
This is more straightforward, but the R seems somewhat isolated.

Diagonal emphasis on the n is reduced;
Should k be disconnected to match P, R, and B?

WORKROOM SANS
abcdefghijklmnopqrstuvwxyz ., ?! 1234567890
ABCDEFGHIJKLMNOPQRSTUVWXYZ

“Americans, like human beings everywhere, believe many things that are obviously untrue. Their most destructive untruth is that it is very easy for any American to make money. They will not acknowledge how in fact hard money is to come by, and therefore, those who have no money blame and blame and blame themselves.”—Kurt Vonnegut, Slaughterhouse Five

Workroom Sans (current draft)
A text passage (above), and the original sign reset in our typeface (left). We still have a number of color issues to resolve. For example, the punctuation should perhaps be larger; the lowercase s and y may be too light and/or too small; the r may be too dark, and the dot of the i may be too close to the stem.

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2

VARIABLES IN TYPE DESIGN

Type Terminology

Type design, like language itself, is influenced by time and cultural context. Therefore, designers use a variety of names to describe the different parts of a letter. While there is no official standard, the terms shown below are fairly universal and are used in this book.

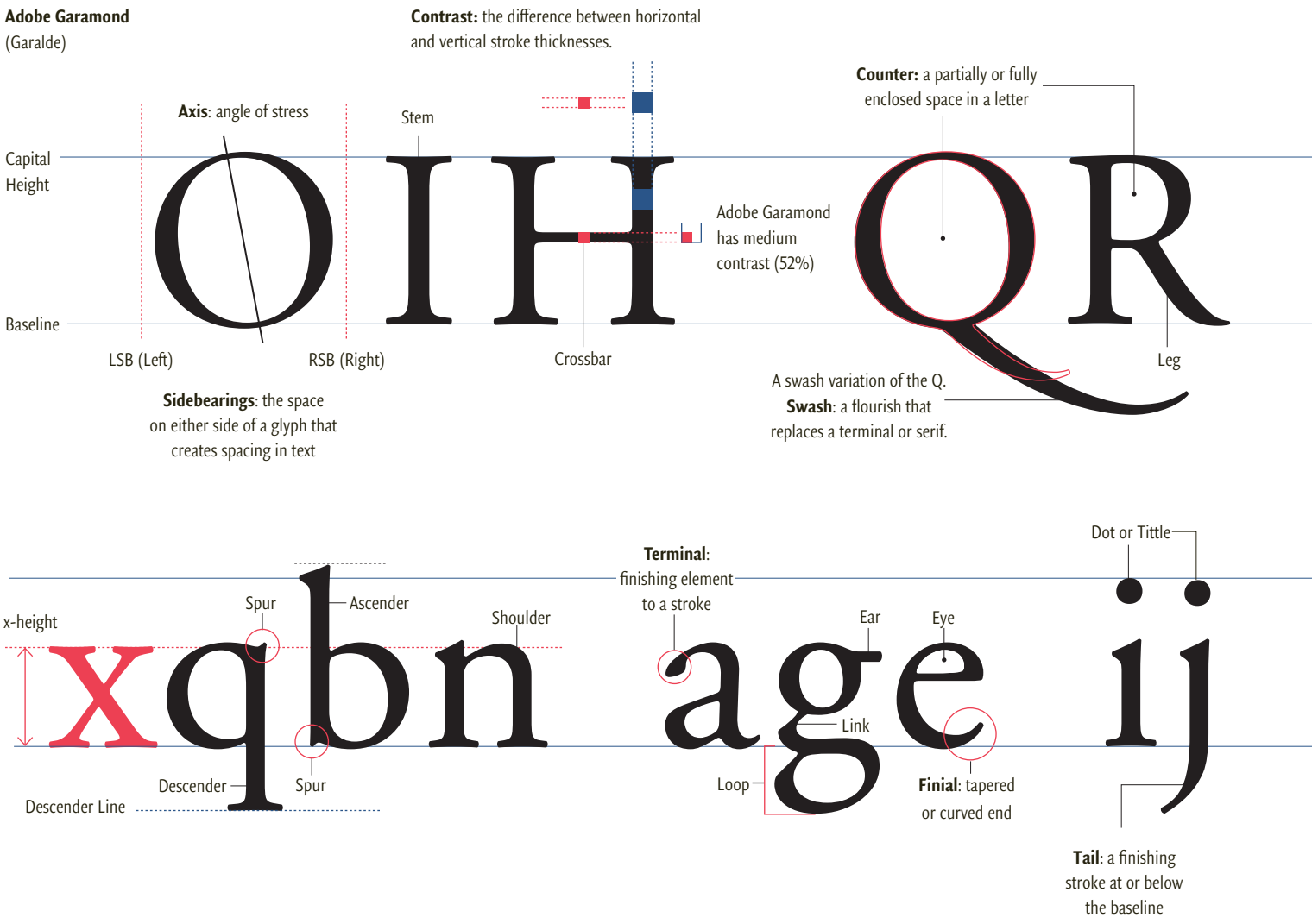
The terms "font" and "typeface" are sometimes used interchangeably. However, this is not quite correct. Historically, the term "font" referred to just a single set of metal type in one size and one style (for example, Garamond Roman, 12 pts.) The term is derived from the French word "*fonte*," which means "a metal casting."

Today, the term "font" is no longer size-specific, because contemporary digital fonts are designed to cover a range of sizes. However, the term "font" does still refer to only one specific style (such as light, bold, italic, and so on).

The word "typeface" was traditionally more inclusive, because it was used to denote a family or collection of related fonts (for example, Garamond Regular and Italic in 10, 12, and 14 pts.) It is still accurate to use the term "typeface" in this way (for example, when describing the use of Garamond generally).

The word "typeface" is also more appropriate when referring to the design of a typeface—the way a typeface looks or works. In contrast, we use the term "font" when describing the actual digital software file (the OpenType or .otf file). Designer Nick Sherman has described a helpful analogy that compares fonts and typefaces to mp3 files and songs.[1] Both a font and a mp3 are digital files, but a typeface, like a song, is a work of art.

1 Eisenberg, Tina Roth. "Font or Typeface?" *Swiss Miss*, 28 September 2009, swiss-miss.com/2009/09/font-or-typeface.html.



ABCDEFGHIJKLMNOPQRSTUVWXYZ

Capitals (also called Majuscules or Upper Case)

abcdefghijklmnopqrstuvwxyz | ABCDEFGHIJKLMNOPQRSTUVWXYZ

Lower Case (also called Minuscules)

Small Caps (capital letters drawn to match the weight and size of the lower case)

abcdefghijklmnopqrstuvwxyz | 0123456789 | 0123456789

Italic

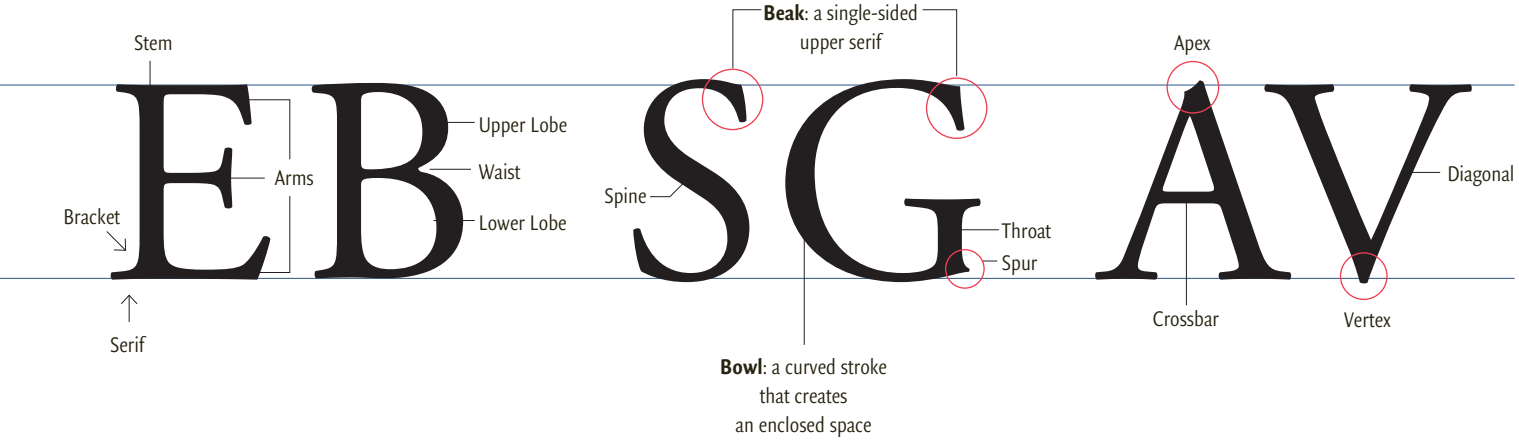
Text Figures (also called Lower Case) and **Lining Figures** (also called Upper Case)

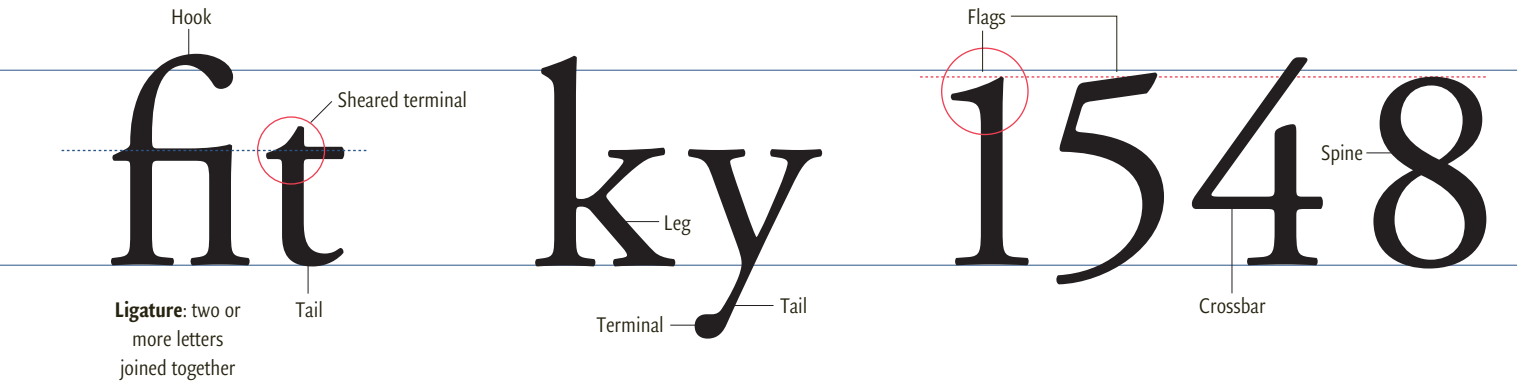
@&* #%^+=÷∂ƒ©°µ®†‡¥«¶§ ¢$£™ .,:;“”[…]/- – — ¡!¿?{}‘’

Symbols and **Punctuation Marks** (also called Analphabetic Characters)

à é î š ç ü å ø æ œ fi fl ß ½ ¼ ¾

Accented Latin (with diacritical marks) and **Ligatures** **Fractions**





Axis and Stress

Many designers believe that for a typeface to be cohesive, all glyphs should appear to be made by the same instrument—for example, a pen, brush, marker, or reed. The ductus of the writing tool—the number of strokes and the direction, sequence and speed of those strokes—should be visible in the shape of each character.

In general, Latin type design has been dominated by two tools: the broad-nib pen and the pointed expansion pen. A broad nib is rigid and has wide and narrow flat sides. When held at an angle (typically 30 degrees), a broad nib produces thick-thin strokes with diagonal stress. In his book *The Stroke* [2005], author and designer Gerrit Noordzij calls this kind of stroke contrast "translation."[2]

In contrast, a pointed pen has a soft, flexible nib. When the writer exerts pressure, the two "legs" of the nib open and create a thicker stroke. As pressure is eased, the legs contract and the stroke becomes thinner. Noordzij calls this expansion, since the pen stroke literally expands.

Some designers prefer the diagonal stress created by a broad-nib pen (as in Adobe Garamond) because weight in glyphs shifts from the verticals to the corners. In theory, the changed position helps to even the overall color of text and adds variety.

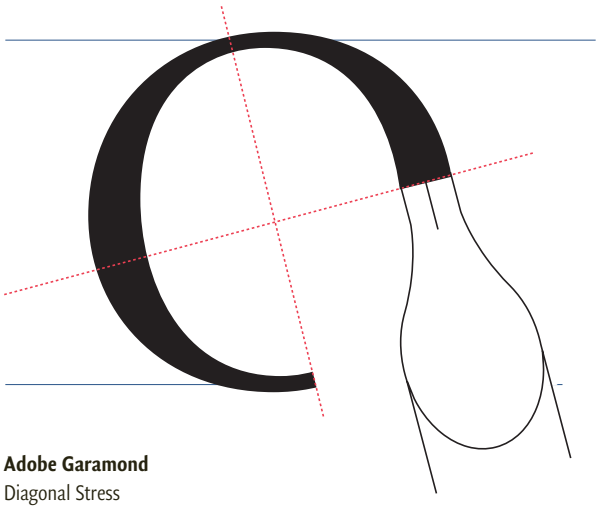
In typefaces with expansion contrast (as in Bodoni), the overall axis is upright and vertical. Upright typefaces are sometimes described as "static" because they have less visual movement than "dynamic" calligraphic typefaces.

There are also reverse contrast type designs (such as Trilby by David Jonathan Ross), where weight is placed in the horizontal strokes rather than in the verticals. Many early versions of reverse contrast types were extreme—visually shocking and perhaps even monstrous. However, there are modern adaptations that are subtle enough for use in text. Proponents argue that the horizontal emphasis may help to draw the reader's eye along lines of text.[3]

2 Noordzij, G. and Peter Enneson. *The Stroke: Theory of Writing*. London: Hyphen Press, 2005.

3 Shaw, Paul, "Slab Happy: Trilby," *Print Magazine*, 5 October 2010, printmag.com/article/slab-happy-trilby-reviewed.

Translation



Adobe Garamond
Diagonal Stress

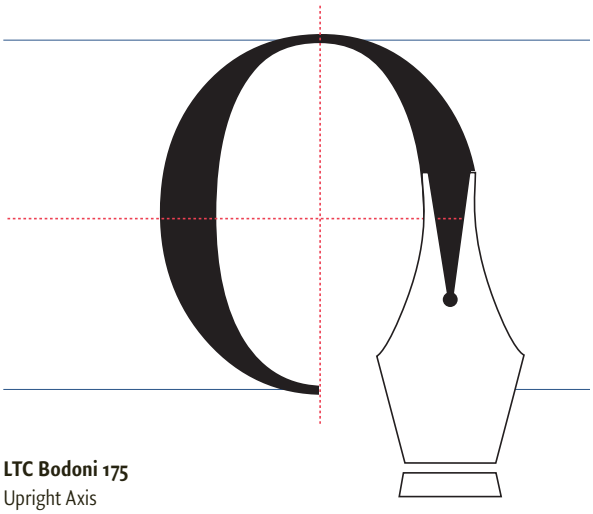
OQCG DBPR JS
nhmr oc bdpq tjf asx
35 69 8

Adobe Garamond 14/18

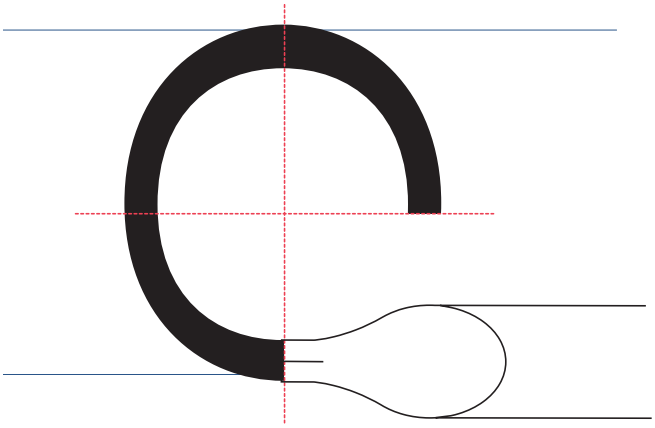
The quick brown fox jumped over th
dog. Voyez le brick géant que j'exam
près du wharf. Zwölf Boxkämpfer ja
Viktor quer über den großen Sylter I
El veloz murciélago hindú comía feli
cardillo y kiwi. La cigüeña tocaba el
saxofón detrás del palenque de pajaa

Expansion

Drawings by Gerrit Noordzij and Jean François Porchez. Far left, a broad-nib pen creates thick and thin strokes. Near left, a pointed pen expands under pressure, creating wider and narrower swelling strokes.



LTC Bodoni 175
Upright Axis



Trilby
Reverse Contrast

OQCG DBPR JS
nhmr oc bdpq tjf as
35 69 8

OQCG DBPR JS
nhmr oc bdpq tjf as
35 69 8

LTC Bodoni 175 13/18

The quick brown fox jumped over t
dog. Voyez le brick géant que j'exar
du wharf. Zwölf Boxkämpfer jagen
quer über den großen Sylter Deich.
murciélago hindú comía feliz cardill
La cigüeña tocaba el saxofón detrás
palenque de pajaatur?

Trilby 12/18

e quick brown fox jumped ove
g. Voyez le brick géant que j'e
ès du wharf. Zwölf Boxkämpfe
ctor quer über den großen Sylt
veloz murciélago hindú comía
rdillo y kiwi. La cigüeña tocab
xofón detrás del palenque de

Serifs and Terminals

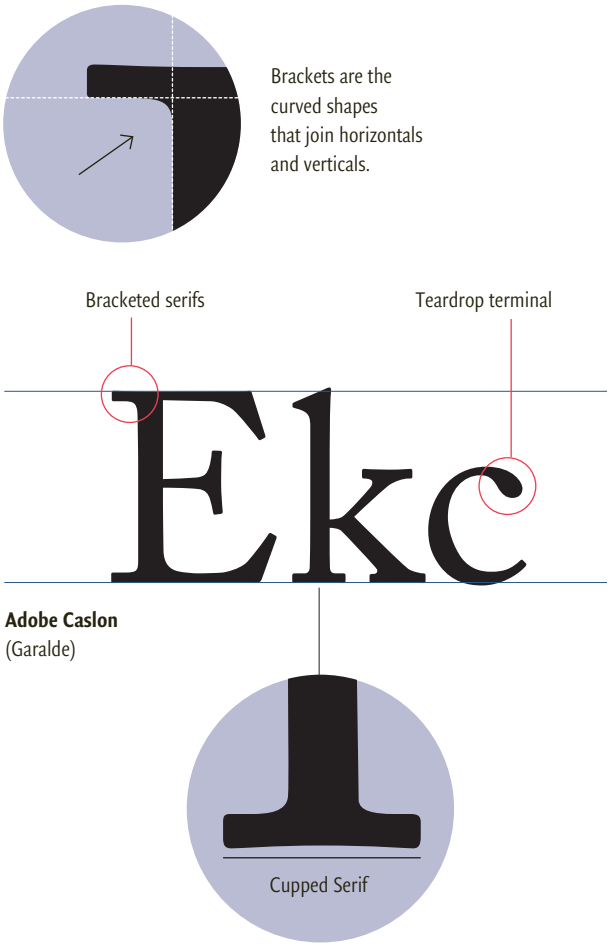
Serifs and terminals occur at the ends of letter strokes. The shape and weight of these endings should be part of a consistent visual system that relates visually and stylistically to the letters.

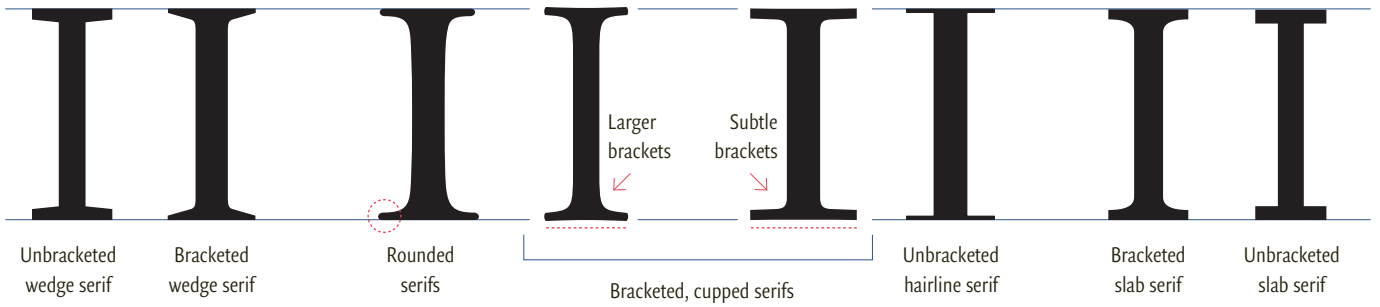
Some typefaces have serifs that are subtly curved or "cupped" at the baseline. According to author Mark Jamra, cupping corrects an optical illusion where foot serifs may appear to bend outward.[4] However, cupping can also be a deliberate design feature based on calligraphy; the pen stroke at the base of vertical stems can be drawn straight or with a slight wave.

Serifs may be connected to the main strokes of a letter with curved supports that are called brackets. Brackets smooth the join of opposing strokes, allowing them to flow more gracefully into one another. From a manufacturing point of view, brackets may have also provided a helpful margin for error. As demonstrated by designer Fred Smeijer, in his book *Counterpunch* [1996], when type was made by hand from metal, it was difficult for craftsmen to consistently create precise joins that met at right angles—just one slip of the tool and a letter would be ruined. In contrast, an organic bracket provides more visual tolerance, because differences in the shape of curves are less noticeable.[5]

4 Jamra, Mark, "Some Elements of Proportion and Optical Image Support in a Typeface," *Visual and Technical Aspects of Type*, Roger Hersch, Cambridge: Cambridge University Press, 1993, pp. 47–55.

5 Smeijers, Fred, *Counterpunch: Making Type in the Sixteenth Century, Designing Typefaces Now*, London: Hyphen Press, 1996, p. 144.



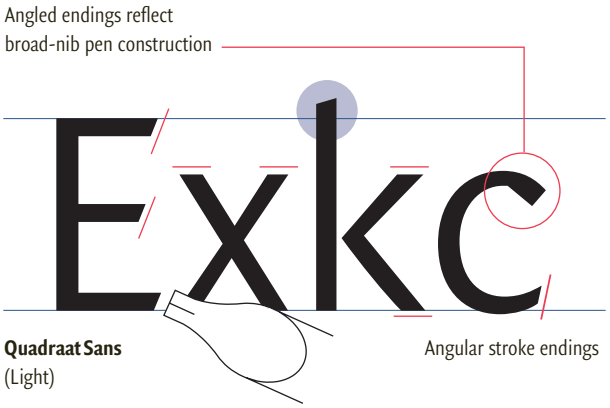


Sans Serif Stroke Endings

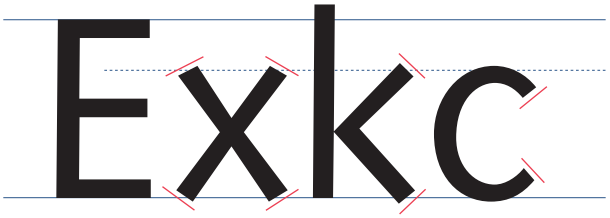
By definition, sans serifs do not, of course, have serifs. Therefore, we need to finish the strokes of sans serif letters in a different way. The most obvious solution is to slice the strokes horizontally, vertically, or at an angle. Alternatively, the endings can be shaped—for example, rounded or faceted.

Shaped stroke endings are often based on a real or imaginary writing tool. For example, the endings can show that a letter was written with a calligraphic pen, a pointed brush, or a chisel-tipped marker. Note that this does not mean that all stroke endings will be identical (and in some cases this would be impossible anyway). But the stroke endings all follow the same tool-based logic.

In many sans serifs, letter strokes are sliced flush to the capline and baseline. However, diagonal strokes may not follow this norm. In Eureka Sans (designed by Peter Biľak) and in Syntax (designed by Hans Eduard Meier) the ends of diagonal strokes are squared and extend slightly above and below these lines. The result can be lively, since the diagonal glyphs have varied heights and can appear to be "dancing." However, this treatment can impact the perceived height and alignment of letters; diagonal letters (such as the V and A) may appear taller than the round or straight letters (such as O or E).



Quadraat Sans
(Light)



Syntax
(Roman)

Stroke endings squared and extended above x-height and below baseline

Stroke endings and joins have softened corners with subtle rounding.

Brandon Grotesque
(Regular)

ITC Legacy Sans
(Book)

Mallory
(Medium)

Calligraphic stroke endings

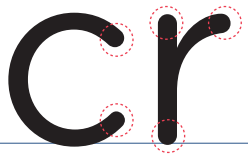
Lydian BT
(Roman)

Letter strokes sliced at 90° angles

Neue Haas Grotesk Display
(65-Medium)

Campaign
(Regular)

Rounded stroke endings



Gotham Rounded
(Book)

Stroke ending relates to brush lettering

Strada
(Regular)

x-height

The x-height of a typeface is a measure of apparent visual size. Just as people, animals, and plants can be large or small—and tall or short—so can typefaces. In general, the x-height of a font ranges between 60 to 75% of the cap-height. Venetian and Garalde typefaces tend to have small x-heights, which contribute to their delicate appearance. Slab serif and sans serif fonts often have taller x-heights, which makes them appear larger and heavier.

Typefaces designed for optimum legibility (signage types and types for small digital screens) usually have tall x-heights (large type seen from afar is largely the same design problem as smaller type seen up close.) Tall x-heights can improve legibility because there is more space to show distinguishing letter features.

However, x-heights can only be increased up to a certain point. Tall x-heights mean less room for ascenders and descenders, which can diminishes legibility (for example, an h may begin to look like an n). Of course, the ascender height can be increased to be taller than the capitals, but this makes a typeface less efficient, as more leading is needed between lines. Note that descenders do not necessarily need to be lengthened to match ascenders. The upper half of letters is more varied and contributes more to legibility.

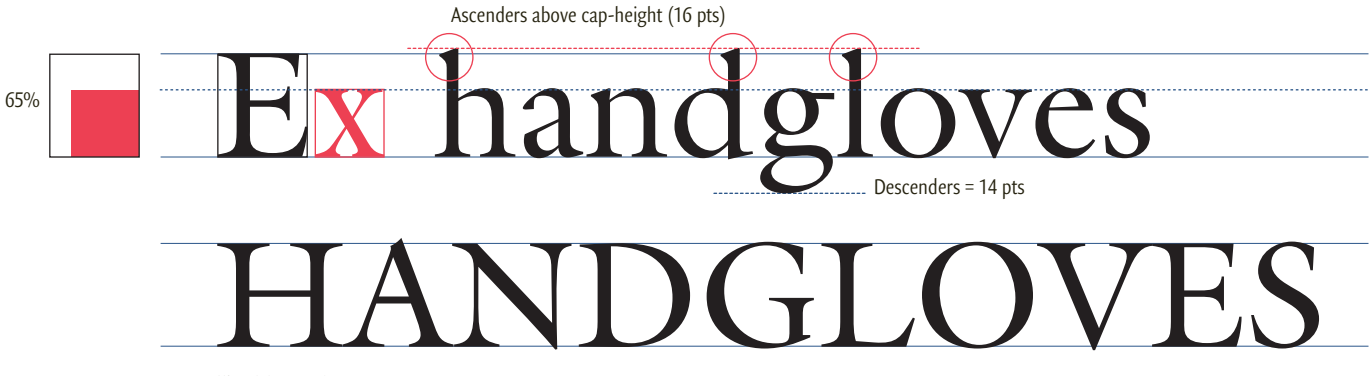
Still, typefaces with short x-heights are not necessarily more space-efficient than typefaces with tall x-heights—but the problem is width rather than height. Shorter lowercase glyphs often need to be wider in order to have adequate open space. For example, the typeface Mrs. Eaves, designed by Zuzana Licko for the Emigre type foundry, has a short x-height and a wide upper- and lowercase O/o. Therefore, longer texts set in Mrs. Eaves require ample horizontal space. The luxurious spacing of Mrs. Eaves is distinctive, and the typeface is one of Emigre's best-sellers; however, designers have often asked for a more economical variation. Thus the design and release of Mrs. Eaves XL, which has a larger x-height (and proportionally shorter ascenders and descenders).

These examples show that x-height follows the "Goldilocks principle"—the optimal x-height is neither too tall nor too short, but somewhere in between. Many typographic variables behave in this way; the "sweet spot" exists in the middle of the continuum.

Of course, decisions about x-height are not only about legibility or efficiency; x-height is also affected by fashion and trends. In the 1960s and 1970s, designers enthusiastically embraced new versions of classic typefaces designed with taller x-heights from ITC (International Typeface Corporation): ITC Bodoni, ITC Bookman, ITC Souvenir, and so on. The predictable cycle ensued: widespread popularity followed by decline and rejection (critic Rob Alderson calls this circuit "hype–ubiquity–backlash;"[6] see also "I Hate ITC Garamond" by Michael Beirut).[7] Now, after a suitable period of rest, some of these designs (or revivals of these designs) are creeping back into the mainstream.

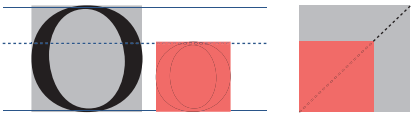
6 Alderson, Rob, "16 Proposals for 2016," *Mag Culture*, 7 January 2016, magculture.com/16-proposals-for-2016.

7 Bierut, Michael, "I Hate ITC Garamond," *Design Observer*, 1 October 2004, designobserver.com/feature/i-hate-itc-garamond/2577.



ITC Galliard (Roman)

Typefounder Pierre Simon Fournier believed the ideal x-height to capital ratio was 3:5. ITC Galliard is slightly taller.



The upper- and lowercase O/o of ITC Galliard have similar proportions.

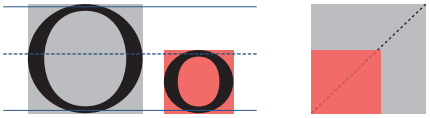
Mrs. Eaves (Roman) 14/18
26 characters = 2.2 inches (12 characters per inch)

The quick brown fox jumped over the lazy dogs. Voyez le brick géant que j'examine p du wharf. Zwölf Boxkämpfer jagen Viktor quer über den großen Sylter Deich. El vel murciélago hindú comía feliz cardillo y kiv

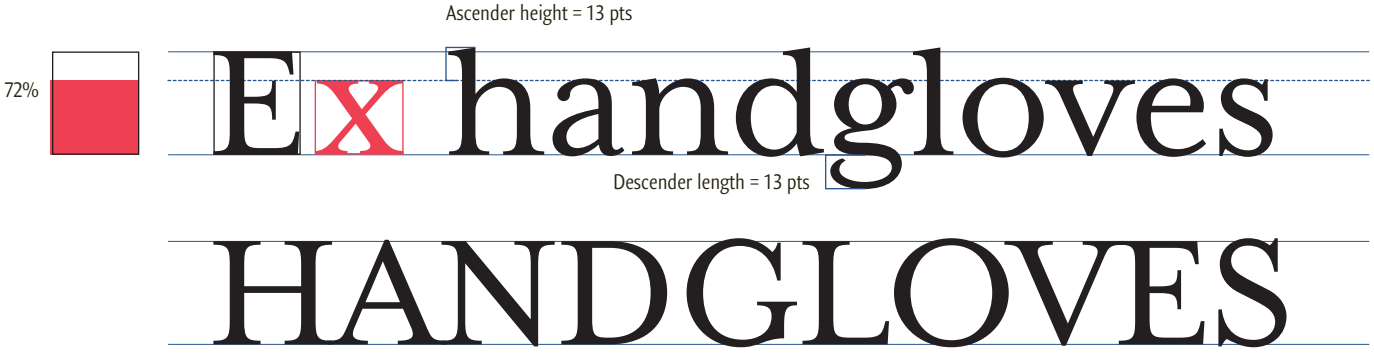
Mrs. Eaves XL (Roman) 14/18
26 characters = 2.4 inches (11 characters per inch)

The quick brown fox jumped over the la dogs. Voyez le brick géant que j'examine près du wharf. Zwölf Boxkämpfer jagen Viktor quer über den großen Sylter Deic veloz murciélago hindú comía feliz card

Mrs. Eaves (Roman)

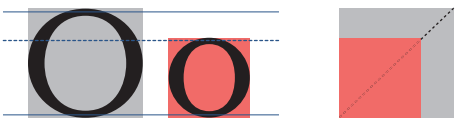


The lowercase o of Mrs. Eaves is slightly wider than the capital



Mrs. Eaves XL (Regular)

Mrs. Eaves XL has a larger x-height (72%) than its parent Mrs. Eaves (x-height = 57%). Note the proportionally shorter ascenders and descenders.



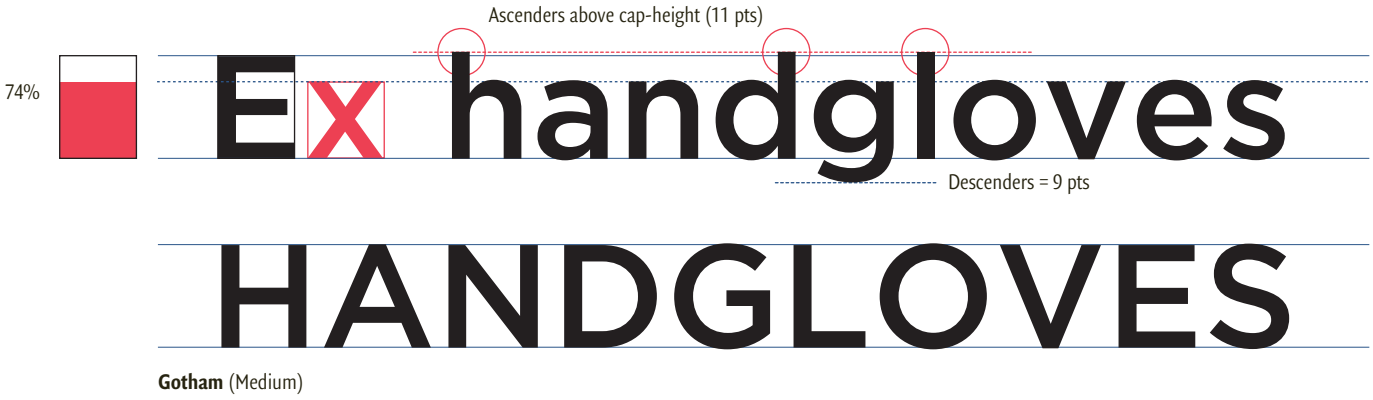
The upper- and lowercase O/o of Mrs. Eaves XL have similar proportions.

Gotham (Medium) 14/18
26 characters = 2.8 inches (9 characters per inch)

The quick brown fox jumped ove
the lazy dog. Voyez le brick géar
que j'examine près du wharf. Zw
Boxkämpfer jagen Viktor quer üb
den großen Sylter Deich. El veloz

Gotham Condensed (Medium) 14/18
26 characters = 1.6 inches (16 characters per inch)

The quick brown fox jumped over the lazy dog. Voyez le b
géant que j'examine près du wharf. Zwölf Boxkämpfer jag
Viktor quer über den großen Sylter Deich. El veloz murcié
hindú comía feliz cardillo y kiwi. La cigüeña tocaba el sax
detrás del palenque de pajaatur? Lorem ipsum dolor sit a



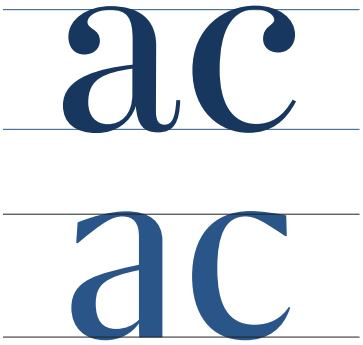
Gotham (Medium)

Gotham Condensed (Medium)

Gotham and Gotham Condensed have about the same x-height. In Gotham, the upper and lower case O/o have similar proportions. However, the condensed lowercase o is wider the condensed capital O.

In the condensed font, matching the proportions of the capital O would make the lowercase o very narrow (see white dotted line). At such a narrow width, the lowercase letter would likely become too dark.

Aperture



Above, Harriet Display, and below, Grifo.
Grifo has more open apertures than Harriet.

Aperture refers to the amount of openness in a glyph. In the words of Robert Bringhurst, author of *The Elements of Typographic Style* [2004], "Aperture [is] often a gauge of grace or good fortune in typefaces."[8] In general, open apertures are considered desirable because they can improve legibility. For example, when letters like the G and C are more open, they are less likely to be confused with an O. Therefore, open apertures are often a feature of types designed for reading in difficult conditions (signage, low-resolution screens, small size displays, and so on).

However, typefaces with smaller, closed apertures (such as Neue Haas Grotesk, below) still have a reason to exist. These designs can have compelling visual presence due to their strongly defined shapes and consistent visual rhythm. Tightly closed letters may be less than optimal for signage or books, but they can have visual impact in headlines, short texts, and other display contexts.

8 Bringhurst, Robert. *The Elements of Typographic Style*. 3rd ed., Hartley and Marks, Publishers, 2004, p. 132.

Frutiger is often used for signage. Letter strokes are sliced either vertically or near vertical, resulting in open forms.

The quick brown fox jumped over the lazy dogs. Voyez le brick géant que j'examine près du wharf.

Frutiger (45 Light)

Neue Haas Grotesk has relatively closed, tight apertures. Note the consistent horizontal endings.

The quick brown fox jumped over the lazy dogs. Voyez le brick géant que j'examine près du wharf.

Neue Haas Grotesk (75 Bold)

Weight

The naming of font weights varies considerably. For example, the "regular" weight may be called normal or roman; a "bold" weight might be called "strong" or even "fat." Some names hint at a system (featherweight is likely lighter than heavyweight). However, other names refer to a recommended use (for example, "book")—or are poetic, subjective descriptors ("blonde").

In 1957 designer Adrian Frutiger released the sans-serif Univers with a numeric naming system that aimed to eliminate this ambiguity. In Univers, type weights are sequential (45=light, 55=normal, 65=bold, 75=black and 85=extra-black). Some foundries did adopt and even expand Frutiger's system (25=ultra light, 35=thin, 95=ultra, etc.). However, overall the system never fully caught on; sadly, it is not universally accepted.

Univers Light (45)
Univers Roman (55)
Univers Bold (65)
Univers Black (75)
Univers Extra Black (85)

On a brighter note, one area that is standardized is the web. In CSS (Cascading Style Sheets)—regardless of what the designer has chosen to name their weights—the regular weight is mapped to 400. In other words, specifying "font-weight: 400" is the same as "font-weight: normal." Similarly, bold is always mapped to 700. In fact, several font editors allow you to set this number in the font's meta-data; the allowable range runs from 100 to 900.

However, a different but related problem is that there is no universal standard for what constitutes a specific weight. Therefore, one designer's 700 might be darker or lighter than another's. For example, the regular weight of Gill Sans is visibly heavier than the regular weight of Helvetica:

Gill Sans Regular
Helvetica Neue Roman (55)

There are several methods for determining the weight or tonal value of a font. Type designer Charles Bigelow decribes using a ratio of the vertical stem thickness to x-height.[9] Lighter fonts have higher ratios, because more stem thicknesses can fit within the x-height. According to Bigelow, the minimum factor to create a clear difference between two weights (i.e., normal to bold) ranges from 1.3 to 1.5 times this ratio.

After examining several typefaces, the typical stem to x-height ratio of a normal weight font ranges from 1:5 to 1:6 (five to six vertical stems fit within the x-height). Using Bigelow's 1.3–1.5 multiplier, a bold weight would have a minimum ratio of 1:3 to 1:4 (three to four vertical stems fit within the x-height), and a light weight would have a minimum ratio of 1:6.5 to 1:9 (six and a half to nine vertical stems fit into the x-height).

It may be helpful to translate these figures into a 1000 unit em (the standard for most type design software). If a regular weight font uses 90 units for the vertical stem thickness, and the regular weight stem to x-height ratio is 1:5, the vertical stem thicknesses of the bold weight will be 113–150 units (the vertical stem thickness will be 25–66% bolder). Correspondingly, the vertical stem thickness of the lighter weight will be 50–69 units (55–77% lighter).

Many designers recommend drawing type fairly large, with an x-height of 2 inches (or 5 cm), so it may also be helpful to see these figures in this context. As a starting point, we will assume that our normal font has a vertical stem thickness of 0.4 inches (1 cm), and a stem to x-height ratio of 1:5. Therefore, the bold weight would have a bold vertical stem thickness between 0.5 and 0.7 inches (1.3–1.7 cm). The matching light weight would have a vertical stem thickness of approximately 0.2 to 0.3 inches (0.6–0.8 cm).

Other type designers have proposed alternate formulas to calculate the progression of stem weights in a typeface. Perhaps the best known is the Interpolation Theory of type designer Luc(as) de Groot. The Interpolation Theory states that the optimum range of weights progresses not linearly, but exponentially.[10]

The De Groot equation has been automated by type designer Pablo Impallari in his Family Stem Weights Calculator.[11] Impallari's calculator requires two inputs: the starting and ending vertical stem widths (e.g. light and bold) based on a 1000 unit em. With these inputs, the calculator returns several possible vertical stem measurements of intermediate weights (regular, semi-bold, etc.).

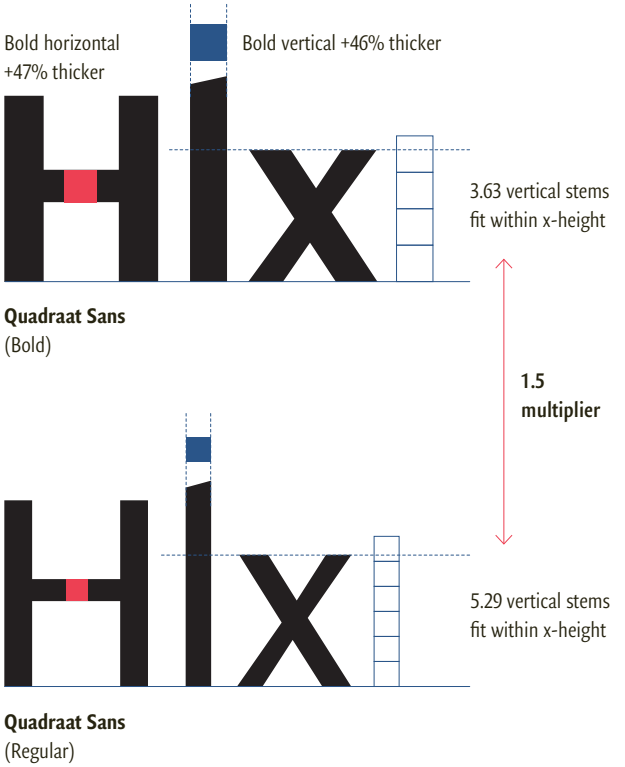
The Bigelow and De Groot formulas focus on calculations for increasing the vertical stem thickness. The horizontal stroke also needs to increase; otherwise the bold version of a typeface would have higher contrast than the regular weight. However, the vertical and horizontal strokes do not necessarily increase at the same rate. For example, in Helvetica Neue, the vertical stem thickness of the bold (75) weight is +67% heavier than the regular (55) weight, while the horizontal thickness is +64% heavier.

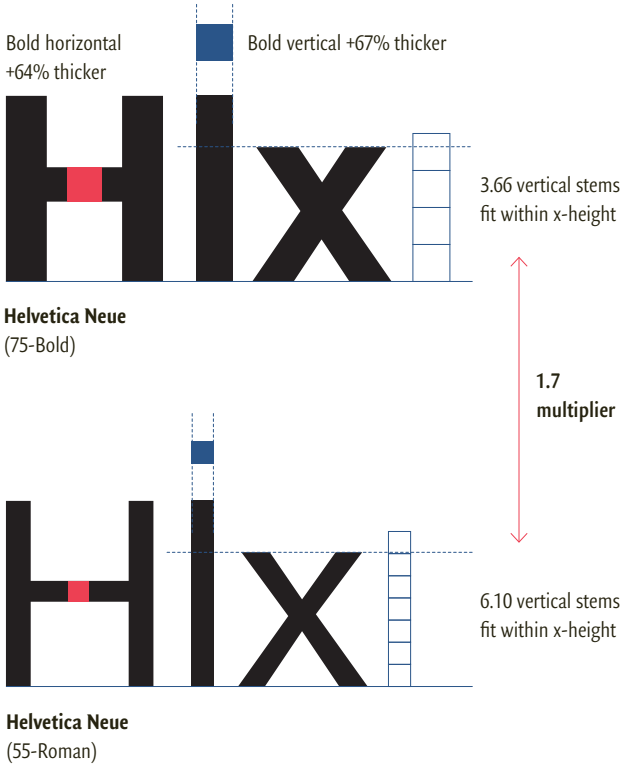
In many typefaces, the width of glyphs increases with weight, because bolder strokes need more physical space. However, there are designs that address this issue. For example, Mercury (designed by Jonathan Hoefler and Tobias Frere-Jones) is available in "grades" with approximately the same character widths. This means designers can change grades without affecting copyfit—a very useful feature for a newspaper typeface.

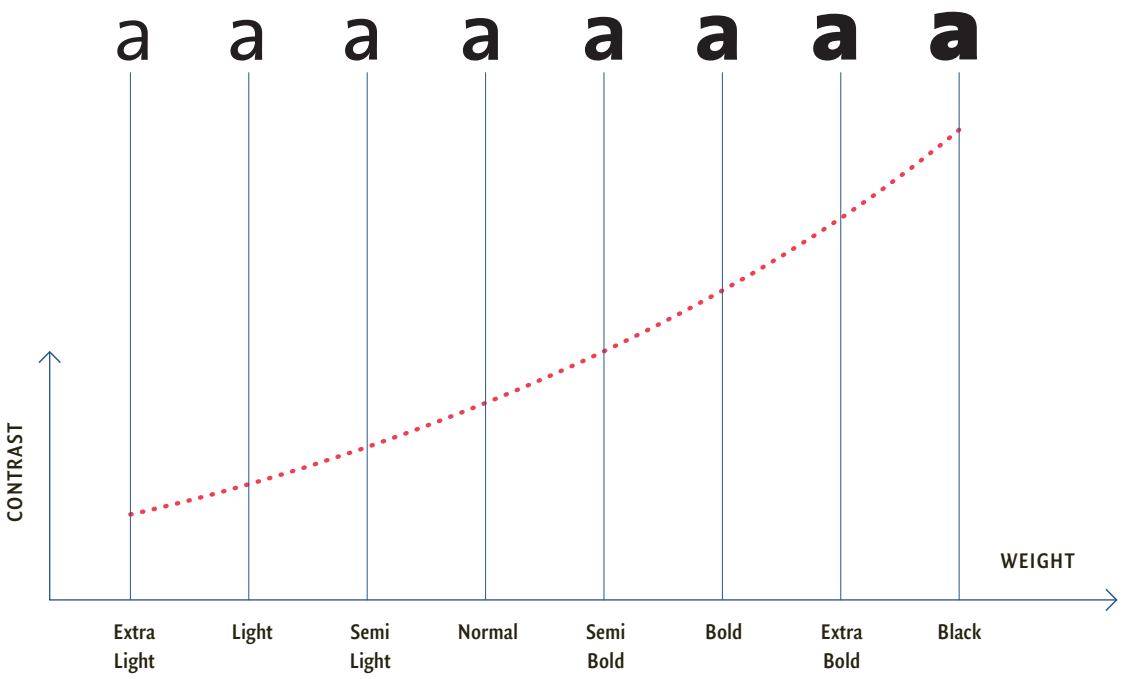
9 Bigelow, Charles, "On Font Weight," *Bigelow & Holmes: Typeface Design & Research*, July 2015, bigelowandholmes.typepad.com/bigelow-holmes/ 2015/07/on-font-weight.html.

10 De Groot, Lucas, "Interpolation Theory," *Lucas Fonts*, 2000–19, lucasfonts.com/about/interpolation-theory/.

11 Impallari, Pablo, "Family Stem Weights Calculator," *The Diacritics Club*, diacritics.club/family-steps.







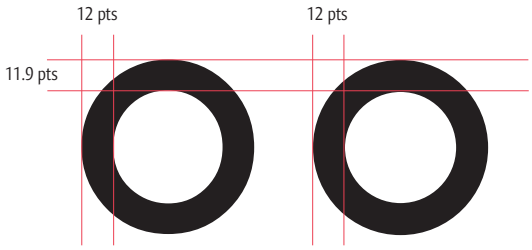
Luc(as) de Groot's Interpolation Theory
The optimum range of weights progresses not linearly, but exponentially.

Stem and Bowl Weights

In most text typefaces, glyphs are made of round bowls and straight strokes (horizontal, vertical, and diagonal). In general, even in "monoline" typefaces, the widths of these strokes vary according to their shape and direction. We vary stroke weights because of the thickness illusion: Lines of the same weight look heavier when rotated horizontally or diagonally.[12]

All lines = 15 points.
Horizontals appear wider than diagonals or verticals.
Diagonals appear wider than verticals.

Scientists and designers debate the cause of the thickness illusion. Some argue that readers have inbuilt expectations of what type should look like because of life-long exposure to Western/European models. Others state that the human field of vision is more horizontal than vertical, and that this affects the perception of size. In any case, the illusion means that type designers must reduce horizontal strokes (and to a lesser degree, diagonal strokes) to create the illusion of a "monoline."



Century Gothic (above, left) has very subtle stroke contrast.
Compare to the geometric circle (above, right).

Specifically, the maximum bowl weight (the widest part of the curve) needs to be heavier than the corresponding vertical stem in order to look equal. A curve reaches maximum weight only briefly; the rest of an arc is lighter. In contrast, a vertical stem maintains full weight throughout. Therefore, a curve can only achieve visual parity to a stem when the swell of the curve is heavier; this allows the optical "average" of a bowl to be equal.

Similarly, the thinnest part of the bowl (the minimum bowl weight) should be slightly narrower than the normal horizontal thickness. A curved bowl reaches its minimum weight only briefly; the rest of the arc is heavier. Therefore, the narrowest part of a bowl needs to be lighter in weight in order to create the optical illusion of matching a parallel horizontal stroke.

These optical adjustments are quite subtle, although more compensation is needed as contrast increases. In low-contrast typefaces (such as Univers), the bowl weight is already close to the normal vertical stroke width, so less adjustment is needed.

Note that the horizontal, vertical, and maximum-bowl stroke thicknesses are not always the same in the upper and the lower case. Lowercase letters are constrained by the x-height; if the same stroke weights were used for both cases, the lower case would be too dark. The specific degree of adjustment needed between cases varies. Bold typefaces and designs with shorter x-heights require more thinning, as there is less room to achieve equal color.

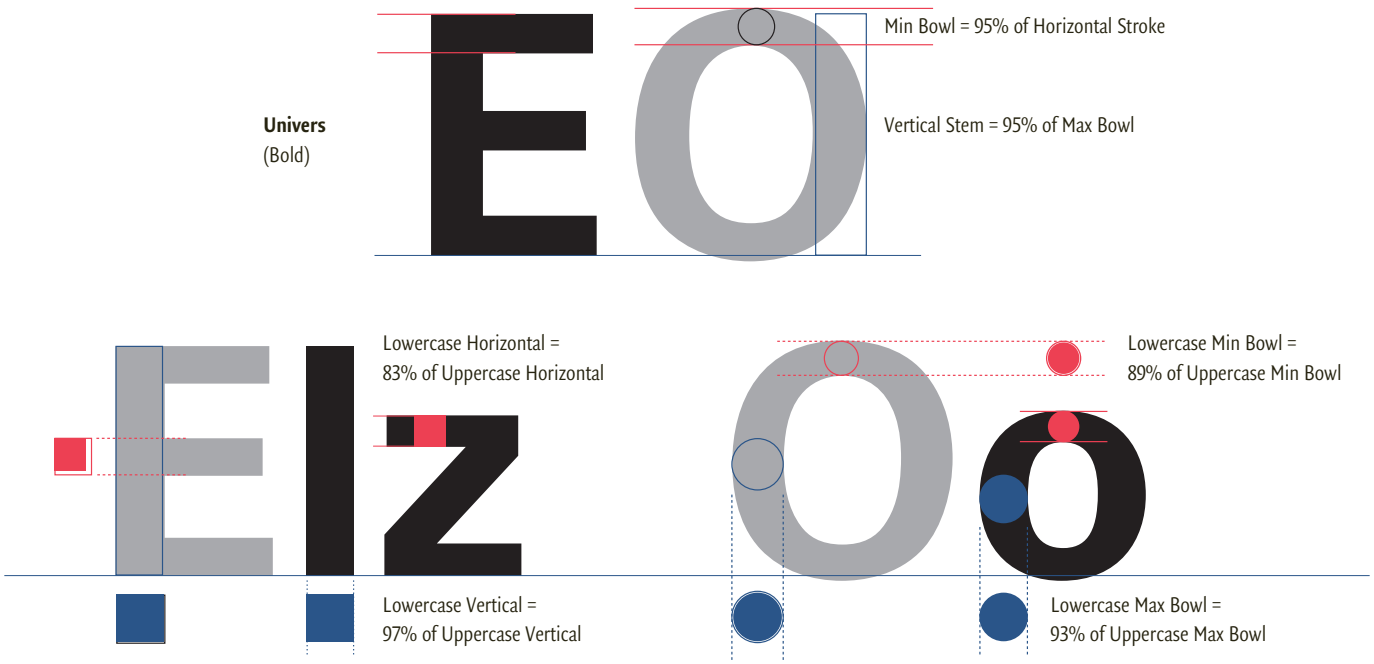
The current norm is for upper- and lowercase letters to match in value, so that text settings appear as an even block of optical gray. However, in the past, type designers often made capitals much darker. For example, in Baskerville, the upper case is quite dark:

Tandem Aliquando,
Quirites! L. Catilinam
John Baskerville

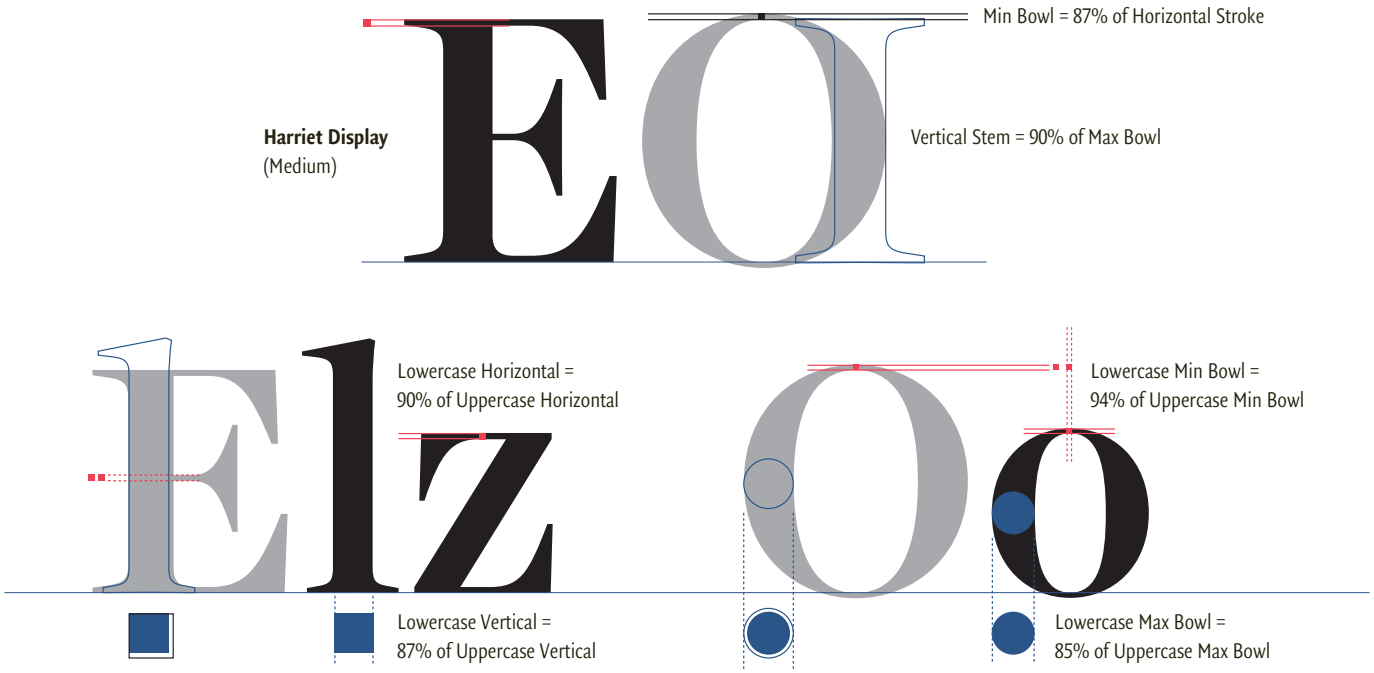
Baskerville Display–Paratype (Regular)

These heavier capitals may have been a technical correction as well as an esthetic preference. In the early years of printing, excess ink built up inside and around metal type. This ink buildup was heavier in the lower case due to the proportionally smaller letter counters and apertures. To compensate, type designers may have increased the weight of the uppercase glyphs to match the darker printing of the lower case.

12 De Waard, Jasper M., et al. "A Thickness Illusion: Horizontal Is Perceived as Thicker than Vertical." *Vision*, Vol. 3, no. 1, 2019.



In Univers Bold, heavier stroke thicknesses (verticals and max bowl) are almost the same in the upper and lower case.
However, thin strokes (horizontals and min bowl) are less in the lower case.



In Harriet Display Medium, thin stroke thicknesses (horizontals and min bowl) are almost the same between the upper and lower case.
However, thick strokes (verticals and max bowl) are less in the lower case.

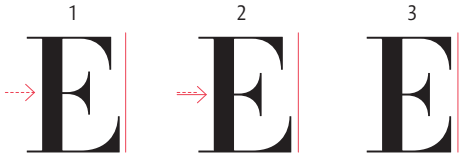
Balancing Shapes

Letterforms in the Roman alphabet are, in general, based on just three simple shapes: circles (O/o, C/c, G, etc.); triangles (A, V/v, W/w, etc.), and squares (H, E, F, T, L, etc.). Of course, some letters are hybrids: the D, B, P, R are circular-square, while the M, N, K, Y are diagonal-square; the S might be considered both circular and diagonal. A fundamental problem in type design is balancing the proportion and sizes of these different shapes. Square shapes (like the H and E) are physically larger than round shapes (like the O) and triangular shapes (like the V). Therefore, to equalize the forms, we expand round shapes above the capline and below the baseline. Similarly, we extend pointed forms (like the N, V/v, and A).

This compensation occurs in both the upper and the lower case and is called overshoot (at the capline) and undershoot (at the baseline). According to tests conducted by Peter Karow, partner at the URW type foundry and author of *Digital Typefaces: Descriptions and Formats* [1994][13] circles appear as large as squares when they are 3% wider; triangles appear as large as squares when they are 5% wider and 3% taller. Of course, not all typefaces have letters based on regular geometric forms. Wider and flatter curves—and blunted points—need less adjustment, since they are closer to being square. Sharper points and rounder shapes need greater compensation.

A similar illusion involves the position of the visual center. The optical center of a letter is slightly higher than the mathematical center. Therefore, a crossbar placed in the exact middle of the H will appear too low. Similarly, the central arm of an E and the waist of the B also needs to be above the true midline.

Note that placing the optical center of a letter above the true (mathematical) midline affects all double-story glyphs (H, E, B, S, 6, 8) in that their upper half becomes shorter than the lower. We further increase the width of the lower story to improve optical balance. Glyphs with equal upper and lower halves appear overly top-heavy.



1_HTF Didot (M-24 Medium) Center arm in optical center.
2_Center arm moved to mathematical center.
3_Top and bottom arms made equal in length.

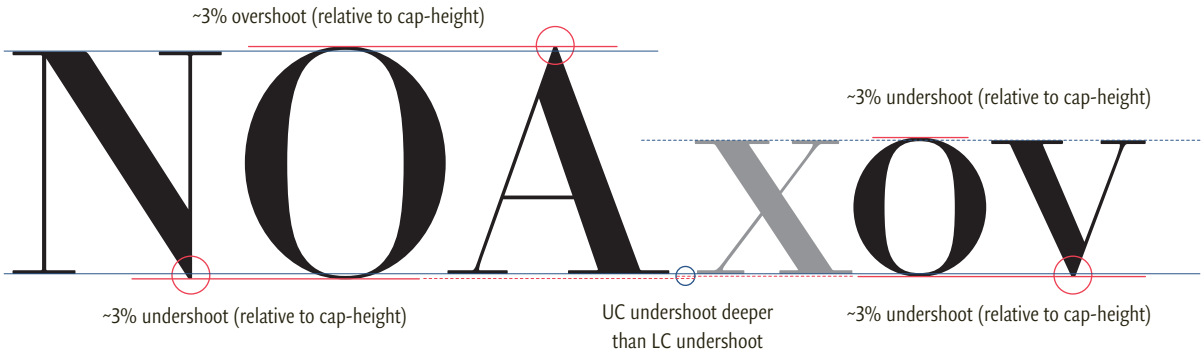
There are typefaces that deliberately ignore these rules of optical compensation as part of their design concept, such as NB Grotesk, which was designed by Stefan Gandl, founder and director of the Neubau design studio in Berlin, Germany. NB Grotesk was designed for the 2008 "Neubauism" exhibition held in Eindhoven, the Netherlands that documented and celebrated the studio's work. Glyphs in Neubau are true monolines that follow a diamond grid; the result is symmetrical characters that are divided in the true mathematical center. The typeface is unorthodox and even crude, but has a compelling visual strangeness.

13 Karow, Peter. *Digital Typefaces: Descriptions and Formats*, Berlin: Springer-Verlag, 1994, p. 12.

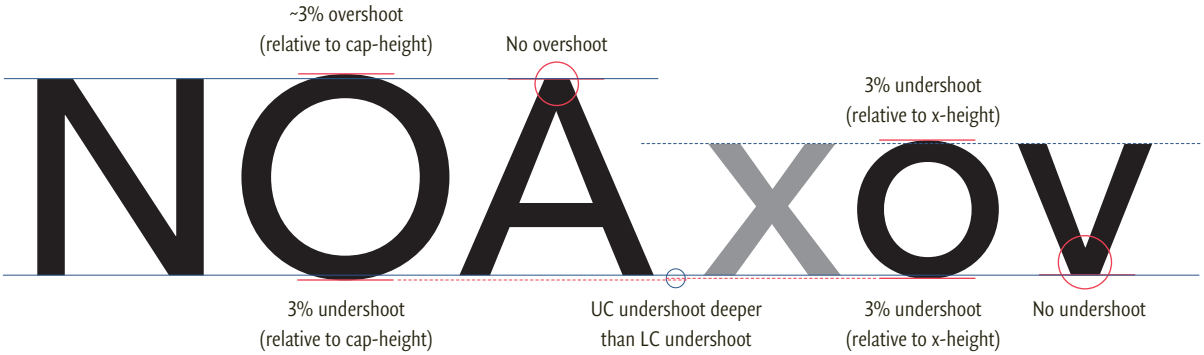
When all forms have the same height and width, the circle and triangle look (and are) physically smaller.

To optically match the square, the circle and triangle must be enlarged.

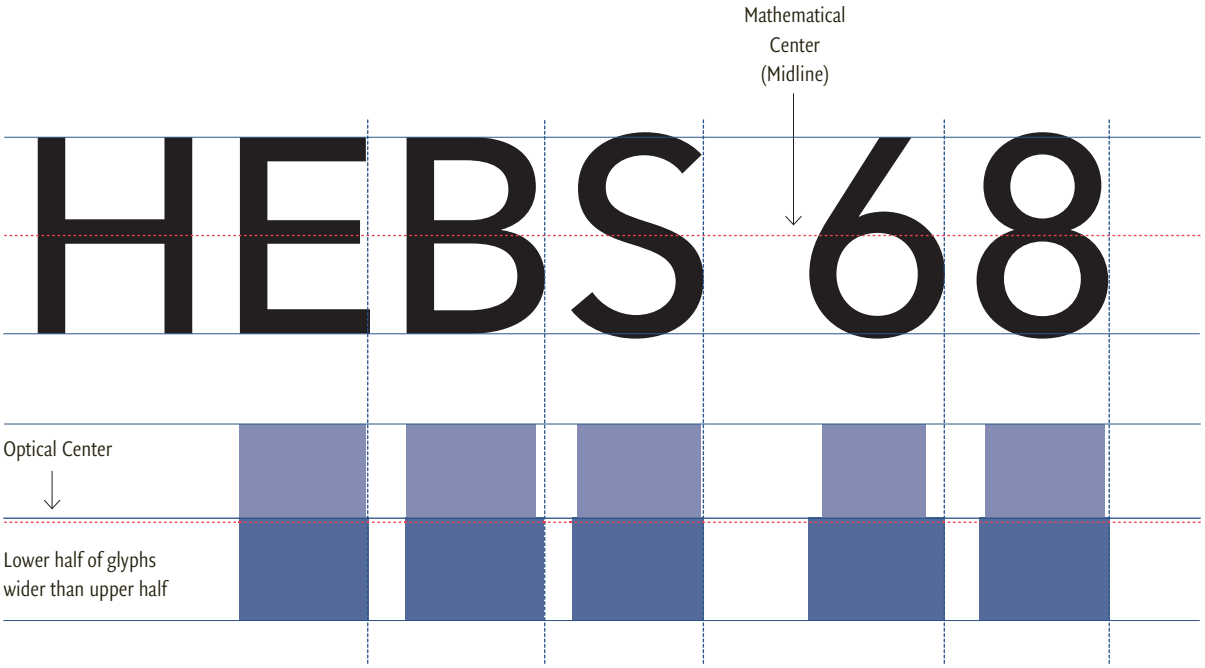
HTF Didot
(M24 Medium)

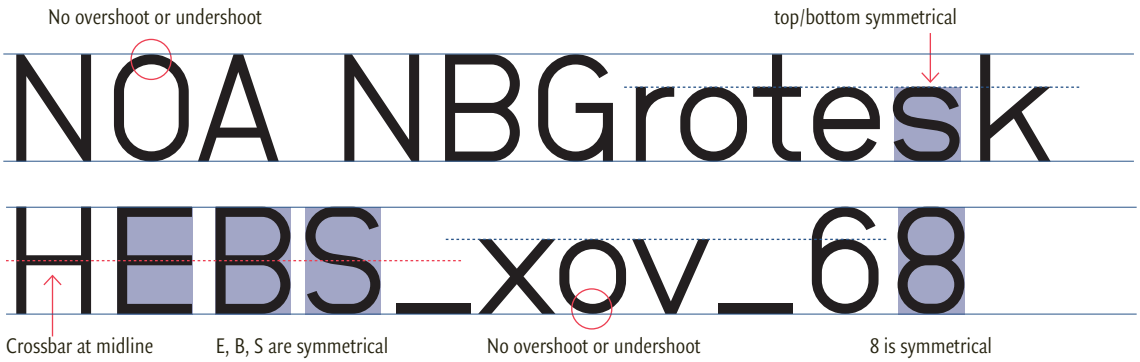


Avenir Next
(Medium)



Avenir Next
(Medium)





NEUBAUISM•
Neubau_
International_
NB Grotesk
UltraLight_Light_
Regular_**Semi**
Bold_Bold_
Black@012345-
[6789]

Neubau Grotesk (shown above) deliberately ignores rules of optical compensation.
Glyphs are true monolines that follow a diagonal grid; double-story characters are divided in the mathematical center.

3

SPACING

Spacing Principles

Sadly, when designing a typeface, drawing the letters themselves is not enough. The negative space between letters is just as important as—if not more important— than the positive letter shapes. Even beautiful characters can look awkward—and even illegible—when badly spaced. Conversely, clumsy letters can be vastly improved by sensitive spacing. In the 2015 documentary *Typographically Speaking*, renowned type designer Matthew Carter explains that many of the letters in his 1996 typeface Verdana (for example, the n and o) are identical or only slightly different from those in MS Sans, a 1992 typeface drawn by Microsoft engineers. Engineers working with Carter on Verdana were baffled, because despite the similarity in many characters, text set in Verdana was noticeably more legible on the low-resolution digital screens of the time (72-dpi) than text set in MS Sans.

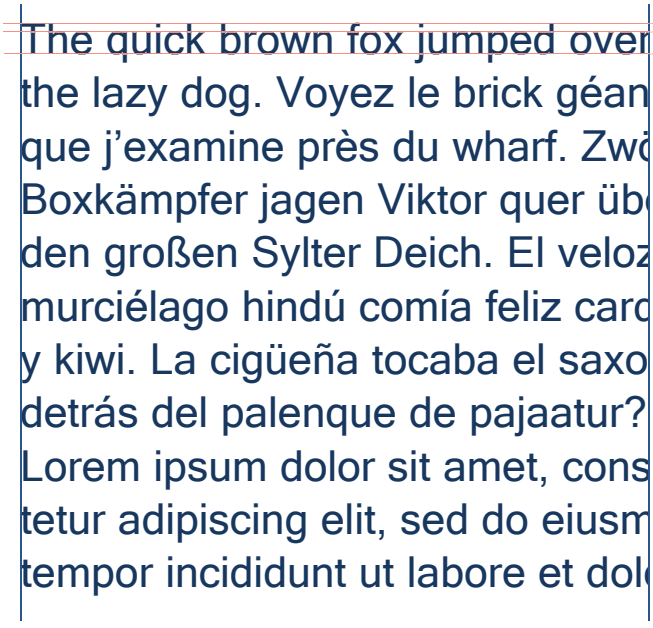
Carter explains that the reason Verdana was more legible than MS Sans was not the letter shapes, but interletter spacing. In MS Sans, adjacent letters were sometimes too far apart (disrupting text with "rivers" of space) or too close together (creating merged letter pairs that were unclear).

In general, a typeface is considered to be well spaced when groups of letters (words, sentences, and paragraphs) form a regular and even rhythm, thus creating a consistent shade of tonal gray, without darker or lighter spots. In this view, typeset words are essentially formal compositions of black and white. When type is set properly, black letter structures are evenly distributed on a white ground, creating a predictable visual pattern. In his 1998 book *Finer Points in the Spacing and Arrangement of Type*, author Geoffrey Dowding describes this visual goal as creating a "stripe-like quality" in text.

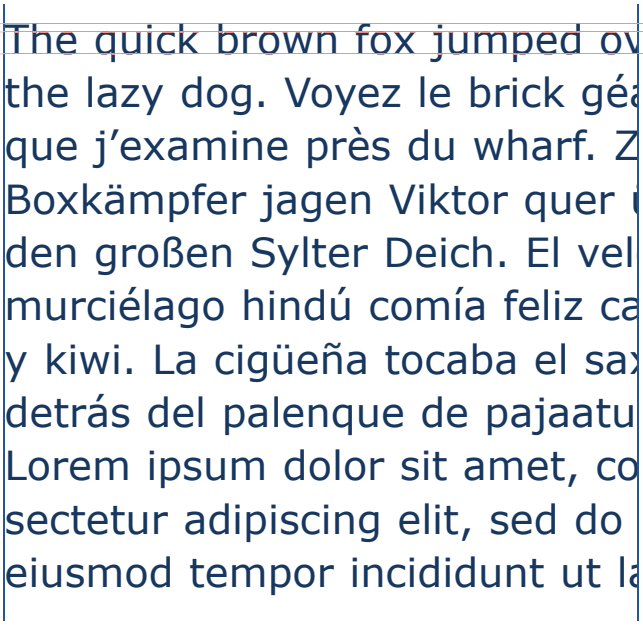
The MS Sans n (outline) is slightly narrower than Verdana

Microsoft Sans (Regular)

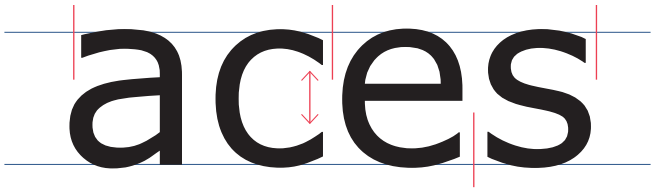
Verdana (Regular)



Characters in Microsoft Sans are narrower than Verdana.
The overall set is tighter and less even (see verticals in "elit").



Characters in Verdana contain more open space.
The overall set is looser (and more even) than in Microsoft Sans.



Verdana has open apertures and vertical stroke endings.
Counters are wider and more circular than MS Sans.

MS Sans has closed apertures and horizontal stroke endings.
Counters are proportionally narrower than in Verdana.

These characters are more open than MS Sans

t, f, r are wider

Verdana (Regular)

These characters are more closed than Verdana

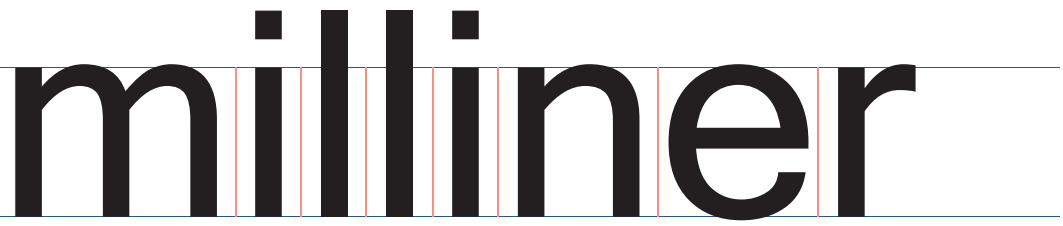
t, f, r are narrower

Microsoft Sans (Regular)

In Verdana, letterspacing around the i and l is relatively wide.

Verdana (Regular)

In MS Sans, letterspacing around the i and l is tighter.



Microsoft Sans (Regular)

Spacing and Counters

To achieve even letterspacing, visualize a glass of water. You should be able to pour the same volume of liquid between every pair of letters. The precise amount of water (the interletter space) varies from typeface to typeface, but the general rule is "spacing matches counters." For example, because the interior spaces of uppercase letters are larger than those of the lowercase letters, capitals have wider interletter spacing.

Because "spacing matches counters," the intended point size of a font affects interletter spacing. Smaller text type (anything 12 points and below) has more open counters than display type, so that small letters do not clog when printed. These text sizes need correspondingly wider spacing to avoid becoming "spotty." Conversely, display sizes can be set more closely. Loose settings of display type can look disjointed and weak.

In the days of metal type, a font was naturally size specific, as each point size was cast separately with the appropriate optical adjustment. Today, when creating digital type, the designer has two choices: A font can be created with "average" spacing, or a family of fonts can be created, with spacing adjusted to a specific size or range of sizes. The latter is preferable, but of course, takes substantially more time and effort. (For more detail on this subject, see *Size-Specific Adjustments to Type Design* [2014] by Tim Ahrens and Shoko Mugikura.)

The general rule of "spacing matches counters" works well for text typefaces of normal proportions and regular weight. However, letters that are light or bold—and letters that are extended or condensed—behave in the opposite way. Light letters have open forms that need tighter spacing in order to bind together and look cohesive in words and text. Conversely, bold or condensed typefaces have narrow counters that may need more space, so that two letters do not merge into a dark spot. Heavy letters that are set too close together can also lead to legibility issues. For example, an r and n may accidentally read as the letter m.

Note that the principles described here are general guidelines. Fashion, technology, and personal preference all play some role in the "normal" set of type. For example, in the 1960s and 1970s, the advent of phototype enabled and popularized very tight settings. Then, as today, it was also the norm to set sans serifs tighter than serifs. Some designers believe that serif faces can tolerate wider spacing better than sans serifs, because the repeating serif forms make the typeface more visually cohesive. (In any event, serifs do require wider letterspacing, because serifs take up additional horizontal space.) Looser setting does recall the look of early printing, which might be relevant for a classical revival. (When type was cast in metal, it was easier to fix problems by increasing space rather than reducing it, since printers could add blank metal spacers instead of laboriously filing down metal type bodies.)

Still, most designers would agree that spacing for a contemporary font should not be obviously tight or loose. Good spacing should be imperceptible. Perhaps the principle of invisibility in design was best articulated by the type designer Adrian Frutiger: "If you remember the shape of your spoon from lunch, it is the wrong shape." Similarly, spacing is generally only noticed by readers when it is incorrect.

Text too loose; legibility impaired

All the virtues of the perfect wine glass are paralleled in typography. There is the long, thin stem that obviates fingerprints on the bowl. Why? Because no cloud must come between your eyes and the fiery

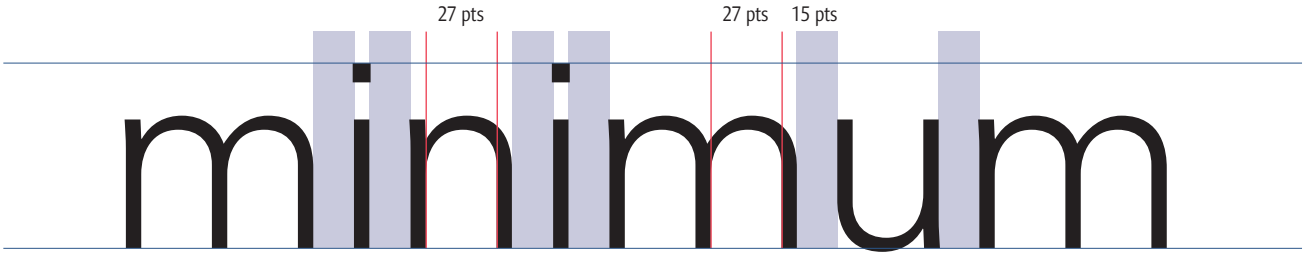
Normal text setting; even color

All the virtues of the perfect wine glass are paralleled in typography. There is the long, thin stem that obviates fingerprints on the bowl. Why? Because no cloud must come between your eyes and the fiery heart of the liquid. Are not the marg

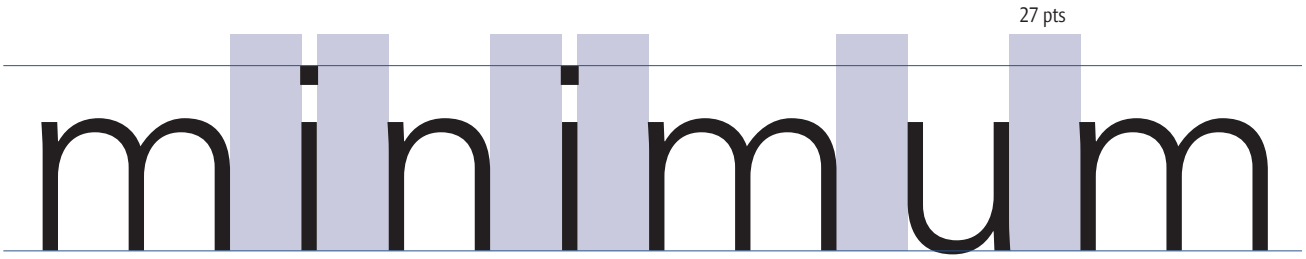
Text too tight; "spotty" color and low legibility

All the virtues of the perfect wine glass are paralleled in typography. There is the long, thin stem that obviates fingerprints on the bowl. Why? Because no cloud must come between your eyes and the fiery heart of the liquid. Are not the margins on book pages similarly me

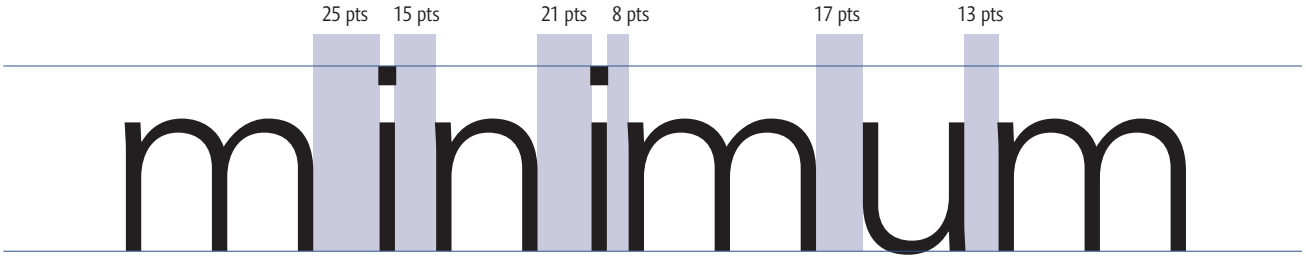
All text (an except from "The Crystal Goblet," an essay on typography by Beatrice Warde) set in Univers 55 (Regular).



Univers 45 (Light): Even spacing between all pairs of letters. Normal set; space between letters is approximately 50% of the 'n' counter.



Univers 45 (Light): Even spacing between all pairs of letters. Wide set; space between letters is equal to the width of the 'n' counter.



Univers 45 (Light): Uneven spacing between pairs of letters. Legibility is compromised.

Bold typefaces have smaller counters, and therefore need tighter letterspacing in comparison to the normal weight.

Lighter typefaces can look weak; tighter letterspacing helps solidify the visual rhythm.

Univers 85 (Extra Black) **minimum**

Univers 55 (Roman) minimum

Univers 45 (Light) minimum

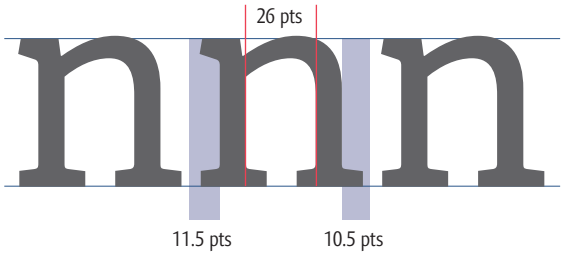
Condensed typefaces have smaller counters that need tighter letterspacing.

Expanded typefaces have larger counters, but need tighter letterspacing to look cohesive; wider spacing looks timid.

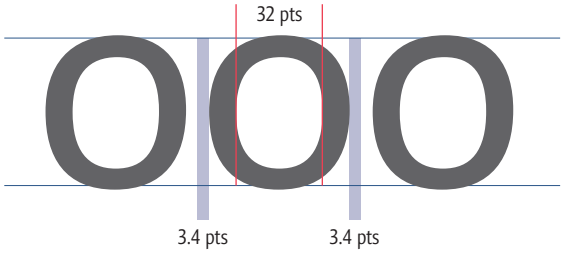
Univers 48 (Ultra Condensed) **minimum**

Univers 53 (Extended) minimum

Setting Sidebearings

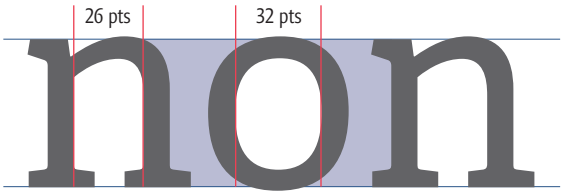


The right sidebearing is smaller, since the arch adds space

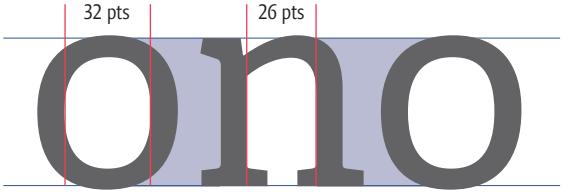


Adelle (Regular)

The sidebearings of the o are symmetrical.
The sidebearings are thinner than the n, since the o is rounded
(the open corners add space).



The space around the o and n is visually equal
to the space inside the letters.



There are two variables that determine the basic letterspacing in a font: the left and right sidebearings. Conceptually, the method is unchanged from the invention of letterpress printing. Letterpress type was individually cast or engraved on a metal block called the type body. When type blocks were set side by side to make words, the physical sidebearings (the distance between the glyph and the ends of the block) created the appropriate spacing. It was easy to increase spacing by inserting blank metal strips, but reducing space was far more tedious, as the sides of each block had to be filed away. Of course, in the digital world, this physical constraint has vanished. Using type design software such as Glyphs or FontLab, virtual sidebearings are easily adjusted to any width.

Determining the ideal sidebearings for each letter is a time-consuming task. The main principle is simple: Sidebearings are proportional to counters and letter profiles. That is, as discussed previously, the space around each letter should relate to the space within the letter. However, because there are many different shapes in a font, there are many different sidebearing widths, even among similarly shaped letters. For example, even though the M, N, E, and H all have vertical sides, the sidebearings of the M and N are narrower, since their verticals are thinner and lighter.

Certain letter shapes cause problems in all typefaces. Single-stemmed glyphs such as the 1, I, i, l, r, and t are particularly troublesome. When the sidebearings are too tight, these letters create dark spots in text. However, when the sidebearings are too loose, they create a lighter pattern in comparison to other letters.

millennial initial
minimum illuminator

Big Caslon (Medium)

Open-sided letters—such as the C, c, G, and r—are also difficult, since they lack a clearly defined boundary. For example, in the letter C, some portion of the interior counter "belongs" to the letter, but some portion also belongs to the interletter space between the C and the next character.

A similar problem occurs in glyphs that cannot be set closely (such as the L, 7, V, v, W, w, Y, y, and r) because of their structure. Diagonals and letters with extending arms have light areas around them, because their branches "push" other letters away while also trapping negative space underneath. These letters need the tightest sidebearings possible to minimize the visual gaps around them.

One formula for sidebearings that takes these multiple factors into account is shown by Walter Tracy in his book *Letters of Credit: A View of Type Design* [2003]. Tracy's information is from Harry Smith, a draftsman for Linotype. Smith used the control characters H, O, n, and o to determine spacing for all other letters. Smith's process is shown at right, on the opposite page.

SIDEBEARINGS FOR CAPITAL LETTERS

1. Set the left and right sidebearings of the H.
   Each sidebearing is 25–50% of the width between the stems. Sans serifs have tighter spacing than serif fonts.

2. Test the sidebearings of the H by setting the word "HHHH". The letters should be harmonious—not too open or cramped.

3. Set the left and right sidebearings of the O. These sidebearings are slightly less than the sidebearings of the H.

4. Test the O by setting the word "HOH". The O should appear balanced between the two H forms, and the color of the word should be even. If not, revise the sidebearings of the O.

5. Re-test the O by setting the word "HHOOHH". Again, all six letters should be harmonious, and the color of the word should be even. If not, revise the sidebearings of the O. The original H may also require readjustment.

6. Once the H and O are satisfactory, the other uppercase sidebearings can be set as follows:

DIAGONAL AND OPEN LETTERS WITH MINIMUM SPACE:

4–**A**–4 4–**V**–4 4–**W**–4 4–**X**–4 4–**Y**–4
4–**T**–4 4–**J**–1

STRAIGHT-SIDED LETTERS WITH HEAVY VERTICALS:

1–**D**–5 1–**P**–5 1–**R**–4 1–**L**–4 1–**K**–4
1–**B**–3 1–**E**–3 1–**F**–3 1–**U**–2 1–**I**–1

STRAIGHT-SIDED LETTERS WITH LIGHT VERTICALS:

2–**N**–2 2–**M**–1

LETTERS WITH ROUND SIDES:

5–**Q**–5 5–**C**–3 5–**G**–2

LETTERS WITH A CENTRAL SPINE:

3–**Z**–3 *–**S**–*

1 Equal to the sidebearing of the H
2 Slightly less than the sidebearing of the H
3 Half of the sidebearing of the H
4 Minimum sidebearing
5 Equal to the sidebearing of the O
* Must be adjusted visually

SIDEBEARINGS FOR LOWERCASE LETTERS

1. Set the left and right sidebearings of the n. The right sidebearing will be slightly thinner than the left, since the arched corner is lighter than the vertical stem. The left sidebearing is 25–50% of the n counter.

2. Test the sidebearings of the n by setting the word "nnnn". The word should be even in color, and neither tight nor loose.

3. Set the left and right sidebearings of the o.
   The sidebearings of the o are smaller than those of the n.

4. Test the o by setting the word "non". The o should appear balanced between the n forms, and the color of the word should be even. If not, revise the sidebearings of the o.

5. Re-test the o by setting the following words:
   "nnonn" "nnonon" "nnoonn"
   Adjust sidebearings of the o and/or n as necessary.

6. Once the n and o are satisfactory, the other lowercase sidebearings can be set as follows:

DIAGONAL LETTERS WITH MINIMUM SPACE:

4–**v**–4 4–**w**-4 4–**x**–4 4–**y**–4

LETTERS WITH SHORT VERTICAL STEMS:

1–**r**–4 1–**m**–2 1–**j**–1 2–**u**–2

LETTERS WITH TALL VERTICAL STEMS:

1–**b**–5 3–**p**–5 3–**k**–4
3–**l**–2 3–**h**–2 3–**i**–1

LETTERS WITH ROUND SIDES:

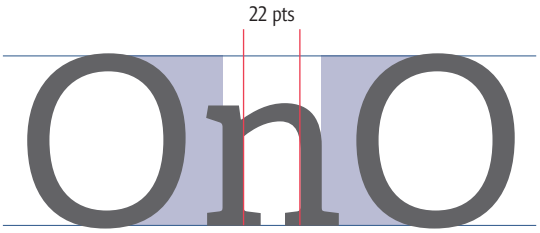
5–**c**–6 5–**e**–6 5–**q**–1 5–**d**–1

IRREGULARLY SHAPED LETTERS:

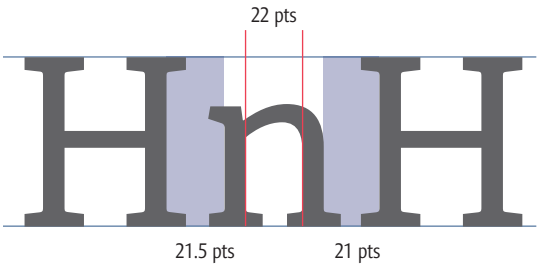
*–**g**–* *–**a**–* *–**s**–* *–**z**–*
*–**f**–* *–**t**–*

1 Equal to the left sidebearing of the n
2 Equal to the right sidebearing of the n
3 Slightly more than the left sidebearing of the n
4 Minimum sidebearing
5 Equal to the sidebearing of the o
6 Slightly less than the sidebearing of o
* Must be adjusted visually

Adapted from *Letters of Credit: A View of Type Design* by Walter Tracy, 2nd edition, 2003 (original printing, 1986). Used by permission of David R. Godine, Publisher.



Above and below, Adelle (Regular).
The capitals need tighter sidebearings in order
to set properly with the lower case.



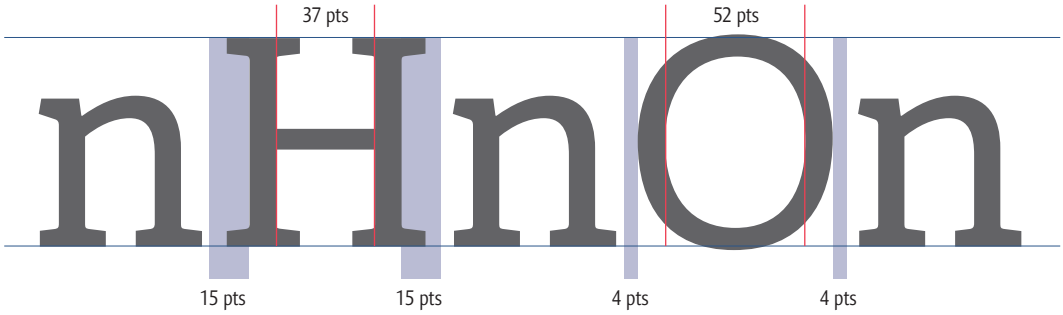
However, there is a known flaw in the Tracy/Smith method: When the upper and lower case are adjusted separately, the capitals will be looser than the lower case. This is visually correct, because the uppercase letters are larger forms with more interior space. However, having more space around the capitals will make them "stand apart" from the lower case in text (they will look too loose).

Therefore, because capitals are more frequently used with the lower case in running text (as opposed to all-capital settings), most type designers make the sidebearings of the capitals tighter than is ideal. Many graphic designers know or perceive this problem, and therefore add tracking to all-caps settings in layout software.

To tighten the spacing of caps, designer Mark Jamra suggests refining the initial spacing of the H and O by setting those letterforms between sets of the lowercase n.[1] Once the best sidebearings for the H and O are determined (relative to the n), the rest of the Walter Tracy/Harry Smith spacing method can be followed.

Today, there are digital tools that use algorithms that can semi-automate the width of letter sidebearings. The LS Cadencer tools developed by designer Frank E. Blokland use a grid to calculate the ideal letterspacing. The grid is adjustable, but it is initially drawn using the width of vertical stems in the font (the "stem-interval"). The HT LetterSpacer tool developed by designer Andrés Torresi also calculates the ideal interletter space, but its formula is based on three variables that users input: 1) the area desired between lowercase letters; 2) how deeply to measure into open counters; and 3) how far to measure into ascender/descender zones. Both of these tools are based on measurements for classic serif and sans serif Latin fonts, and can have unpredictable results when used for display types. The spacing generated by these tools is not perfect; rather, they provide a starting point for further refinement.

To fit the capitals with the lower case, we set the control characters H and O between a series of lowercase n forms.



When spacing is acceptable, the vertical stems form a consistent, regular rhythm.

Testing Spacing

The most thorough test for spacing involves looking at every possible letter combination by setting each character between every other character. A quicker but less thorough test involves setting each letter between a series of o's and n's (Briem, 2001).[2] The Swiss designer and educator Emil Ruder describes yet another spacing test in his 1967 book *Typographie: A Manual of Design*[3] (shown below). Words in the left columns are often difficult to space, while words listed in the right columns are usually free of problems. When spacing is set correctly, all columns should have equal color. If the left columns are darker than the right, the overall set is too tight.

1 Jamra, Mark, "Basic Character Spacing in Type Design," *TypeCulture*, 2004, typeculture.com/academic-resource/articles-essays/basic-character-spacing-in-type-design/.

2 Briem, Gunnlaugur S.E., "Spacing: Useful Texts," 2001, 66.147.242.192/~operinan/2/2.3.5a/2.3.5.10.useful.texts.html.

3 Ruder, Emil. *Typographie: A Manual of Design.* Teufen: Niggli, 1967, pp. 72-73.

AAA ABA ACA ADA AEA AFA AGA AHA AIA AJA AKA ALA AMA…
BAB BBB BCB BDB BEB BFB BGB BHB BIB BJB BKB BLB BMB…
aaa aba aca ada aea afa aga aha aia aja aka ala ama ana aoa apa aqa…
bab bbb bcb bdb beb bfb bgb bhb bib bjb bkb blb bmb bnb bob bpb…

Whitman (Roman). Ideally, each character should be tested by setting it between every other character.

[LEFT COLUMNS]

vertrag	crainte	screw
verwalter	croyant	science
verzicht	fratricide	sketchy
vorrede	frivolité	story
yankee	instruction	take
zwetschge	lyre	treaty
zypresse	navette	tricycle
fraktur	nocturne	typograph
kraft	pervertir	vanity
raffeln	presto	victory
reaktion	prévoyant	vivacity
rekord	priorité	wayward
revolte	proscrire	efficiency
tritt	raviver	without
trotzkopf	tactilité	through
tyrann	arrêt	known

[RIGHT COLUMNS]

bibel	malhabile	modo
biegen	peuple	punibile
blind	qualifier	quindi
damals	quelle	dinamica
china	quelque	analiso
schaden	salomon	macchina
schein	sellier	secondo
lager	sommier	singolo
legion	unique	possibile
mime	unanime	unico
mohn	usuel	legge
nagel	abonner	unione
puder	agir	punizione
quälen	aiglon	dunque
huldigen	allégir	quando
geduld	alliance	uomin

Whitman (Roman). If the left columns are darker than the right, the overall spacing of the font is too tight.
Test words from Emil Ruder and Niggli, Imprint of Braun Publishing AG, Switzerland.

Word Space, Numbers, and Punctuation

The word space is a character with an inherent conflict of interest: The space must be wide enough to separate words, but also narrow enough to encourage the visual grouping of letters into horizontal, stripe-like lines of text.

Traditionally, in the early years of printing, the word space was about half an em; this fraction is called the en. An em is a unit equal to the point size; for example, an em in a 16-point typeface is 16 points wide. The en and em measures were so named because traditionally, the capital N and M fit within these spaces. However, as described previously, metal type was more loosely spaced than digital type is today, and using the en as a word space today would be rather unusual.

In the official OpenType character specifications, a quarter of an em is considered the average word space.[4] Because expanded designs need more space to match their wider counters, the recommended space for wide typefaces is one third of an em, with the maximum set at half an em. Conversely, bold or condensed fonts need a tighter word space. The minimum recommended word space is no less than one fifth of an em. A fifth of an em is traditionally called a "thin space," and is used before and after an em dash.

In practice, contemporary type designers often make the word space approximately the width of an i, including the sidebearings. However, author David Gates advises the width of a lowercase o in his book *Lettering for Reproduction* [1969].[5] Other designers use half the width of a capital O, or the counter width of the lowercase n. The default in most font editors is 240 units of the 1000 unit em, which is slightly less than a quarter of an em.

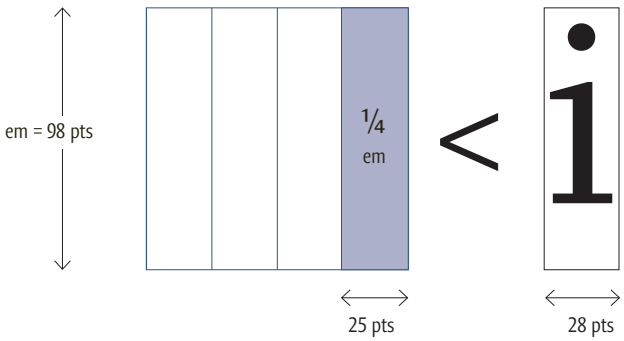
Letterspacing differs for tabular figures (which need to align in tables) and proportional figures (which are spaced for even color). Each tabular figure should be visually centered within a fixed width (usually an en space) to ensure alignment. Proportional figures have varied spacing that depends on the specific shape of the number. Depending on the typeface design, systemization might be possible (for example, one side of the zero could match six and/or nine).

To facilitate use with tabular figures, the comma, period, and colon are centered in half of the width of a number (a quarter em). Some designers make this width narrower (a fifth of an em). The semicolon and single quote can be placed in this same width for consistency. Double quotes require a wider body that is generally twice the width of the single quote.

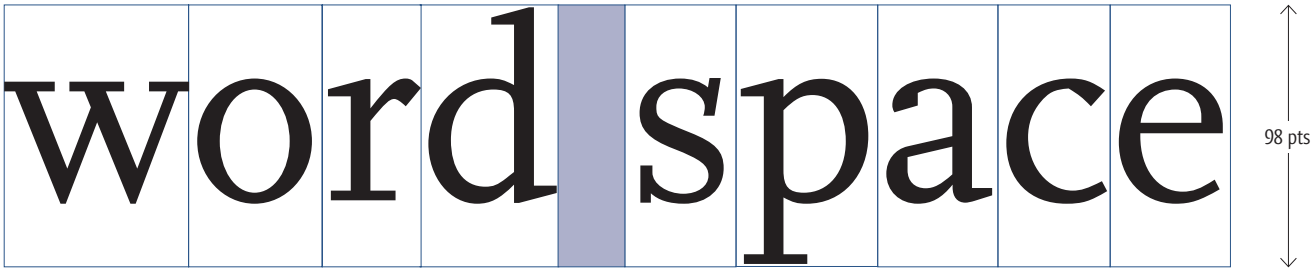
The question mark and exclamation point vary, but often the question uses the double quote width, while an exclamation needs just a bit more than the single quote width. Designers may offset the exclamation mark, question mark, colon, and semicolon subtly to the right. This shift prevents the marks from merging with the preceding letter. It is also possible to draw an alternate colon for use with numbers; a colon for time (e.g. 4:00 pm) often aligns better when it is slightly higher than a colon for letters.

4 "Character Design Standards – Space Characters for Latin 1 – Typography," 2017, docs.microsoft.com/en-us/typography/develop/character-design-standards/whitespace.

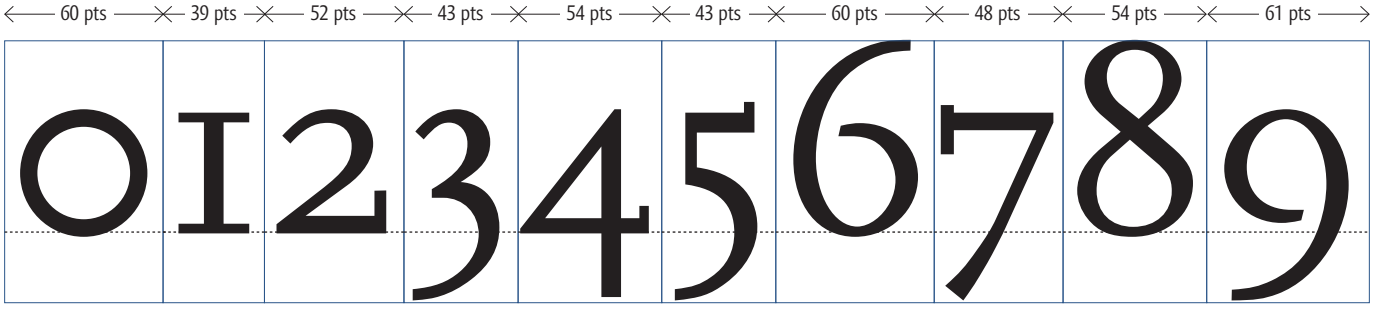
5 Gates, David. *Lettering for Reproduction*. Watson-Guptill Publications, 1969, p. 37.



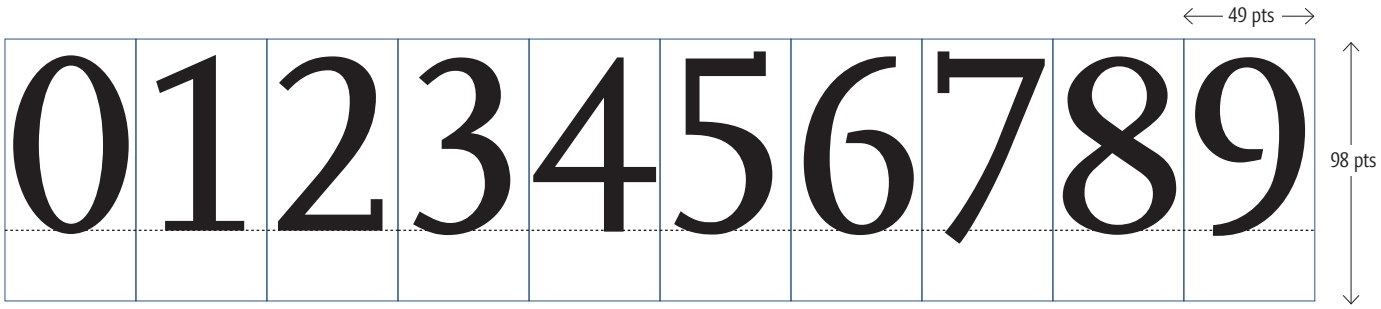
In Scala Serif, the word space is one quarter of the em-space—just a bit less than the width of the lowercase i.



FF Scala (Regular)



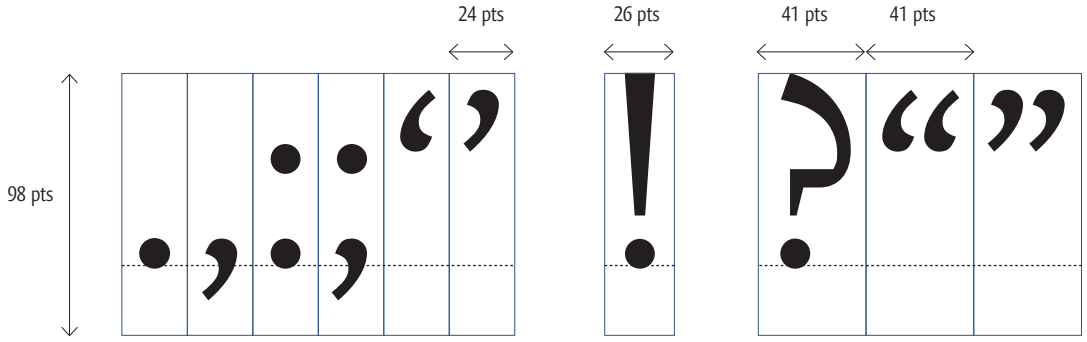
FF Scala (Regular, Proportional Oldstyle Figures)
Proportional figures have varying character widths.



FF Scala (Regular, Tabular Lining Figures)
Tabular figures are centered within an en-space for alignment.

Scala Serif shown at right and below. The word space should be wide enough to separate words, but narrow enough to encourage the visual grouping of letters into horizontal lines of text.

The quick brown fox jumped over the lazy dog. Voyez le brick géant que j'examine près du wharf. Zwölf Boxkämpfer jagen Viktor quer über den großen Sylter Deich. El veloz murciélago hindú comía feliz cardillo y kiwi. La cigüeña tocaba el saxofón detrás del palenque de pajaatur? Lorem ipsum dolor sit amet, consectetur adipiscing elit.



Narrow punctuation is fitted in a quarter em-space, but the exclamation point requires a slightly wider measure.
Wide punctuation (question mark and quotes) use approximately 40% of the em-space.

Kerning

Unfortunately, sidebearings alone often fail to completely resolve the color of a typeface. Certain glyph combinations are unavoidably problematic. For example, Ty is a letter pair that usually needs tighter spacing, since the diagonal of the y can be nested under the crossbar of the T to avoid an awkward gap. Similarly (but more rarely), there are character pairs that need additional space for clarity, or to avoid touching—for example, RX, XA, TY, VT, OC, Co, Bo, So, Dv, vw, vy, and gy). The process of finding and improving these problem character combinations is called kerning.

The term kerning can be confusing, since it had a slightly different meaning when type was cast in metal. In metal type, a kern was a physical component—a part of a letter that extended beyond the outer edge of the metal type body. Kerns were unusual, since the extended form was fragile, difficult to manufacture, and time-consuming to use. However, kerned type enabled far better letter-spacing, since the overhanging element allowed characters to be positioned closer to each other.

Today, kerning is, of course, accomplished digitally. Using font editing software (such as Glyphs or FontLab), designers can specify precise shifts in spacing for any letter pairs. The optimum number of pairs varies according to the overall design. Typefaces that have fairly consistent letter profiles can look good without too much kerning, but display faces without repeating silhouettes need many pairs to produce even color. Additionally, larger type sizes need more kerning than small sizes, since the gaps between letters are more obvious when type is bigger.

The opposite page shows the most commonly kerned letter combinations. When the first edition of this book was published in 2006, a modern font had 500–3,000 kerning pairs. The upper limit was determined by the PostScript format, which was one of two standard formats then in use (the other format was TrueType). Larger numbers of kerning pairs were discouraged, because they increased the size of font files and, more critically, overwhelmed the limited processing capacity of many publishing applications.

However, as of 2007, we have the OpenType font format, which was developed jointly by Adobe and Microsoft and approved by the ISO (International Standards Organization). OpenType fonts can have far more characters (up to 65,535 glyphs) than PostScript (which was limited to 256 glyphs) and therefore, correspondingly more kerning pairs.

To manage kerning information more efficiently, OpenType uses class-based kerning rather than individual pairs. Class-based kerning requires designers to define several groups (or classes) of similarly shaped letters. For example, the A, Ā, Á, Ä, and Ã can be organized into one kerning group. Classes can also be divided into left and right (for example the left sides of the O, C, and G can be defined as a kerning class). Since these letters (or letter sides) need the same amount of kerning, a single value can be propagated to the entire class. The concept is similar to style sheets; many individual instances are replaced with a single array.

Class-based kerning is a powerful, time-saving tool, but its use does require careful planning. If a glyph is missed, it will not be kerned. Additionally, mistakes in class definition can result in unforeseen and undesirable kerns. Luckily, the structure of class-based kerning does allow for exemptions; specific pairs can be assigned a unique kerning value. However, exemptions should be used with discretion: A large number of unique values defeats the efficiencies of the class system.

Harriet Display (Light)

The A is evenly spaced between the verticals of H and N in HAND, but too loose around the V in AVAIL.

"AVA" is kerned tighter.

Adobe Caslon (Regular)

The y is evenly spaced between the verticals of H and b in Hybrid, but too loose after the T in Type.

Kerned; y is nested under the T.

PMN Caecilia (55-Roman)

The v is evenly spaced between vertical i's in civic, but too loose between the round e's in evening.

"eve" is kerned tighter to match the spacing of "ning."

UPPER CASE TO UPPER CASE

AC AG AO AQ AT AU AV AW AY
BA BE BL BP BR BU BV BW BY
CA CO CR
DA DD DE DI DL DM DN DO DP DR DU
DV DW DY
EC EO
FA FC FG FO
GE GO GR GU
HO
IC IG IO
JA JO
KO
LC LG LO LT LU LV LW LY
MC MG MO
NC NG NO
OA OB OD OE OF OH OI OK OL OM ON
OP OR OT OU OV OW OX OY
PA PE PL PO PP PU PY
QU
RC RG RY RT RU RV RW RY
SI SM ST SU
TA TC TO
UA UC UG UO US
VA VC VG VO VS
WA WC WG WO
YA YC YO YS

UPPER CASE TO LOWER CASE

Ac Ad Ae Ag Ao Ap Aq At Au
Av Aw Ay
Bb Bi Bk Bl Br Bu By
Ca Cr
Da
Eu Ev
Fa Fe Ff Fi Fo Fr Ft Fu Fy
Gu
He Ho Hu Hy
Ic Id Iq Io It
Ja Je Jo Ju
Ke Ko Ku Kv Kw Ky
Lu Ly
Ma Mc Md Me Mo
Nu Na Ne Ni No Nu
Oa Ob Oh Ok Ol
Pa Pe Po
Rd Re Ro Rt Ru
Si Sp Su
Ta Tc Te Ti To Tr Ts Tu Tw Ty
Ua Ug Um Un Up Us
Va Ve Vi Vo Vr Vu Vy
Wa Wd We Wi Wm Wr Wt Wu
Wy
Xa Xe Xo Xu Xy
Yd Ye Yi Yp Yu Yv

LOWER CASE TO LOWER CASE

ac ad ae ag ap af at au av aw ay ap
bl br bu by
ca ch ck
da dc de dg do dt du dv dw dy
ea ei el em en ep er et eu ev ew ey
fa fe ff fi fl fo
ga ge gh gl go gg
hc hd he hg ho hp ht hu hv hw hy
ic id ie ig io ip it iu iv
ja je jo ju
ka kc kd ke kg ko
la lc ld le lf lg lo lp lq lu lv lw ly
ma mc md me mg mn mo mp mt mu mv my
nc nd ne ng no np nt nu nv nw ny
ob of oh oj ok ol om on op or ou
ov ow ox oy
pa ph pi pl pp pu
qu
ra rd re rg rk rl rm rn ro rq rr rt rv ry
sh st su
td ta te to
ua uc ud ue ug uo up uq ut uv uw uy
va vb vc vd ve vg vo vv vy
wa wx wd we wg wh wo
xa xe xo
ya yc yd ye yo

UPPER CASE WITH PUNCTUATION

apostrophe	A’ L’ and ‘S
quotes	A” L”
period	B. C. D. F. J. N. O. P. S. T. U. V. W. Y.
comma	B, C, D, F, J, N, O, P, S, T, U, V, W, Y,
semicolon	F; P; T; V; W; Y;
colon	F: P: T: V: W: Y:
hyphen	T- V- W- Y-

LOWER CASE WITH PUNCTUATION

apostrophe	f’ and ‘s ’t
period	b. d. e. f. g. j. o. p. r. s. t. v. w. y.
comma	b, d, e, f, g, j, o, p, r, s, t, v, w, y,
hyphen	r-

In general, the most problematic characters to space are the open-sided and diagonal forms: rt, jp, vwy, LT, JP, VAWY, 47. The exact number of kerning pairs depends on the specific design of the font. Consistent forms require less kerning. The most commonly kerned pairs are shown in the table above.

Left, a metal type kern from the typeface Cloister. The swash of the N extends beyond the metal type body. From the type collection of Springtide Press.

METRICS
Adobe Caslon with designer's spacing/kerning
Note tighter "VE"

OPTICAL
Adobe Caslon with Adobe's algorithm
See looser "VE"

Prior to the OpenType format, both pair kerning and class-based kerning had limited value, because not all software applications recognized or implemented the kerning information embedded in a font. However, today most office and desktop publishing systems support class-based kerning. In fact, some publishing software, such as Adobe InDesign and Adobe Illustrator, even offer graphic designers a choice of kerning: "optical" or "metrics." Metrics preserves the kerning created by the type designer. Optical overrides the designer's kerning table with Adobe's algorithm. In general, optical kerning should only be used when the font is poorly crafted, or when two consecutive characters belong to different fonts. In the latter case, neither font's kerning table is likely to offer good results.

As in letterspacing, there are now digital tools that can automate or semi-automate kerning. Type designer Mark Frömberg developed Kernkraft, a plugin for Glyphs that scans characters in a font and produces a table of all possible kerning pairs. BubbleKern, a program developed by Toshi Omagari, a designer at Monotype, goes a step further.[6] BubbleKern calculates the actual kerning pairs based on outlines (bubbles) that you draw around each of your glyphs. Note that both of these tools provide a starting point rather than final, finished kerning—manual fine-tuning is still required.

Both spacing and kerning are tedious tasks that require focus and concentration. The fitting of sidebearings comes first, because kerning is a support and further refinement of the initial spacing. A well-crafted typeface should still set adequately without kerning. During the completion of these phases, it may again be necessary to redesign specific letters in order to resolve spacing—not all settings can be optimized with sidebearing and kerning adjustments. The need to review and revise character outlines and fit should not be perceived as discouraging. Type design is a slow and iterative activity; spacing is a task that may take months—and, sometimes, years—rather than hours and days. In the words of designer Jan Tschichold: "Type, like all art, is not for the impatient ones."

6 Omagari, Toshi "Bubble Kern, ATypI 2016, Warsaw," atypi.org/type-typography/bubblekern.

UPPER CASE

Proportions

In the *Theory of Type Design* [2018], author and type designer Gerard Unger describes proportions as the "floor plan" of a typeface.[1] Just as a floor plan reveals the basic structure of an architectural space, specific typographic measurements form the framework upon which a typeface is built. Unger lists the following critical components of the typographic floor plan:

the ratios between x-height, capital height, and overall height
the position of the baseline and x-height within the total height
the average width for all signs (normal, condensed, wide), and
the relative widths of individual characters (l,n,m)

The beauty of proportion is easily overlooked in our modern world; we are more concerned with surfaces in "the society of the spectacle." However, letters are ancient constructions; they came from cultures that examined, in depth, the ideal ratio of width to height. At any rate, we have little choice but to take the issue of proportion seriously. Proportion is one of the few aspects of type design that we can control and manipulate; we have little chance of proposing new letters, or even altering the basic shape of existing ones.

The capital letters can be designed following two different proportional systems: classic (also called old style) and modern. Classic proportions are based on ancient inscriptional models. For both esthetic and practical reasons, the Romans used a square or geometries of a square (the golden rectangle and the root five rectangle) for the widths of the capital letters.

In his 2014 book *The Art of Letter Carving in Stone*, stone carver and calligrapher Tom Perkins analyzed the Roman capitals carved in the base of the Trajan column in Rome and determined:[2]

M, O, Q are square
L, K, S, X are half-square in width
B, E, F, I, J, P are the width of a root five rectangle
A, H, R, T, U, Y, Z fit within two stacked golden rectangles
C, D, G, N, V are the width of two root five rectangles
W fits within a square with a root five rectangle

In practice, many typefaces described as having classic proportions do not strictly conform to this theoretical model. They have broader and narrower widths, but their proportions are not exactly square or specific ratios of a square. Although the Roman capitals are beautiful and graceful, they can be impractical, since they result in wide letters that require generous spacing. Classic proportions may also be limiting, since they cannot be used for condensed or expanded width designs. Additionally, classic proportions produce capitals with uneven color—the narrow letters can be darker than the expanded forms.

In contrast, modern proportions prioritize the goal of even color. That is, if we consider a letter to be a formal composition of black and white (with black letter strokes and white negative space inside and around the letter), each composition should optically mix to create the same shade of tonal gray, with no lighter or darker spots in a line of text. Said another way, each letter needs to contain the same amount of white space. Researchers believe that even color promotes readability, because random changes in letter color create lighter and darker areas in text that can fatigue readers.

Classic proportions are usually used for Venetian and Garalde typefaces. Transitional types vary: In some, proportions are modern and uniform, but in others, variations in the width of the capitals are clearly apparent. Didone and slab serif typefaces almost always have modern proportions.

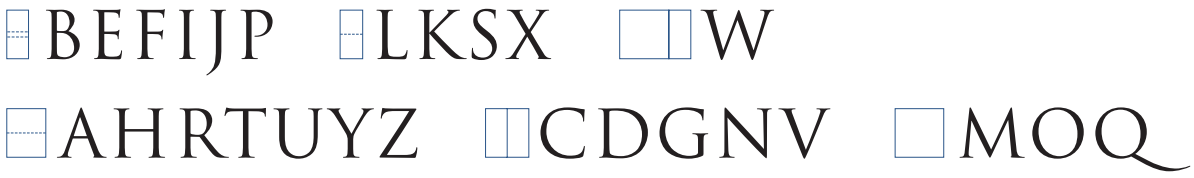
Sans serif capitals may be designed with either classic or modern proportions. Humanist sans serifs (such as Quadraat Sans and Gill Sans) typically have classic proportions. Geometric sans serifs (such as Futura and Gotham) are, as their name implies, based on perfect or near-perfect circles and squares. However, grotesques and neo-grotesques usually have modern proportions. The hallmarks of the modernist movement were simplicity and objectivity; the even color and spatial efficiency of modern proportions naturally align with these ideals.

The concept of two distinct proportional systems is traditional and perhaps somewhat conservative. Display and/or experimental typefaces have deliberately violated this norm. For example, the typeface Anisette by Jean François Porchez has both wide and narrow capitals; these styles may be used individually or combined in the included discretionary ligatures. Similarly, Peter Biľak's Neue (an all-capitals design commissioned for the New School in New York City by Paula Scher of Pentagram, see p. 13) includes three different widths as well as a "random" style that mixes the three proportions together. In his review on *Typographica*, designer Tobias Frere-Jones described this random mix as "jarring" but also arresting and energetic—succeeding even though "tradition and psychology tell us that compact and super-wide shapes do not go together."[3]

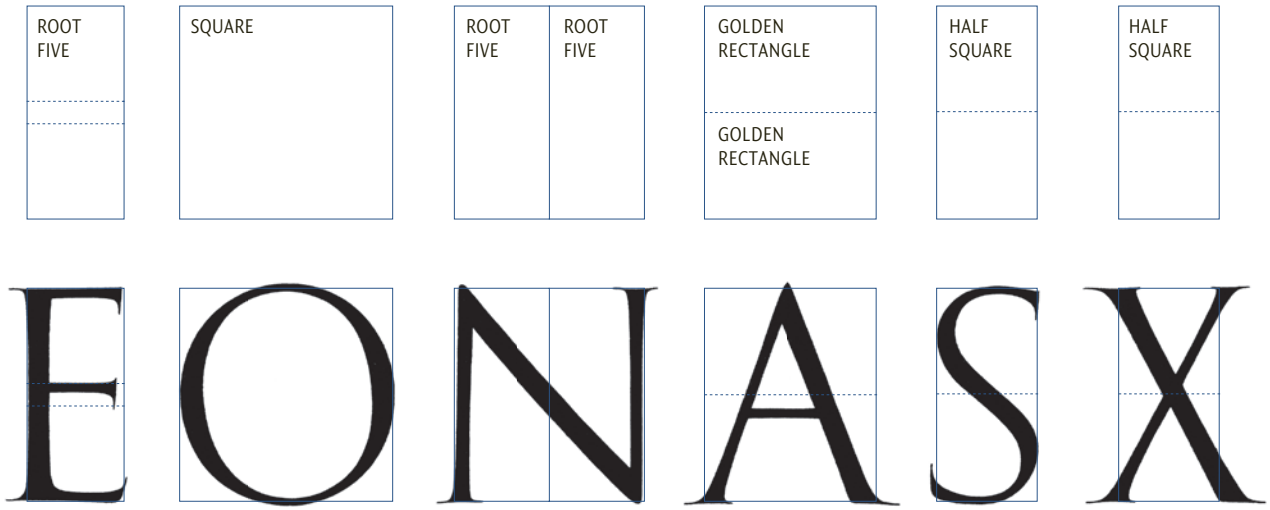
1 Unger, Gerard, *Theory of Type Design*, Rotterdam: nai010, 2018, p.105.

2 Perkins, Tom, *The Art of Letter Carving in Stone*, Marlborough: Crowood Press, 2014, pp. 78–82.

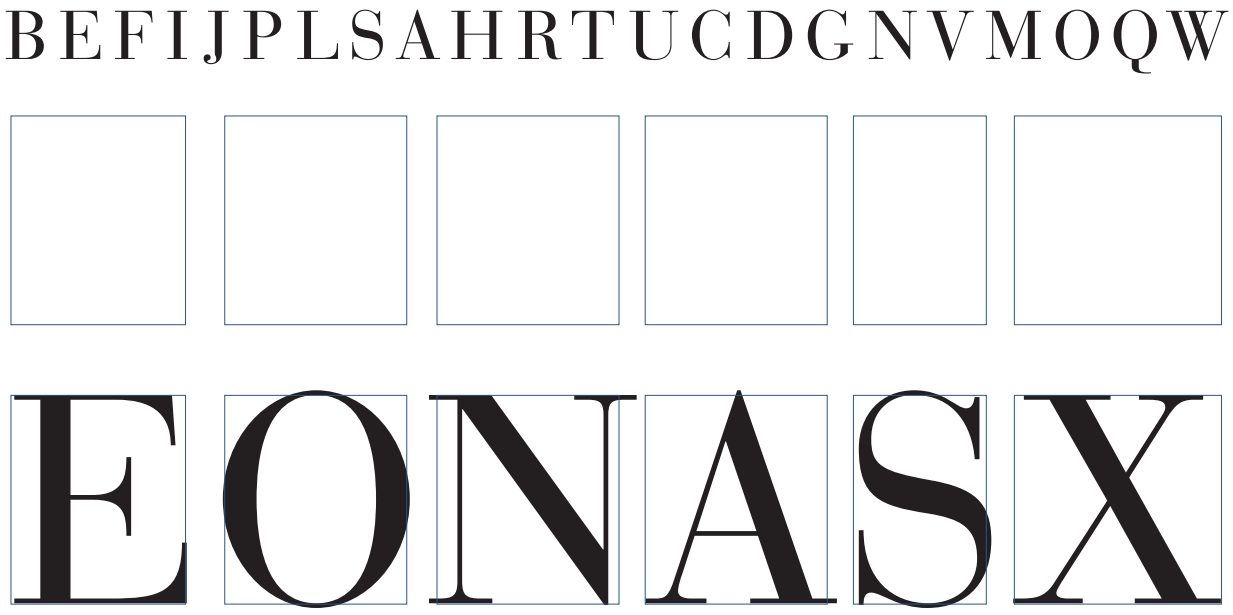
3 Frere-Jones, Tobias, "Neue," *Typographica*, 2016, typographica.org/typeface-reviews/neue/.



Trajan (Regular)



Trajan Capitals (drawn by Tom Perkins)
Classic Proportions



Bauer Bodoni (Roman)
Modern Proportions

Capital O

In general, text typefaces have capital O shapes that are circular or oval. Rectangular, square, and even diamond-shaped O forms exist in display fonts (see two examples of octagonal, Grecian designs below), but they can cause problems as a typeface system expands. The design of the O impacts all other round letters; a square O logically leads to a square C, G, Q, and so on. An unusually shaped O might also reduce legibility: How will a square O be different from a straight-sided D? Additionally, from a formal perspective, eliminating curves in a typeface means removing a basic and essential contrast: circular shapes against squares, rectangles, and diagonals.

Of course, we can be less rigid in applying the design principle of consistency. A font could have a square O, but a round C and G. However, there does need to be a kind of logic, method, or set of principles that guide how letters are constructed. For example, all open-sided letters could be round, but enclosed letters square. The goal is to avoid designing individual letters as arbitrary or random exceptions, because these outlier glyphs jump out in a typeface and cause the overall design to be less coherent.

SERIF CAPITAL O

In early serif typefaces (Venetian and Garalde), the O is almost perfectly circular, with low contrast and angular stress. These attributes stem directly from the early calligraphic models that were created by professional writers, known then as scribes. Scribes used ink pens with nibs that had broad and narrow flat sides; when held in the right hand at a 30 to 45-degree angle, these pens made thick-thin strokes with oblique emphasis.

Typically Venetian typefaces are more calligraphic and have the most dramatically angled stress; Garalde designs are more moderately tilted. In later serif typefaces (transitional and Didone) the O becomes more oval and upright, and has higher contrast, owing to changes in culture and philosophy—as well as advances in technology (thin strokes were made possible by new alloys of harder metal). When slab serifs and sans serifs emerge, contrast diminishes and weight increases, largely due to the need for bolder voices in a more commercial environment. Type designer Eric Gill found these heavy styles "overbold" and even "fatuous," but acknowledged that in his time, "every advertisement has to try and shout down its neighbors."

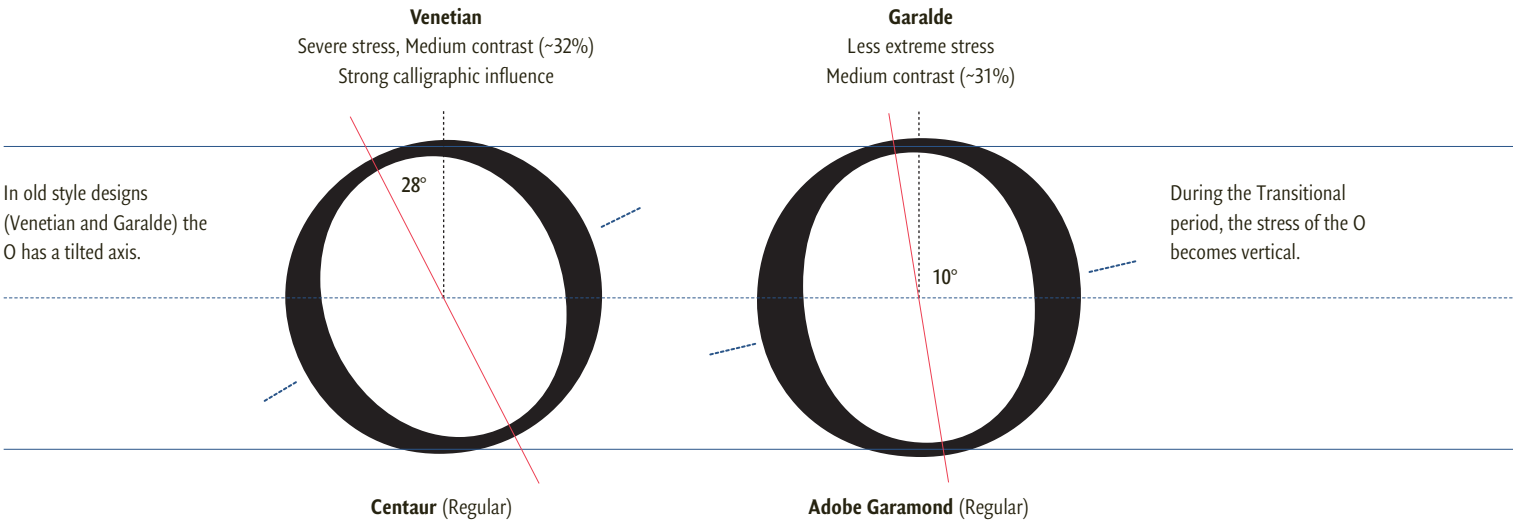
United Serif (Condensed Heavy)

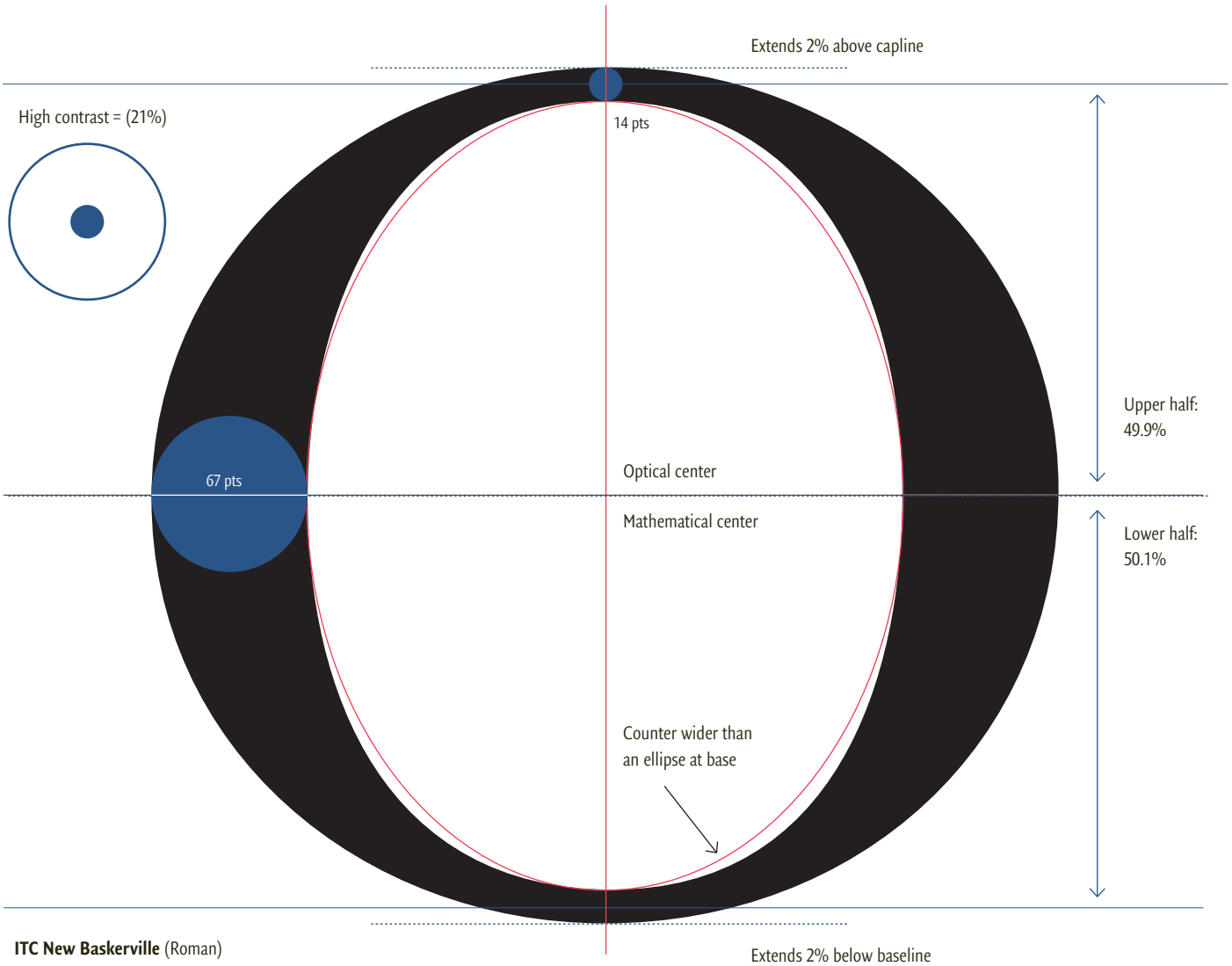
VOYEZ LE BRICK GÉANT QUE J'EXAMINE PRÈS DU WHARF.

Acropolis (Black)

VOYEZ LE BRICK GÉANT QUE J'EXAMINE PRÈS DU WHARF.

United Serif and Acropolis are two examples of Grecian designs—typefaces that have beveled, straight-sided letters. Note how the bevels are applied to all round glyphs. The straight sides of the glyphs allow the typeface to be set very tightly.



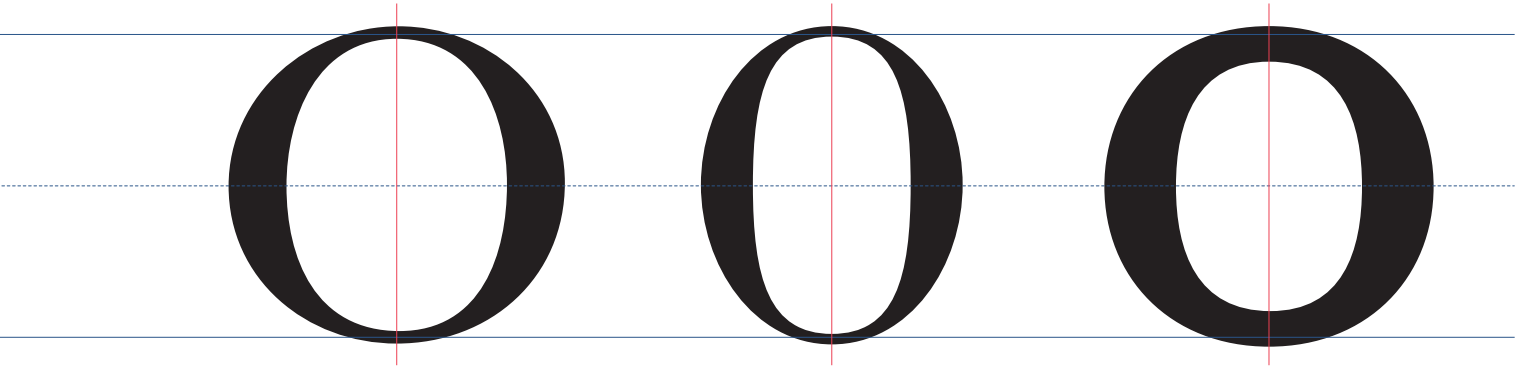


ITC New Baskerville (Roman)

Transitional
Vertical or near vertical axis
High contrast (~21%)

Didone
Vertical axis, high contrast (~24%)
Delicate, upright oval form

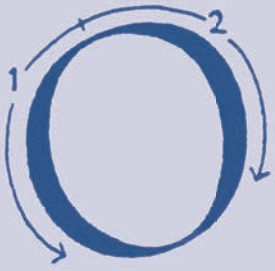
Slab Serif
Vertical axis, low contrast (~49%)
Bold, squarish form



ITC New Baskerville (Roman)

Bodoni (Roman)

Clarendon (Medium)

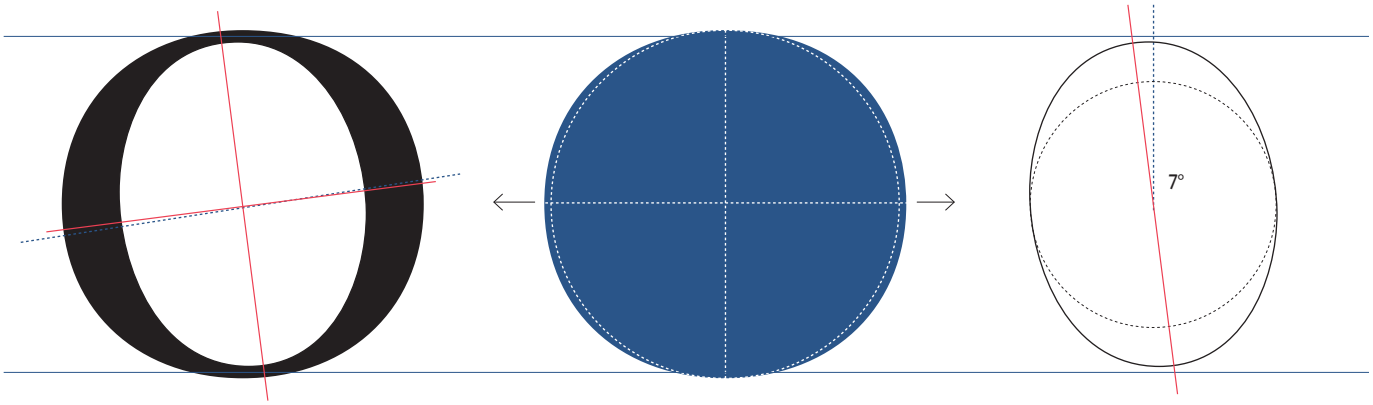


Capital O by author and calligrapher Michael Harvey
from his 1996 book *Creative Lettering Today*.

OBLIQUE STRESS

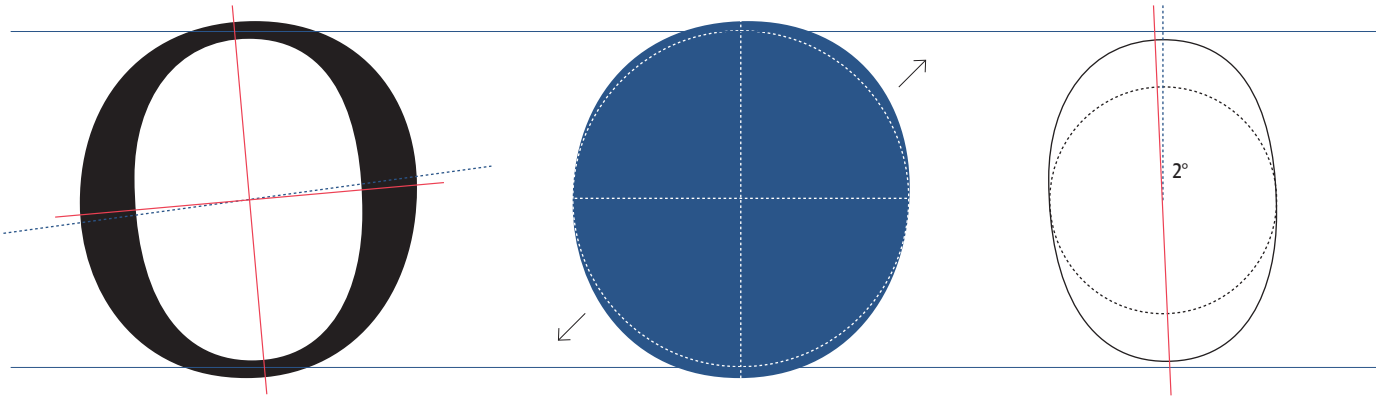
An O with oblique stress is the result of two-stroke calligraphic construction. You can examine the contours of a tilted O by drawing an O with a broad-nib pen or a double pencil. The axis of the inner form is different from that of the outer form; a tilted O is not merely an upright O that has been rotated.

Note that the inner form of the O is not necessarily a perfect geometric ellipse. The counter is usually wider at the top and bottom (it has more "shoulder") to avoid creating an unattractive, pointed, diamond-like shape (we will have true diagonal shapes when designing the V, A, W, X, K, etc.). Similarly, the outer form of the O is not always a perfect circle. The optical center is often lower than the mathematical middle. The capital O might also be flatter or heavier at the base to help the letter optically rest on the baseline. The O might also have subtle exaggeration at the upper right and lower left of the exterior contour (again, a vestige of the original calligraphic construction).



ITC Galliard (Roman)
High contrast = 19%

Wide form



Méridien (Roman)
Medium contrast = 32%

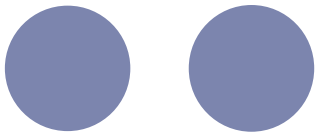
Strong thrust at lower left and upper right

SANS SERIF CAPITAL O

The sans serif O has the same basic construction as its serif counterpart. It has a vertical or diagonal axis, and it overshoots the baseline and capline. In general, most sans serif types have an upright axis. However, humanist sans serifs are more closely based on calligraphic Renaissance models, and these designs may have an oblique axis.

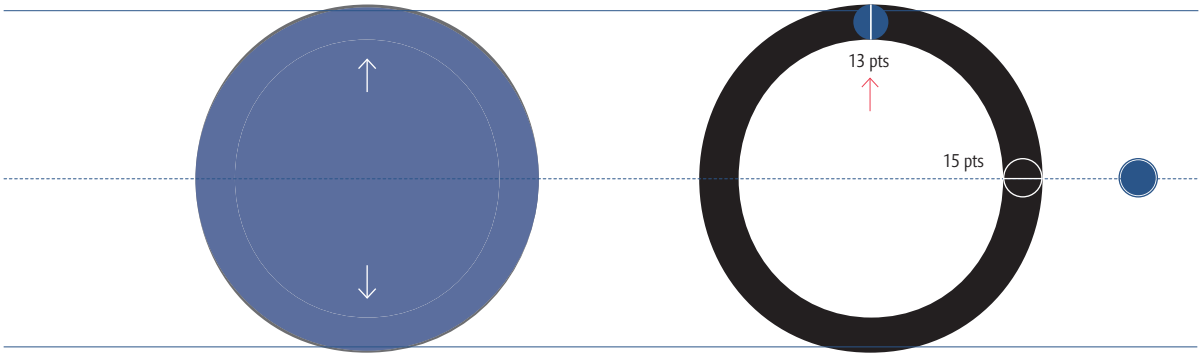
In geometric sans serifs, the O often appears to be an exact circle. However, this is usually an optical illusion. The human eye exaggerates the horizontal dimension. According to author Peter Karow, on average, circles and squares must be slightly taller (about 1%) than their width in order to appear mathematically correct.[4]

Humanist sans serifs and grotesque types tend to have more contrast than neo-grotesques and geometric sans serifs, but in general, sans serifs have low contrast, and can even appear to be monoline. However, so-called "monoline" types are often drawn with very subtle contrast (see Gotham, shown below).



Left, a true mathematical circle.
Right, a circle that is 1% taller than its width.

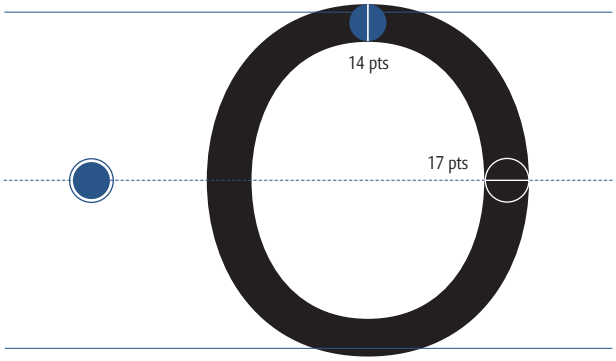
4 Karow, Peter. *Digital Typefaces: Descriptions and Formats*, Berlin: Springer-Verlag, 1994, p. 12.



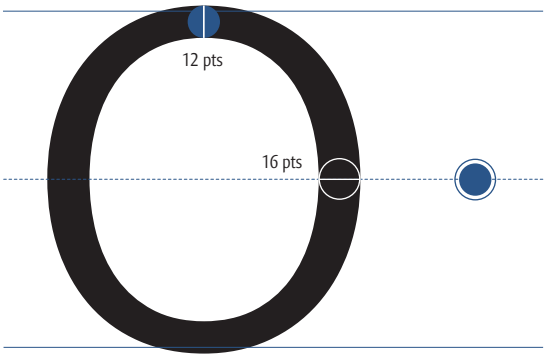
Gotham's O (shown in gray) is 1% taller than a true circle (shown in blue).

The stroke width narrows subtly (not a true monoline).

Gotham (Book)
Very low contrast = 88%



Helvetica Neue (55-Roman)
Very low contrast = 85%



Quadraat Sans (Regular)
Very low contrast = 77%

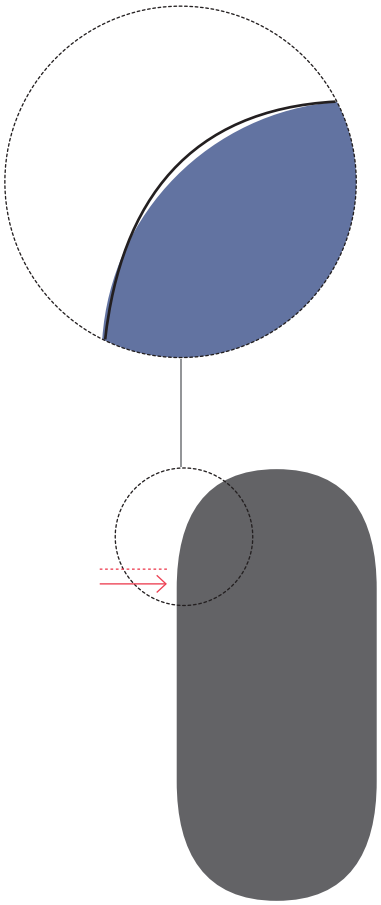
A squircle (left) and a rounded rectangle (right).
On the rounded rectangle, cusp points are visible where
the straight line segments meet corner curves.

THE BONE EFFECT

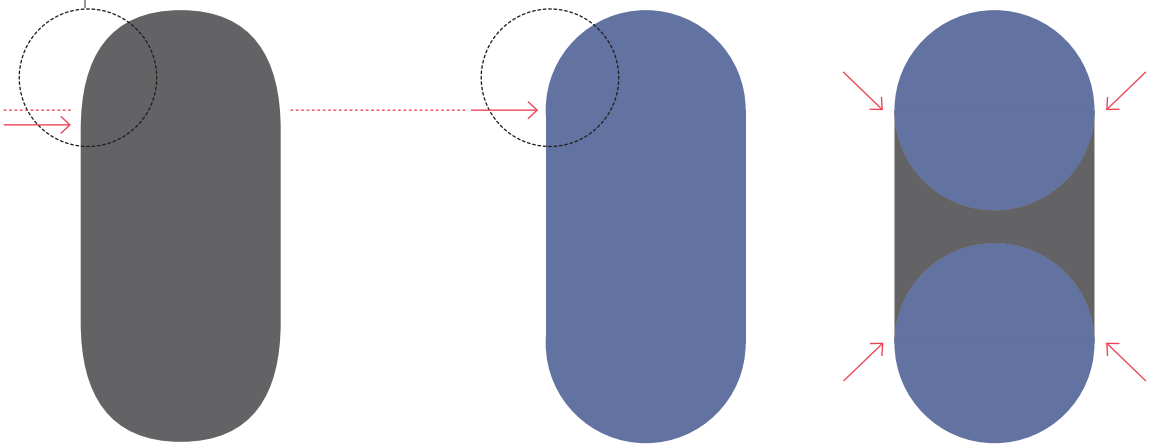
The O is often squarish or rectangular in Didone, slab serif, and sans serif typefaces. However, the contours of both the inner and outer forms are sometimes subtly rounded rather than being perfectly straight. Rounding avoids creating an optical illusion known as the "bone effect"in which vertical sides appear to flex inward.

If straight vertical sides are part of the desired visual language for your typeface (as in DIN, for example), the bone effect can still be reduced by easing the transition between straight and curved segments. Specifically, many designers recommend using an Euler curve (which is also called a clothoid). The Euler curve is used for motorways and roller coasters; it is unique in that its curvature increases with distance. In type design, this means that the tangent end of an Euler curve can connect smoothly with a straight segment, then progressively unfurl into an arched branch or bowl without any conspicuous "cusp" points. Several digital font editors incorporate or imitate the Euler Curve in their "visual correction" tools.

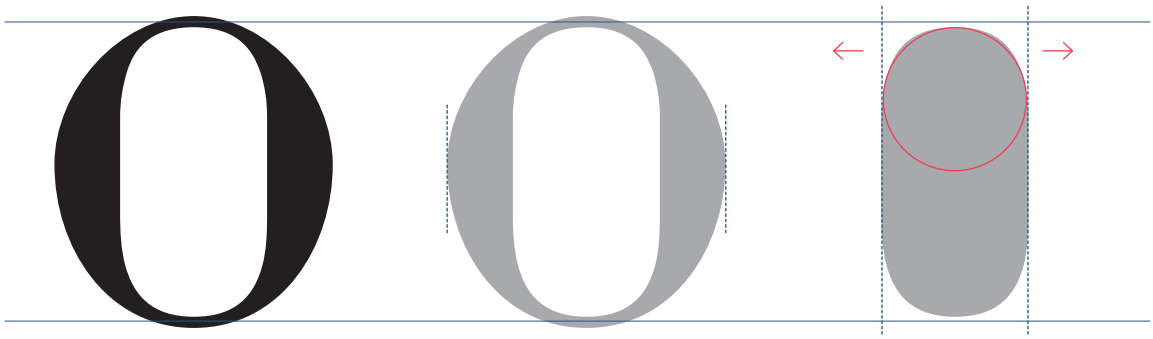
Another way to optimize a squarish O while still avoiding the bone effect is to use a "superellipse"—an ideal version of a rounded rectangle popularized by the Danish poet and architect Piet Hein, who used the shape in both urban design and furniture. Many contemporary typefaces (including Hermann Zapf's Melior, House Industries's Velo Serif/Sans, and Stéphane Elbaz's Pilat) use or emulate either a superellipse or a square version of a superellipse called the "squircle" (a portmanteau of "square" and "circle").



In the gray shape, the curve transition has been softened.
The curve begins lower, and "bumps out" higher.
In the close-up, the blue form shows the unrefined shape;
the black line is the improved, eased form.



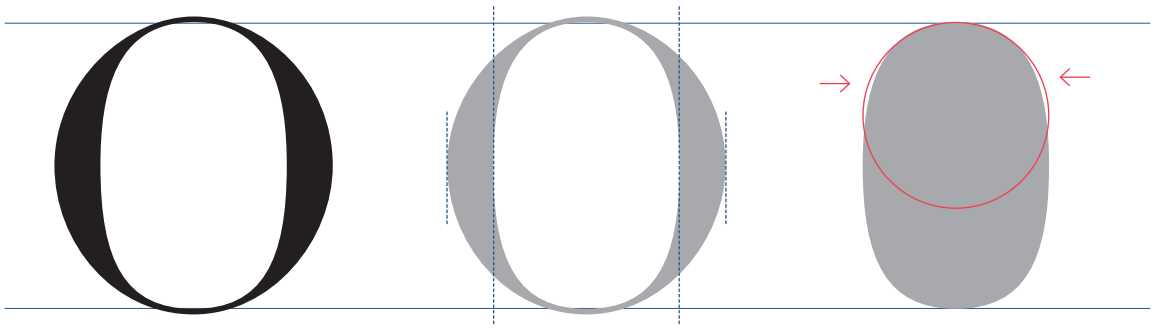
The two blue shapes above are composed of two half circles joined to a rectangle.
Notice the "bone effect" and visible transition "cusp" points.



Bodoni (Regular)

Exterior rounded, but interior sides close to vertical. Bone effect visible (mostly from counter).

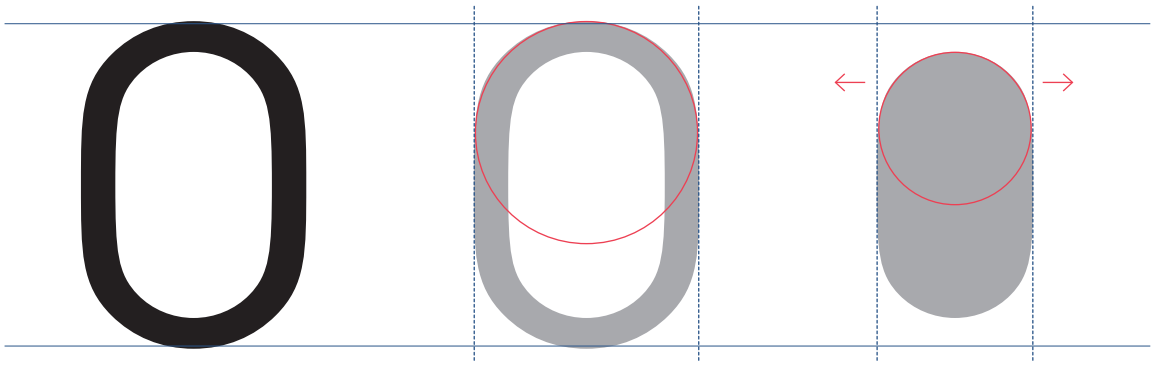
Counter subtly wider than a true circle



LT Didot (Regular)

Bone effect minimized by rounding exterior and interior contours

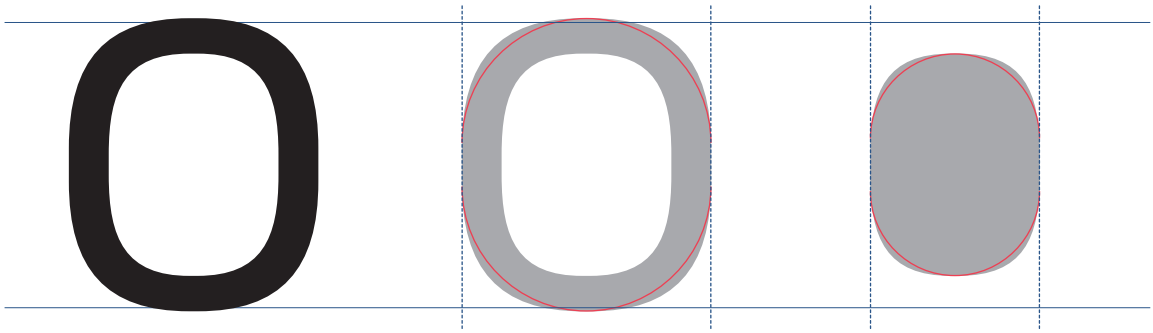
Sides of counter are gently sloped



FF DIN (Regular)

Exterior and interior sides close to vertical

Counter very subtly wider than a true circle



Pilat (Book)

A superellipse has broader, squarish shoulders (half circles shown with red lines)

Counter broader than a true geometric circle

Capital E

The O is one of two control main characters for the upper case—a basic glyph that sets the character width and stroke weight for all curved letters. Typically the H is the other control character, since it shows the vertical stroke weight (and the visual center) for all square letters. However, in a beginning class on type design, I sometimes assign the E rather than the H. The E often has more personality than the H, because the structure is more varied. Also, the E demonstrates the proportional system more clearly, since it is a narrow letter (when using classic proportions).

Specifically, in the classic system, the width of the E is based on a root five rectangle. In the modern system, the width of the E is based on even color. Because the E contains more space than the O, a modern E should be slightly narrower than the O.

The horizontal arms of the E have the same thin horizontal thickness. However, the length of the arms can vary: The central arm is usually the shortest, and the bottom arm is the longest.

The visual center of the E is slightly higher than the midline (the mathematical center). In some typefaces, this asymmetry is exaggerated to reference a specific style. As designer Paula Scher explains in the 2017 Netflix documentary series *Abstract*, "if you raise the crossbar of an E, it looks Art Deco… but if you lower the crossbar, it looks Moderne."

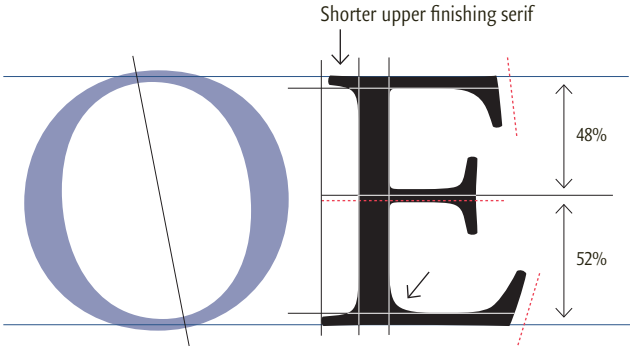
SERIF CAPITAL E

The E has five serifs. The two serifs on the left of the vertical stem are finishing serifs, while the three on the arms are balancing serifs. The length and width of the finishing serifs often match the horizontal and vertical stroke widths (a decision that fits with the logic of calligraphy), but designers do make them larger or smaller as desired. The lower finishing serif is often longer than the upper to increase the weight and stability of the E on the baseline.

The balancing serifs are literally named; they provide visual weight that counterbalances the heavy weight of the main vertical stem. Since the three arms of the E are different sizes, the serifs also vary: The bottom serif is the largest; the center is the smallest; and the top serif is in between. The heavier bottom serif visually anchors the E on the baseline.

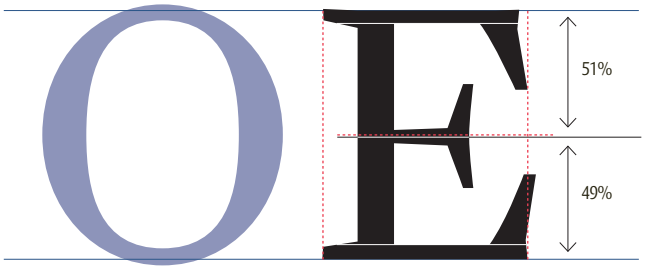
SANS SERIF CAPITAL E

The E establishes an important aspect of the overall design of a sans serif: the stroke endings. In humanist sans serifs, the arms of the E may be sheared at an angle to suggest the use of a calligraphic pen. Alternatively, as discussed previously (see p. 37) the ends could be rounded, subtly blunted, or shaped in other ways, as long as there is design logic to these decisions.



Adobe Garamond
(Regular)

Large lower interior bracket;
subtle upper interior brackets

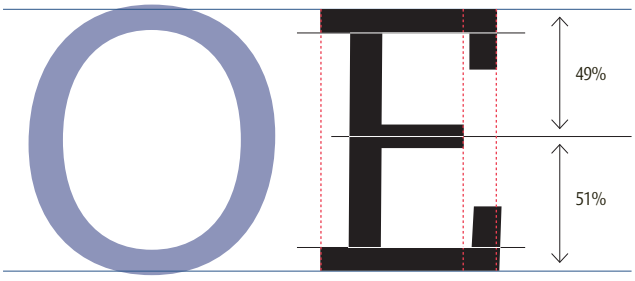


Rosart
(Regular)

Top heavy form;
unbracketed wedge serifs

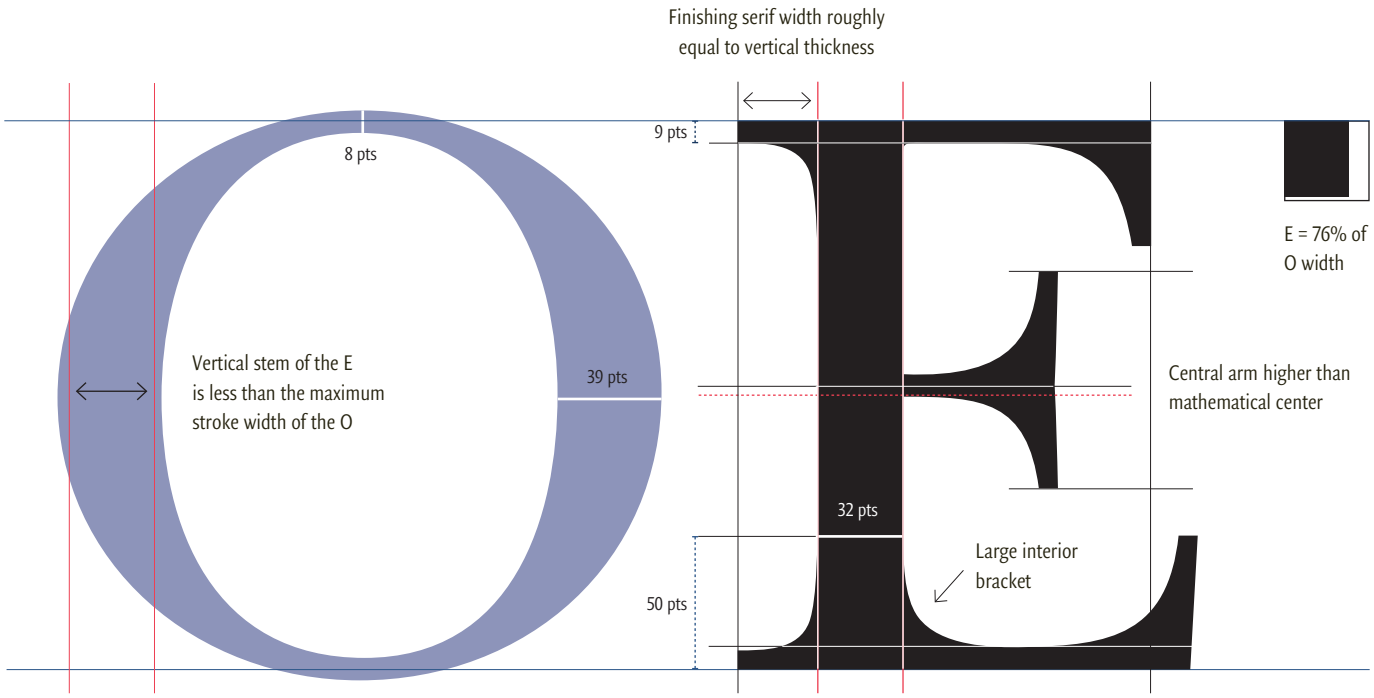
Quadraat Sans
(Regular)

Angled stroke endings
recall calligraphy

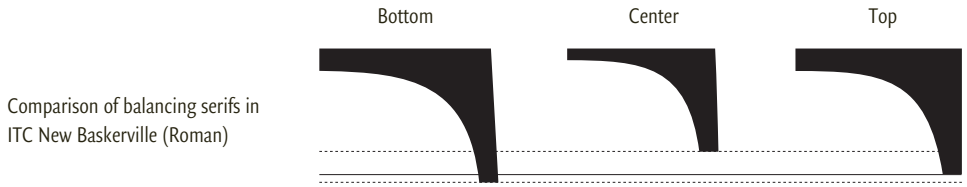


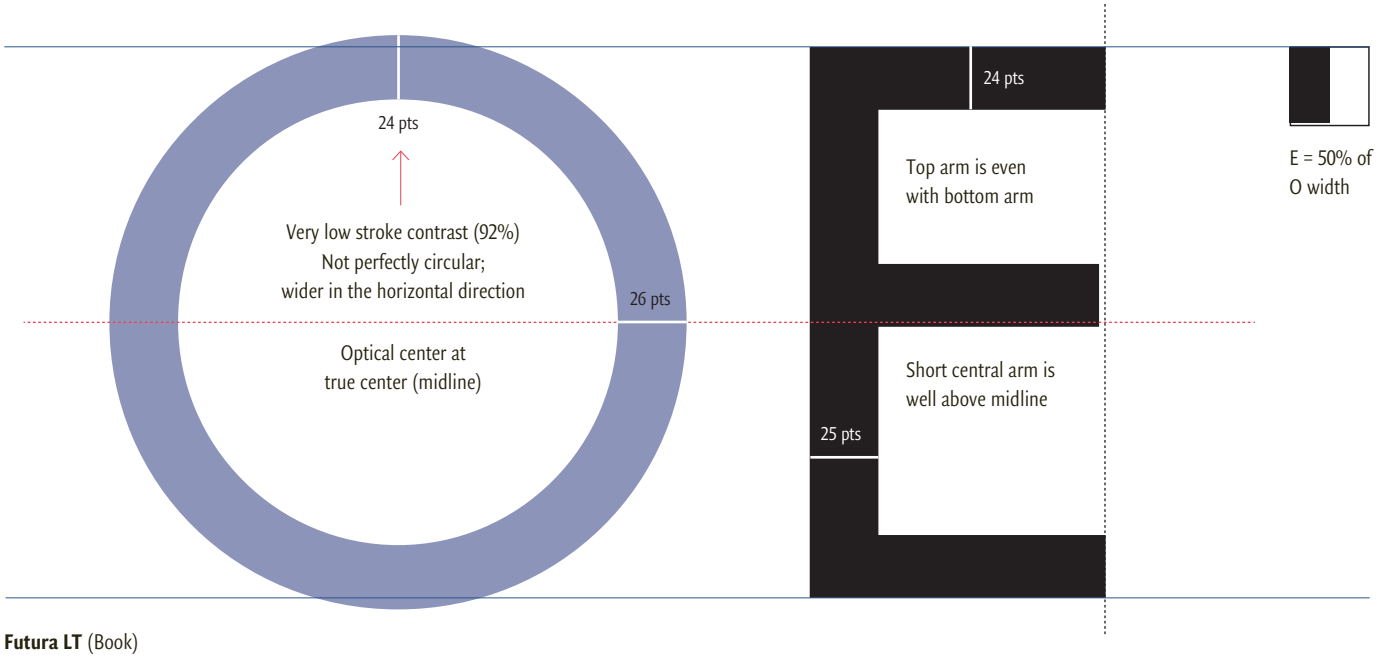
PMN Caecilia
(55-Roman)

Color is improved by
removing center serif



ITC New Baskerville (Roman)





Futura LT (Book)

Capital F, H, I, L, and T

The F, H, I, L, and T are closely related to the E. The I can be drafted quickly, since it is a single vertical stem. The H is also simple: two vertical stems connected by a horizontal crossbar. The crossbar of the H should align with the center arm of the E.

In a happy coincidence, both the classic and modern proportional systems yield the same result: an H that is slightly narrower than the O. Essentially, the two vertical stems should be slightly tighter than the sides of the O. This placement allows the square counters of the H to hold as much space as the O's round interior. However, note that this general rule only holds true for a normal-width and normal-weight H. In condensed or bold fonts, the H may need to be the same width as the O—or even wider, because the two heavy stems of the H can appear to optically converge when set close to each other.

On the Trajan column, the T and H have the same width: Both fit within two golden rectangles. In the modern system, the T is slightly narrower than the H. As discussed earlier (see p. 52), the T is a letter that creates spacing problems, because its structure pushes other characters away. Shortening the arms of the T helps to alleviate this issue. A narrower T also addresses an optical illusion where the T tends to look wider than it really is (because of the long horizontal crossbar). A narrower T is also darker, which helps this single-stem letter better match the other capitals. If still more density is needed, the crossbar can be subtly thickened.

In the classic system, the F is the same width as the E (on the Trajan column, both are root five rectangles). The L is slightly wider, since it is fitted to a golden rectangle. In the modern system, one can begin making the F and L by copying the E and deleting one or two arms. Unfortunately, that leaves an F and L that are both too light. On the F, the center arm can be subtly lowered to fill the open gap. Still more density can be achieved by making the F and L narrower. A narrow L has the added benefit of avoiding common spacing problems: LA/La, LO/Lo, and so on.

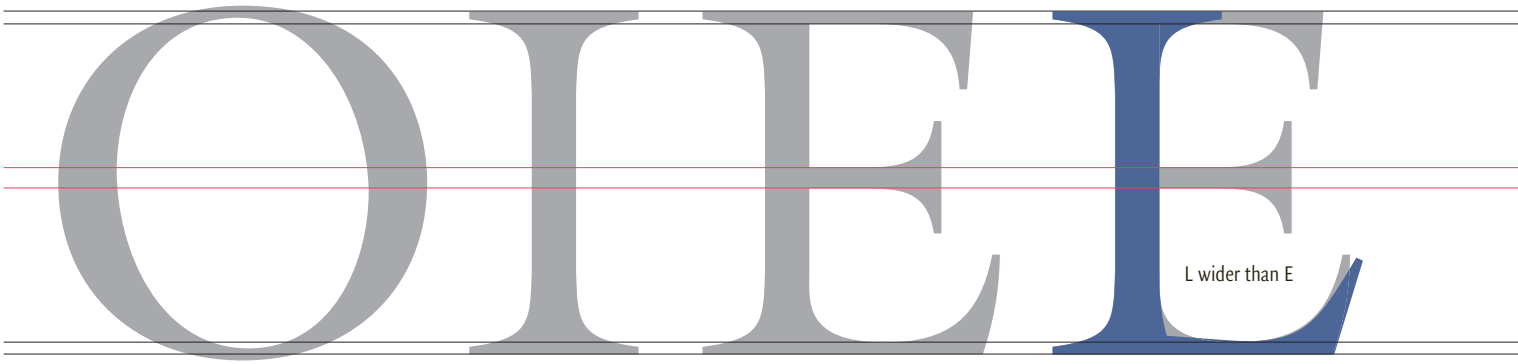
SERIF CAPITAL T, F, L

In Venetian and Garalde typefaces—or any design influenced by calligraphy—the serifs of the T may be asymmetric (see Adobe Garamond at right, which has a tilted left serif and a vertical right serif). In the more rational transitional, Didone, and slab serif typefaces, the crossbar serifs of the T usually match the balancing serifs of the E. However, if the letters T, F, and L seem too light (due to their open areas), the balancing serifs can be enlarged.

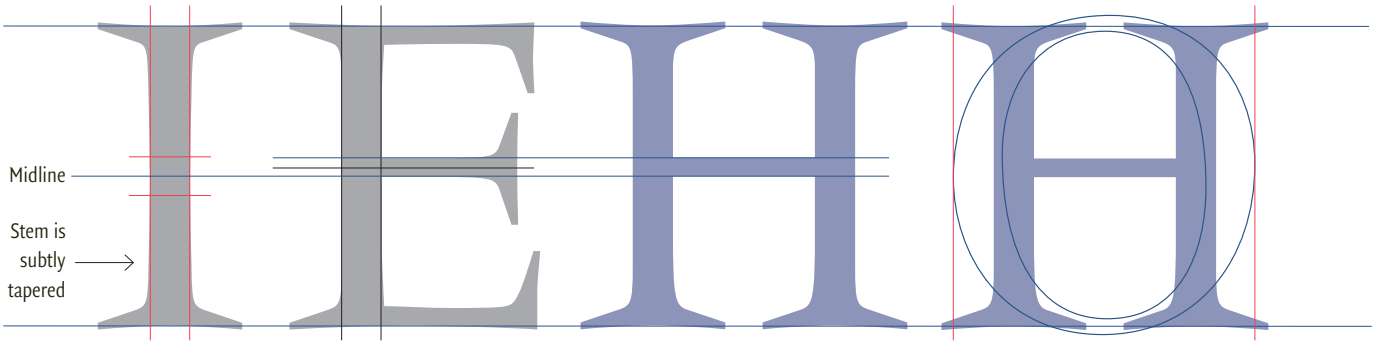
VOYEZ LE BRICK GÉANT
QUE J'EXAMINE PRÈS DU WHARF

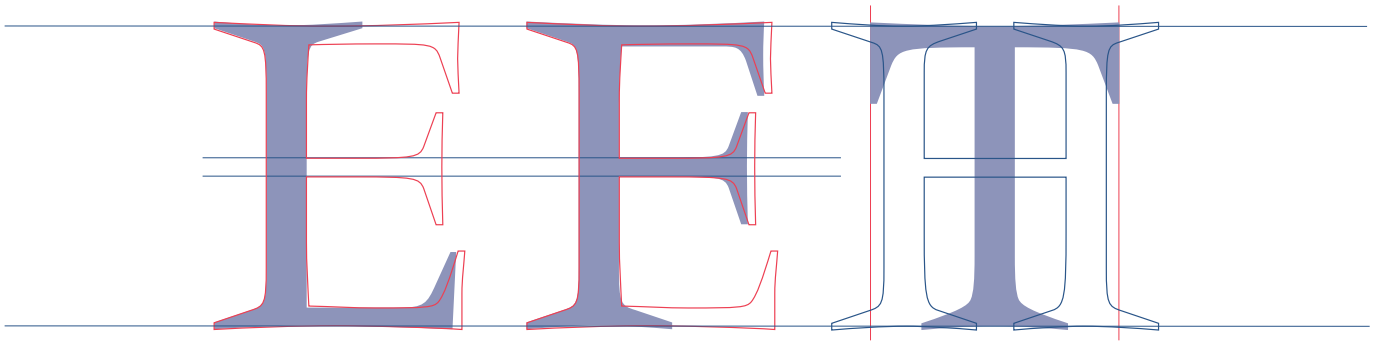
Trajan (above) has classic proportions; note the narrow E, F, and L.
Méridien (below) has modern proportions; each letter strives to have the same value/density.

VOYEZ LE BRICK GÉANT
QUE J'EXAMINE PRÈS DU WHARF



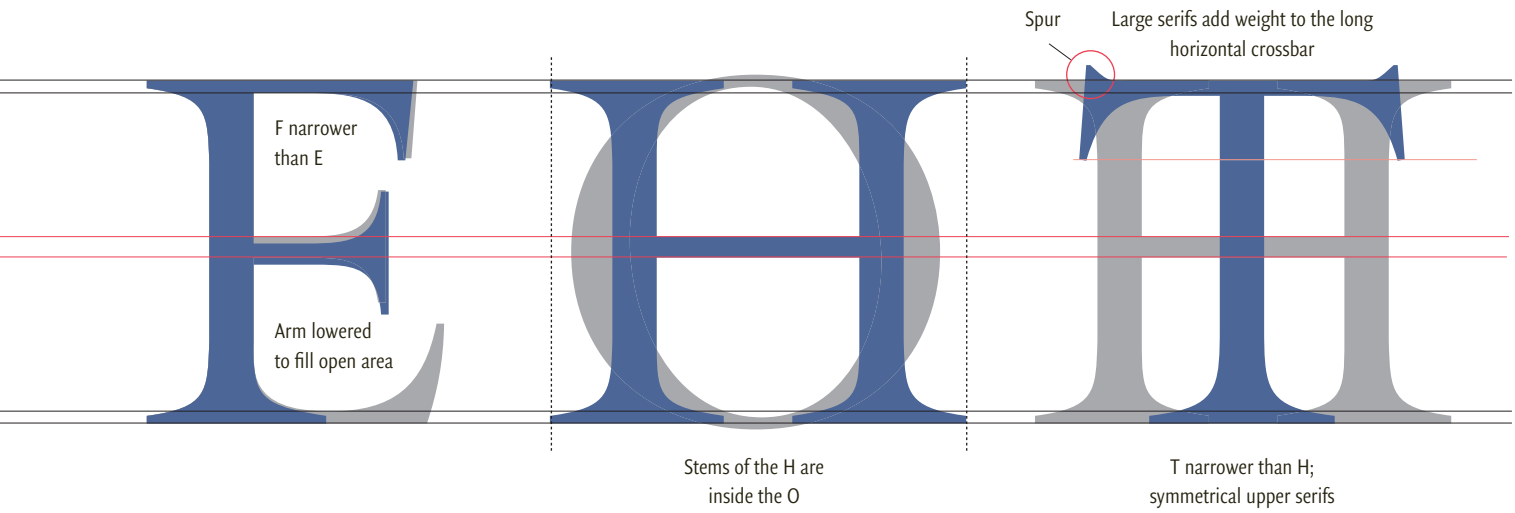
ITC Galliard (Roman)





Méridien (Roman)

Adobe Garamond (Regular)



SANS SERIF CAPITAL I

Of the letters in this group, only the sans-serif I has a structural variation. In most sans serifs, the I is simply an unadorned vertical stem. However, in monospaced typefaces, or types designed for difficult reading conditions (for example, designs for optical recognition, signage, or low-resolution screens), crossbars are often added to the top and bottom of the I to help to distinguish the letter from the lowercase L and the number 1. When crossbars are used, they are typically no wider than the thickness of a vertical stem. As in the T, long crossbars can cause spacing problems.

SPACING AND TESTING OEHILT

Once all six letters OEHILT are drawn, you should space the glyphs by adding sidebearings (see p. 54) and group these letters into words: HOTEL, TOILE, LITHO, ELIOT, HOLE, HOLT, HILT, HEIL, TILE, THE, HOE, TOE, OIL, etc. To generate words, the online tool adhesiontext.com (created by type designer Michael Sousa) is very helpful, as you can specify both the letters to be combined as well as the language(s) of the produced words. Setting your first words is very exciting—and of course, necessary in order to see the emerging personality of your typeface.

HOTEL, TOILE, LITHO, ELIOT, HOLE, HOLT, HILT, HEIL, TILE, THE, HOE, TOE, OIL.

Aglet Slab (Regular)

HOTEL, TOILE, LITHO, ELIOT, HOLE, HOLT, HILT, HEIL, TILE, THE, HOE, TOE, OIL.

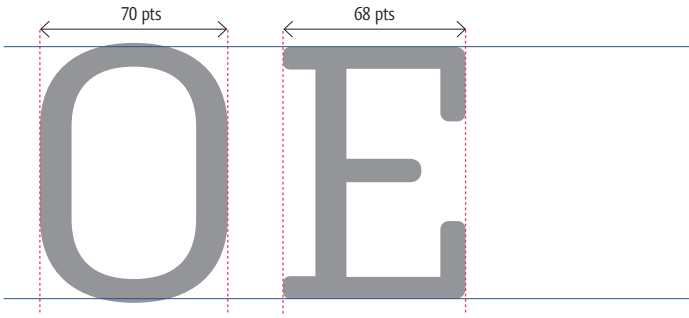
Officina Sans ITC Pro (Medium)

HOTEL, TOILE, LITHO, ELIOT, HOLE, HOLT, HILT, HEIL, TILE, THE, HOE, TOE, OIL.

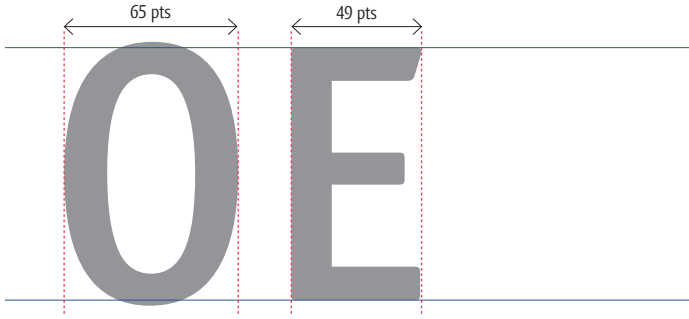
Lydian BT (Roman)

HOTEL, TOILE, LITHO, ELIOT, HOLE, HOLT, HILT, HEIL, TILE, THE, HOE, TOE, OIL.

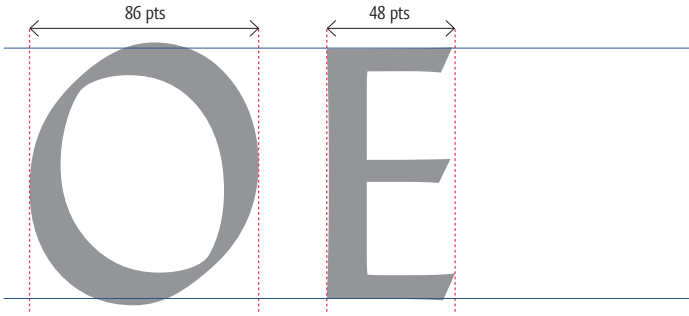
Univers (55-Roman)



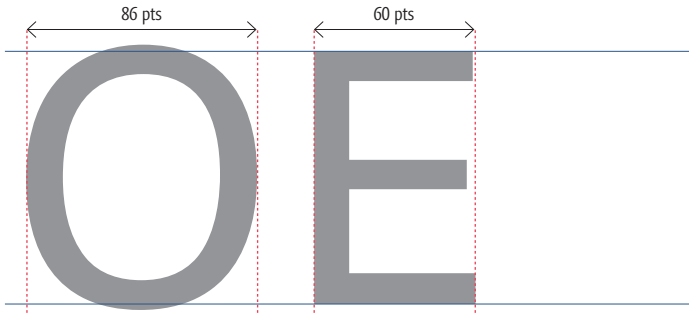
Aglet Slab (Regular)



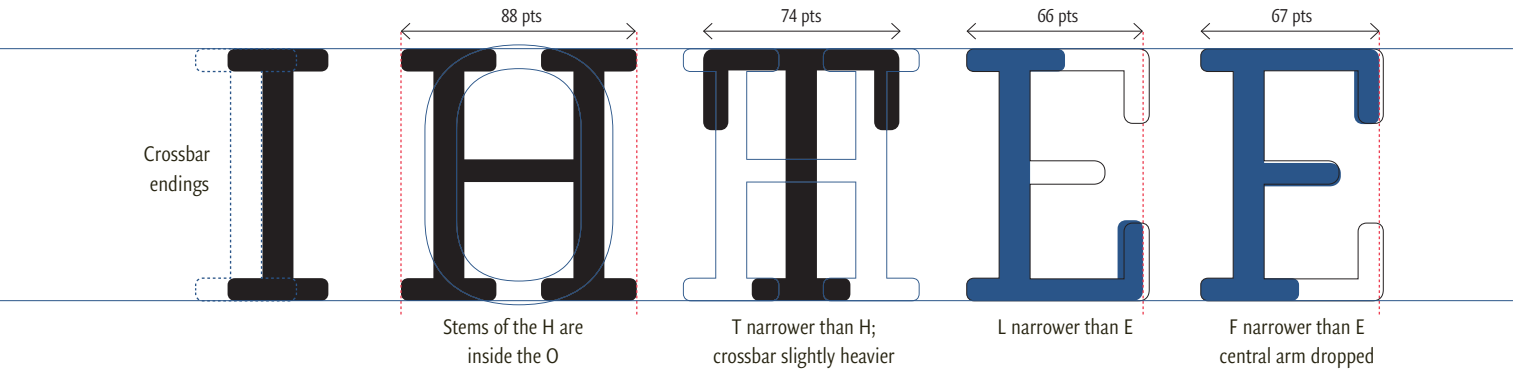
Officina Sans ITC (Medium)

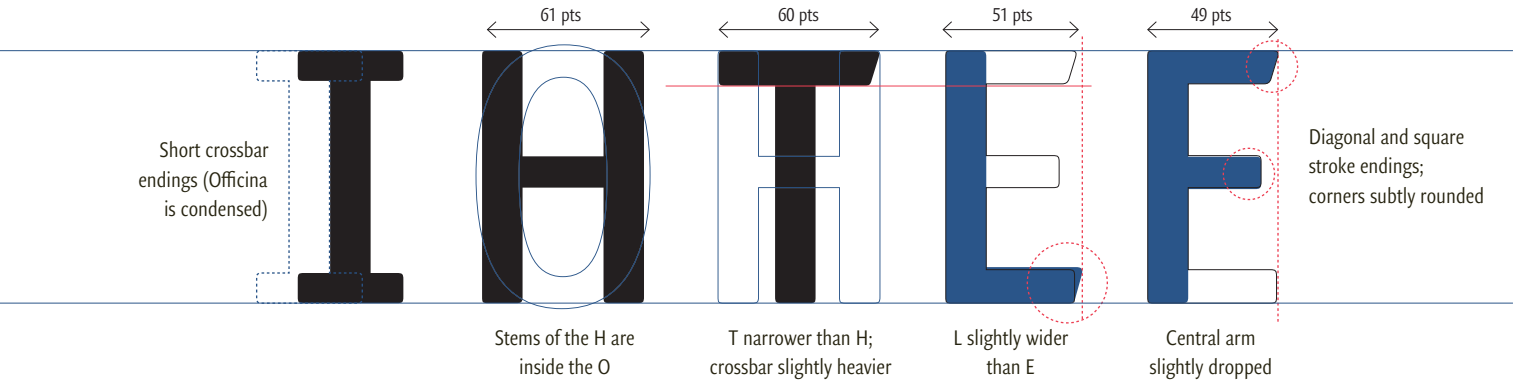


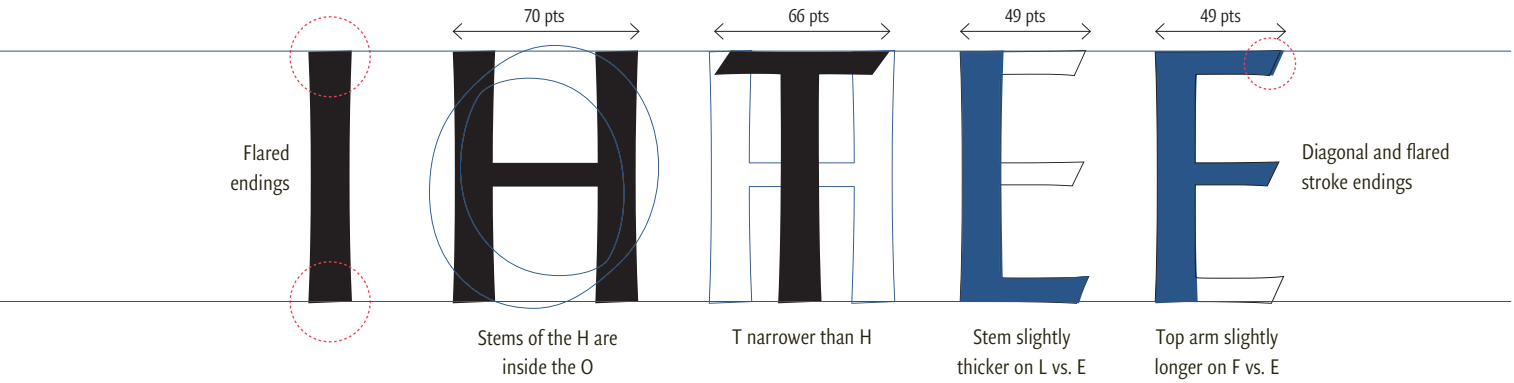
Lydian BT (Roman)

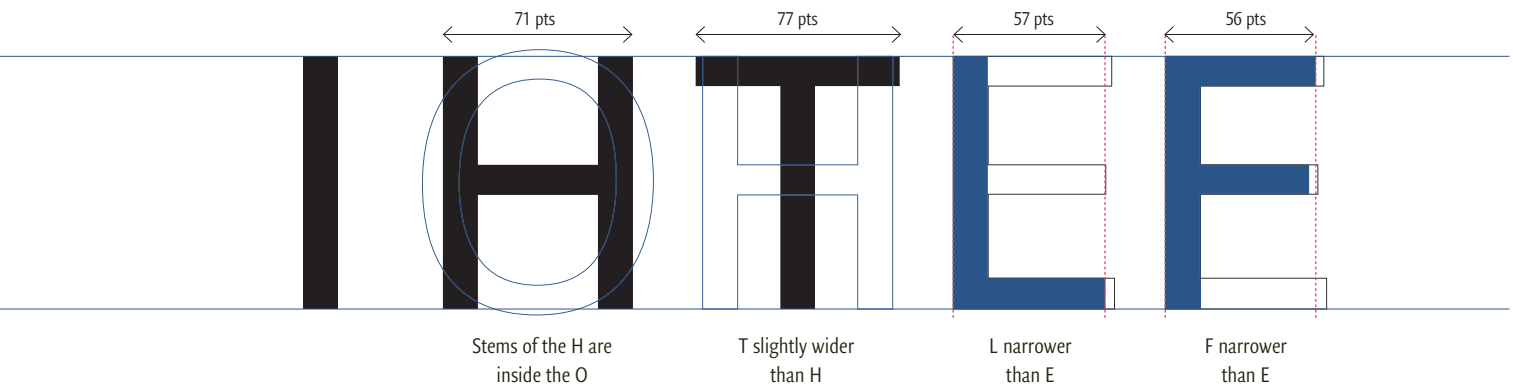


Univers (55-Roman)


88 pts
74 pts
66 pts
67 pts
Crossbar endings
Stems of the H are inside the O
T narrower than H; crossbar slightly heavier
L narrower than E
F narrower than E central arm dropped


61 pts
60 pts
51 pts
49 pts
Short crossbar endings (Officina is condensed)
Diagonal and square stroke endings; corners subtly rounded
Stems of the H are inside the O
T narrower than H; crossbar slightly heavier
L slightly wider than E
Central arm slightly dropped


70 pts
66 pts
49 pts
49 pts
Flared endings
Diagonal and flared stroke endings
Stems of the H are inside the O
T narrower than H
Stem slightly thicker on L vs. E
Top arm slightly longer on F vs. E


71 pts
77 pts
57 pts
56 pts
Stems of the H are inside the O
T slightly wider than H
L narrower than E
F narrower than E

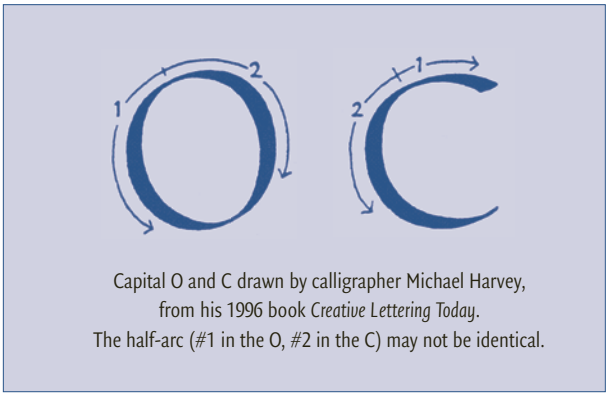
Capital C

On the Trajan column, the capital C is a wide letter—the width of two root five rectangles. A modern C is slightly narrower than the O, as its open side holds more negative space inside the letter.

In typefaces based on calligraphy (Venetians, Garaldes, and humanist sans serifs), the C and O are related, but not necessarily identical. When writing an O, a calligrapher forms two half-arcs that are connected at an oblique angle. In contrast, when writing a C, the calligrapher makes a curve that is slightly longer, followed by a shorter curve. This difference in the path of the writing tool can create subtle changes in weight and tilt.

In an upright, constructed typeface (Didone, slab serif, grotesque, neo-grotesque, and geometric sans serif), it is possible to begin drafting the C by slicing the O. However, this procedure makes a C that is too light (because of the open side). To add density, the C can be redrawn to be narrower than the O. Alternatively, the maximum bowl thickness could be extended over a larger portion of the arc, or subtly increased overall.

The C is our first capital that uses the concept of aperture—the amount of openness in a glyph (see p. 40). One could follow the amount of open space in the E (and possibly the F) to determine the aperture of the C. However, it is more likely that all three letters would be adjusted simultaneously to meet pre-established criteria; having open or closed letters is a design decision driven by the intended function and desired personality of your typeface.



Capital O and C drawn by calligrapher Michael Harvey, from his 1996 book *Creative Lettering Today*. The half-arc (#1 in the O, #2 in the C) may not be identical.

SERIF CAPITAL C

In Venetian, Garalde, and Didone typefaces, the top of the C ends with a vertical or angled "beak" serif. The shape of the beak often relates to the serif on the top arm of the E. However, the beak of the C may need to be larger to counterbalance the weight in the bowl—otherwise, the C can look as if it is tilting backward. If the top of the C hangs low, a spur on the beak serif may help to visually pull the letter back up to the capline.

The bottom of the C can be finished with a serif that relates to the beak, or extended into a tail. For the former, the lower serif should be drawn larger than the upper (the lower part of any glyph needs more weight). In the latter scenario, the tail can end with either a blunted tip or an extended thin stroke. The ending should look as if it has been drawn with the same writing tool as the rest of the letter (such as a broad-nib or expansion pen).

Strada (Regular)

COLLECT TIC-TOC
CLICHÉ COCCO ECTO
HITCH TELIC COOL

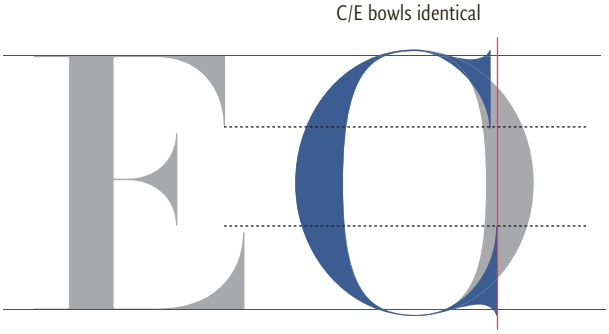
Melior (Roman)

COLLECT TIC-TOC
CLICHÉ COCCO ECTO
HITCH TELIC COOL

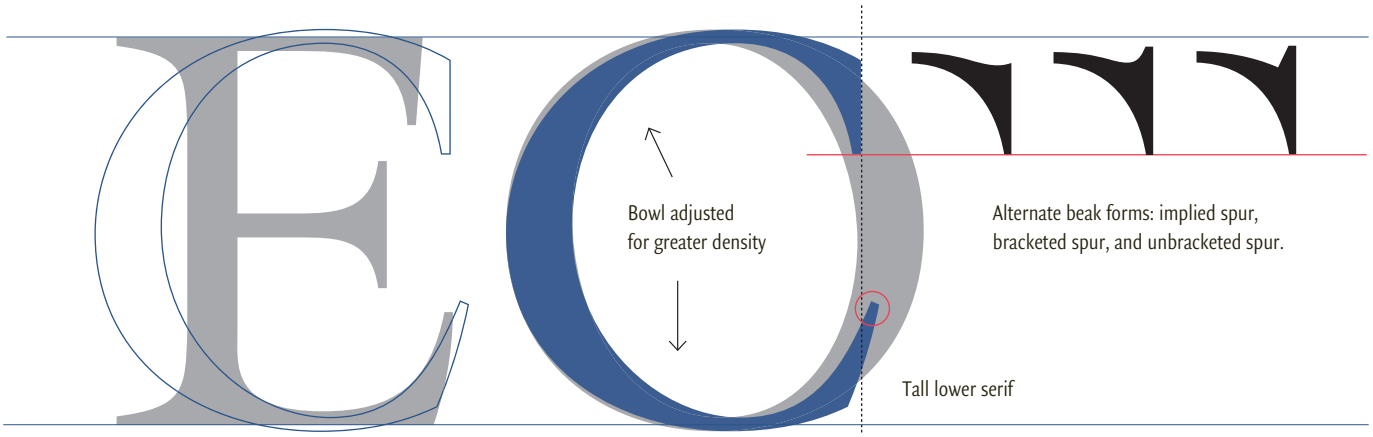
Strada (above) has open apertures and sets more tightly; Melior (below) has more closed apertures. The Melior O/C is also wider and therefore sets less efficiently.

SANS SERIF CAPITAL C

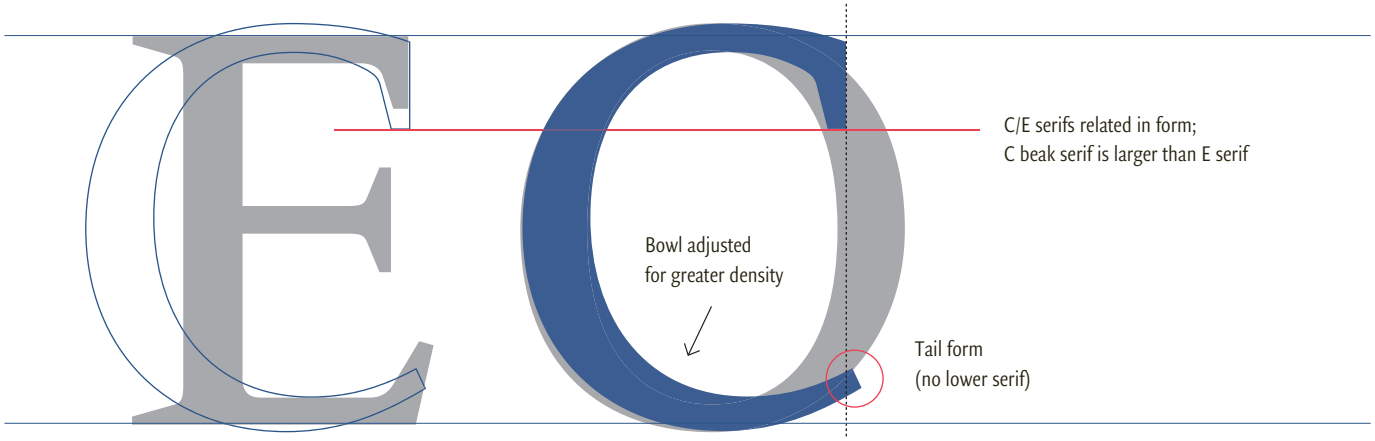
In a sans serif, the ends of the C should be influenced by the endings of the E designed earlier. That is, if the ends of the E were based on a specific tool, you should imagine how that tool would form the endings of the C. The endings of the C and E do not need to be identical (that may be impossible given their different shapes), but they should have a similar underlying logic.



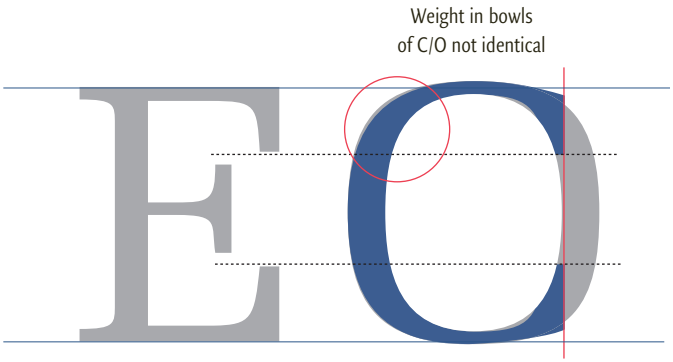
HTF Didot (M96-Medium) Lower C serif taller than E



ITC Galliard (Roman)

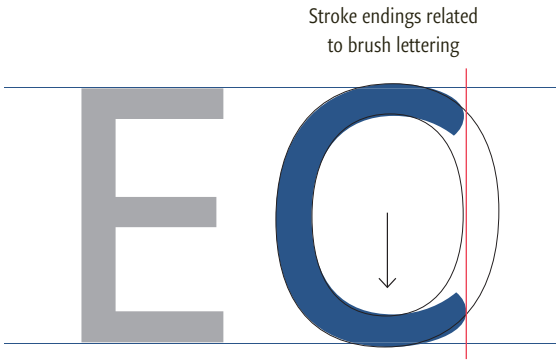


Le Monde Journal (Regular)



Melior (Roman)

C serifs taller than E serifs



Strada (Regular)

Weight in bowls of C/O not identical

Capital G

When following classic proportions, the G has the same width as the C: a double root five rectangle. However, a G with modern proportions may be slightly wider than the C. Because the G has a throat, it can become much darker than the C. To reduce color, the G can be drawn wider, and/or its bowl can be subtly thinned.

In a normal-weight, normal-width text typeface, the throat is usually at or below the visual center. The Goldilocks effect (see p. 39) applies here: Short is better for legibility, because a G with more interior space is less likely to be confused with an O. However, a G with an overly short throat could be confused with the C. In some fonts, the throat is drawn slightly heavier than the normal vertical stem thickness. Extra weight can help a short throat counterbalance the larger bowl.

It can be challenging to gracefully connect the bowl of the G to the throat, especially in condensed fonts, since the G has limited interior space. A vertical or horizontal spur can be added at the join to ease the transition. A vertical spur has a stabilizing effect, since it reinforces the upright axis. A horizontal spur visually extends the curve of the bowl and emphasizes forward motion.

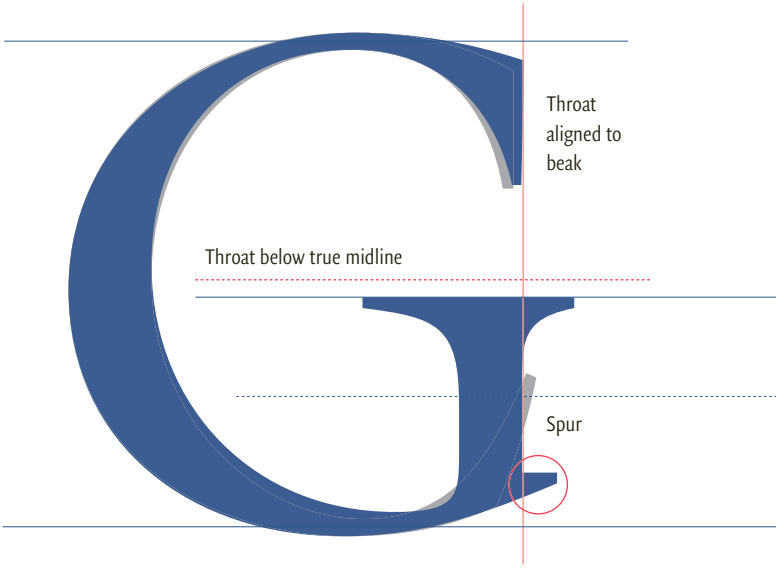
The bar at the top of the throat is often heavier and more visually dominant than other serifs. The bar is usually asymmetrical; it extends further into the bowl (to the left) than it does to the right. The G will be more legible (less like a C) if the extension into the bowl is generous—at least the thickness of the throat, if not more. Additionally, shortening the right side (or eliminating it entirely) helps to avoid spacing problems between the G and characters that follow (Gl, Gh, GE, GN, GR, etc.).

SPACING AND TESTING GC + OEHILT

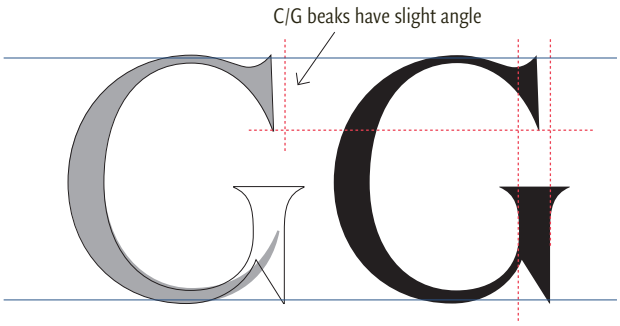
Once the O, C, and G are complete, you can expand your testing of text, since you will now have both square and round letters. The letters GC+ OE + HILFT can be combined into words such as: FLEECE, LIGHT, TIGHT, ECLECTIC, HECTIC, GILET, CHOCO, OILCLOTH, LIFT, OFF, TEETH, GET, IT, LOGIC, GOTHIC, LOFT, HI, CHIEF, HIT, THE, GOTH CHILI, HELIO, etc.

GLEE ICE LIGHT TO ELECT FLEECE TIGHT GO OFF HIT GILET OIL HI CLOTH. TIGHT GLO HELIO TEETH HE CHIEF HIT GET GOTHIC THE

Caecilia LT (55-Roman)

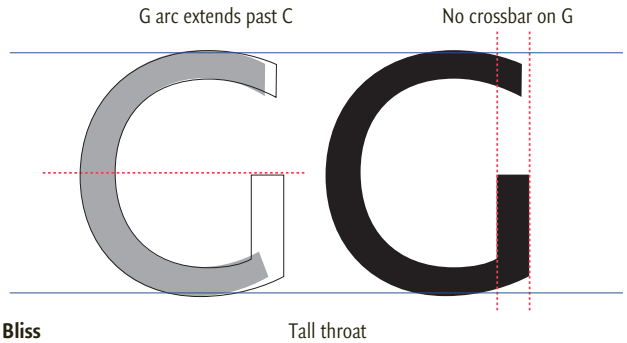


ITC Galliard
(Roman)



Domaine Display
(Regular)

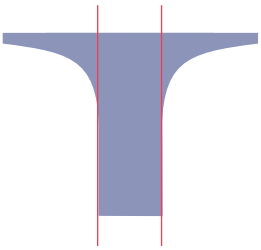
Sharply notched throat



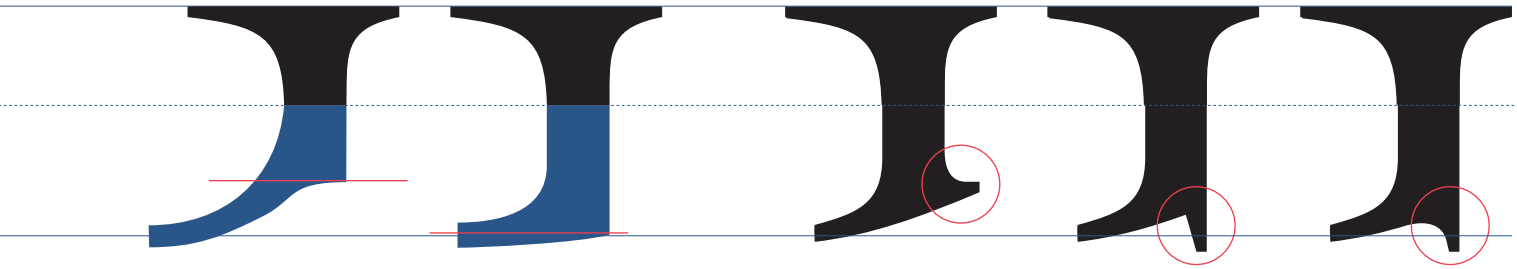
Bliss
(Regular)

Tall throat
ends just below midline

Galliard has a longer left serif and shorter right serif on the top bar. An alternate option is a one-sided right-facing serif.

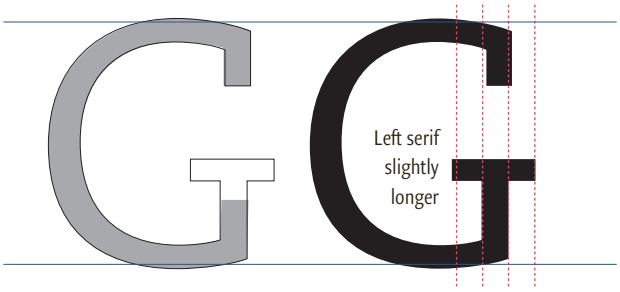


Yet another option is placing equal serifs on the top bar.



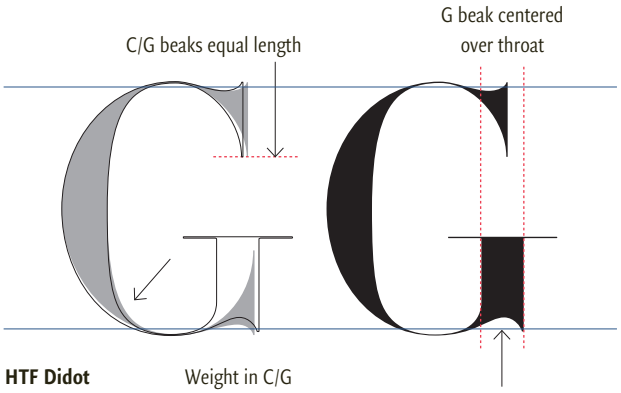
Alternate throat positions:
high (well above baseline) or low (resting on baseline)

Alternate spur designs:
bracketed horizontal spur, vertical spur, or bracketed vertical spur



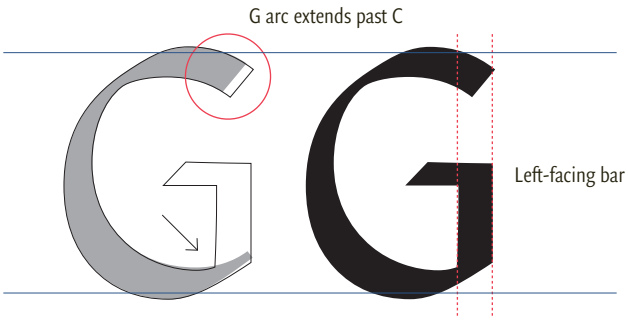
PMN Caecilia
(55-Roman)

Weight in C/G bowls identical



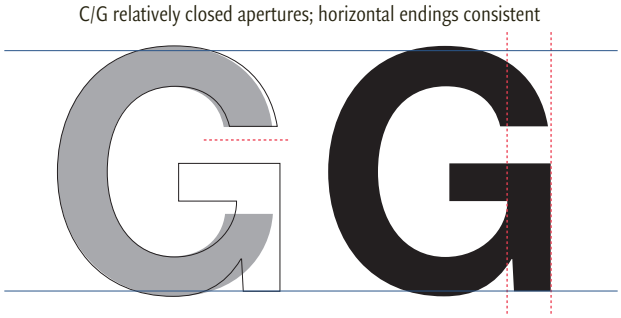
HTF Didot
(M96 Medium)

Weight in C/G bowls identical



Lydian BT
(Roman)

Weight in C/G bowls not identical



Neue Haas Grotesk Display
(Medium)

G forms a spiraling arrow

Capital S

The S is a letter that is both loved (for its sensual curves) and feared (for its difficulty). Most designers agree that the S is the most challenging letter in the Roman alphabet. However, type designer Chris Lozos identifies the S as his favorite letter; he finds it "demanding but also satisfying."[5]

One method for constructing a capital S begins with two equal circles. First, the circles are stacked to form the basis of the double-story letter. Next, the bottom circle is enlarged (for optical stability, the lower story of a letter is always larger.) Then, both circles are expanded to create overshoot and undershoot. Finally, the circles are opened and their tails are extended outward. Because the lower tail is part of the larger lower bowl, it requires greater extension outward. As the last step, the "kink" in the center is smoothed so that the spine forms a continuous ogee curve.

Once the basic skeleton of the S has been formed, it needs be fleshed out with stroke weights. Because the S is a narrow letter (using classic proportions, the S fits within a half-square), the maximum weight in the spine may not match the maximum bowl thickness of the O; it can be lighter or darker as needed to create equal density to other capitals. The thickest part of the S typically occurs in the middle of the spine, but this weight can be shifted lower to make the bottom half of the letter heavier. More rarely, the center of the spine may be slightly thinned, with the maximum weight moving to the corners of the S (see Helvetica, p. 85).

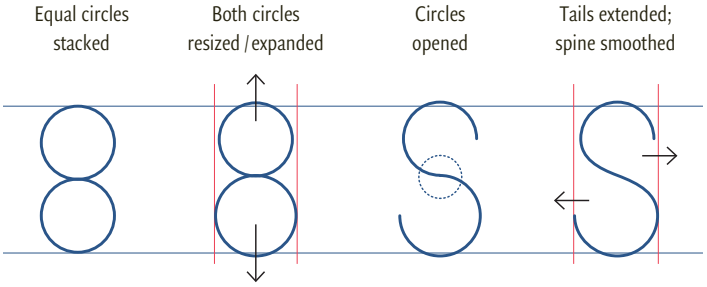
The minimum stroke width of the S is usually the horizontal stroke thickness. In typefaces with vertical stress, the minimum width occurs at 12 and 6 o'clock. In designs with oblique stress, the light areas move to the upper left and lower right—approximately 11 o'clock and 5 o'clock.

There are type designers who disagree with any constructed method for drafting an S. They believe that the best forms are drawn freehand in a fluid medium (such as ink or paint), using the hand, wrist, arm, and body to create an organic shape.

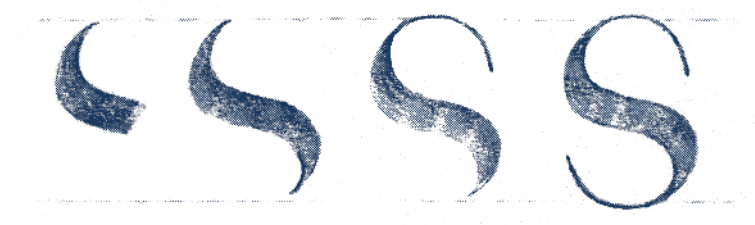
When drawing a freehand S, sign painters often recommend focusing on the spine. First, determine the starting and finishing points of the spine. The horizontal distance between these points sets the width of the S; the vertical distance determines the relative size of the upper and lower bowls. After the spine is drawn, the upper and lower curves are added to complete the letter. Then, serifs can be appended. Traditionally, the serifs on the S are similar to the beak serifs on the C and G. However, the S serifs may be drawn smaller to avoid closing the aperture (an enclosed S could be confused with either the capital B or the number 8).

Types with an upright axis usually have a stable S, but designs with an oblique axis may have an S that subtly tilts forward (as in Adobe Garamond). There are also S forms that tilt slightly backward (see Chiswick Sans, p. 84).

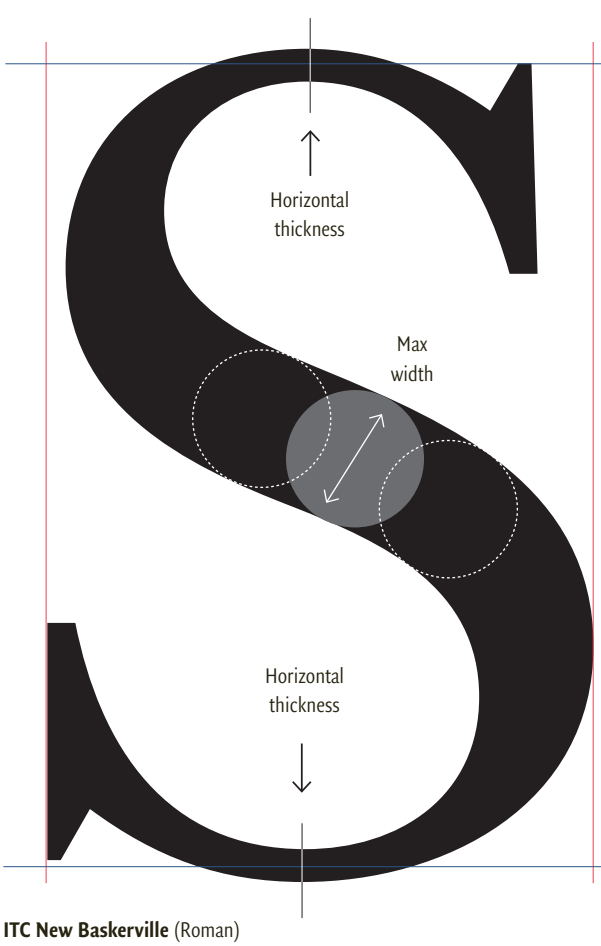
5 "The Letter S," 2015, typedrawers.com/discussion/comment/14067#Comment_14067.



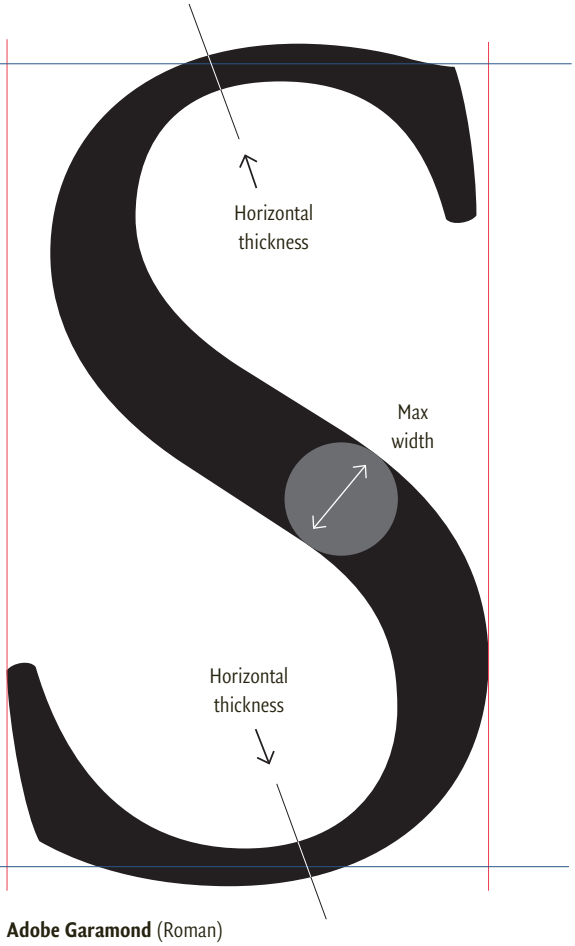
The construction of an uppercase S, beginning with two equal circles.



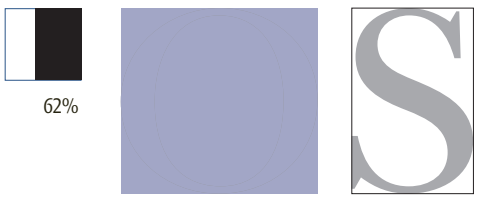
Capital S drawn by author David Gates using a broad-edge graphite pencil.
The main spine is drawn first, in two halves. From *Lettering For Reproduction* [1969] by David Gates; reproduced with permission of Watson-Guptill Publications.

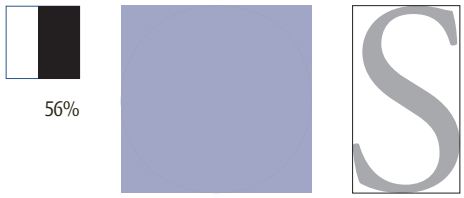


ITC New Baskerville (Roman)



Adobe Garamond (Roman)





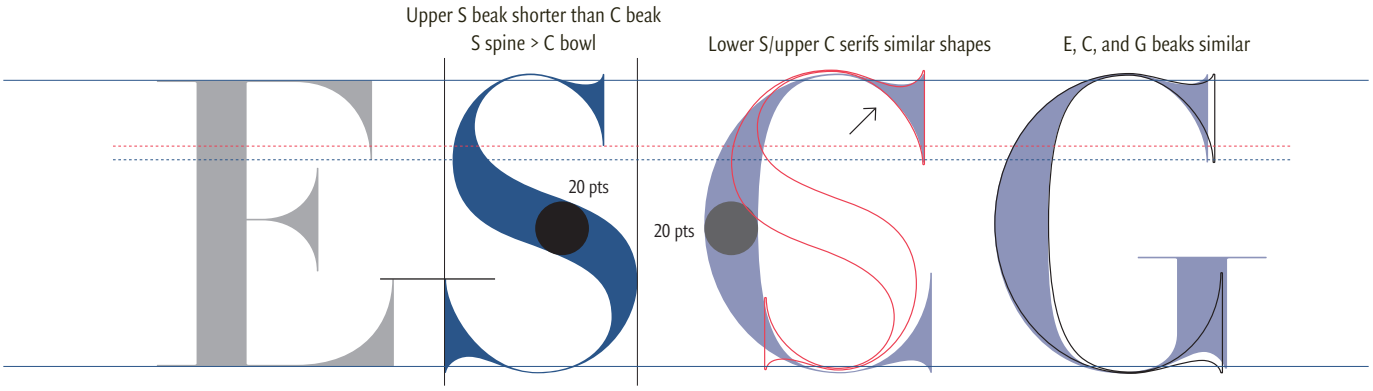
New Baskerville and Adobe Garamond are based on classic proportions; the S is narrower than the O.

Rosart (Regular)

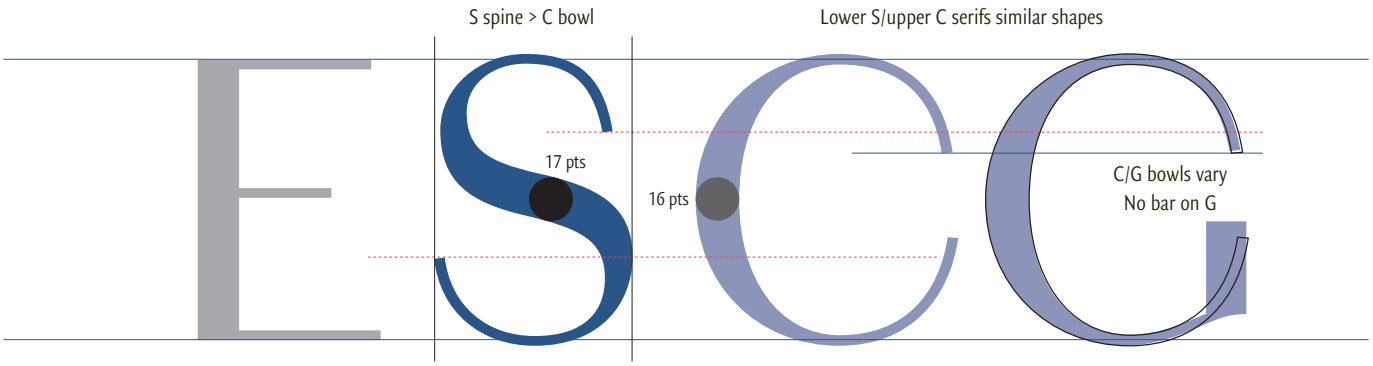
Beak form on the S similar (but not identical) to the C/G

HIGH-CONTRAST CAPITAL S

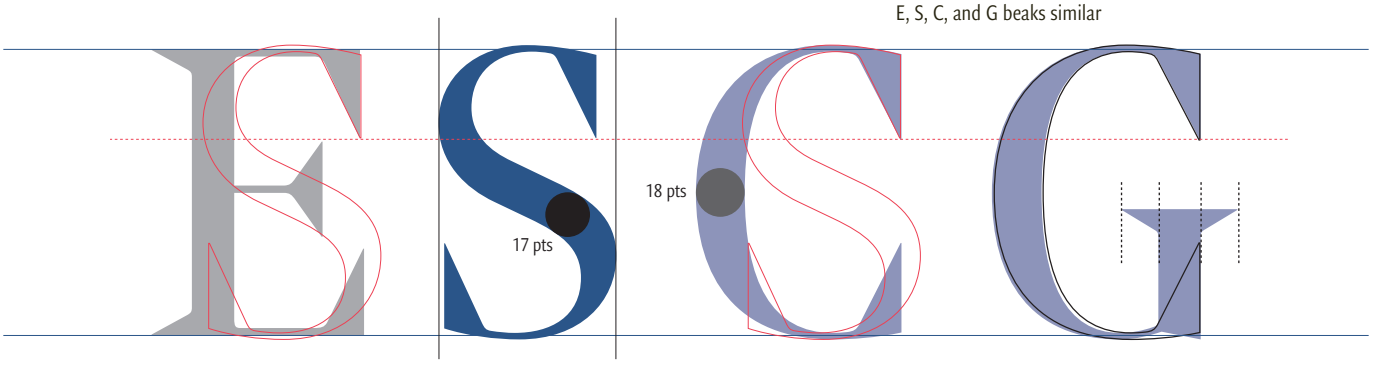
In many typestyles, the thin weights of the S appear only briefly before increasing toward the spine and outer serifs. However, in high-contrast designs, the thinner stroke weight is often carried across a wider segment of the bowls to emphasize stroke contrast.



HTF Didot
(M96 Medium)



Chiswick Sans
(Regular)

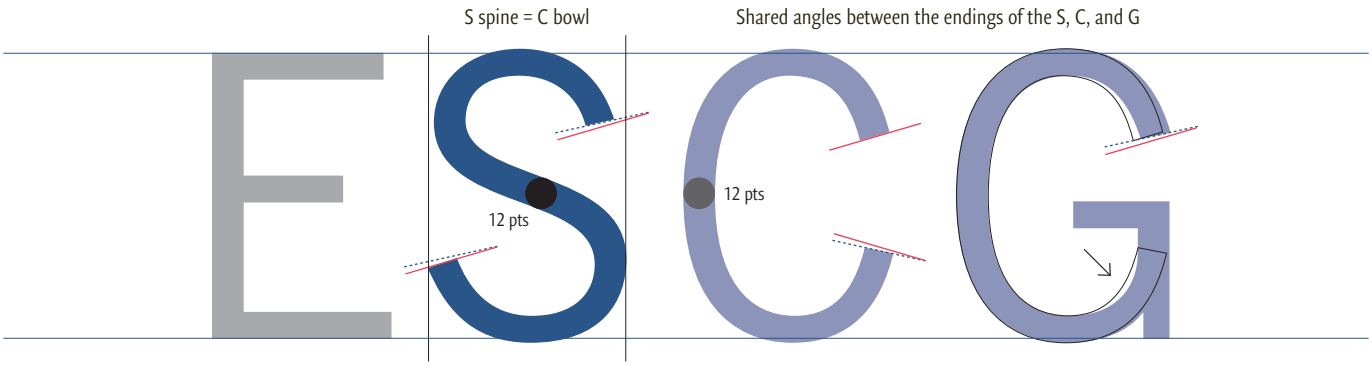


Noe Display
(Regular)

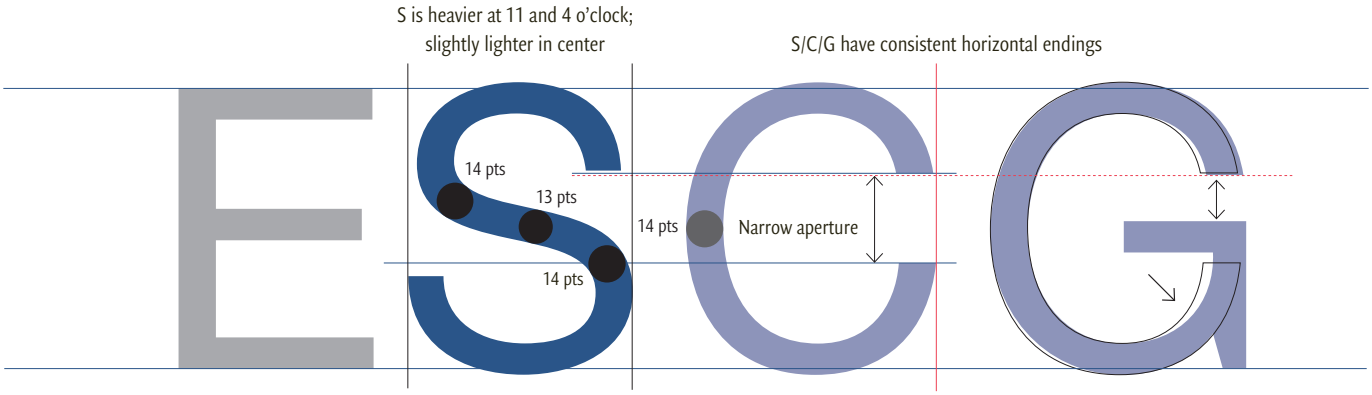
SANS SERIF CAPITAL S

In a sans serif, the stroke endings of the S, C, and G should form a unified, coherent form language. However, while these endings relate to each other, they need not be identical. Varied stroke endings can enliven a design that would otherwise be monotonous.

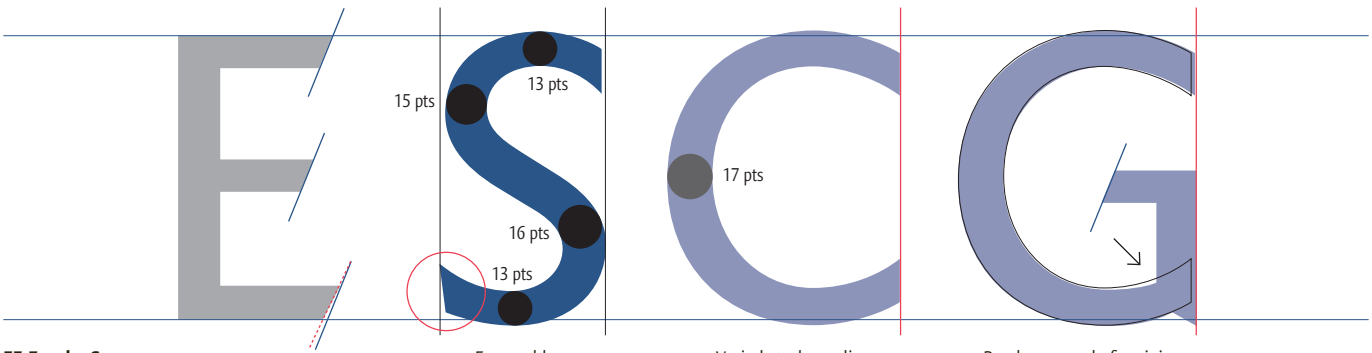
Capital S drawn by calligrapher Michael Harvey from his 1996 book *Creative Lettering Today.* Stroke endings result from the ductus of the pen.



Trade Gothic
(Regular)



Helvetica Neue
(55-Roman)



FF Eureka Sans
(Regular)

Capital J

The J is the youngest letter in the Roman alphabet. The I was used in Roman numerals as a one; the J was a swash version of the I that signaled the final I in a sequence (for example, the number thirteen was written as XIIJ). This origin explains the shape of the J, which is a vertical stroke extended into a left-facing, curved tail. The curve can range from a sharply jointed diagonal to a gradual, circular turn.

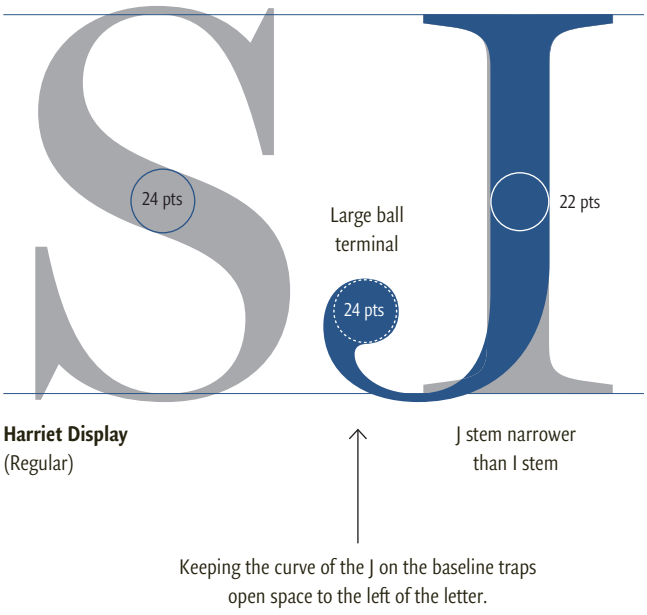
The length of the tail of the J varies: It can be curved above the baseline (often matching the overshoot of the O) or dropped lower (ranging between 25–35% of the capital-height). Placing the curve of the J on the baseline can result in difficult spacing, because the curve may trap open space to the left of the J; nesting the tail under the baseline is more efficient, because the tail can fit beneath the previous character. However, the J rarely extends to the full descender length. While longer tails can be dramatic and expressive, they are often inefficient, since they may collide with the line of text below. To address this issue, designers can create both shorter and longer versions of the J for use in either text or display.

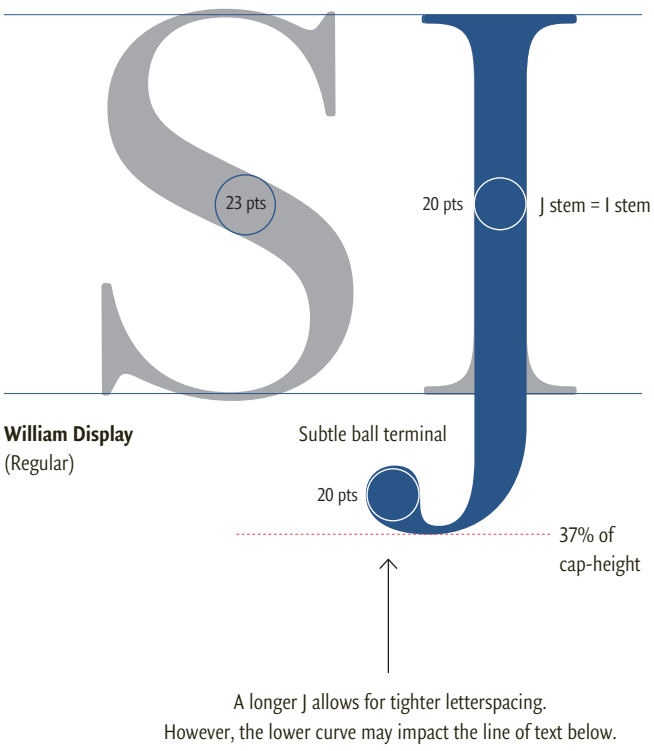
SERIF CAPITAL J

The tail of a serif J may end with a point, a flared wedge, a serif, or a round terminal. In general, Venetian and Garalde designs have terminals that look calligraphic. Transitional types have terminals that have been refined and translated from the broad-pen originals; often the terminal is an elliptical teardrop. Didones need a large, circular terminal to achieve the mass and weight necessary to demonstrate the characteristic high contrast of the typestyle. Slab serifs exhibit the most variation, but in general, either a flared ending (the result of a vertical or angled slice) or a tapered blunted point is typical.

SANS SERIF CAPITAL J

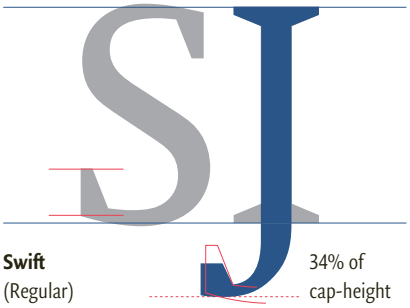
The sans serif J relates to the other round-combination glyphs, and therefore often has a similar aperture and stroke endings as the S and C. Since neo-grotesques and geometric sans serifs emphasize consistency and rationality, the short J tends to appear in those typestyles. In grotesque and humanist sans serifs, the long form of the J is more common.





Requium Text
(Roman)

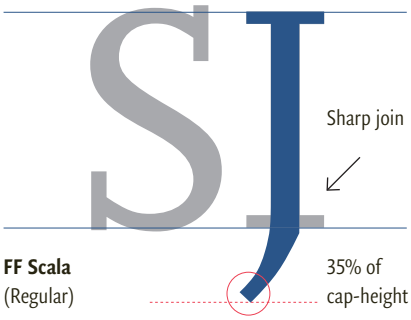
31% of
cap-height



Swift
(Regular)

34% of
cap-height

Serifs similar
but not identical



FF Scala
(Regular)

Sharp join

35% of
cap-height

Blunted tip

Right serif shorter than left

Méridien
(Roman)

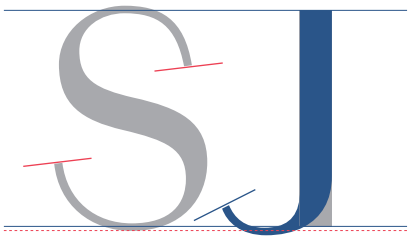
Serifs similar
but not identical

Trianon Display
(Regular)

Stem eroded for
compact design

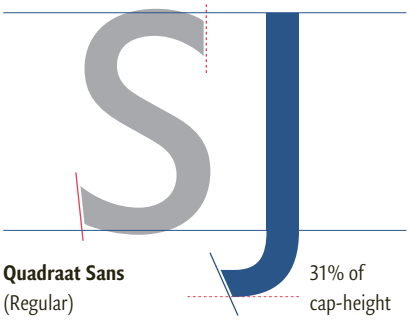
Didot HTF
(M42-Medium)

Undershoot matches
on S and J



Chiswick Sans
(Regular)

J curve deeper
than S undershoot



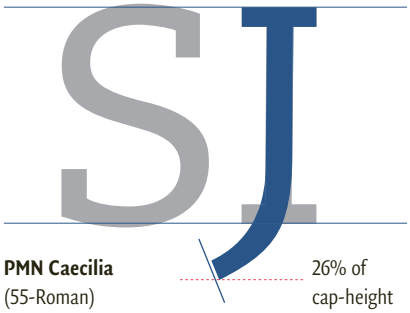
Quadraat Sans
(Regular)

31% of
cap-height

J serifs shorter than I serifs

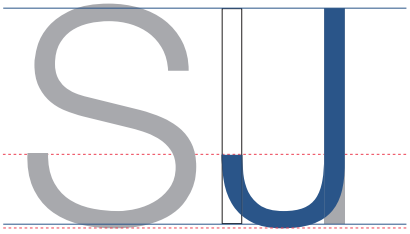
Eames Century Modern
(Regular)

Unbracketed
round terminal



PMN Caecilia
(55-Roman)

26% of
cap-height



Helvetica Neue
(Light)

Horizontal cuts
in S and J

Gotham
(Medium)

Angular cuts are similar
but not identical

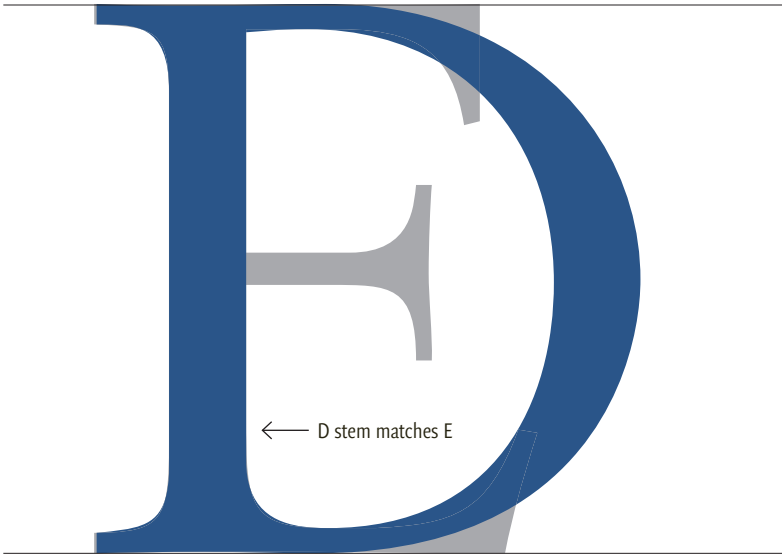
Capital D

The bowl of the D and the O are usually not identical, as most D forms do not have overshoot or undershoot. The bowl of the D is usually redrawn to fit within the cap-height and baseline.

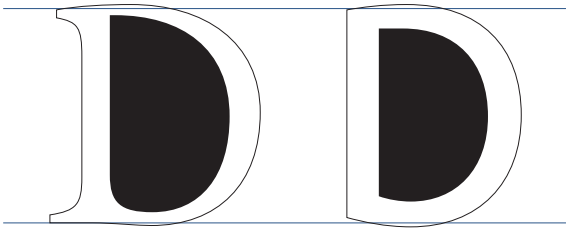
In typefaces with an upright axis, the maximum bowl width occurs in the optical center (slightly above the true midline). In typefaces with calligraphic influence, the bowl of the D may be drawn with asymmetric thrust, as in the lowercase n (see p. 144). This moves the maximum weight of the bowl above center. Type designer Jean François Porchez believes there are advantages to this asymmetry.[6] A tilted axis moves mass from the center of the letters (usually their widest point) to the corners, more evenly distributing the color of text (and relieving visual congestion). In terms of formal contrast, diagonal emphasis can also add visual variety to the alphabet, which is largely made of repeating vertical and horizontal forms.

In both the classic and modern proportional systems, the D is slightly narrower than the O (as a letter with a straight side, the D must be condensed in order to enclose the same amount of interior space as the O). The shape of this interior counter is particularly critical to the beauty of the letter. When the bowl is bracketed to the stem, an expressive, teardrop-shaped counter is formed. An unbracketed bowl creates a more stable, half-round shape. However, even in the latter format, the semicircular counter is not necessarily symmetrical; it may be wider or narrower at the base than at the top to create dynamic balance.

6 Lacava, Lucie, "Chapter 12: Newspaper Text," *Digital Fonts and Reading*, Mary C. Dyson and Ching Y. Suen (eds.), Singapore: World Scientific, 2016, pp. 209–225.



Sabon (Garalde)

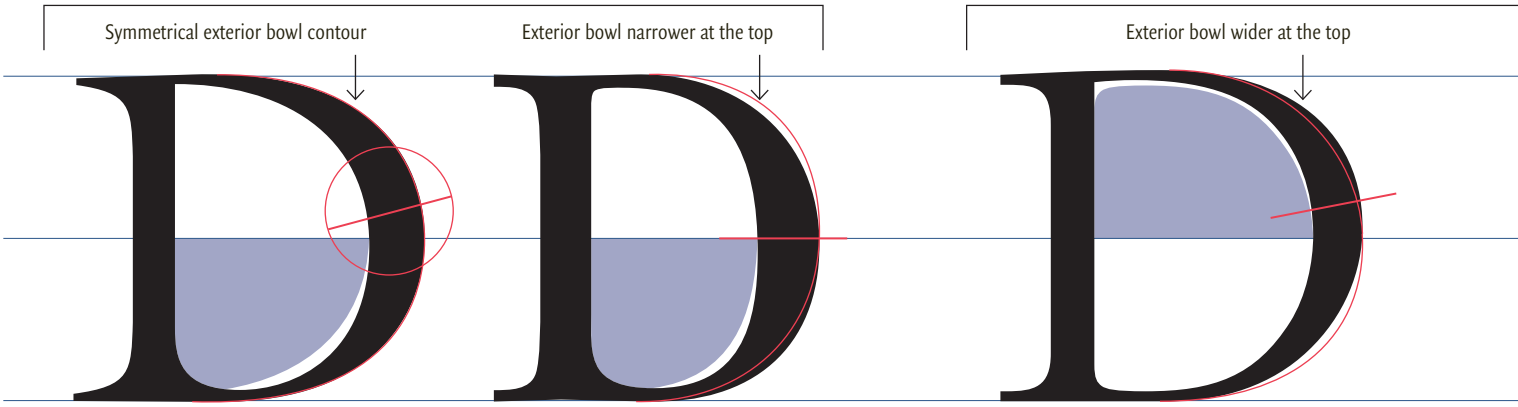


Quadraat (Regular) **Quadraat Sans** (Regular)

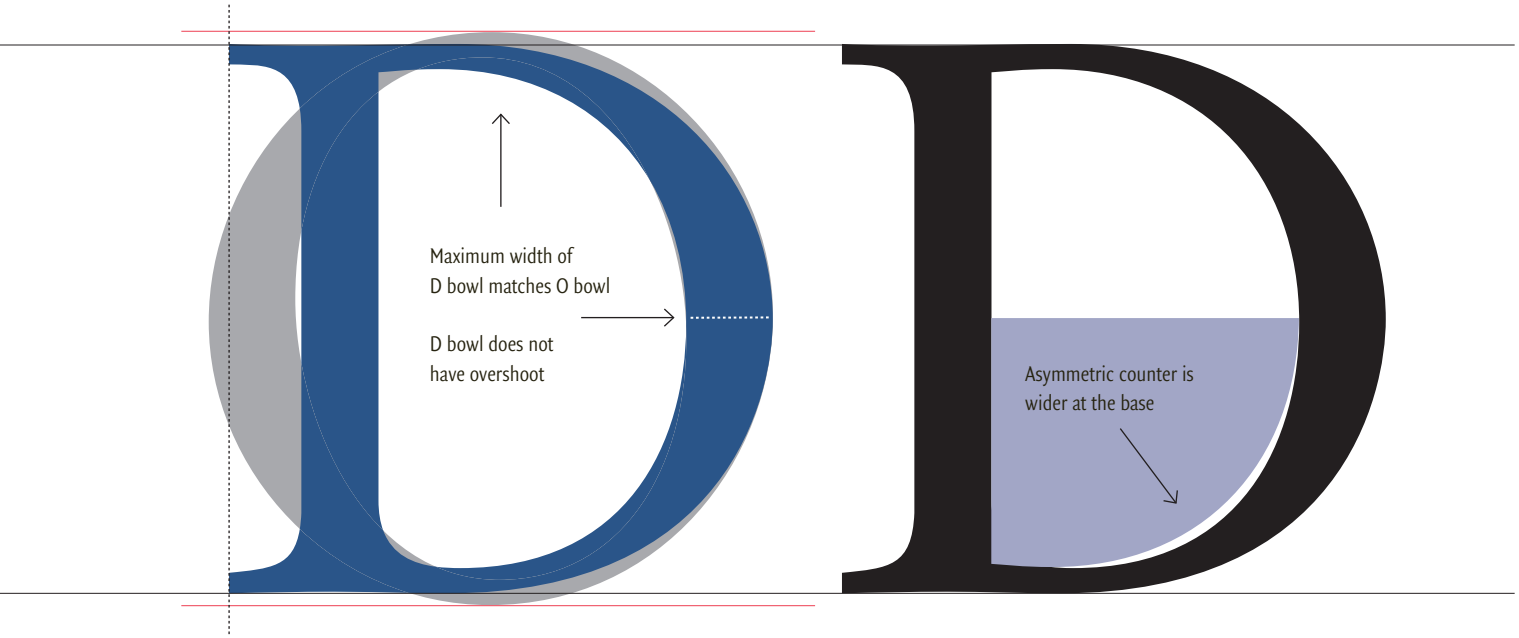
The Quadraat D is unusual in having overshoot and undershoot. The sans counter is semicircular; the serif counter is teardrop-shaped.

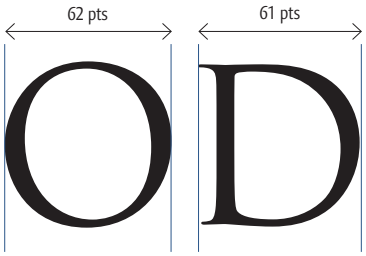
Asymmetric interior counter is wider at the base

Asymmetric interior counter is wider at the top



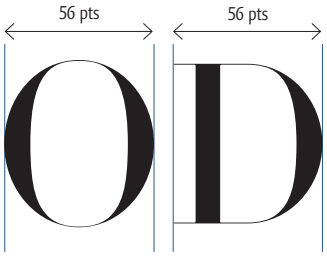
ITC Galliard (Roman) **ITC New Baskerville** (Roman) **Bembo MT** (Regular)





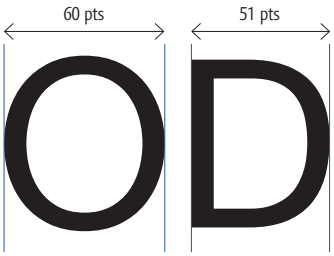
Trajan (Regular)

In the classic proportional system,
the D is slightly narrower than the O.



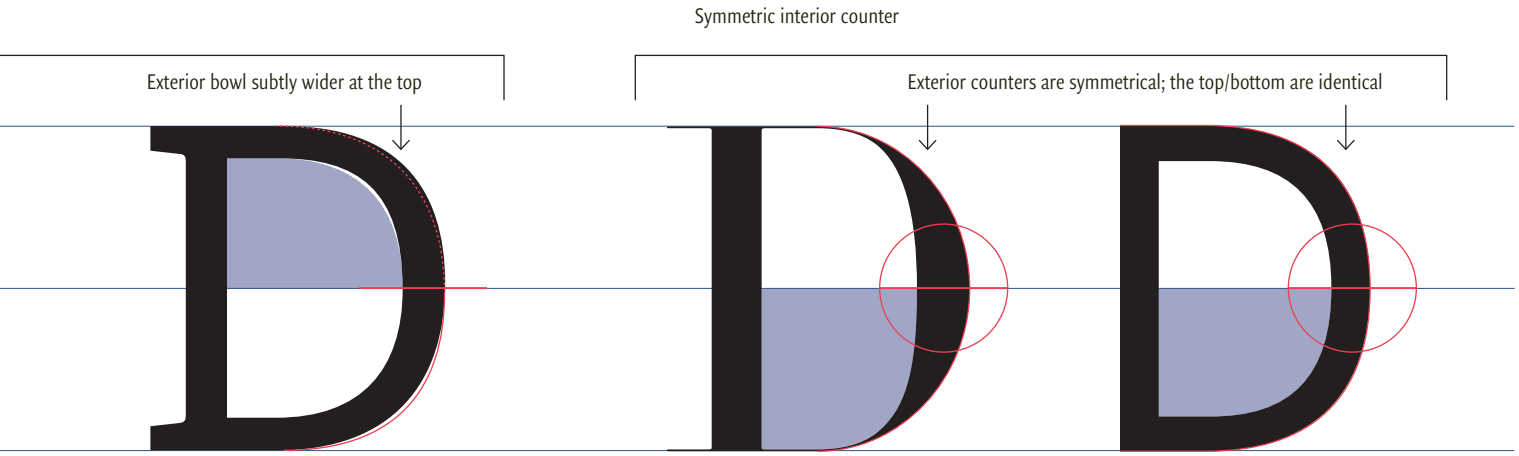
HTF Didot (M96-Medium)

The D and O have vertical emphasis;
the letters are roughly equal in width.



Benton Sans (Regular)

In the modern proportional system,
the D and O have equal interior space.



Adelle (Regular)

HTF Didot (M96-Medium)

Benton Sans (Regular)

Capital B

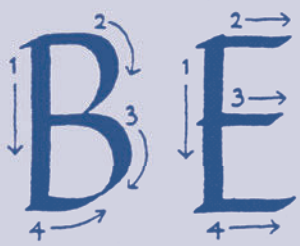
The B usually has the same division of space as the E. Both letters also have about the same character width. In typefaces with classic proportions, the B is a narrow letter (fitted to a root five rectangle) with semicircular lobes and counters. In typefaces with modern proportions, the B is wider, and therefore has extended counters with more horizontal emphasis.

As in all double-storied letters, the lower lobe of the B must be larger than the upper for optical balance (if they were equal, the letter would appear inverted). These lobes cannot have the same maximum bowl weight as the O, because the letter would become too dark. To prevent clogging, the bowl weight in the upper lobe is lighter than the bowl weight of the lower lobe. However, both of these weights are usually heavier than the vertical stem thickness.

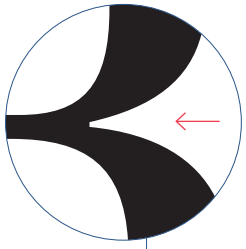
There are non-traditional B forms, but in a conventional structure, the lobes of the B meet and overlap in a central stroke. This stroke can be curved, diagonal, or horizontal.

In bold and/or condensed fonts, it can be difficult to keep the join at the waist of the B open and clear. To address this problem, designers sometimes insert an additional form into the join called an "ink trap" (so named because the space absorbs excess printer's ink that would normally spread into the surrounding area).

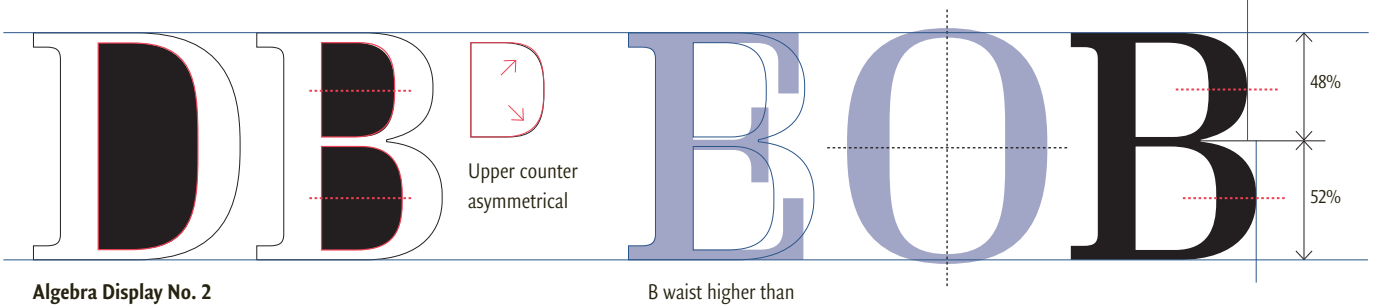
As in the D, the counters of the B give the letter its personality. The counters form either semicircular or teardrop shapes, depending upon their bracketing. In some typefaces, the D and B counters are similar, but this is a matter of taste. Differences in the counter shapes of the D and B can add diversity and visual interest.



The capital B and E by calligrapher Michael Harvey from his 1996 book *Creative Lettering Today*. The central arms of the letters align. Note that the waist of the B is a horiztonal stroke.

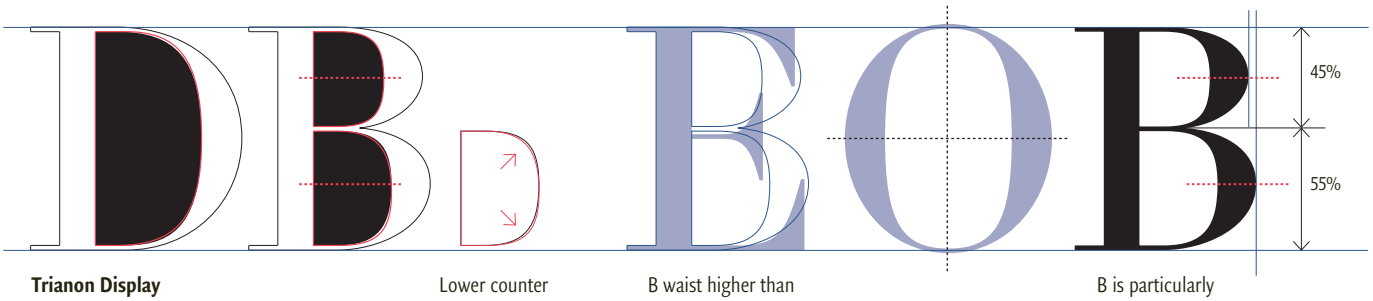


Enlargement of the B in Algebra Display (see below). A small ink trap has been inserted at the waist to help keep the join clear.



Algebra Display No. 2
(Regular)

B waist higher than central arm of the E

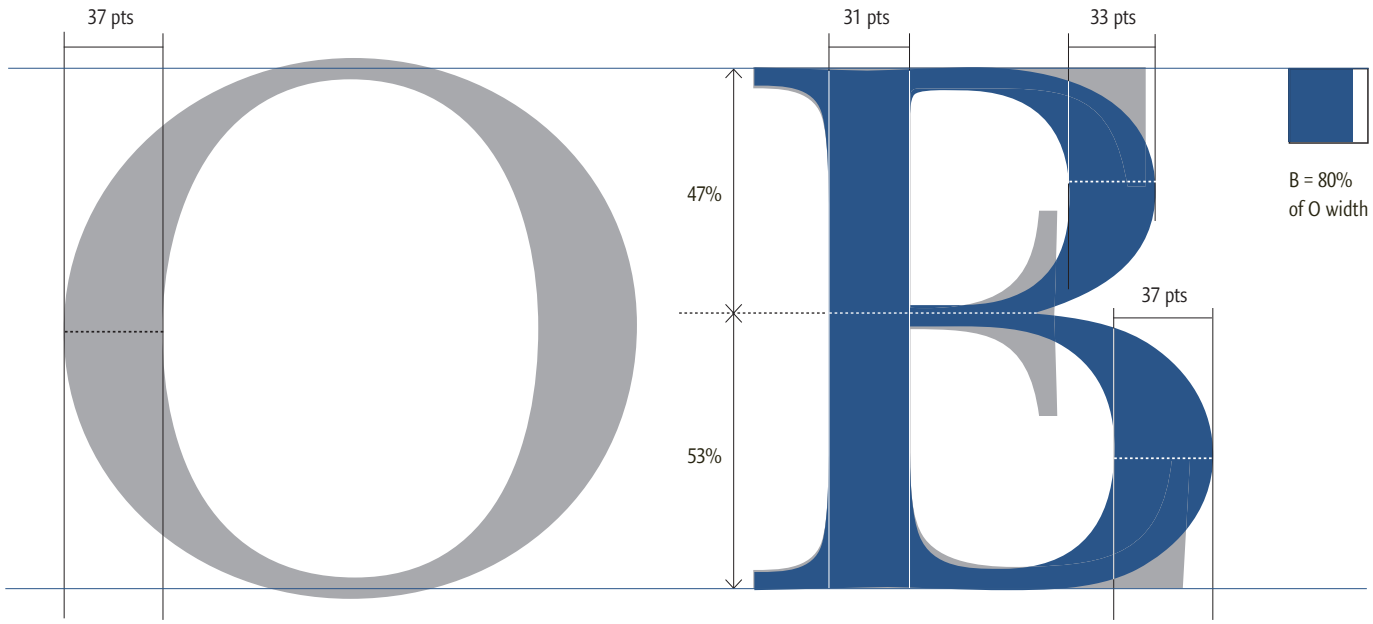


Trianon Display
(Regular)

Lower counter asymmetrical

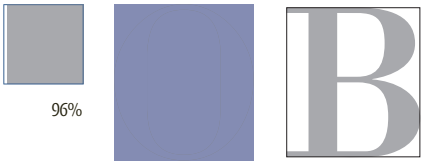
B waist higher than central arm of the E

B is particularly high-waisted

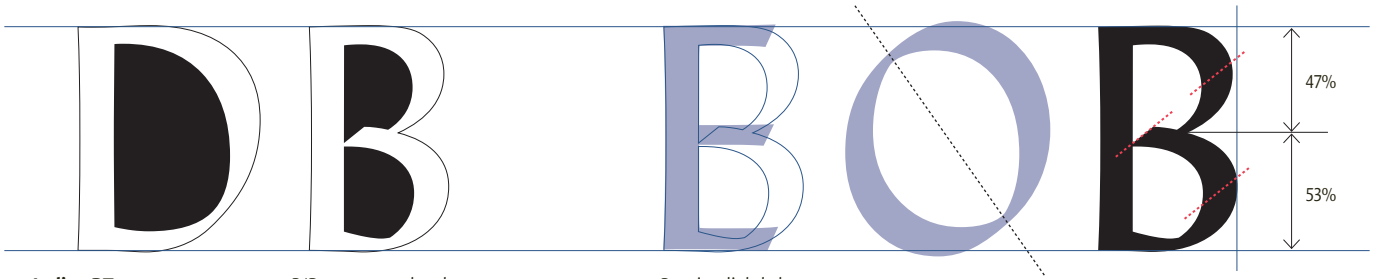


ITC New Baskerville (Roman)

Stempel Garamond has classic proportions.
The B is narrower than the O.



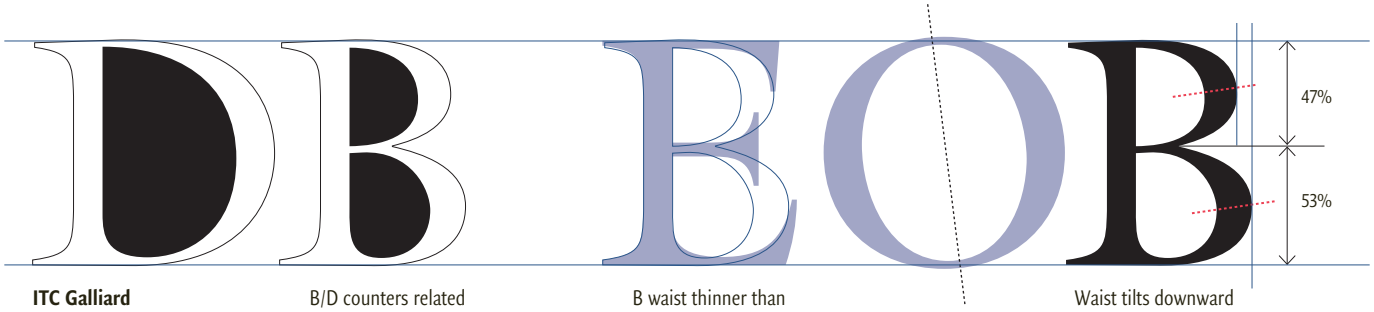
Bodoni has modern proportions.
The B and O are almost equal in width.



Lydian BT
(Roman)

B/D counters related

B waist slightly lower
than central arm of E



ITC Galliard
(Roman)

B/D counters related

B waist thinner than
central arm of the E

Waist tilts downward
Lower counter = teardrop

Capital P and R

On the Trajan column, the P and B have the same narrow width: a root five rectangle. The R is a wide letter with the same proportion as the T: two stacked golden rectangles.

The size of the bowls of the P and R fall between the upper and lower lobe of B. However, the bowl of the R is usually smaller than the P bowl, because a generous tail fills the lower half.

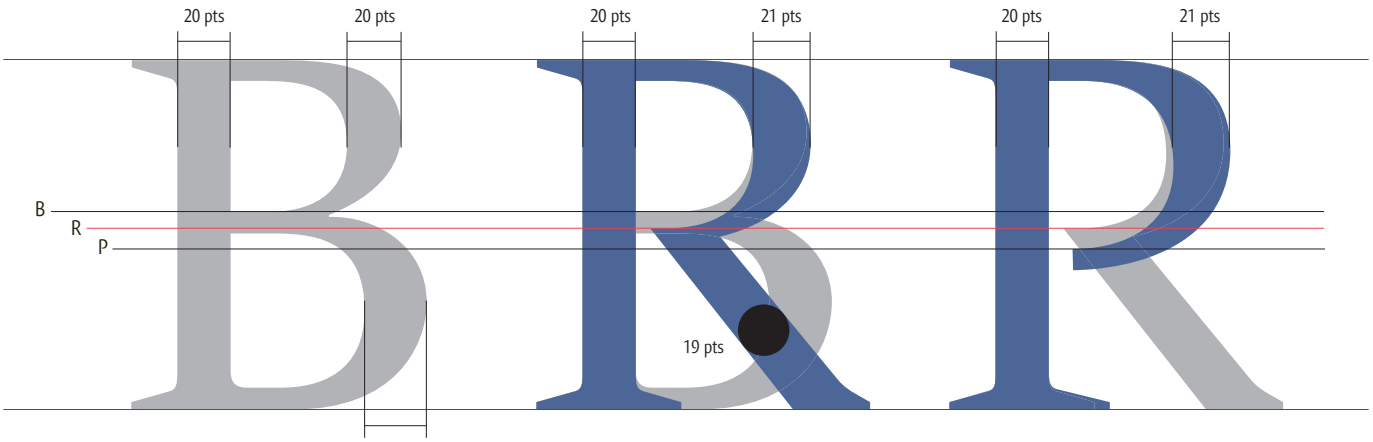
As in the B, the shape of the lower portion of the bowls on the P and R can be curved, diagonal, or horizontal as it joins the stem. The bowls may also be disconnected. When disconnected, the gap between strokes should be large enough to be visible at the intended size of use (details in display fonts can be finer than details in text-size fonts).

Due to its unique structure, the R is often cited as a "favorite" letter. In the words of designer Yomar Augusto, "[The R] combines vertical, horizontal, diagonal and round shapes, carrying almost the entire DNA of an uppercase family."[7]

The R is indeed a beautiful letter—particularly for its diagonal or curved leg, which offers designers a rare opportunity for personal expression. Note that a curved arch enables the letter to be narrow, while a diagonal creates a wide form. When the leg is diagonal, it should extend decisively past the outer edge of the upper bowl for balance.

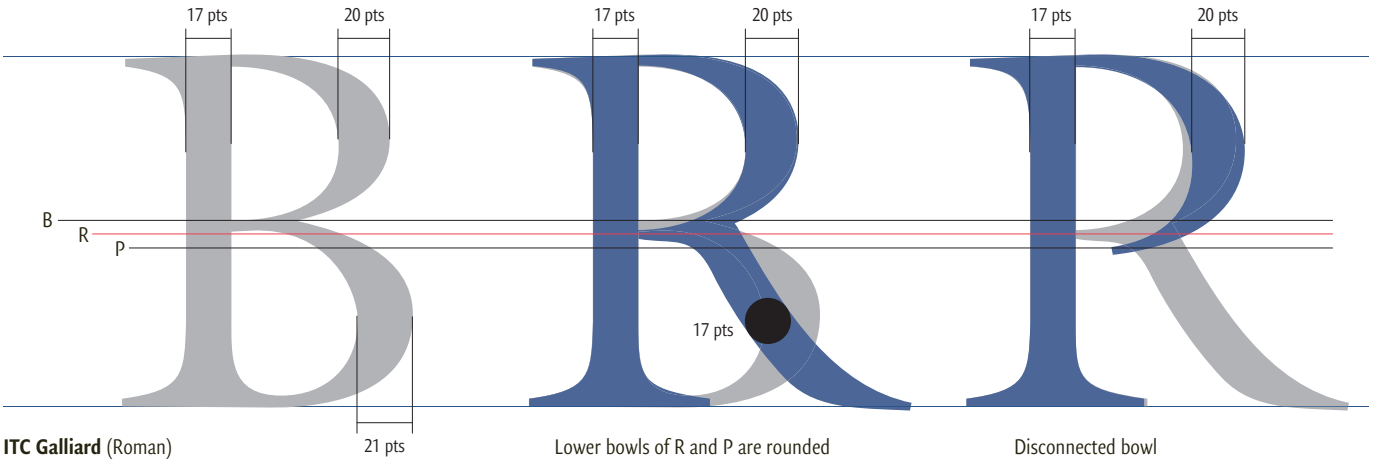
A long tail creates spacing problems, especially when the R is followed by a letter with a vertical stem (as in Rh, Ri, RL, RE, RK, RM, RN, and RU). Many typefaces (such as Bembo, shown on the opposite page) have both a more conventional shape (usually the default) as well as an alternate swash variation.

7 Heller, Steven, "15 Typographers Introduce Us to Their Favorite Letterforms," *Wired*, Condé Nast, 2016, wired.com/2016/01/14-typographers-introduce-us-to-their-favorite-letterforms/.



Le Monde Journal (Normal)

Lower bowls of R and P are disconnected



ITC Galliard (Roman)

Lower bowls of R and P are rounded

Disconnected bowl

R

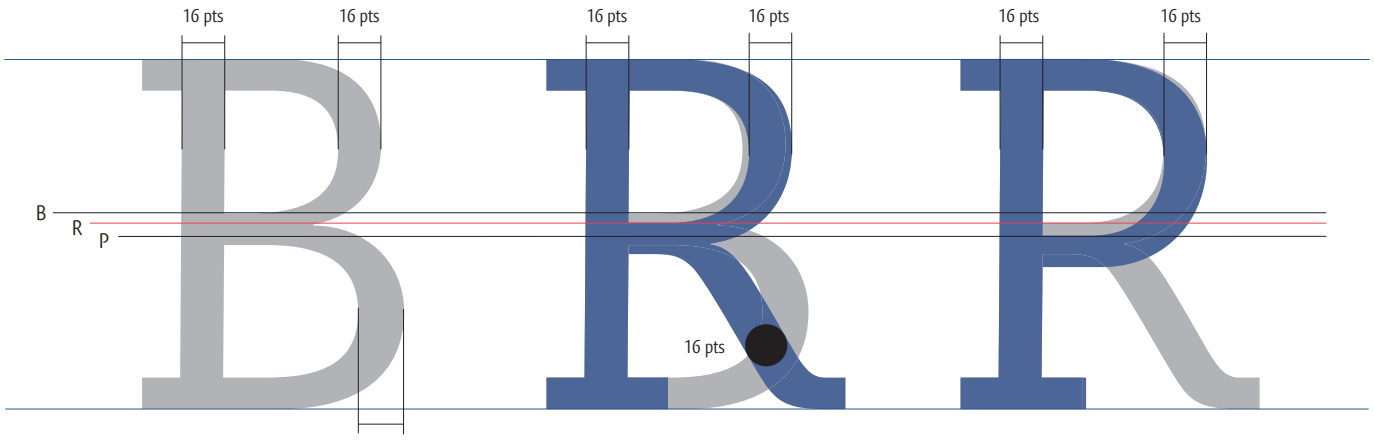
FORMERLY
EARN TORQUE
PURR CURVE
FORWARD TRY
RHYTHMIC

The default version of the R in Bembo has a short leg/tail.

R

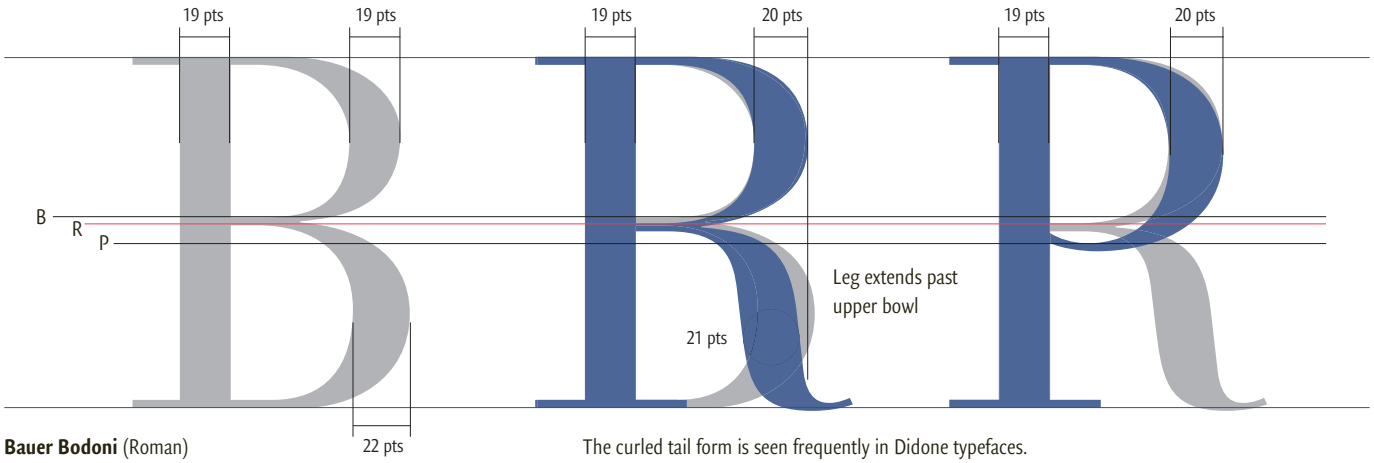
FORMERLY
EARN TORQUE
PURR CURVE
FORWARD TRY
RHYTHMIC

The elegant long-tailed version of the R; note spacing issues.



PMN Caecilia (55-Roman)

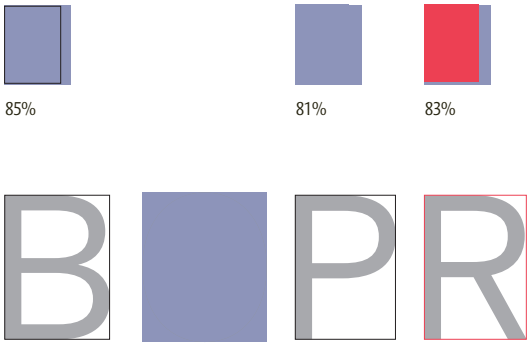
Bowls of the R and P are flat (horizontal) at the bottom, which is typical in sans serifs.



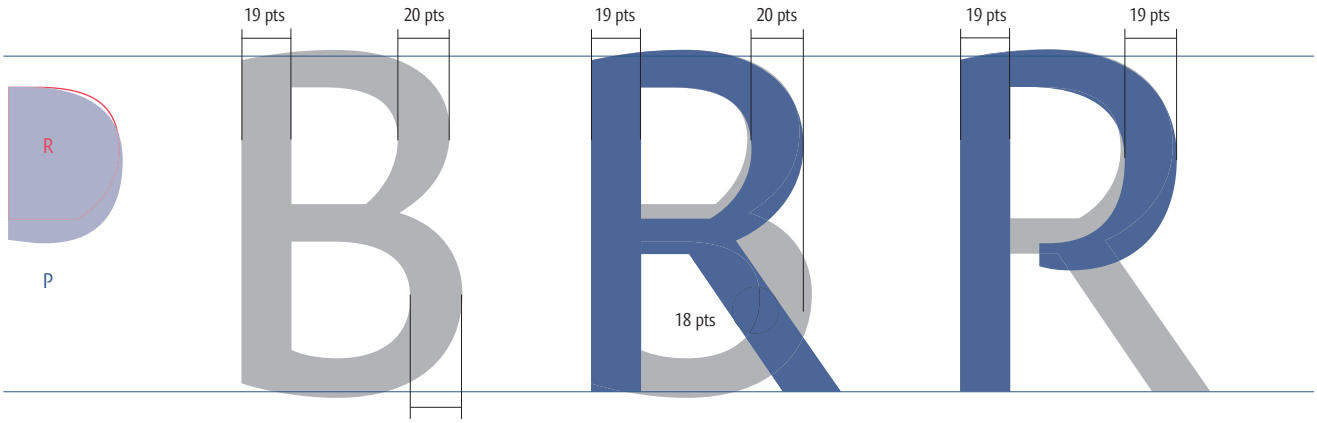
Bauer Bodoni (Roman)

The curled tail form is seen frequently in Didone typefaces.

Galliard has classic proportions.
The B and P are narrower than the O (both 77%).
The R is slightly wider than the O (102%).



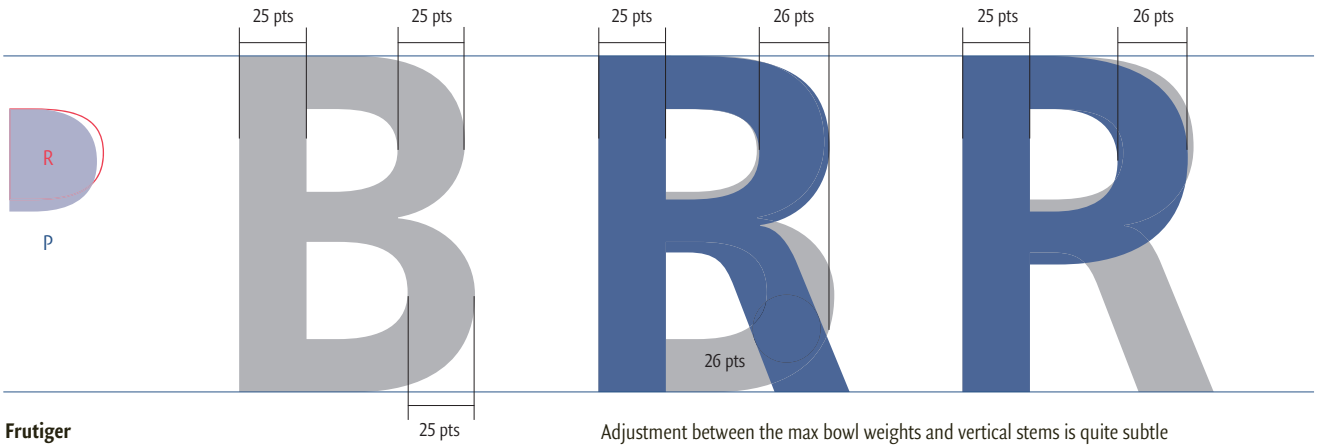
Benton Sans has modern proportions.
The B, P, and R are all narrower than the O (and almost equal):
B = 85%, P = 81% and R = 83% of the width of the O.



Quadraat Sans
(Regular)

Calligraphic construction evident in upper bowl shapes of B/R

No weight differences between the vertical stem and max bowl weight



Frutiger
(65-Bold)

Adjustment between the max bowl weights and vertical stems is quite subtle

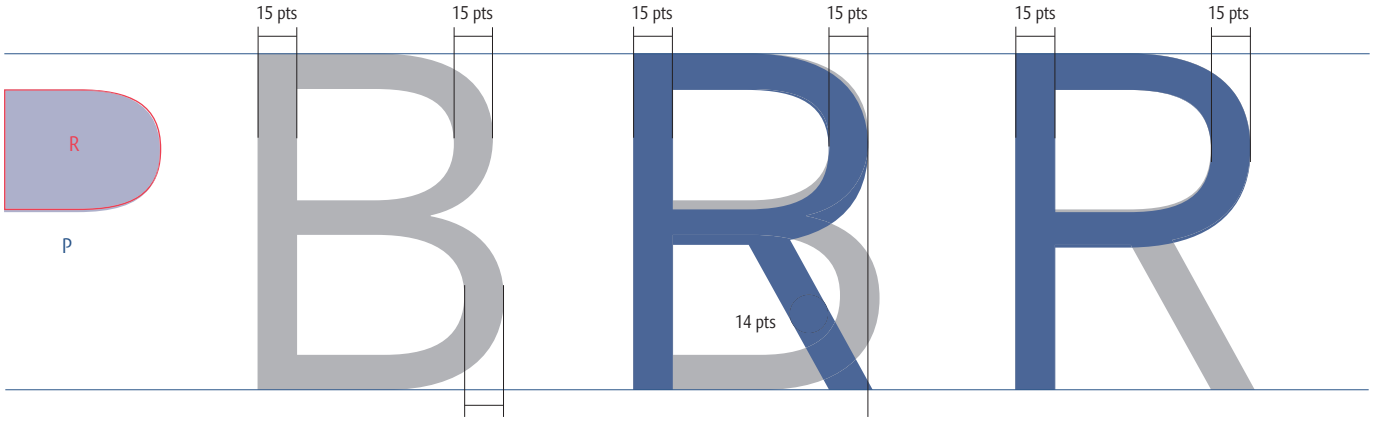
SPACING AND TESTING

Once the D, P, B, and R are complete, you have fifteen letters, which is more than half of the capitals (E + HILFT + OCG + SJ + DBRP) to combine and test. With this combination of vowels and consonants, you can begin to set sentence-like phrases to see the emerging quality of text. For example:

THE BOTTLE HOLDER SEES POST BIRDS. GO FILTER DOOR TO DOOR. EDIT ERRORS OR FORGO GOLD JIGS. SOLDIERS RISE TO DEFLECT OFFICE HOLDERS. CROCHET OR BOIL SLICED ROOTS. OBLIGE THE ELDER BROTHERHOOD LIFTS.

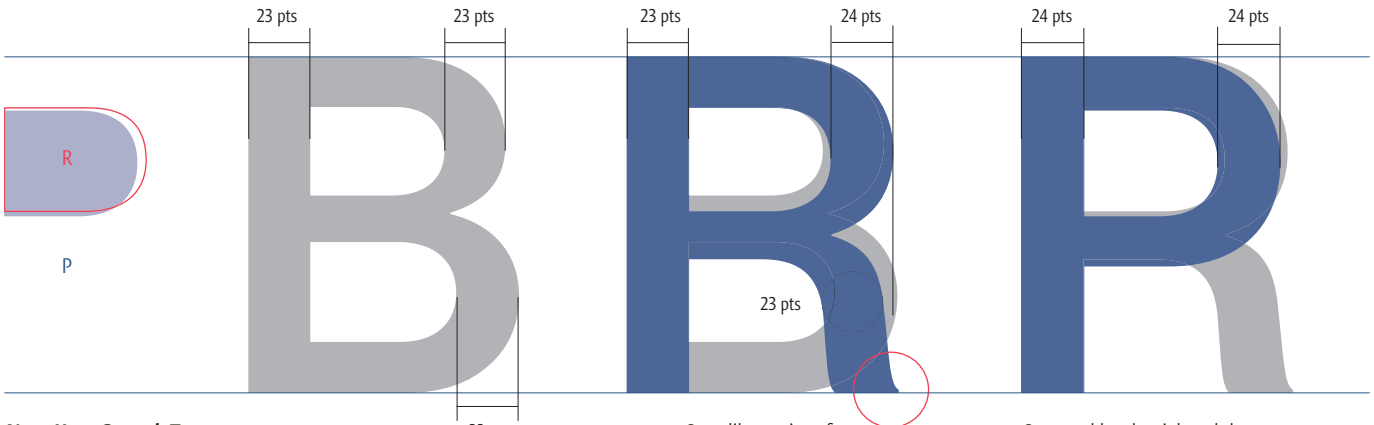
Eames Century Modern (Regular)

Above, Eames Century Modern. The R has an extended but upright tail. This vertical design helps fill the open space that would otherwise occur to the right of the R.



Benton Sans
(Regular)

No adjustment between the max bowl weights and vertical stems



Neue Haas Grotesk Text
(65-Medium)

Spur-like vestige of calligraphic construction

Stem and bowl weight subtly thicker to achieve even color

Capital Q

Many designers have waxed poetic on the beauty of the letter Q. The personality is, of course, captured by the tail. Anything is possible: The tail can be a stiff, formal stump; a controlled regal wave; a flamboyant or an irreverent flourish. To create unity, the tail of the Q and leg of the R can be designed as a pair; for variety, the two letterforms can have contrasting shapes.

The most common tail shape is a right-facing curve. Short tails interfere less with surrounding letters, but long tails are more expressive and dynamic. Other tail variations include ogee curves (as in Bembo, Ambroise, and Walbaum), straight diagonals (as in Algebra), and Z-shaped swashes (as in Noe).

In serif typefaces, a serif or ball-shaped terminal may be appended to the tip of the tail. In sans serifs, the end of the tail can be cut at various angles, shaped, or blunted. Because of this emphasis on stroke endings, the sans serif Q may have a stronger relationship to glyphs such as the C and S rather than the R.

There are five main ways to join the tail of the Q to the bowl. Most often (as in Bembo), the tail flows from the lower left in calligraphic stroke. However, the tail can also be disconnected and tangent (as in Palatino) or disconnected and overlapping (as in Trump Mediaeval). The tail can also begin inside the bowl (as in Eames Century Modern)—as long as the interior counter of the Q can remain clear (a concern at small type sizes). In the fifth and last method, the tail flows from the lower right side of the bowl (as in Didot and Harriet).

William Display Std (Regular)

Two versions of a Caslon capital Q by Maria Doreuli.
The long tail is elegant and dramatic, but less suitable for solid typesetting,
as the form extends into the line below.

Palatino
(Roman)

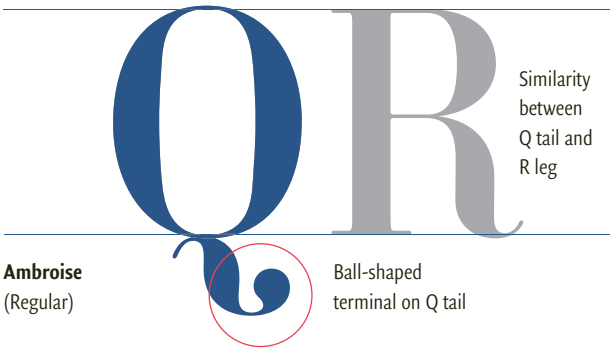
Tail tangent to bowl; design shows calligraphic influence

Feijoa Display
(Regular)

Tail narrows at join to bowl

HTF Didot
(M-24 Medium)

Tail shows the thin stroke/
high contrast



Similarity between Q tail and R leg

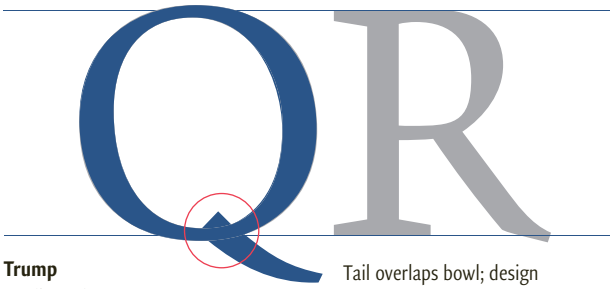
Ambroise
(Regular)

Ball-shaped terminal on Q tail

Bembo MT
(Regular)

Similarity between Q tail and R leg

Tail flows from bowl



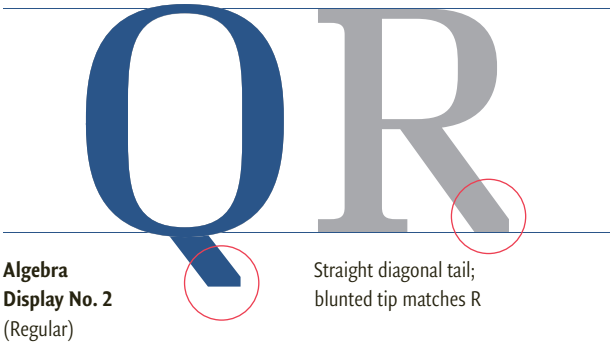
Trump Mediaeval
(Roman)

Tail overlaps bowl; design shows calligraphic influence

FF Scala
(Regular)

Serif on Q tail relates to ending on R leg

Tail at maximum stroke width at join to bowl

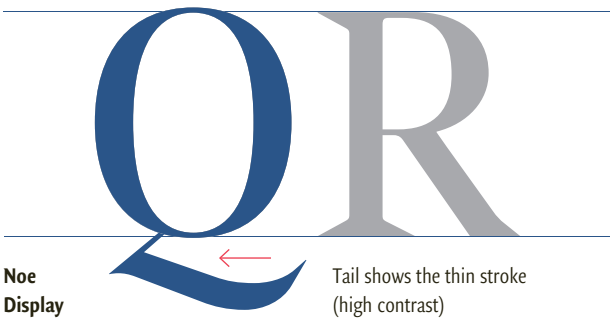


Algebra Display No. 2
(Regular)

Straight diagonal tail; blunted tip matches R

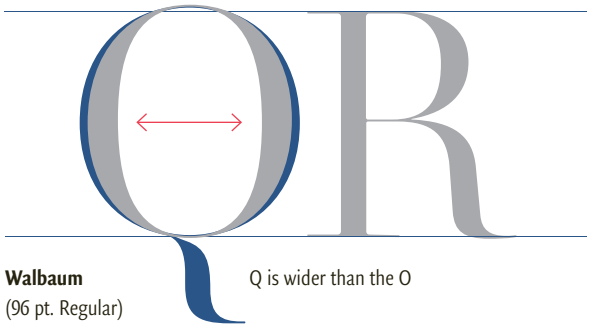
Harriet Display
(Regular)

Dramatic z-form inspired by Baskerville



Noe Display
(Regular)

Tail shows the thin stroke (high contrast)



Walbaum
(96 pt. Regular)

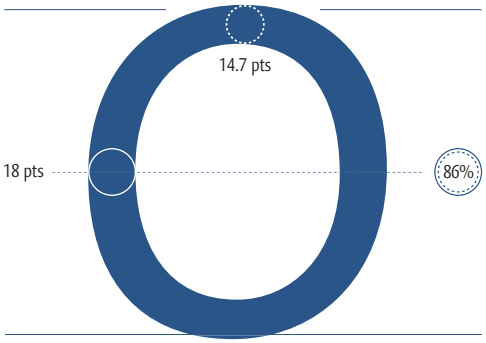
Q is wider than the O

Eames Century Modern (Regular)

Similarity between Q tail and R leg

STROKE THICKNESSES IN THE CAPITAL Q

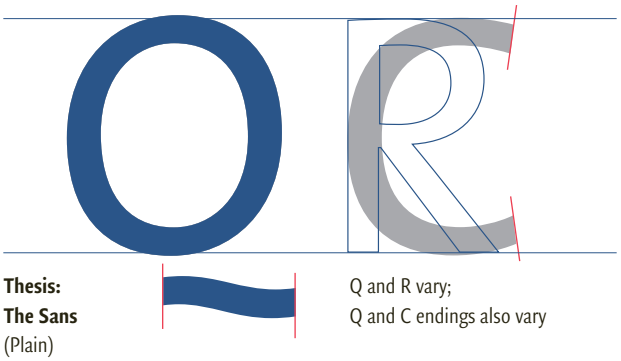
The thickest part of the tail is often slightly less than the maximum bowl thickness (for example, one could use the vertical stem thickness). This medium width prevents the Q from becoming too dark (and avoids congestion with adjacent glyphs).



Thesis:
The Sans
(Plain)

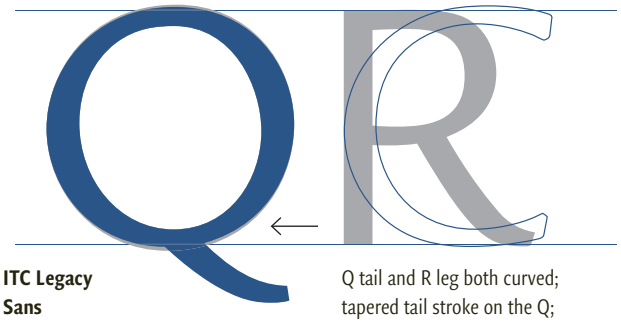
In his 2011 *Print* magazine article "Flawed Typefaces," historian Paul Shaw is critical of Q in Thesis for being "distracting"—and for potentially looking like a capital O with a lower accent mark.

BRUSQUE



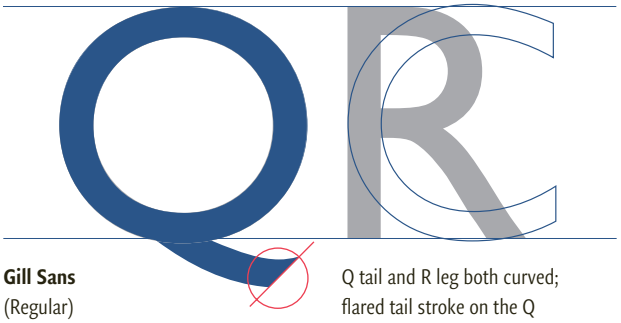
Thesis:
The Sans
(Plain)

Q and R vary;
Q and C endings also vary



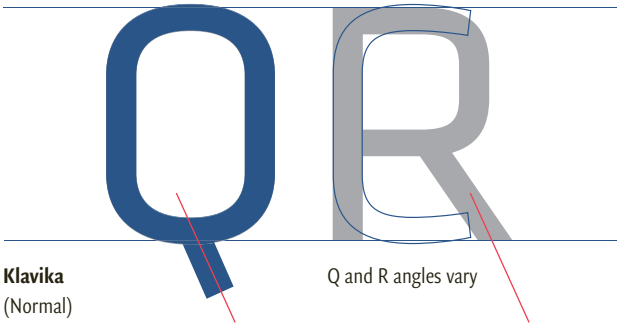
ITC Legacy
Sans
(Book)

Q tail and R leg both curved;
tapered tail stroke on the Q;
Q bowl narrowed at join



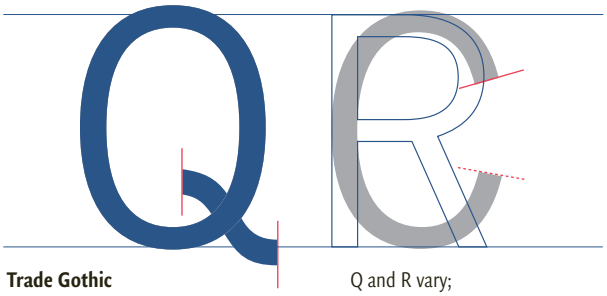
Gill Sans
(Regular)

Q tail and R leg both curved;
flared tail stroke on the Q



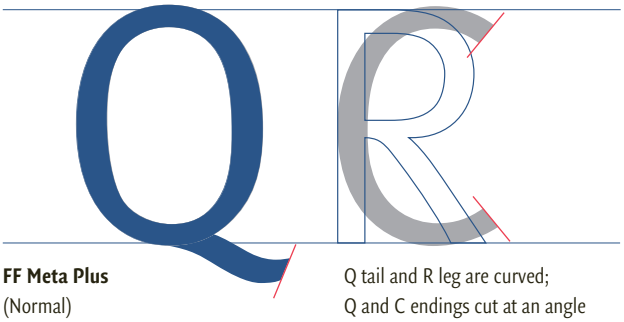
Klavika
(Normal)

Q and R angles vary



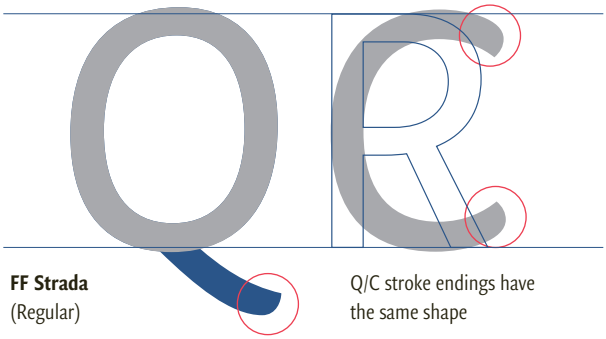
Trade Gothic
(Regular)

Q and R vary;
Q and C endings also vary



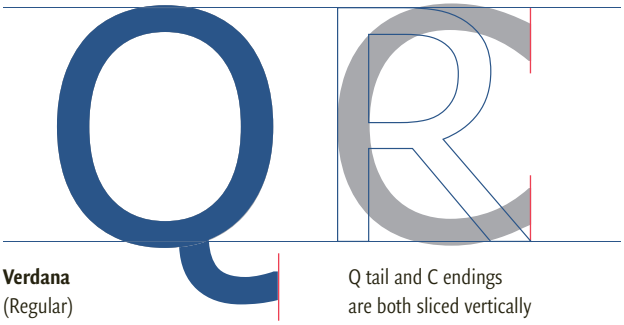
FF Meta Plus
(Normal)

Q tail and R leg are curved;
Q and C endings cut at an angle



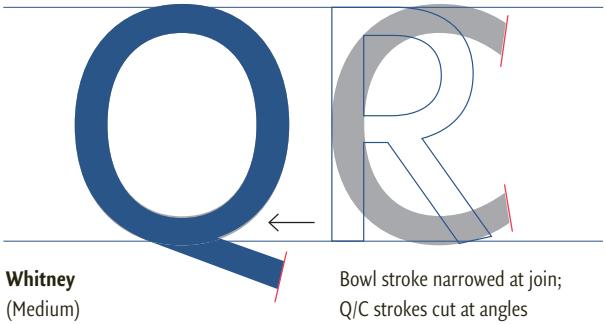
FF Strada
(Regular)

Q/C stroke endings have
the same shape



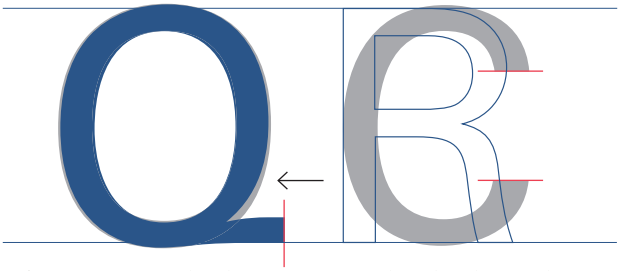
Verdana
(Regular)

Q tail and C endings
are both sliced vertically



Whitney
(Medium)

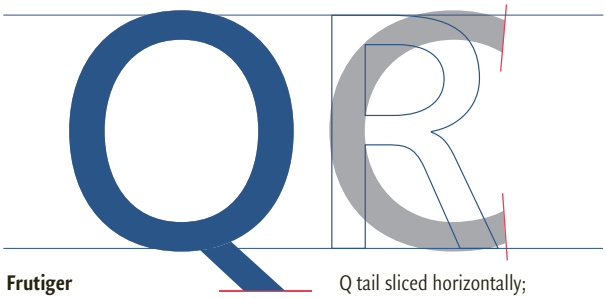
Bowl stroke narrowed at join;
Q/C strokes cut at angles



Univers
(55 Roman)

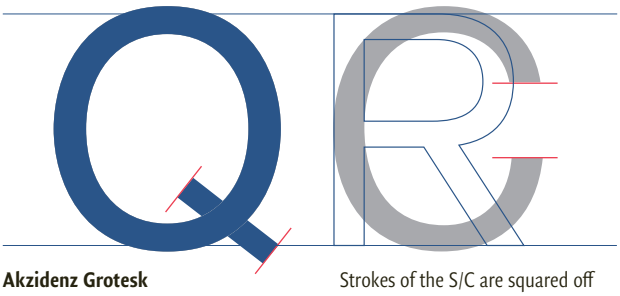
Bowl stroke
narrowed at join

Stroke endings horizontal
or vertical throughout



Frutiger
(55-Roman)

Q tail sliced horizontally;
C sliced at subtle angles



Akzidenz Grotesk
(Regular)

Strokes of the S/C are squared off
(cut at 90-degree angles)

Capital V and A

The V is the building block for four diagonal letters: the A, W, M, and Y. The V and the A are almost identical rotated shapes. When using classic proportions, the V and A are typically narrower than the O. When using modern proportions, the V is roughly the same width as the O (the negative space inside the V and O should be approximately equal). However, because the crossbar may increase density (especially in bold fonts), an A with modern proportions may be drawn slightly wider than the V.

There are display typefaces that have V and A forms that are rounded at the base, but in a conventional text design, the diagonals of the V and A meet in a sharp or blunted join. The bottom of the V is called the vertex; the top of the A is called the apex. As discussed previously (see p. 46), narrow and sharply pointed joins need more overshoot and undershoot than wider, broader joins.

In typefaces influenced by calligraphy, the A or the V may be drawn with subtle asymmetry, leaning to either the left or right. Calligraphic origin can also be evident in an angled vertex (as in Fedra, shown at right). In typefaces with an upright axis, the legs are generally drawn at symmetrical angles—the left stroke mirrors the right (as in Caecilia, below).

DIAGONAL STROKE WEIGHTS

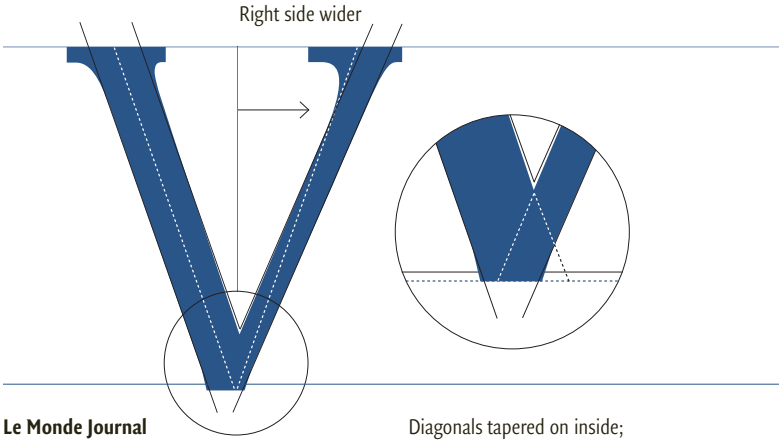
The diagonals of the V and A can be difficult to measure precisely, because they are rarely even and parallel. Designers may extend serif brackets into the diagonal arms to create graceful, tapering strokes. Additionally, designers usually taper the inside of diagonals to open counters and prevent glyphs from becoming too dark.

In many typefaces, the thin diagonal arms of the A and V are drawn slightly heavier than the normal horizontal thin stroke. Research shows that horizontal lines look heavier than verticals of the same thickness (Waard 2019). Because diagonals have partial vertical emphasis, they may need additional weight to match the appearance of horizontals.

The width of the thick diagonal stroke varies. In normal or light weights, the thick diagonal can be subtly increased (perhaps 5–10%) so the V looks equal in density to other letters that are wider and/or more complex (such as an E or H). However, in heavier designs, the diagonal may be equal or slightly lighter (perhaps 85–95%) to avoid a heavier letter. To avoid buildup at the join, an additional ink trap can be inserted at the vertex/apex.

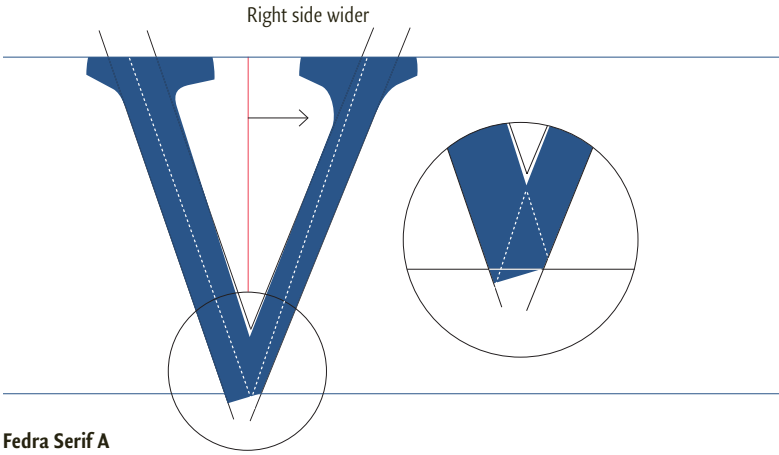
HAVE

Above, Amplitude, designed by Christian Schwartz, has visible ink traps, even in the medium weight.

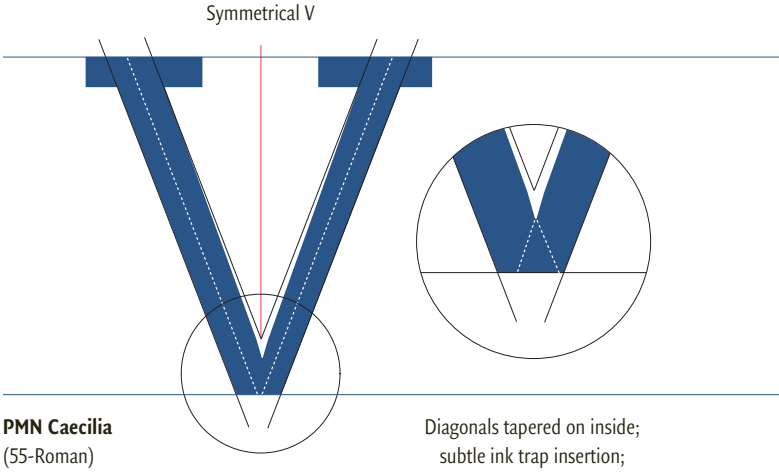


Le Monde Journal
(Normal)

Diagonals tapered on inside;
vertex width less than thick diagonal

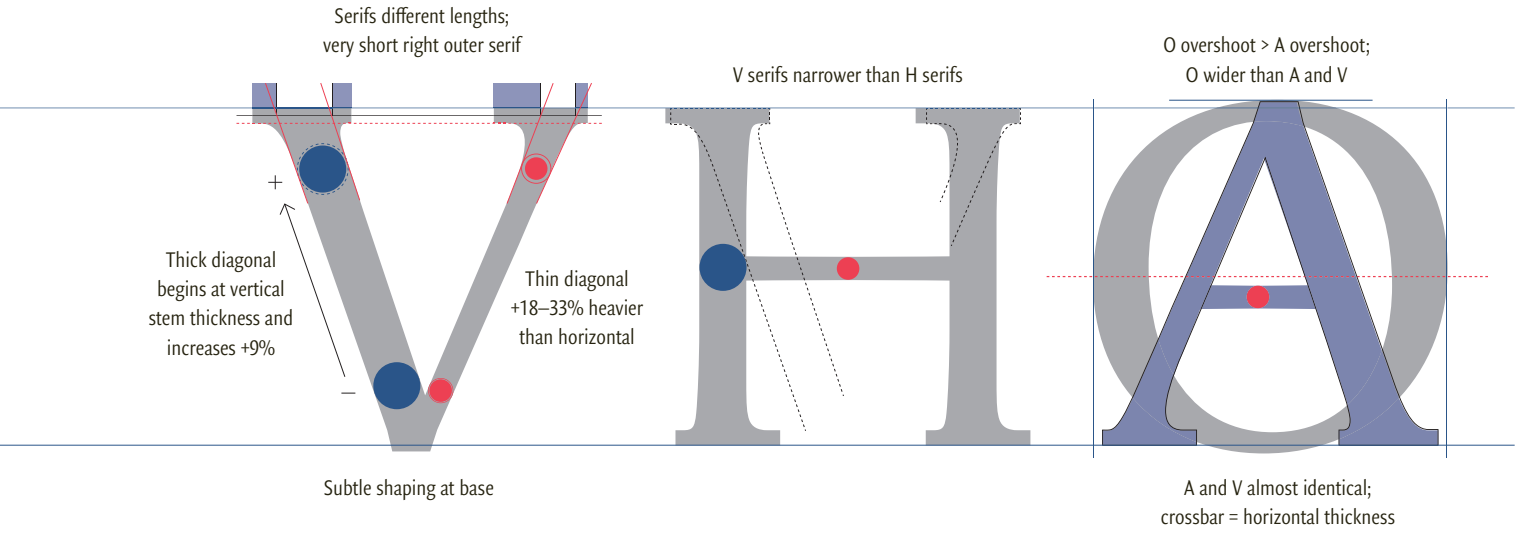


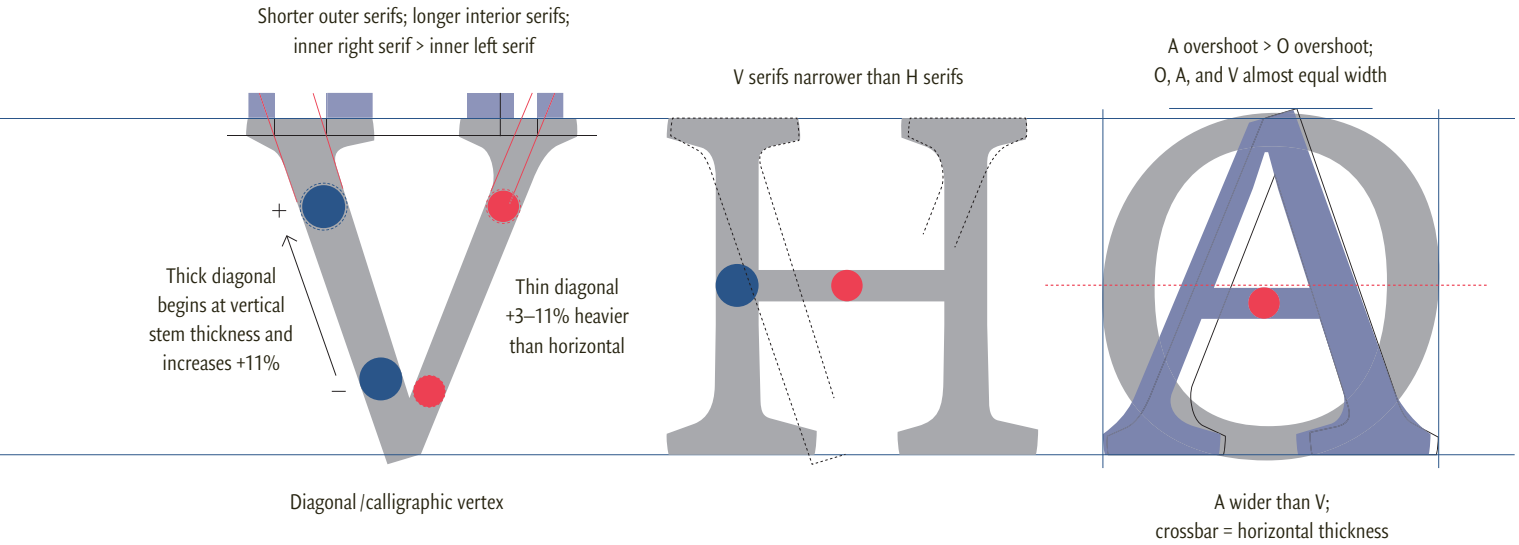
Fedra Serif A
(Book)

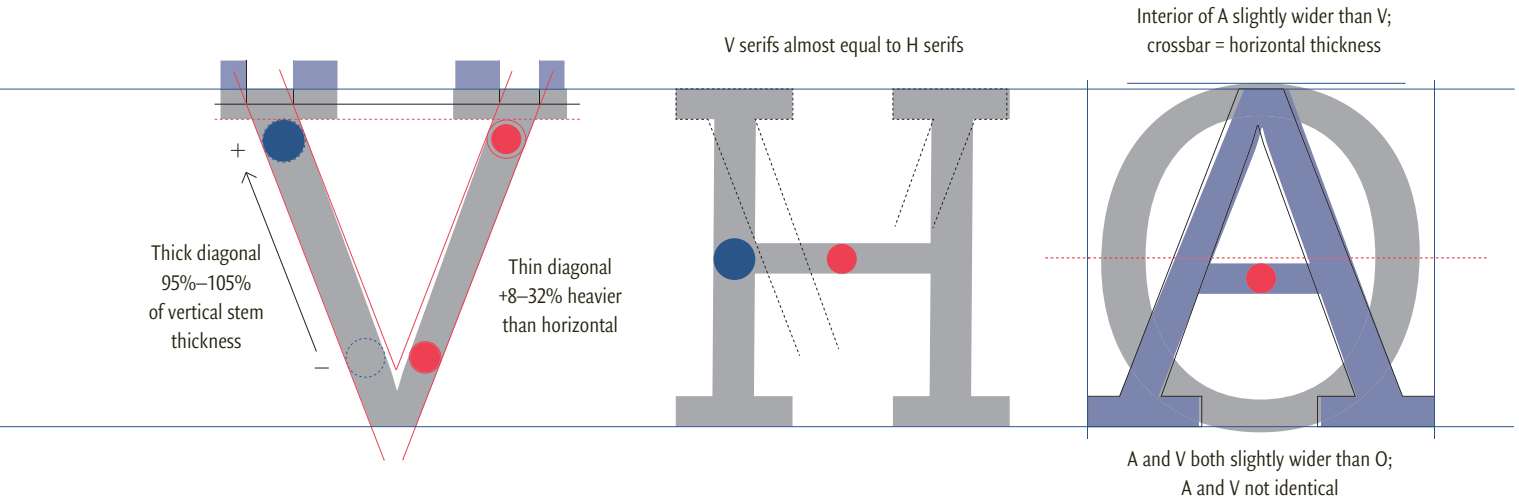


PMN Caecilia
(55-Roman)

Diagonals tapered on inside;
subtle ink trap insertion;
vertex > thick diagonal


Serifs different lengths;
very short right outer serif
V serifs narrower than H serifs
O overshoot > A overshoot;
O wider than A and V
Thick diagonal
begins at vertical
stem thickness and
increases +9%
Thin diagonal
+18–33% heavier
than horizontal
Subtle shaping at base
A and V almost identical;
crossbar = horizontal thickness


Shorter outer serifs; longer interior serifs;
inner right serif > inner left serif
V serifs narrower than H serifs
A overshoot > O overshoot;
O, A, and V almost equal width
Thick diagonal
begins at vertical
stem thickness and
increases +11%
Thin diagonal
+3–11% heavier
than horizontal
Diagonal /calligraphic vertex
A wider than V;
crossbar = horizontal thickness


V serifs almost equal to H serifs
Interior of A slightly wider than V;
crossbar = horizontal thickness
Thick diagonal
95%–105%
of vertical stem
thickness
Thin diagonal
+8–32% heavier
than horizontal
A and V both slightly wider than O;
A and V not identical

DETAILS OF THE CAPITAL A

The crossbar of the A is generally positioned below the midline (the mathematical center). This crossbar is not always drawn with the normal horizontal stroke thickness. Because horizontals look heavier than diagonals of the same weight, the crossbar may need to be subtly thinned so that it appears equal to the thin diagonal. In bold fonts (such as heavy slab serifs) this adjustment also helps prevent the counter of the A from becoming too dark.

DIAGONAL SERIFS

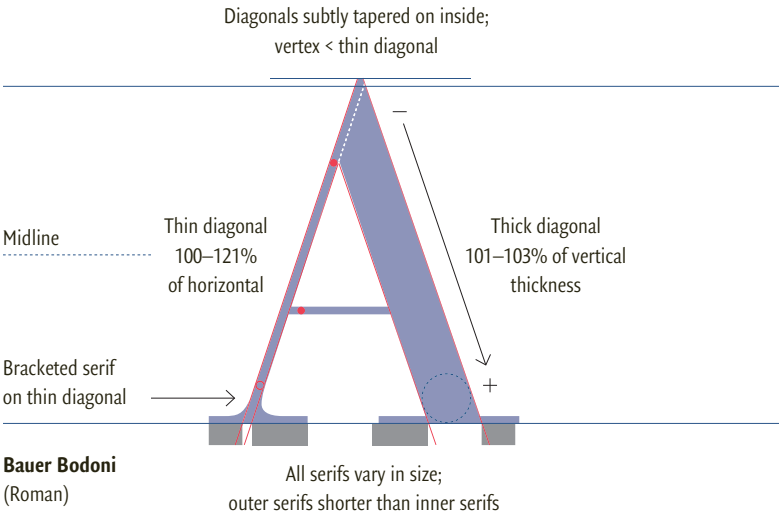
Serif construction is challenging on diagonal letters, because the intersection of a horizontal and diagonal is asymmetric. Asymmetry forces the inner and outer brackets to differ in shape; the curve on the inside must be sharper than the curve on the outside. However, while brackets cannot be identical, they can still be related. The overall degree of bracketing can be similar, and the general shape and speed of the curves consistent.

There is no set formula for the width of the serifs on the V and A. In general, outer serifs are shorter than inner serifs in order to improve spacing. As discussed earlier in the chapter on spacing, the triangular structure of the V and A creates awkward gaps; making the outer serifs shorter allows the letters before and after the V and A to be set more closely.

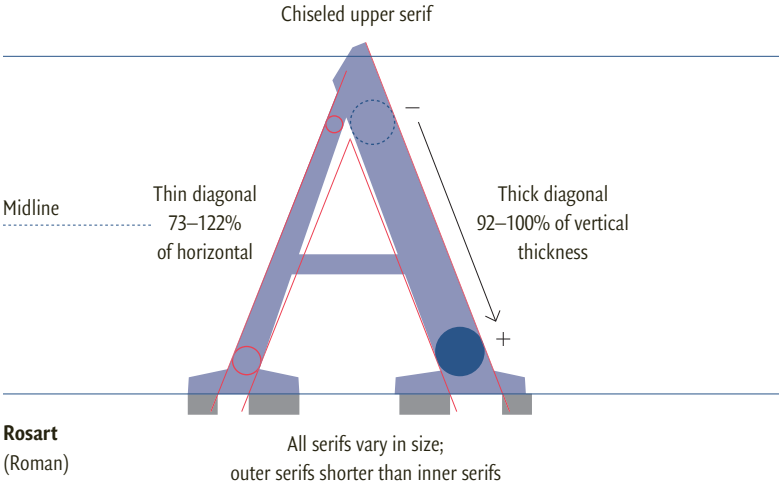
In humanist types, the apex of the A sometimes has a serif-like extension of the thick diagonal stroke. In slab serifs (particularly those intended for display use) the A may be adorned with a flat horizontal stroke that rests on the apex like a small hat.

NAVAL

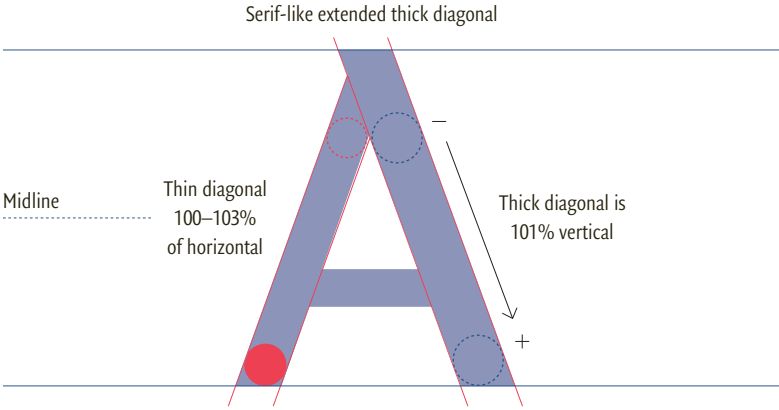
Above, Archer, a typeface designed by Tobias Frere-Jones and Jonathan Hoefler for use in *Martha Stewart Living* magazine. The top of the A has a hat-like serif.



Bauer Bodoni
(Roman)



Rosart
(Roman)

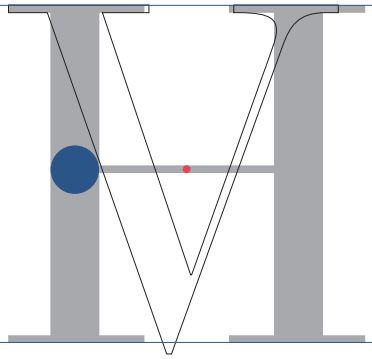


Quadraat Sans
(55 Roman)

Thick diagonal of
A and V are identical

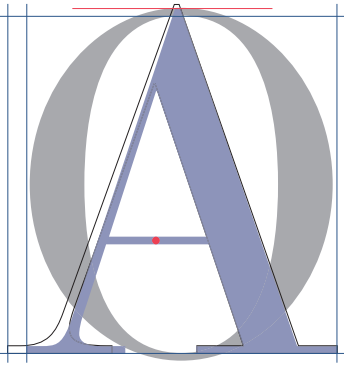
Thin diagonal ranges from
100–114% of horizontal

Outer V serif slightly
less than H serif



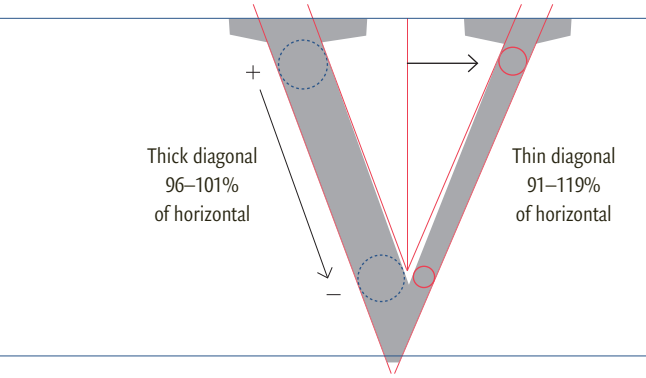
Horizontal = 16% of
vertical stem thickness

A overshoot < V undershoot;
V wider than A; both wider than O



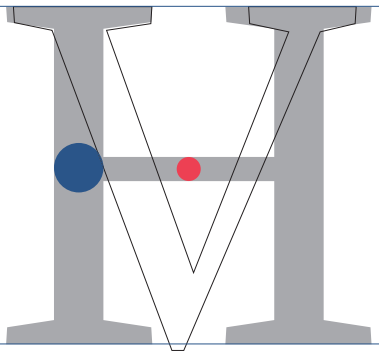
Crossbar = horizontal thickness

Right side wider



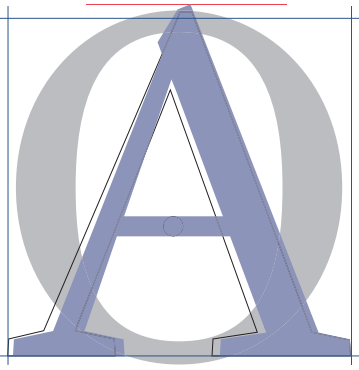
V has lower contrast vs. A

Outer V serif shorter
than H serif



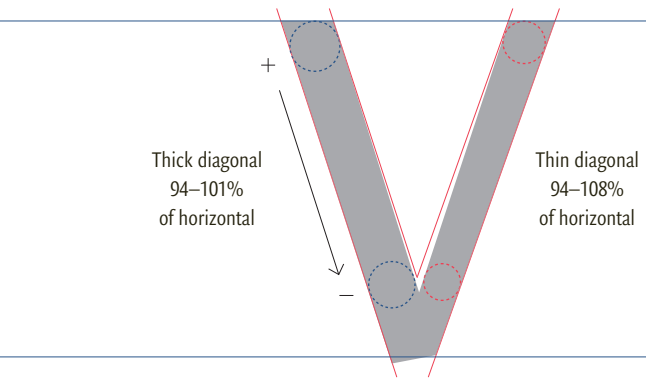
Horizontal = 49% of
vertical stem thickness

A and V both wider than O;
A overshoot > V undershoot

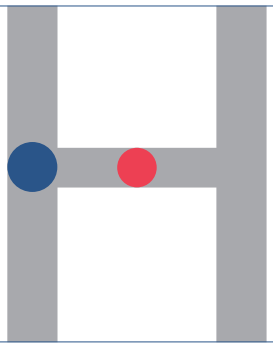


Crossbar = 83% of horizontal

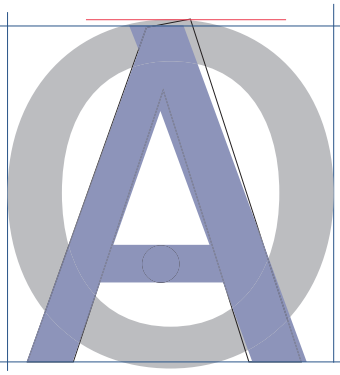
A and V both narrower than O;
V undershoots (A is aligned)



Diagonals of V and A are not identical;
V has lower contrast vs. A



Horizontal = 79% of
vertical stem thickness



Crossbar = 95% of horizontal

DIAGONAL STROKE ENDINGS

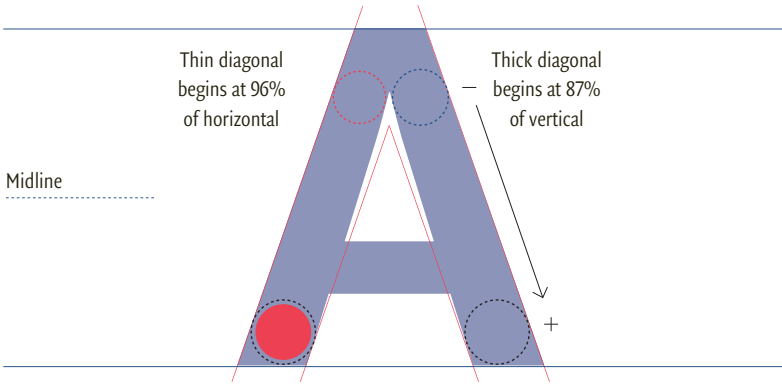
In most sans serifs, the diagonal strokes of the A and the V end at the capline and baseline. One alternate option is to square the ends of diagonal strokes, as in Syntax, designed by Hans Eduard Meier. These endings (which are related to calligraphy) create a warm, playful personality, since the stems extend above and below the capline and baseline—a lively "dancing" effect.

SPACING AND TESTING

Because the V and A are our first diagonal capitals, it's best to check their density before moving forward with the W, M, Y, etc. By spacing and setting the V and A with the other capitals, we can correct color and proportion as needed. The A is particularly important, as it is a vowel (and grammatical article) that occurs frequently in several languages. The humanist sans-serif Syntax is shown below:

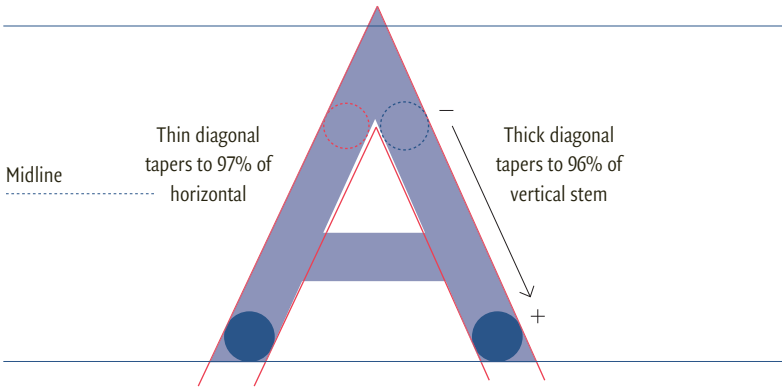
VERTICAL BARS ALIGN ACROSS OUR VESTS. LIVER TASTES AS BITTER AS A FORGED PHOTOSTAT. PRIESTS VETO THE ADVERTISED TEAS. THE SILVER CLAD ASTROLOGERS RAVISH SOLAR BLOGS. THE ELVISH NATIVES EVAPORATE BOG GASES.

Syntax (Roman)



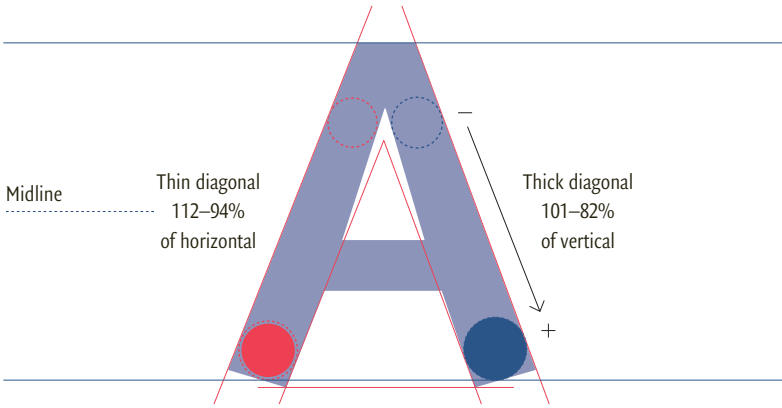
Neue Haas Grotesk Display (65-Medium)

Both legs = 96% vertical thickness at base; diagonals are tapered



Futura PT–Paratype (Medium)

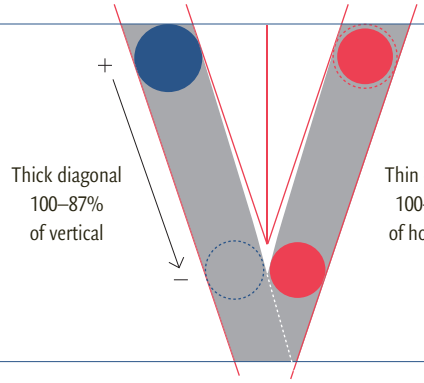
Both legs = 100% vertical thickness at base



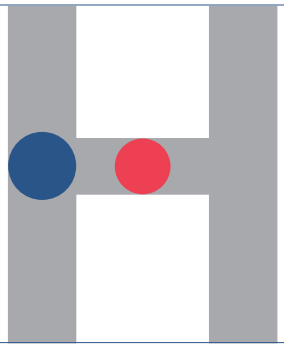
Syntax (Bold)

Diagonal stems extend to undershoot line; diagonals are strongly tapered

Thick diagonal of A and V are identical,
but V has lower contrast vs. A

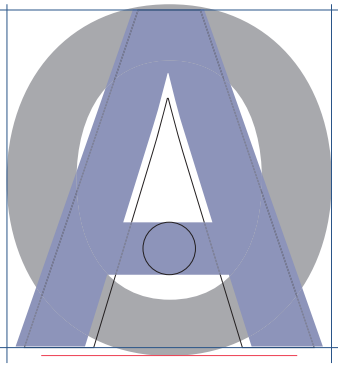


Vertex wider than thick stroke



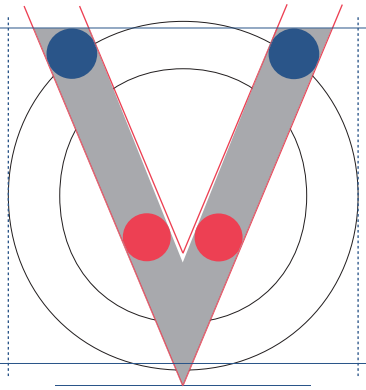
Horizontal = 82% of
vertical stem thickness

O wider than A and V;
no overshoot/undershoot on A or V

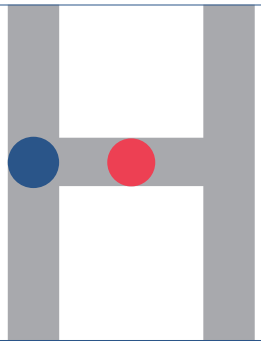


A wider than V;
crossbar = 94% horizontal thickness

V narrower than O

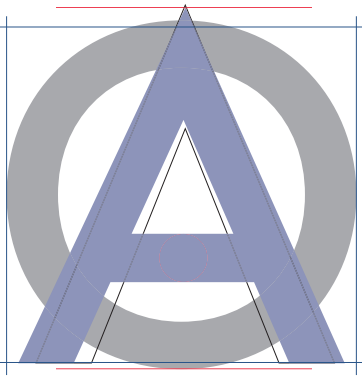


Symmetrical V; strokes taper from
vertical to horizontal thickness



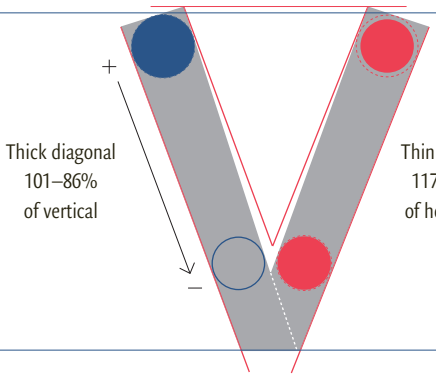
Horizontal = 94% of
vertical stem thickness

Pointed apex extends past overshoot



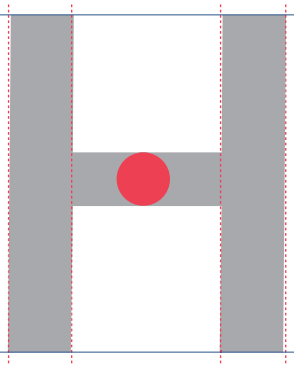
A narrower than O;
crossbar = horizontal thickness

Diagonal stems extend to overshoot line

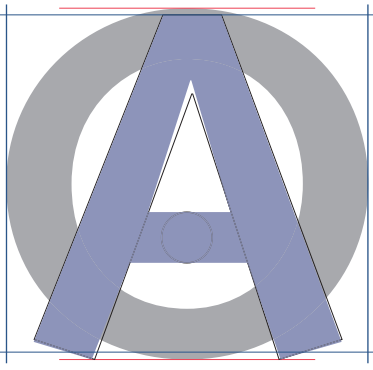


Vertex wider than thick stroke;
V has lower contrast vs. A

Vertical stems not quite parallel/upright



Horizontal = 44% of
vertical stem thickness



A and V approximately same width;
crossbar = 96% horizontal thickness

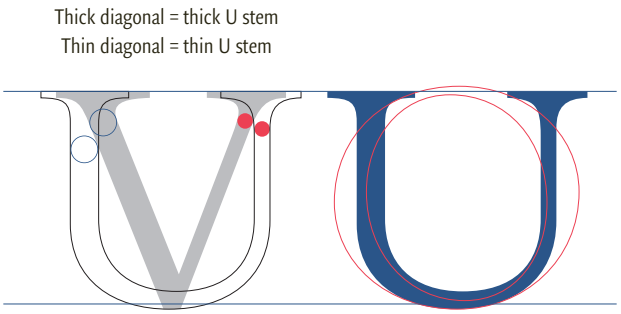
Capital U

It may seem odd to place the U with the diagonal capitals, but the U is actually closely related to the V. Prior to the development of the U, the V represented both a consonant and a vowel sound. When the V appeared at the beginning of a word, it was pronounced as a consonant; when the V appeared in the middle of a word, it was pronounced as a vowel.

A round-shaped V was not seen until the Middle Ages, when the uncial and semi-uncial style of calligraphy became popular. The uncial style rounded many letterforms, including both the V and the A. Over time, the rounded version of the V became a distinct letter in its own right; it was used specifically to represent only the vowel sound. After several centuries, this informal convention solidified into regular and "official" practice.

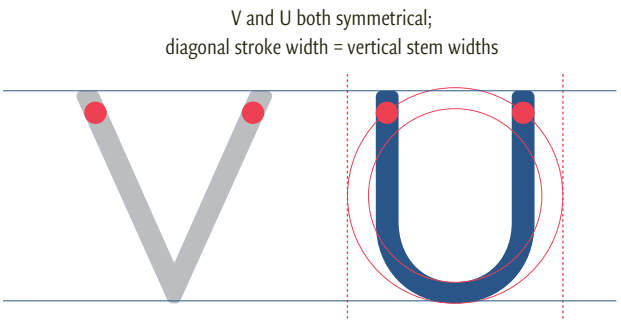
The history of the U explains how its structure is derived from the V. In most serif typefaces, the V and the U are asymmetric, with a heavy stem on the left and a thin stem on the right. The two letters are also approximately equal in width. In designs influenced by calligraphy, the arc that connects the two vertical stems of the U is also asymmetric—the bowl is lower on the left, at approximately 8 o'clock. This shape gives the U a more dimensional and dynamic quality.

However, in sans serifs (and other rational typefaces), the U may be constructed with a symmetrical bowl. In these designs, the two stems may also be symmetrical, with two thick verticals rather than the traditional thick-and-thin strokes. The structure of this fully symmetrical U is substantially darker and heavier than the traditional calligraphic form. Therefore, this version of the U may need to be drawn slightly wider, since, as in the H, the two thick verticals tend to optically merge, creating the illusion of a darker and narrower form.



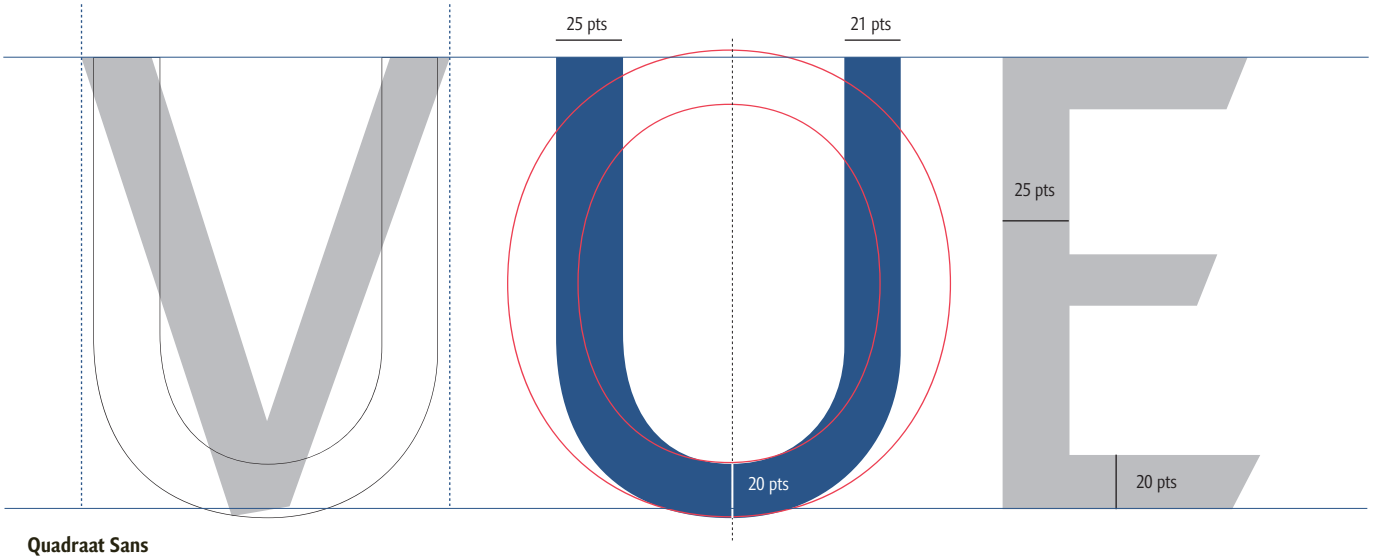
Bembo MT
(Regular)

U and O have same undershoot



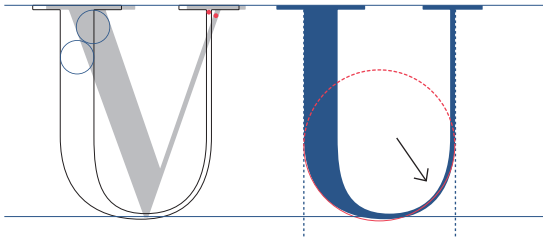
Brandon Grotesque
(Regular)

U and O have same undershoot



Quadraat Sans
(Regular)

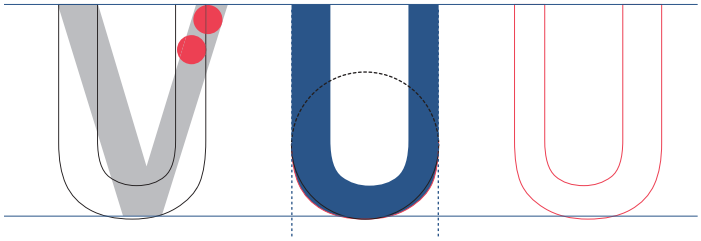
Thick diagonal = thick U stem
Thin diagonal = thin U stem



Trianon Display
(Regular)

Bowl of the U is asymmetrical
(compare to geometric circle)

Thick diagonal = thick U stem
Thin diagonal = thin U stem

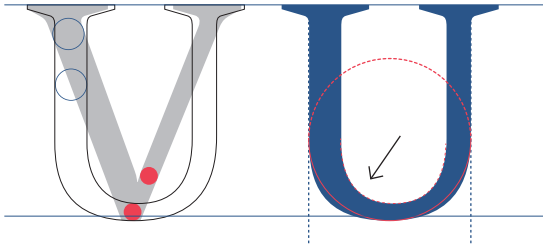


Franklin Gothic
(Medium)

Bowl of the U is symmetrical
(but not perfectly circular)

Contrast visible
when U is mirrored

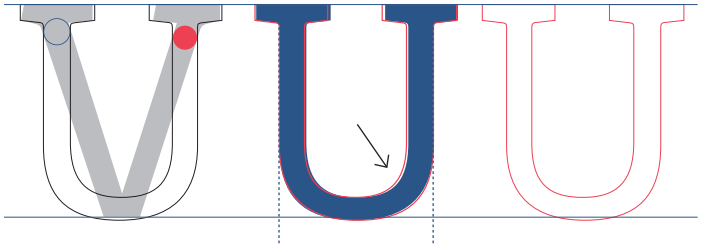
Thick and thin strokes of
V and U match



Le Monde Journal
(Normal)

Interior symmetrical;
exterior curve lower at left
(compare to geometric circle)

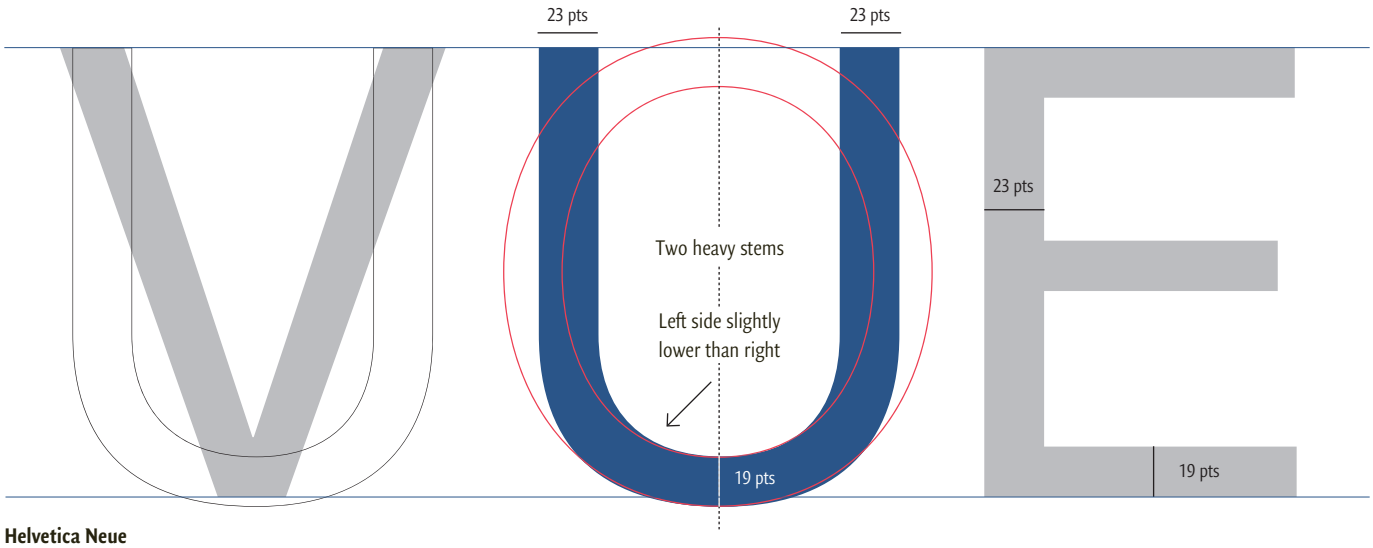
Thick diagonal = thick U stem
Thin diagonal = thin U stem



Adelle
(Regular)

Subtle asymmetry
interior and exterior

Contrast visible
when U is mirrored



Helvetica Neue
(Regular)

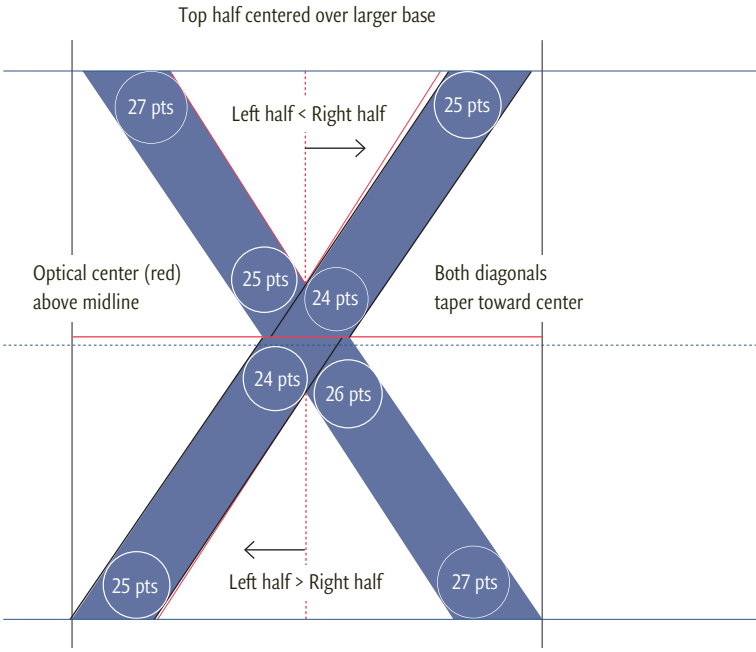
Capital X

We briefly detour from letters based on the V to confront the X, because we need to examine the Poggendorff illusion, an optical phenomenon that affects several of the diagonal glyphs that remain ahead. The Poggendorff illusion is named for German physicist Johann Christian Poggendorff (1796–1877), who discovered that a line appears to shift when it is interrupted by a larger intervening structure. The illusion is often demonstrated with a high-contrast X—after the crossing, the thin stroke appears to shift upward. The degree of shift depends on angle and contrast; Didones and high-contrast transitionals are strongly affected, but horizontal or equal width lines do not produce the illusion.

To correct for this illusion, the thin stroke of the X can be staggered. The degree of offset varies: The break may be a subtle, almost imperceptible adjustment, or the designer may choose to deliberately exaggerate the shift.

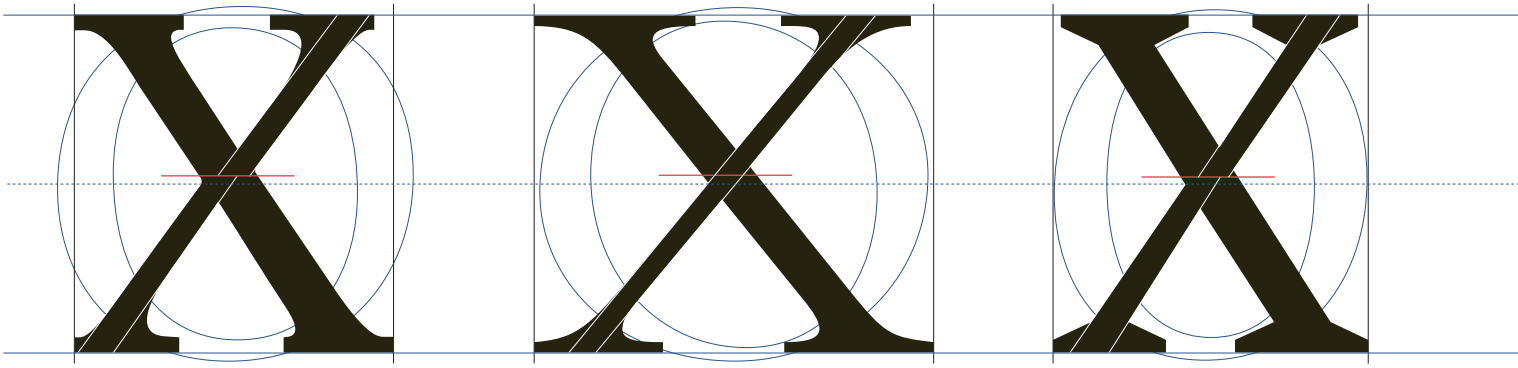
As in the other double-storied letters, the X cannot be drawn with equal upper and lower halves; true mathematical division creates an unbalanced, top-heavy form. Therefore, the lower half of the X is usually drawn wider, so that the intersection of the legs occurs in the visual center of the capitals, aligning with the crossbar of the H (and/or the center arm of the E).

The left-right alignment of the legs in the X varies. In humanist designs, the left side of the letter is flush left. In rational typefaces, the upper half of the X is centered over the bottom half. This centered placement is less dynamic; it reinforces a static, upright, and vertical axis.



Helvetica
(Regular)

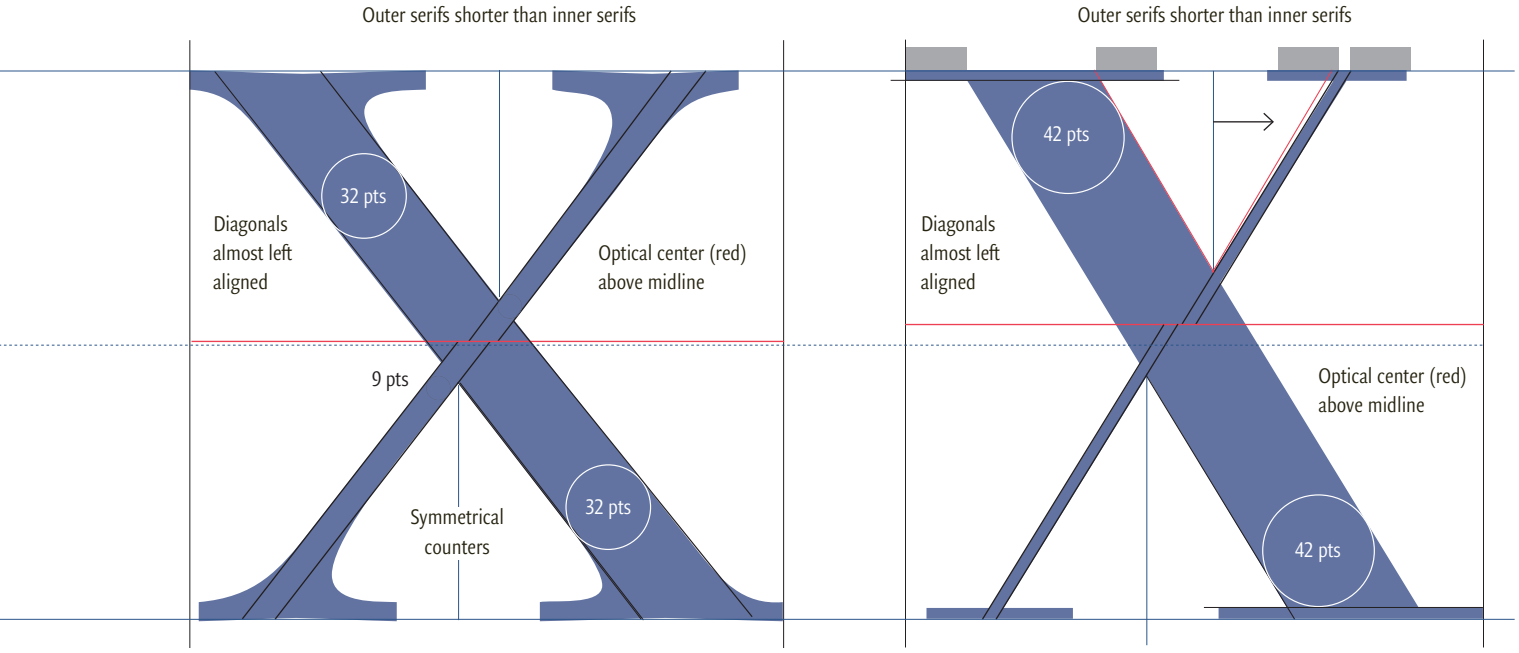
The illusion of optical break increases with contrast and angle.



Apolline
(Regular)

Bembo MT
(Regular)

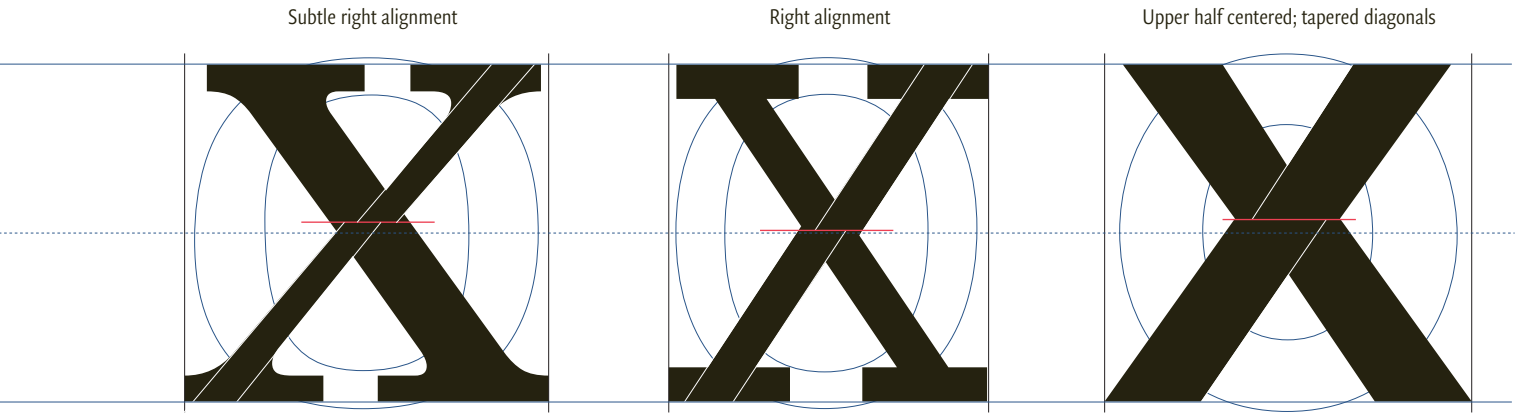
Swift
(Regular)



ITC New Baskerville
(Roman)

Linotype Didot
(Roman)

When two contrasting strokes cross, the thin line appears to shift upward.
Offsetting the strokes gives the illusion of an unbroken line.



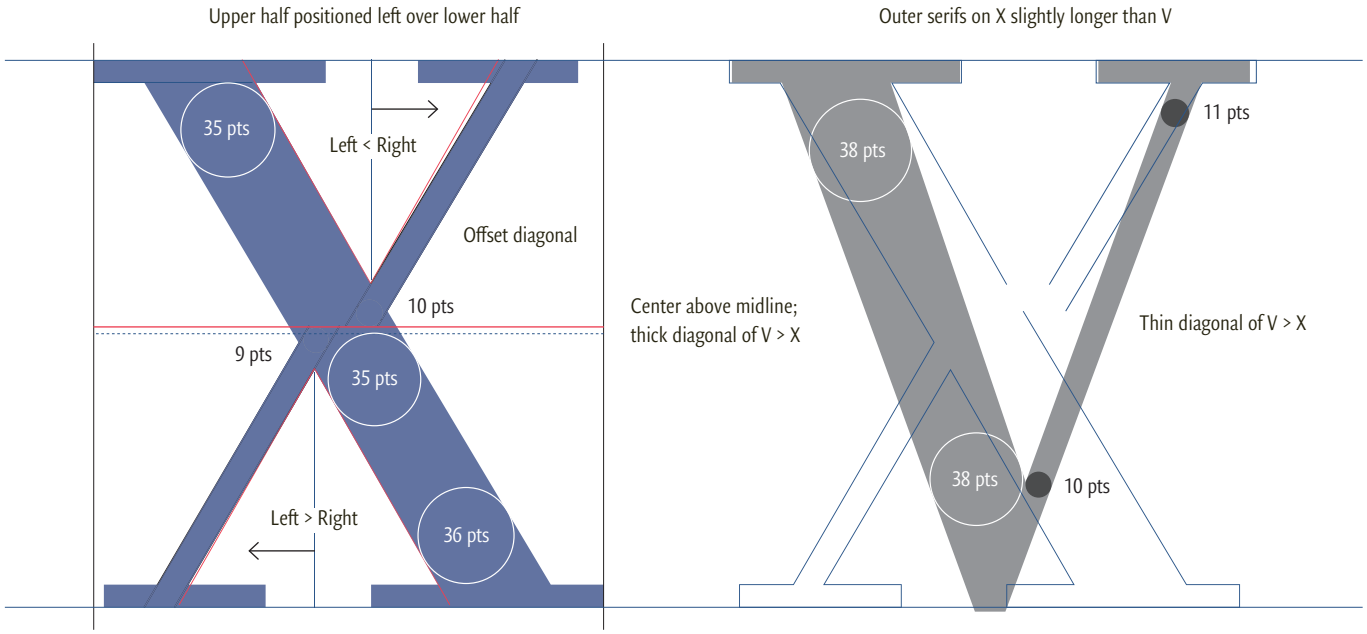
Superclarendon
(Regular)

Questa Slab
(Regular)

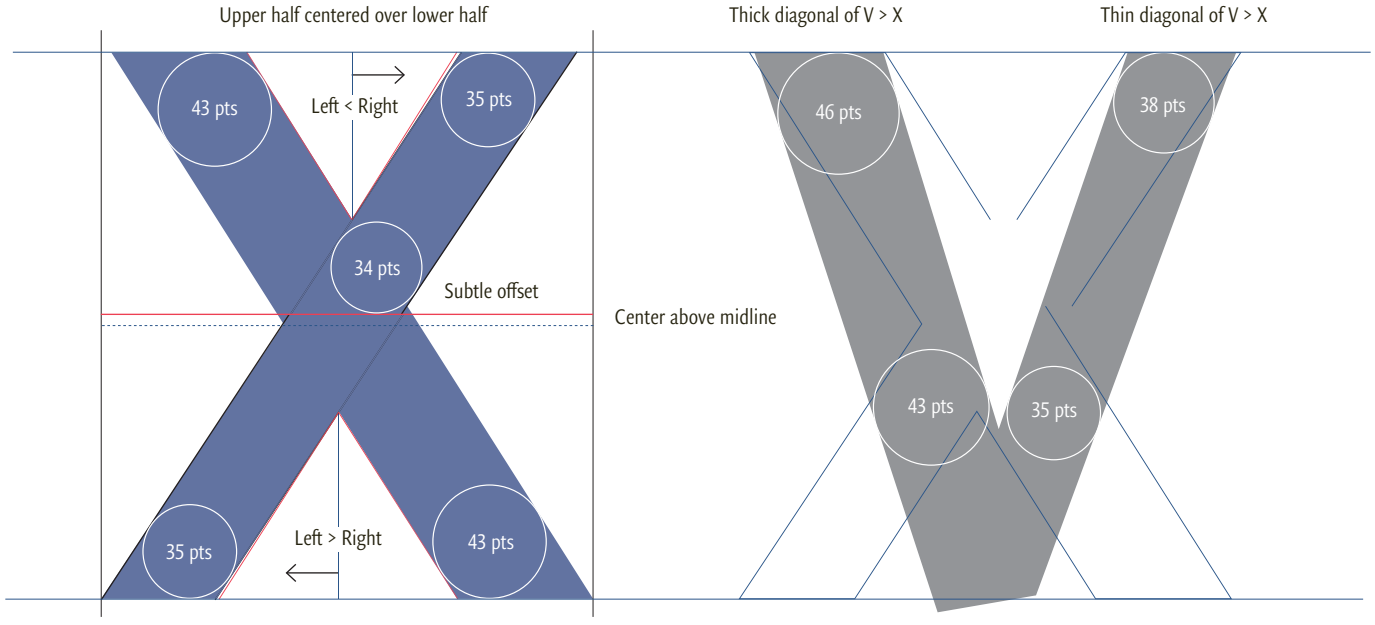
Akzidenz-Grotesk
(Bold)

DIAGONAL STROKE WEIGHTS OF THE X

As shown previously in the V and A, the strokes of the X are often tapered to open the central intersection. The diagonals of the X usually need to be thinner than the V and A; because the structure is more complex, using the same weights would make the X too dark. As in all diagonal letters, the outer serifs can be shortened to facilitate tighter letterspacing.



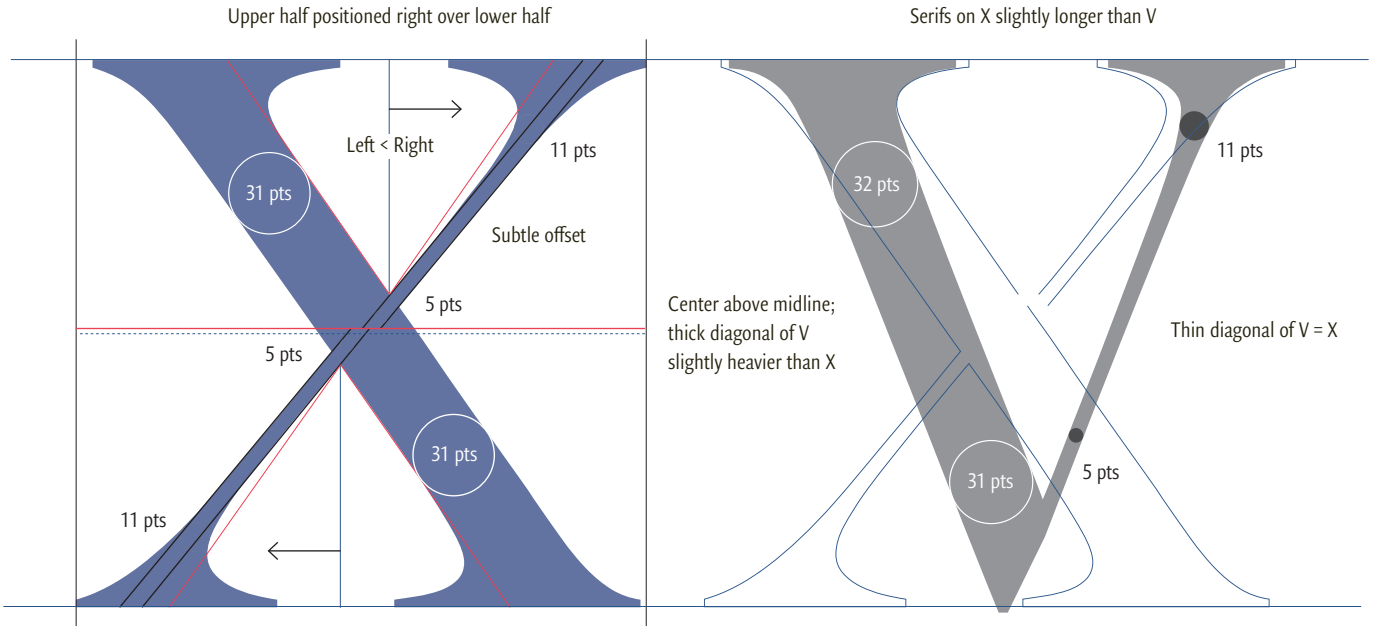
Abril Display (Semi Bold)



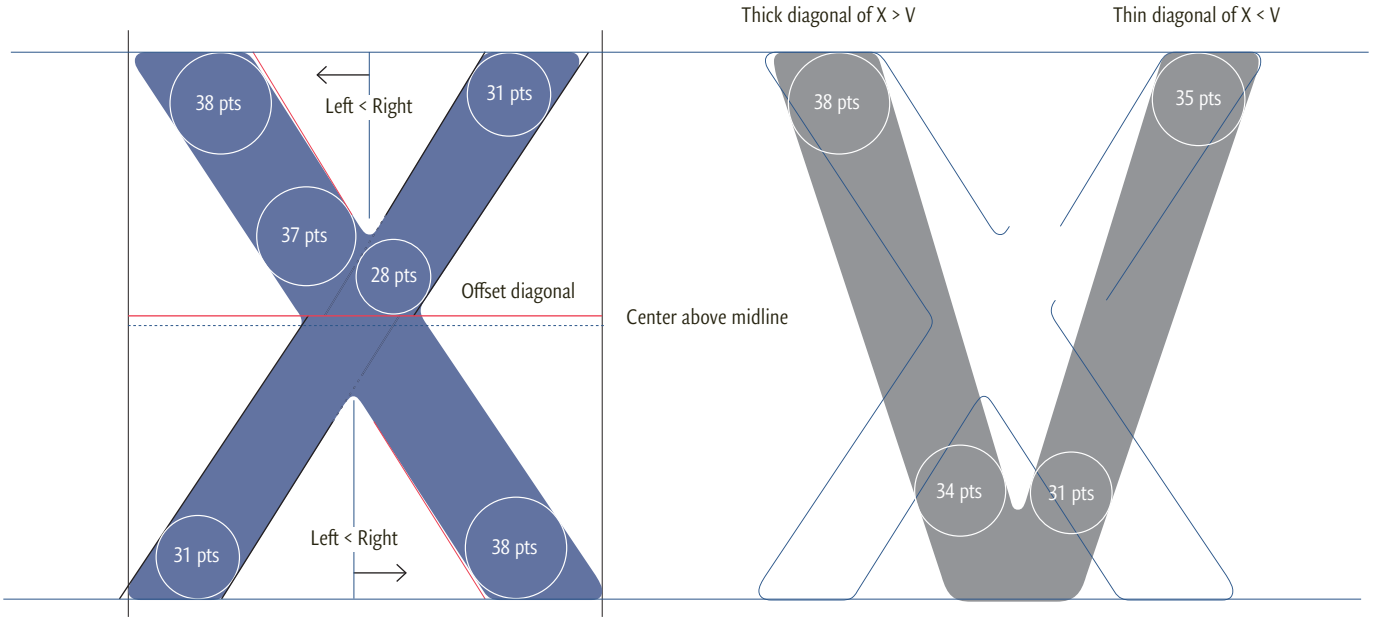
Quadraat Sans (Bold)

SPACING AND TESTING

To check color and density, set words that contain the X and V as well as round and square letters: FOXGLOVES, VOX, EXPLOIT, EXTEND, VORTEX, CERVIX, VIDEOTEXT, GRAVLAX, OVERTAX, AVIATRIX, EXCLUSIVE, EXCAVATE, REFLEX, EXCESSIVE, OVEREXAGGERATE, EXPRESSIVE, EXERCISE, VEX, EXCURSIVE, FIXATIVE, OXIDES, EXECUTIVE.



Big Caslon (Medium)



Praxis Next (Semi Bold)

X and V have rounded junctions and ends

Capital W

The W is actually a double V ligature—in fact, the name of W is literally "double-U." (As described earlier, the U and the V were, at one time, interchangeable letters: See p. 106.) There are three main methods for constructing the ligature: 1) The V shapes can be condensed and joined; 2) the V shapes can be expanded and overlapped; or 3) the first V shape can be cropped by the second.

The first option—the joined W—is the easiest to construct, since the condensed V forms are simply set side by side (a W made with two normal-width V forms would be too wide). Note that the two V shapes are not necessarily identical or symmetrical—the outer strokes are often drawn more upright than the inner strokes. This adjustment makes the W less diagonal and therefore enables tighter letterspacing; it also reduces the overall width of the letter. The central vertex does not need to extend past the capline (in fact, it could be dropped slightly lower) because the height of the W is already set by the outer arms. However, as in the V, the lower joins should undershoot the baseline, unless they have been significantly blunted or cropped square.

The second version of the W (made from expanded and overlapped V forms) is more difficult to design, since the intersection creates a darker area. To relieve crowding, the original V forms can be drawn asymmetrically, so that the inner forms have more room to extend and overlap. Specifically, we draw the interior arms at a wider angle than the outer arms (which should be more upright).

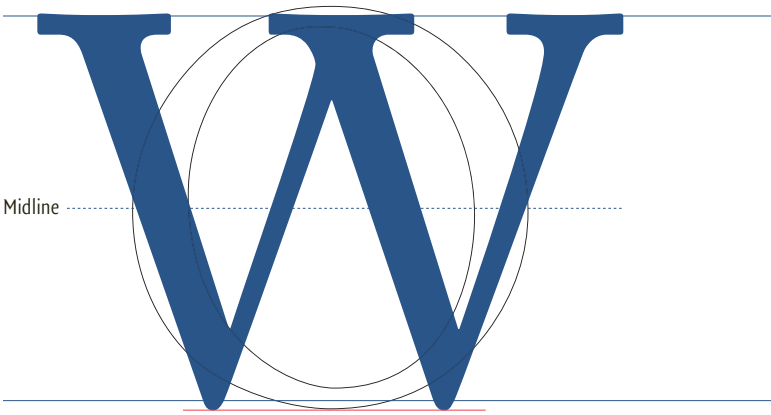
The third option (where the first V is cropped by the second) is the most compact structure. Unfortunately, this format produces a letter with somewhat uneven color; the left side is darker than the right. If the color difference is too pronounced, the angle of the final leg can be moved subtly inward.

In most typefaces with a cropped W, only one of the interior legs is removed. However, there are faces where both legs have been truncated above the intersection. In general, this style of W will color more evenly when the crossing is higher (well above the optical center)—a low vertex leaves the W with an open and light center. Additionally, the shape of the open center can be ill-defined and amorphous.

In general, in any of these structures, the W looks best when the interior counters are clearly triangular in form. The lower triangle should be slightly larger for stability and balance.

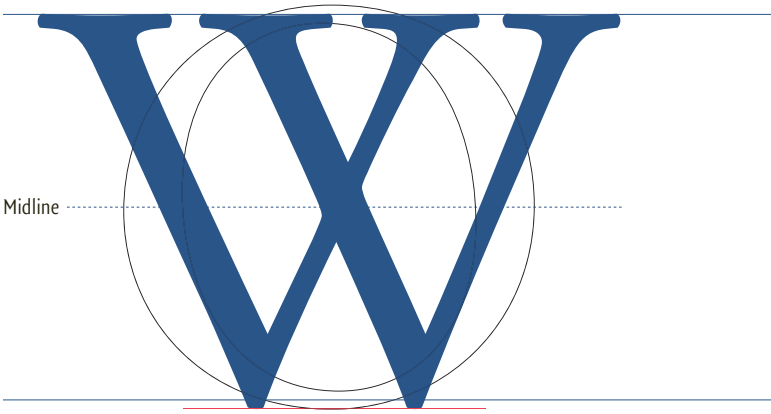
As a later addition to the original Roman alphabet, the W has no inscriptional model to follow. Type designers generally strive to make the W as narrow as possible without creating an overly dark letter; in the typefaces shown on this spread and the next, the W is 29–49% wider than the O.

Joined version: V shapes are aligned



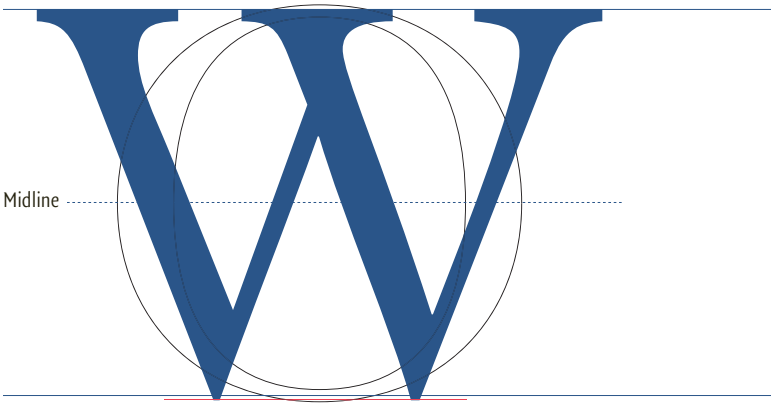
Adobe Caslon (Regular)
O undershoot = V undershoot
W is 48% wider than O

Overlapped version: V shapes are crossed

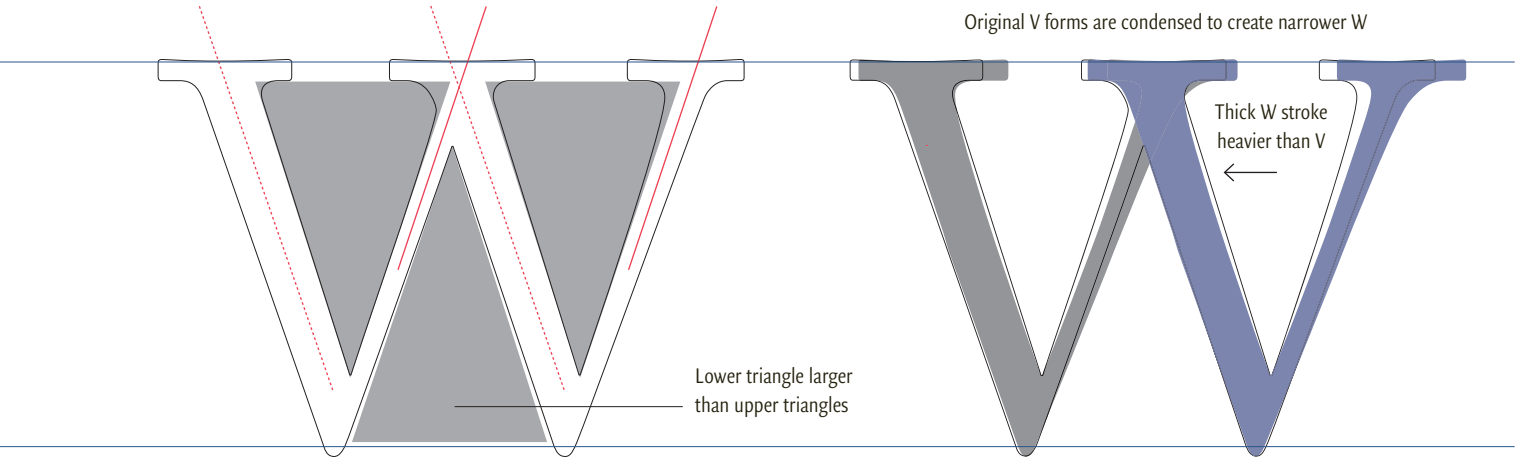


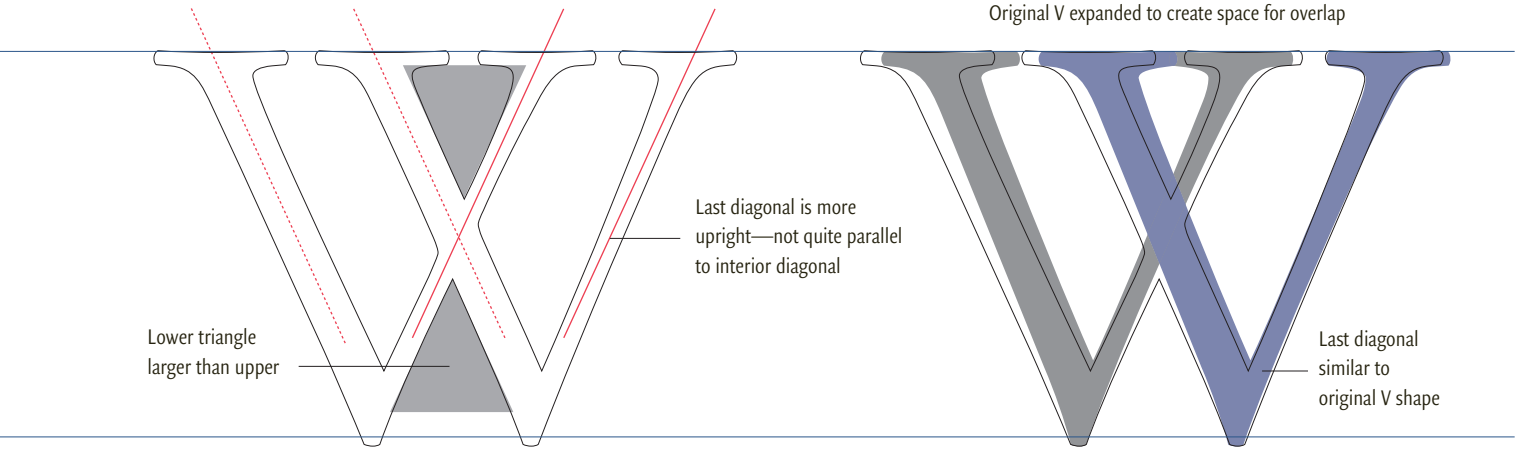
Adobe Garamond (Regular)
O undershoot = V undershoot
W is 42% wider than O

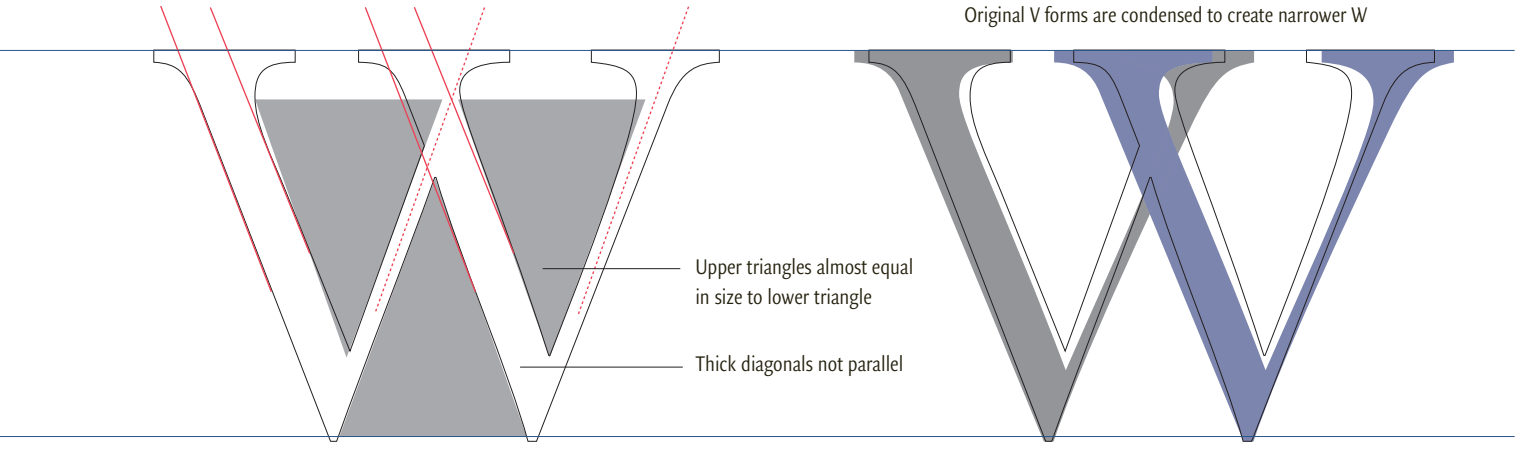
Cropped version: second V shape crops first



Granjon (Roman)
O undershoot slightly deeper than V undershoot
W is 40% wider than O


Lower triangle larger than upper triangles
Original V forms are condensed to create narrower W
Thick W stroke heavier than V

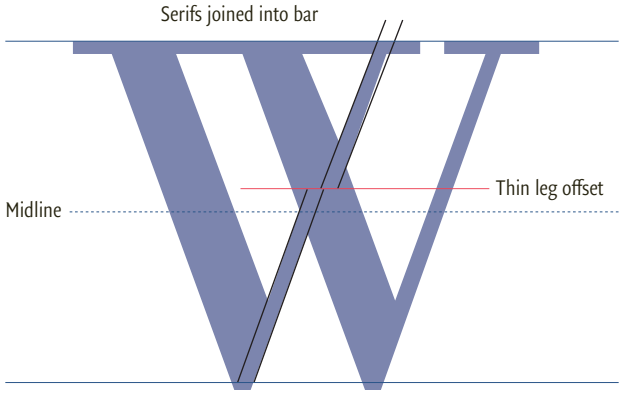

Last diagonal is more upright—not quite parallel to interior diagonal
Lower triangle larger than upper
Original V expanded to create space for overlap
Last diagonal similar to original V shape


Upper triangles almost equal in size to lower triangle
Thick diagonals not parallel
Original V forms are condensed to create narrower W

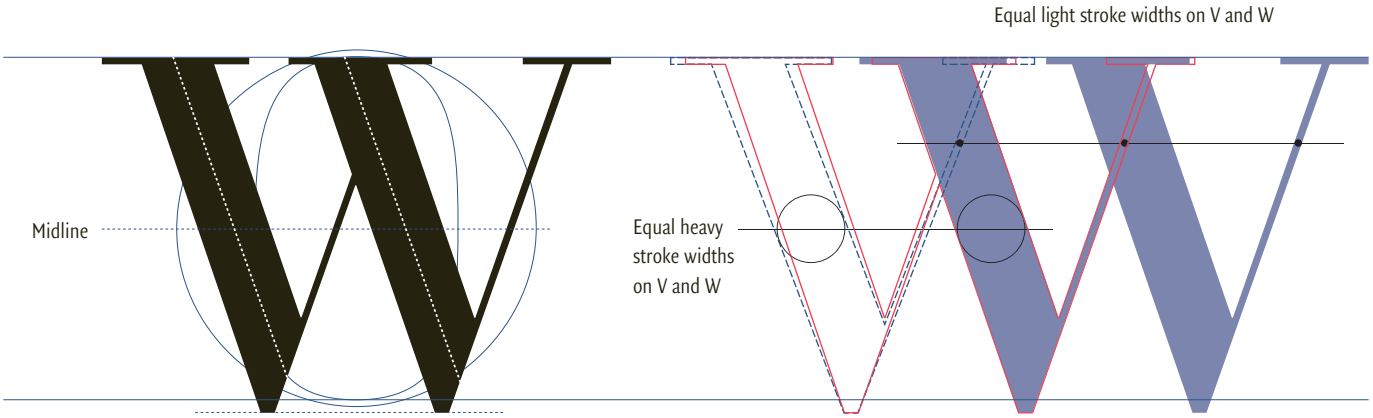
DETAILS OF THE SERIF W

When the W is constructed from two aligned V forms, the center serif can be retained or eliminated. Removing the center serif can helps to even color and ease congestion.

When the W is made from two expanded and overlapped V forms, the center serifs can be combined into a single horizontal bar. Width and color permitting, the left serif could also be joined under this central "roof." Both of these options create an enclosed triangular counter; this counter can be difficult to keep open and clear, especially at small type sizes. More space can be created by offsetting the thin leg of the first V to the right, above the intersection. As in the letter X, this adjustment also corrects the illusion of a discontinuous line (the Poggendorff illusion).



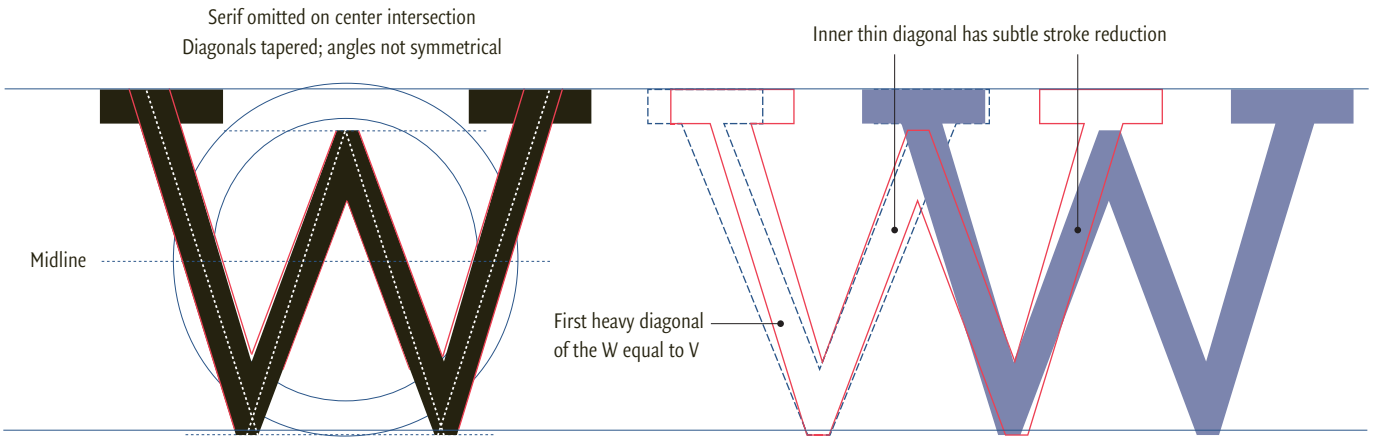
Bodoni
(Roman)



Linotype Didot
(Bold)

W undershoot > O undershoot;
W is 41% wider than O

Blue dashed line = V
Red line = W



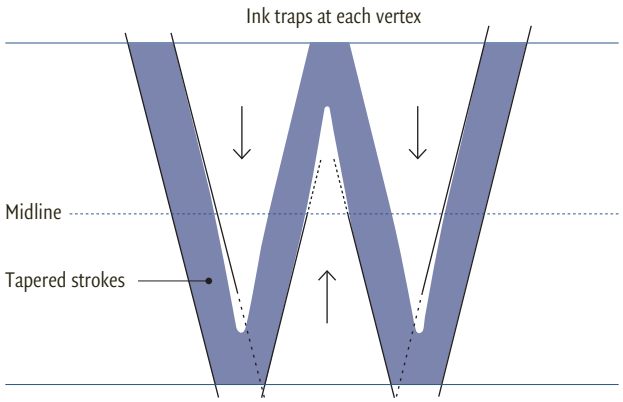
Archer
(Medium)

W undershoot < O undershoot;
W is 42% wider than O

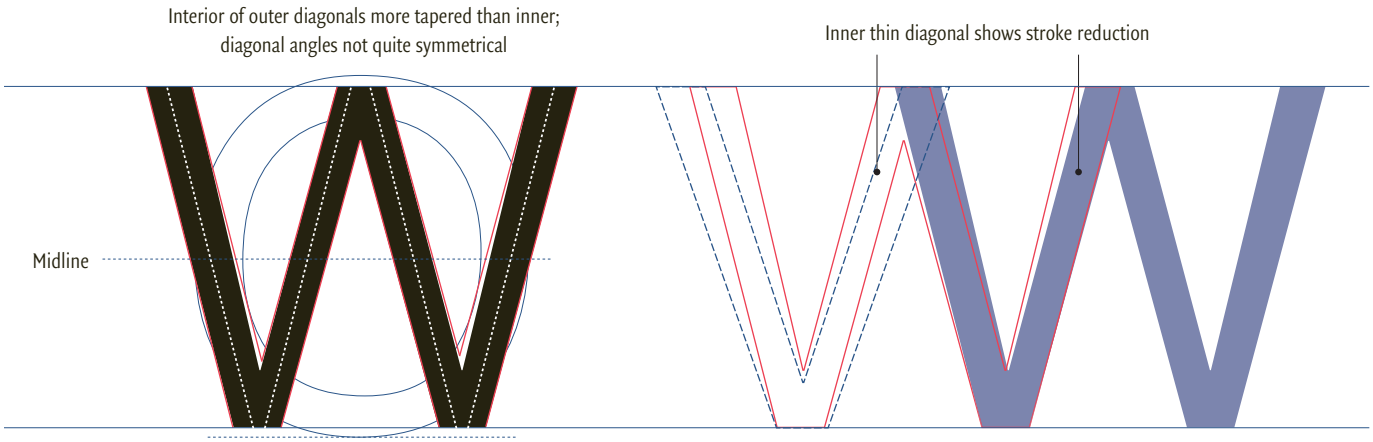
Blue dashed line = V
Red line = W

DETAILS OF THE SANS SERIF W

In sans serifs, the W made from two expanded and overlapped V forms is relatively rare, although it is seen in some humanist designs. The first option (the W made from two condensed and joined V forms) is the most common. If the resulting W is too wide, the first and last diagonals can be drawn at a more upright angle. If this adjustment clogs the vertex, additional space can be created by tapering the strokes, but if possible, the outside strokes of the W should remain symmetrical. Alternatively, an ink trap could be used to open the lower joins of the W. Both of these features are present in Bell Gothic (shown at right), a typeface designed for small size type in telephone directories.



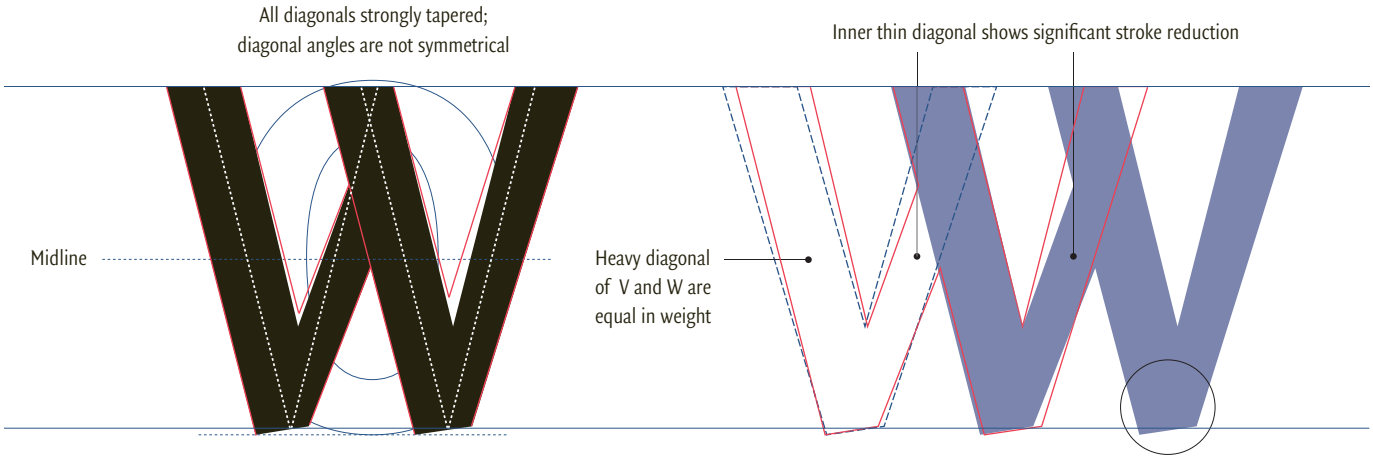
Bell Gothic Std
(Bold)



Helvetica
(Regular)

No undershoot on W;
W is 29% wider than O

V form (dashed blue line) is wider than half the W (red line)



Quadraat Sans Condensed (Bold)

W undershoot = O undershoot;
W is 49% wider than O

Blue dashed line = V
Red line = W

Calligraphic vertex

Capital Y

The Y can be considered a short V on a vertical stem. In a typeface with calligraphic influence, the left arm of the V flows directly into the center stroke (the broad-nib pen pivots from the diagonal to the straight vertical stem). Then, the right arm is added with a second diagonal stroke that joins the stem at a slightly higher point. In a constructed typeface with an upright axis, the second diagonal stroke is often placed lower, so that the join is horizontal, and the left and right sides of the letter are symmetrical.

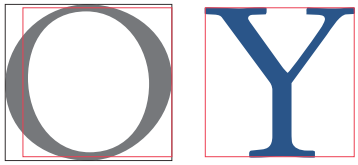
The arms of the Y are not always identical—the right arm may extend further than the left. This adjustment is subtle; its purpose is not to create obvious asymmetry, but to increase the open space inside the arms. As in all diagonal glyphs, the arms can be tapered to prevent clotting at the vertex.

The relationship between the X and the Y is similar to that of the R and the P, or the E and the F. In these pairs, one letter has two features that are stacked, while the other has a single instance. To prevent the simpler figure from being too light or uneven, the single feature is enlarged. Specifically, in this pairing, the upper V of the Y is usually larger than the upper V of the X.

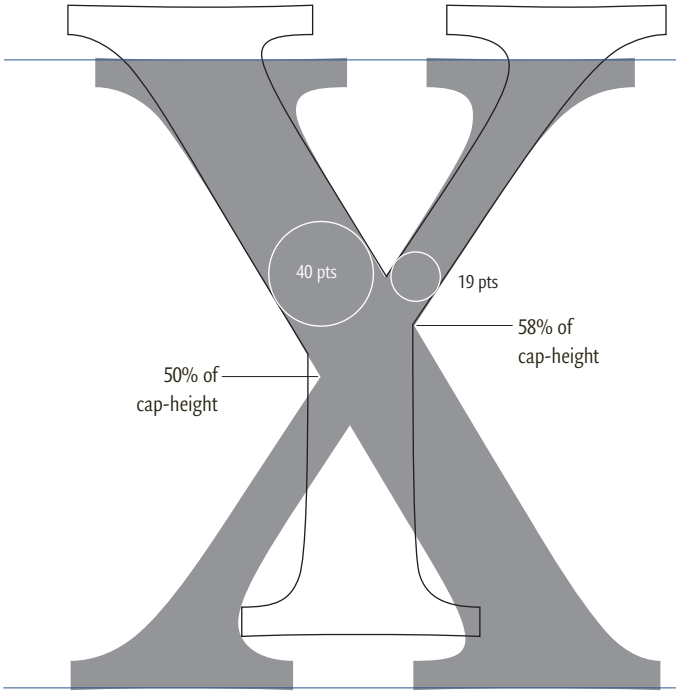
The Goldilocks effect (see p. 39) applies to the division of space in the Y; the stem of the Y should be neither too tall nor too short. If the vertex is too low, the Y will be top-heavy. However, if the vertex is too high, the space between the arms will be too small and the letter too dark (the gesture of the arms may also become timid). In general, the stem of the capital Y ranges between 35 and 50% of the capital-height.

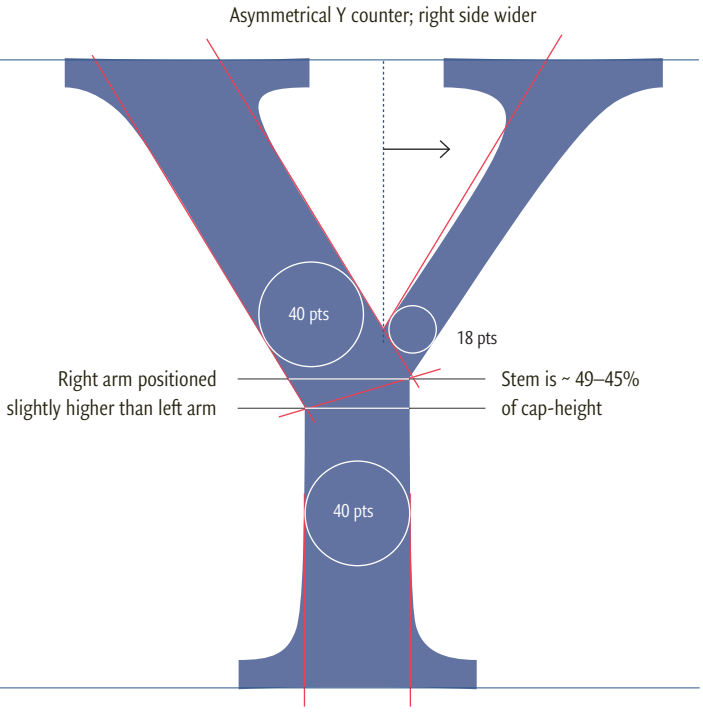
In the classic proportional system, the Y is a wide letter, but narrower than the O. When using modern proportions, the Y and O are close to the same width. Didone typefaces often have a narrow Y to match the upright, rectangular O, but slab serifs typically have wider O letterforms—and thicker stroke weights—that require a broader capital Y.

Stempel Garamond has classic proportions.
The Y is narrower (89%) than the O.

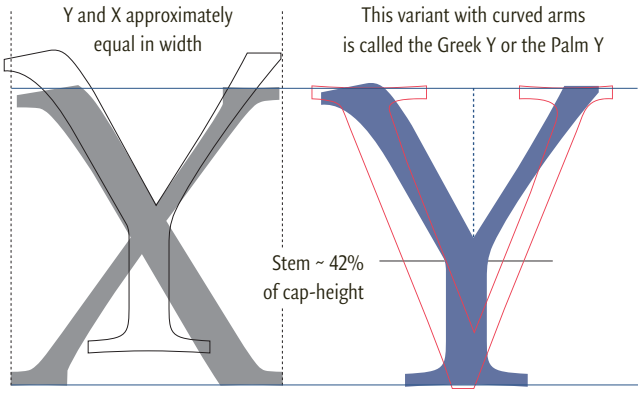


Bodoni has modern proportions.
The Y is wider than the O (106%).



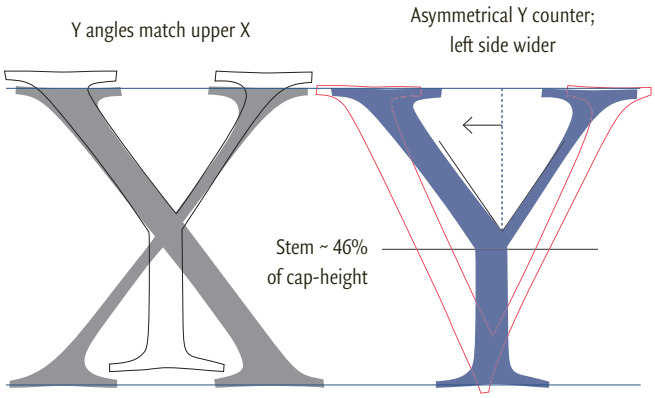


Albertina
(Medium)



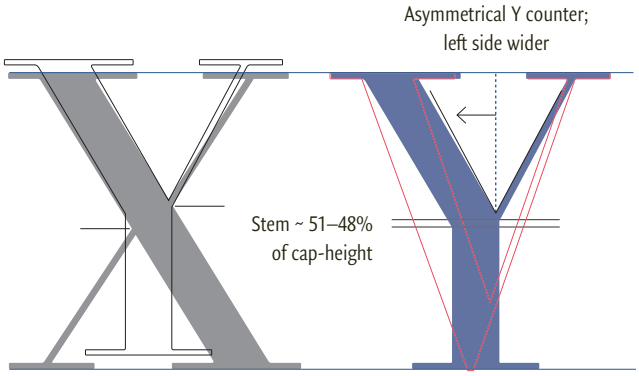
Palatino
(Regular)

V slightly wider than Y



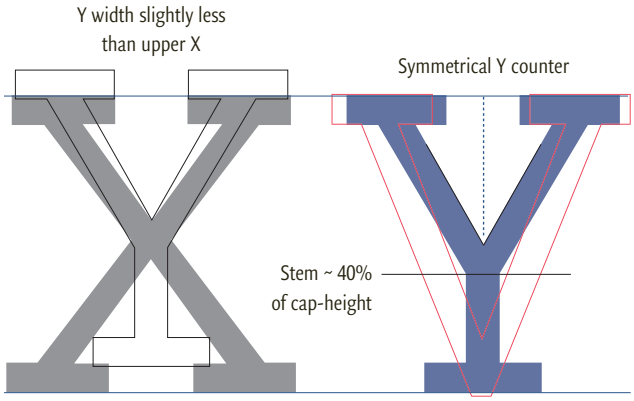
Centaur
(Regular)

V wider than Y



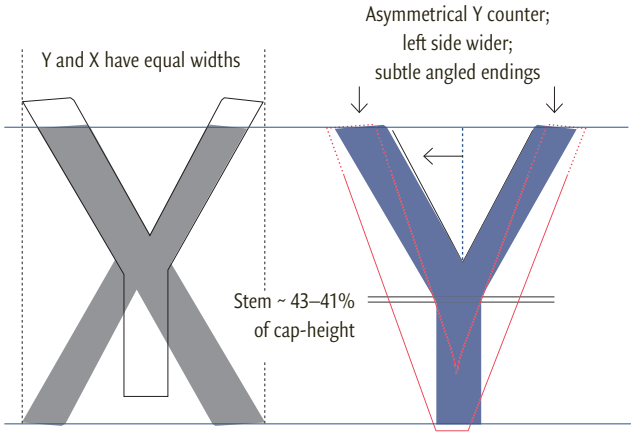
Trianon Display
(Regular)

V and Y same character width



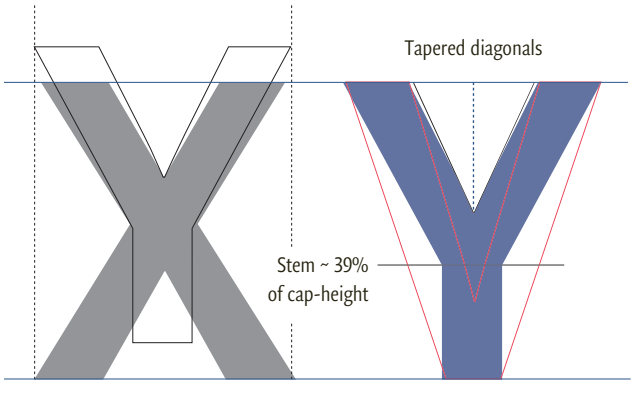
Archer
(Medium)

V wider than Y



Le Monde Sans
(Normal)

V slightly wider than Y



Neue Haas Grotesk Display
(65-Medium)

X, V, and Y approximately equal
in character widths

Capital M

The M is our last diagonal letter related to the V. The M consists of a condensed V supported by legs on either side. The legs may be either vertical or diagonal; the diagonal version is often described as having "splayed legs." The splayed M follows the original Greek inscriptional model, and still influences the upright design that is more common today. Even when the legs of the M are straight, the first stem is thin and the last stem is thick, following the widths of the original calligraphic diagonals.

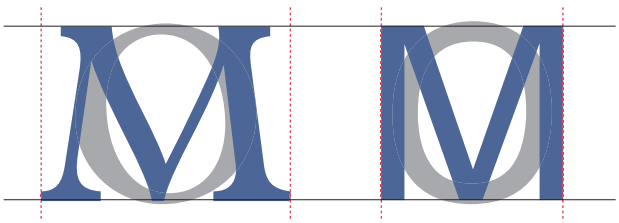
Since it is an older style, the splayed M is more common in Venetian and Garalde typefaces; there are also humanist sans serifs with this form. This splayed M colors more evenly than the upright variation, since the three interior triangles can be more similar in size and shape. However, the splayed configuration does result in a wider character. Also, as in the capital A and V, spacing problems can occur when diagonal legs "push away" neighboring letters.

When using classic proportions, the M is a square letter. In normal-width and normal-weight typefaces with modern proportions, the M is still usually square, because it has to be wider than the O to be equal in density. For this reason, the M is used as a typographic unit of measure—the em. One em (also called an em space) is equal to the point size or "set": In 6-point type, an em is 6 points; in 12-point type, an em is 12 points.

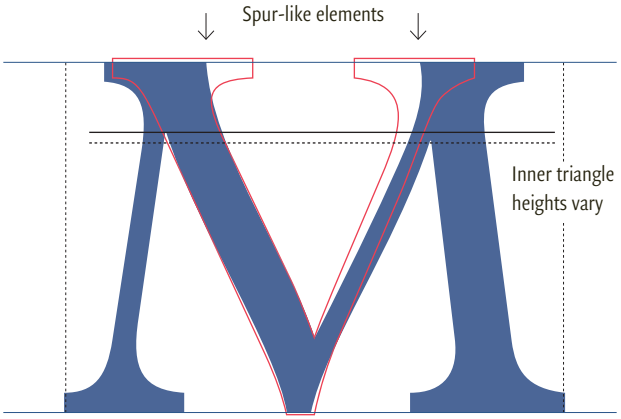
As discussed previously for other diagonal letters, the strokes of the M may be tapered at the joins to reduce congestion. If additional interior space is needed, the inner serifs on the legs can be removed. In some serif typefaces, the top of the legs are completely unadorned, with no upper serifs on either the outside or inside. In this case, the pointed joins of the M should overshoot the capline, or the letter will appear shorter than other capitals. However, the vertex of the M does not undershoot. In fact, the vertex is often set subtly higher to reduce complexity—and prevent serif collisions—at the baseline.

SPACING AND TESTING

To check the density of the M, set words that contain multiple instances: HUMMUS, MAIM, MADAME, MUSEUM, MAMMOTH, MEMBER, FEMME, MAXIM, MIDTERM, CHAMOMILE, SEMI-MYTH, EMBLEM, MEMORIAM, AMFAM, SMARMY, COMMA.

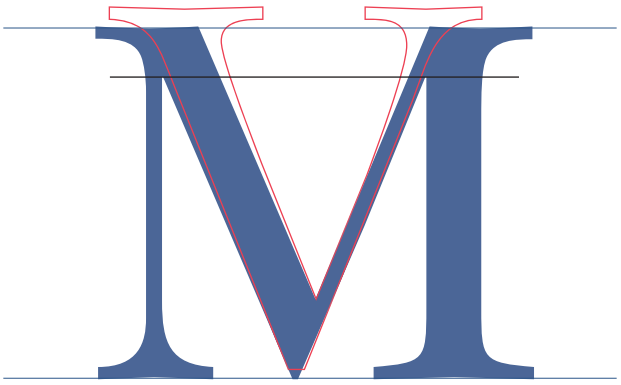


Plantin, left and Univers, right.
The M is a wide letter; wider than the O

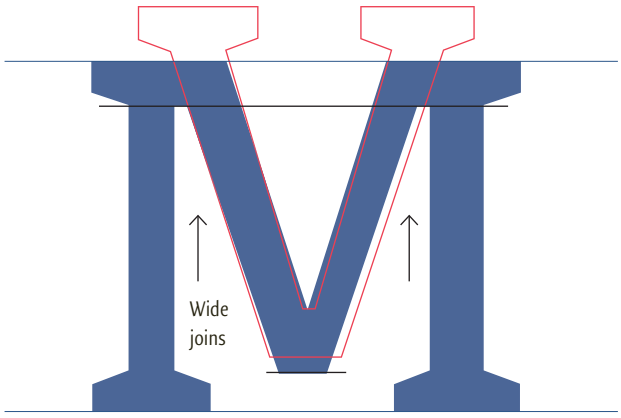


Plantin
(Regular)

Curved diagonals

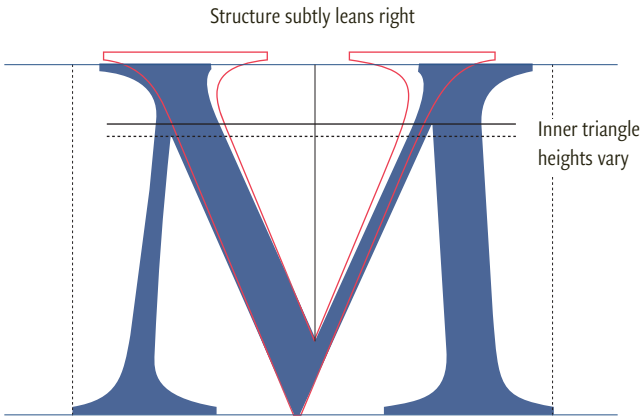


ITC New Baskerville
(Roman)

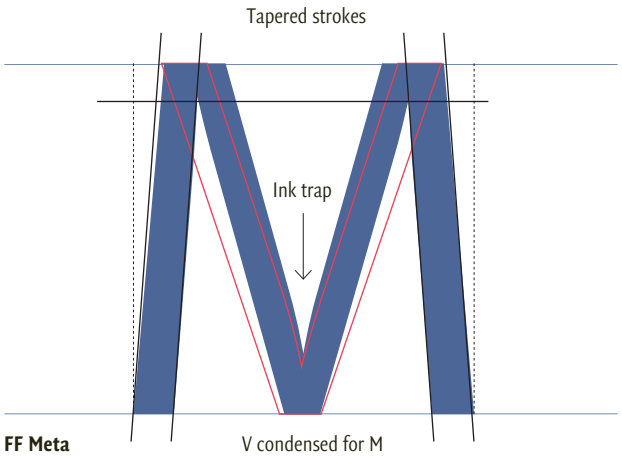


FF Olsen
(Regular)

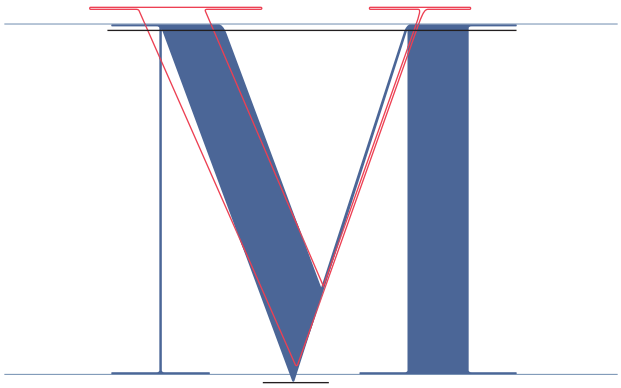
High vertex



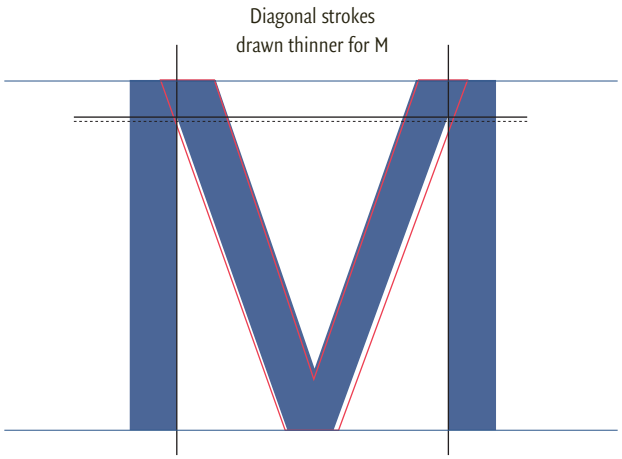
ITC Galliard
(Roman)



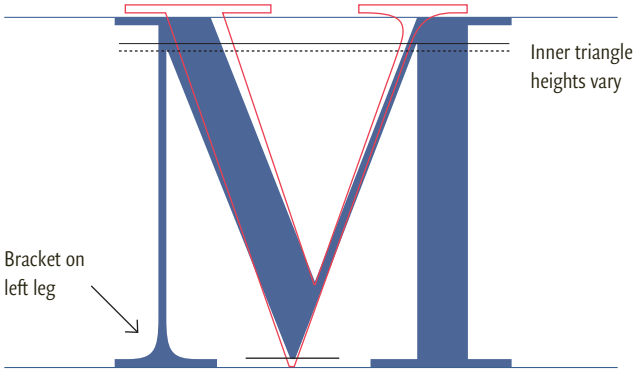
FF Meta
(Normal)



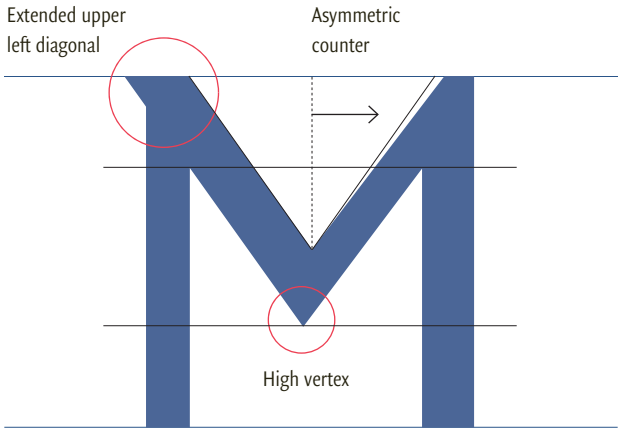
HTF Didot
(M42 Medium)



Univers
(55-Roman)



Bauer Bodoni
(Roman)



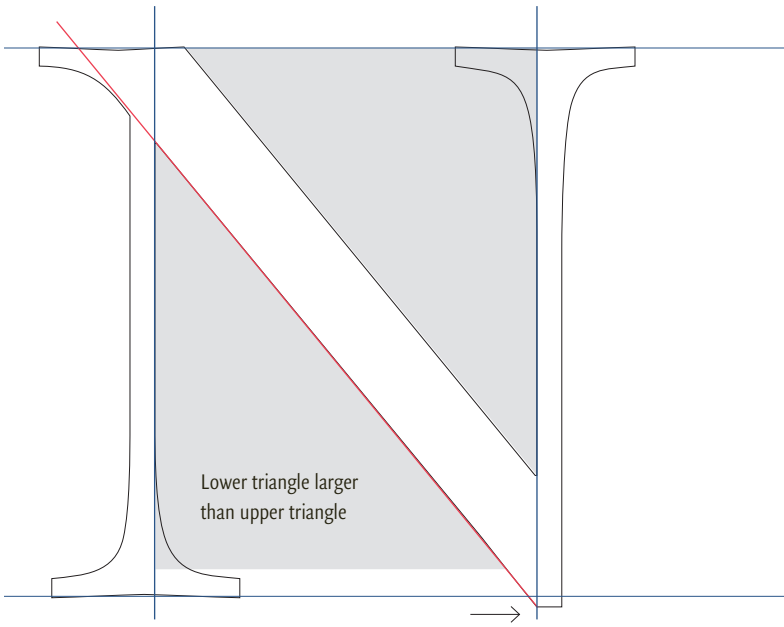
Quadraat Sans
(Regular)

Capital N

The N is similar to the M in that the original version was angular: The wide diagonal in the center of the letter was flanked by two thinner lines running in the opposite direction. As in the M, over time these strokes have become vertical. However, the verticals still retain their original thin horizontal stroke width, rather than conforming to conventional calligraphic practice, where verticals are thick strokes. As discussed previously (see p. 44), because vertical strokes tend to look thinner than horizontal strokes of the same weight, the vertical strokes of the N can be subtly increased if the letter appears too light.

In either proportional system, the N is slightly narrower than the O. The classical N fits within two root five rectangles (see p. 64). When using modern proportions, the N can be square or rectangular, depending on the width of the O.

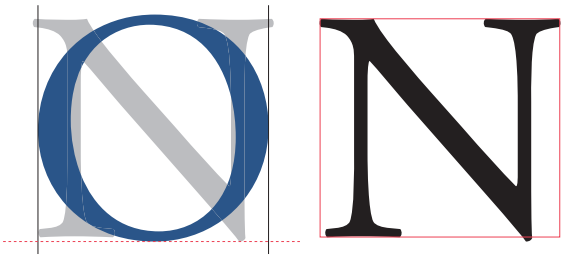
When constructing an N, the angle of the center diagonal is critical. Ideally, the diagonal divides the space within the N into a larger lower counter and a smaller upper counter (otherwise, the N would appear unbalanced). Keeping these proportions is particularly important for narrow letters (for example, those in Didone typestyles) because taller forms are inherently less stable.



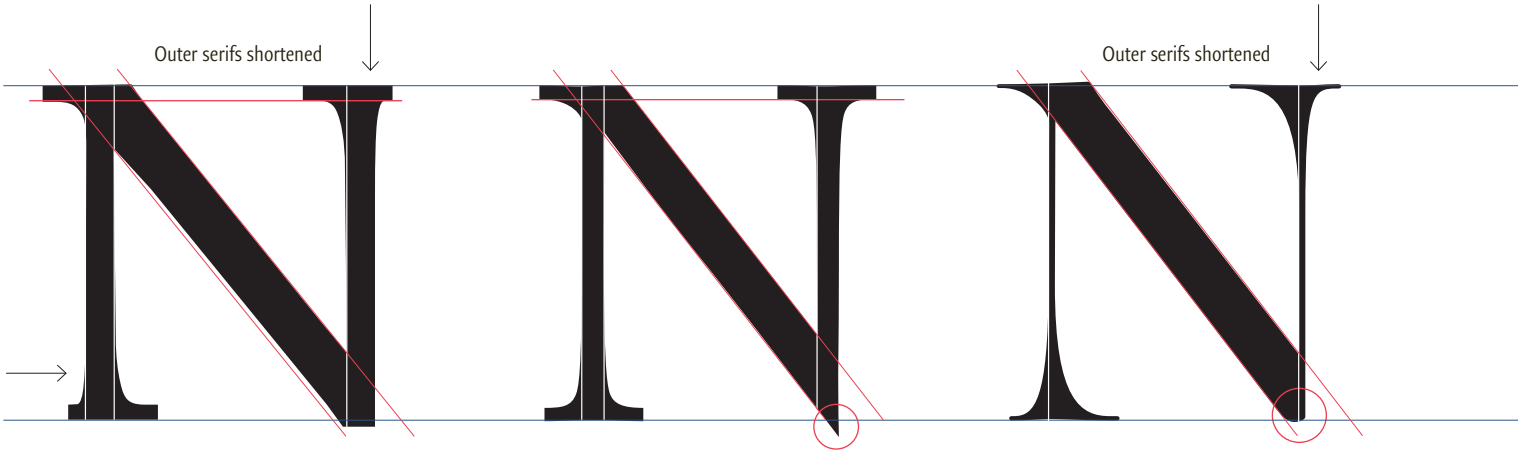
ITC New Baskerville (Roman) — Blunted point below baseline

SERIF CAPITAL N

In serif typestyles, the top of the main diagonal is extended and finished with a left-facing serif. In Venetian and Garalde typefaces, the shape of this serif corresponds to the start of a downstroke with a brush or broad-nib pen. In Didone or slab serif typefaces, the serif may be simpler (a hairline or a block). Although there are display fonts that extend the main diagonal with a downward flourish, in most text typefaces, the lower end of the diagonal is a sharp or blunted point. As in the other diagonal capitals, thin and narrow points need more baseline undershoot than squared-off, blunted points.



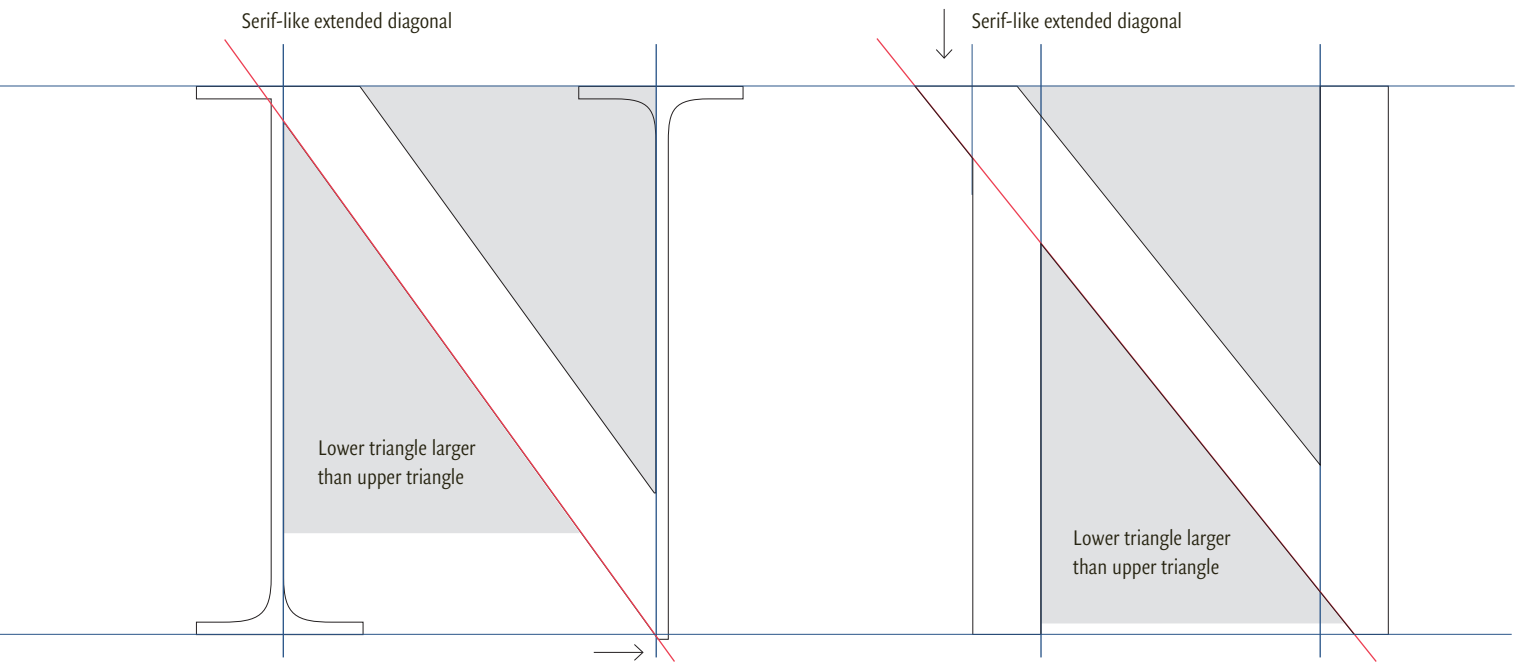
Adobe Garamond, above, has classic proportions;
N and O almost equal in width; both letters close to square.



Apolline (Regular) — Blunted lower point

Albertina (Regular) — Sharp lower point

Ogg (Medium) — Rounded lower point

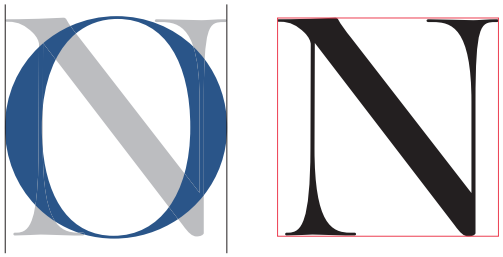


Bauer Bodoni
(Roman)

Blunted point below baseline

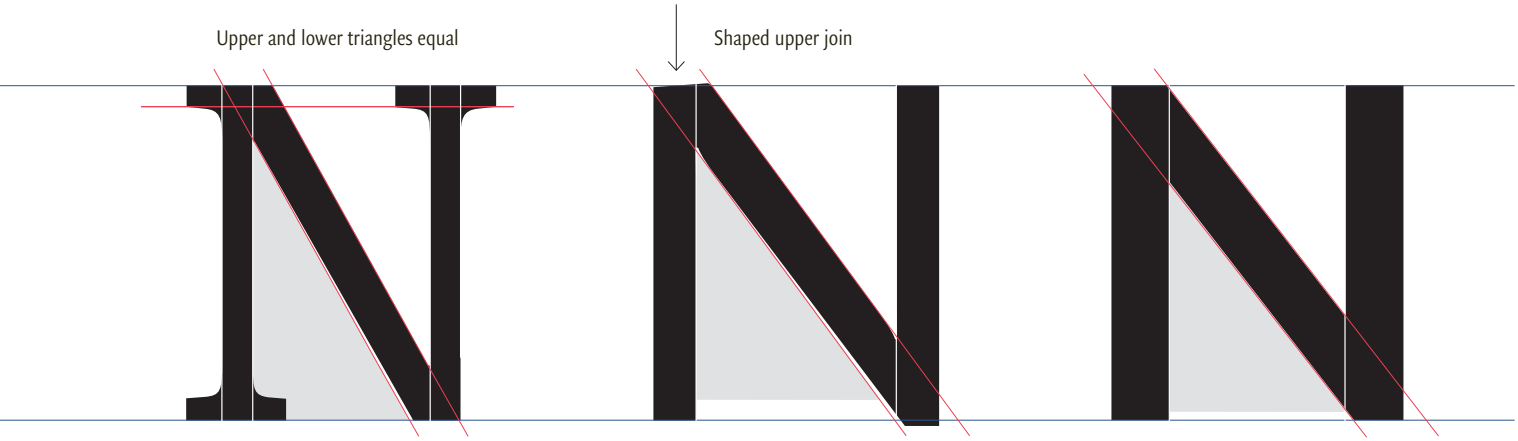
Quadraat Sans
(Regular)

Blunted point on baseline



Ogg, above, has modern proportions;
N and O are equal in width, but neither is square.

Helvetica, above, has modern proportions;
O wider than N; N and O both rectangular.



Portada
(Regular)

Le Monde Sans
(Normal)

Diagonal narrowed
to open join

Gotham
(Medium)

Blunt point narrower
than thin stroke

Capital K

In most typefaces, the diagonal letters tend to stand out—their forms are quite distinct from round and square glyphs, which blend together more easily. Perhaps because it is a hybrid letter (both square and diagonal), the K is considered a "bridge" letterform; its presence builds coherence in a typeface.

The structure of the K is similar to the R; both letters can be constructed with either a single or a double junction. The single junction is perhaps more elegant—and particularly suited for geometric sans serifs—since the interplay of triangles is more obvious. However, the double junction colors more evenly; it also creates a K that is easier to condense and letterspace (because the open area between the arm and the leg is reduced).

In a single junction K, the arm and the leg meet at the optical center; the join could be aligned with the center of the H and E. As discussed previously (see p. 82), double-story letterforms need a wider base for stability. Therefore, the lower diagonal is typically extended past the upper arm. The junction itself can be pointed or blunted. When pointed, the point may be hidden by overlap with the vertical stem. A different option involves joining the arm and leg to the vertical stem with a short horizontal crossbar, creating an H-like form.

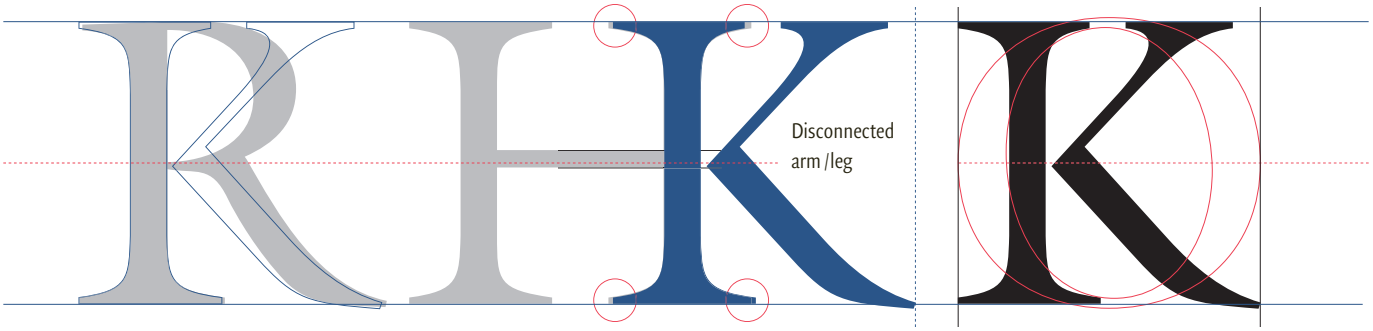
In any of these structures, an open space can be left between the junction and the vertical stem. This gap may help to alleviate congestion where the three strokes of the K join.

In the double junction K, the arm and the stem meet well below the midline. The leg is positioned along the lower half of the arm. In this structure, the key issue is dividing the three interior counters to achieve harmony and balance; they should feel related in shape even though they are distinctly different triangles.

In either single or double junction construction, the diagonal strokes of the K may be straight or curved. Adding curves to the K is less conventional, but it does give the letter more formal contrast. Still, a K composed of strict diagonals can be equally arresting (especially in wedge serifs). As in the other diagonal letters, the diagonals may be tapered at the joins to relieve congestion.

In a serif K, the leg may end with either symmetrical serifs, a single right-facing serif, or a blunted point. The last option tends to occurs when the leg is a curved tail. When serifs are used, they may be drawn shorter on the outside to facilitate even spacing.

The R and K are generally the same width; in both classic and modern proportions, the K is usually a narrow letter. However, in bold or extended designs, the K may be wider (wider than the O).

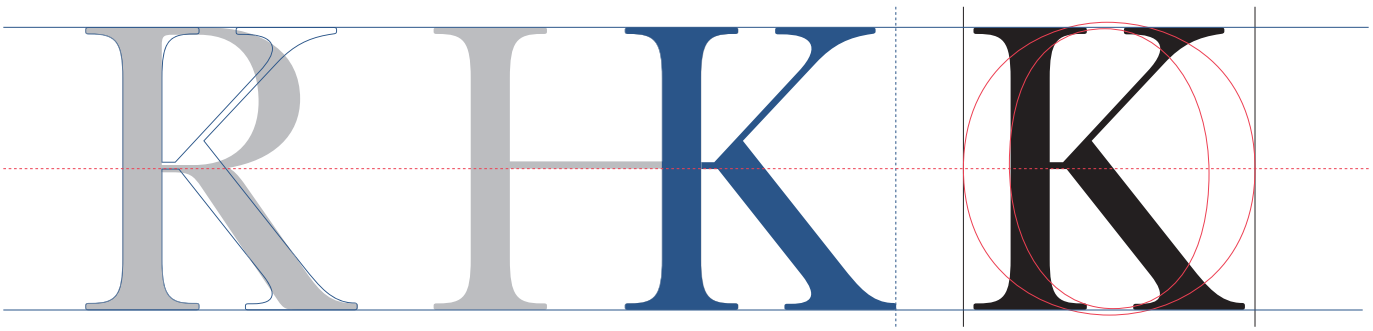


ITC Galliard
(Roman)

R and K legs both curved

K serifs vary from H

Classic proportions;
K and O equal in width



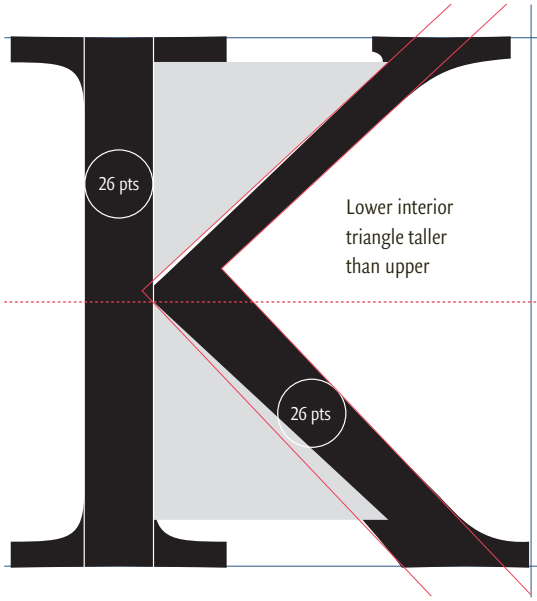
William Display
(Regular)

R and K leg both diagonal

Horizontal crossbar connection

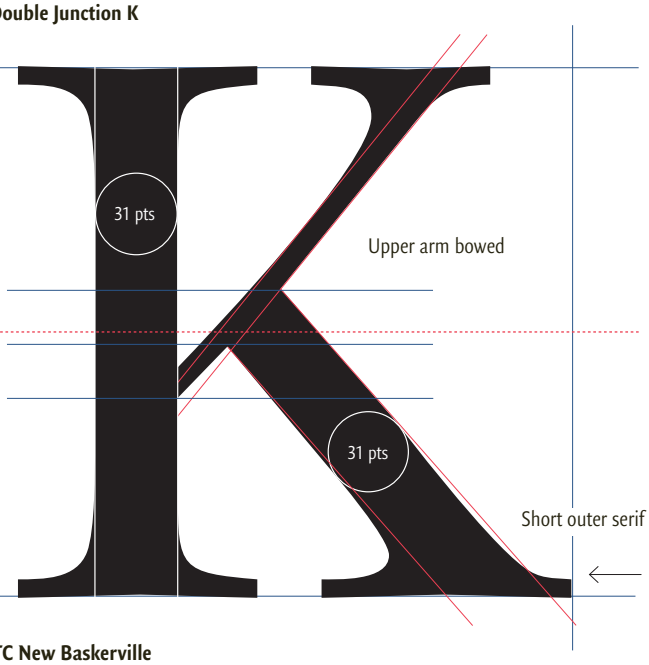
Classic proportions;
K narrower than O

Single Junction K

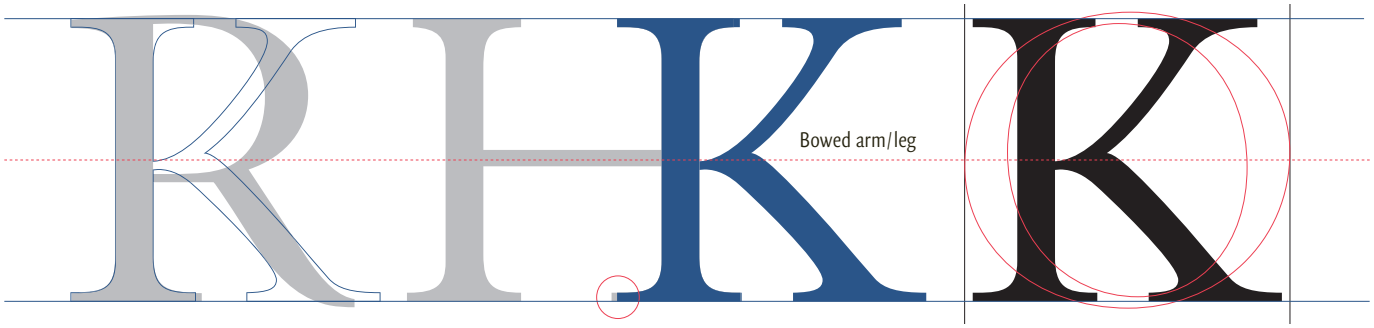


Melior
(Regular)

Double Junction K



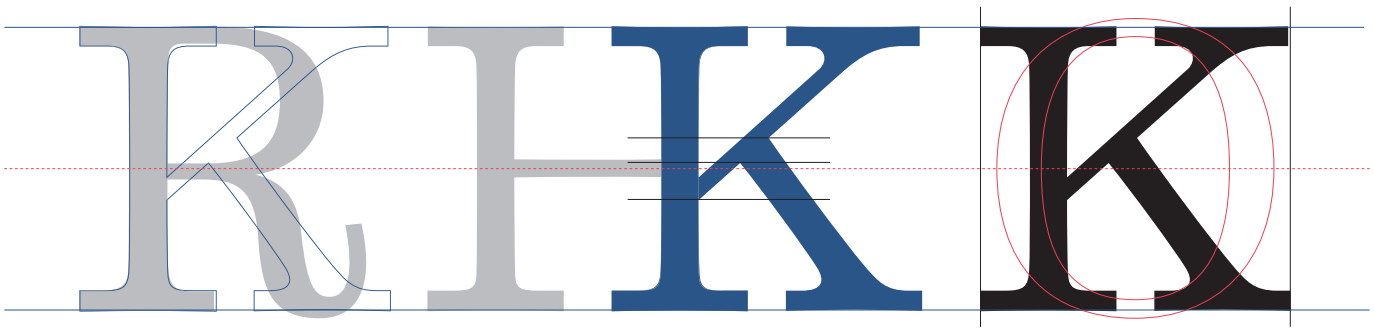
ITC New Baskerville
(Roman)



Bembo MT
(Regular)

R and K legs curved
in opposite directions

Classic proportions;
K narrower than O

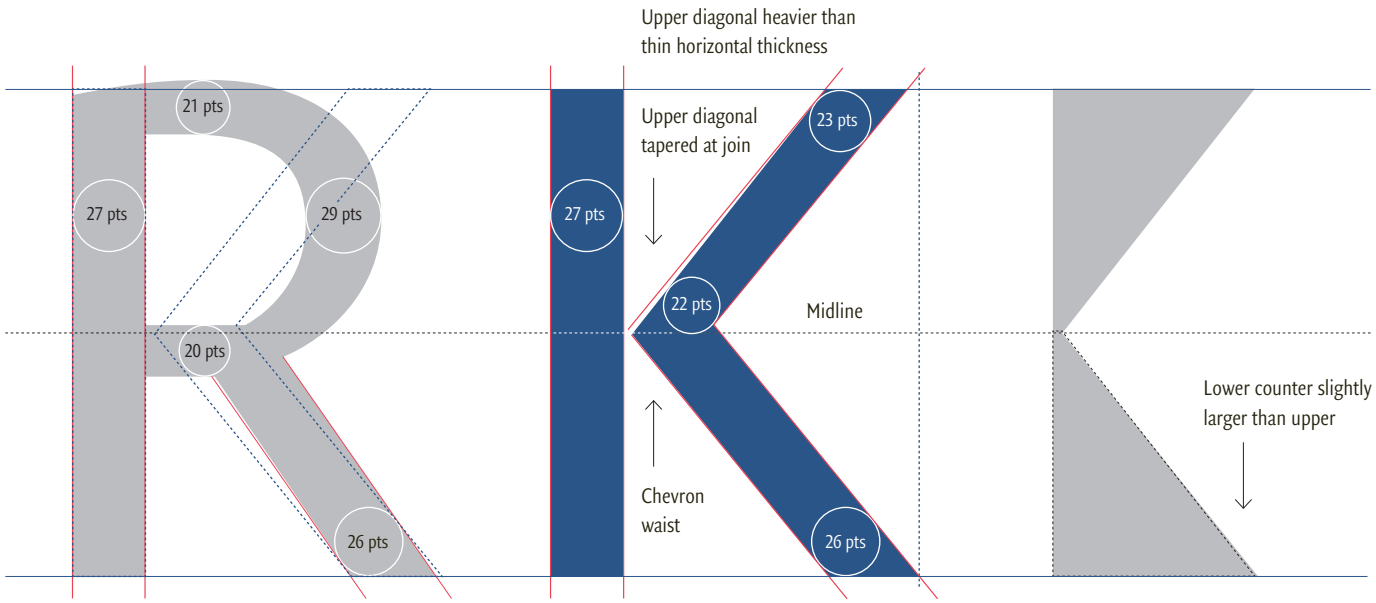


Eames Century Modern
(Regular)

R and K legs
unrelated in design

Double junction

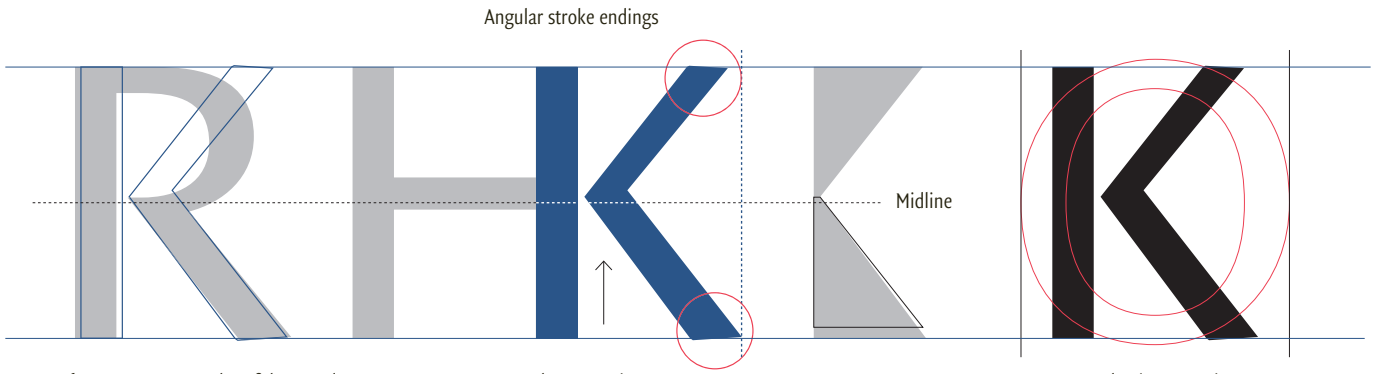
Modern proportions;
K wider than O



Quadraat Sans
(Regular)

Angles of the R and K vary

Lower diagonal extends past upper diagonal



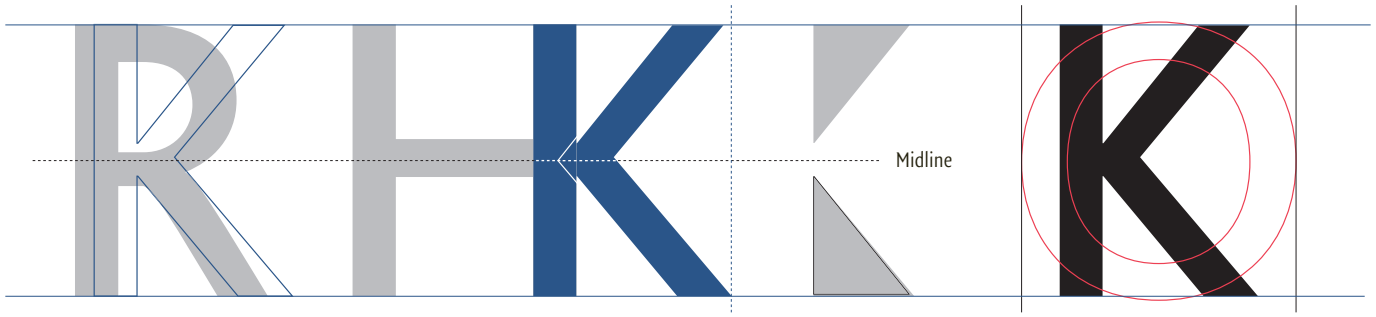
Le Monde Sans
(Normal)

Angles of the R and K vary

Chevron waist

Lower counter larger than upper

Classic proportions; K narrower than O



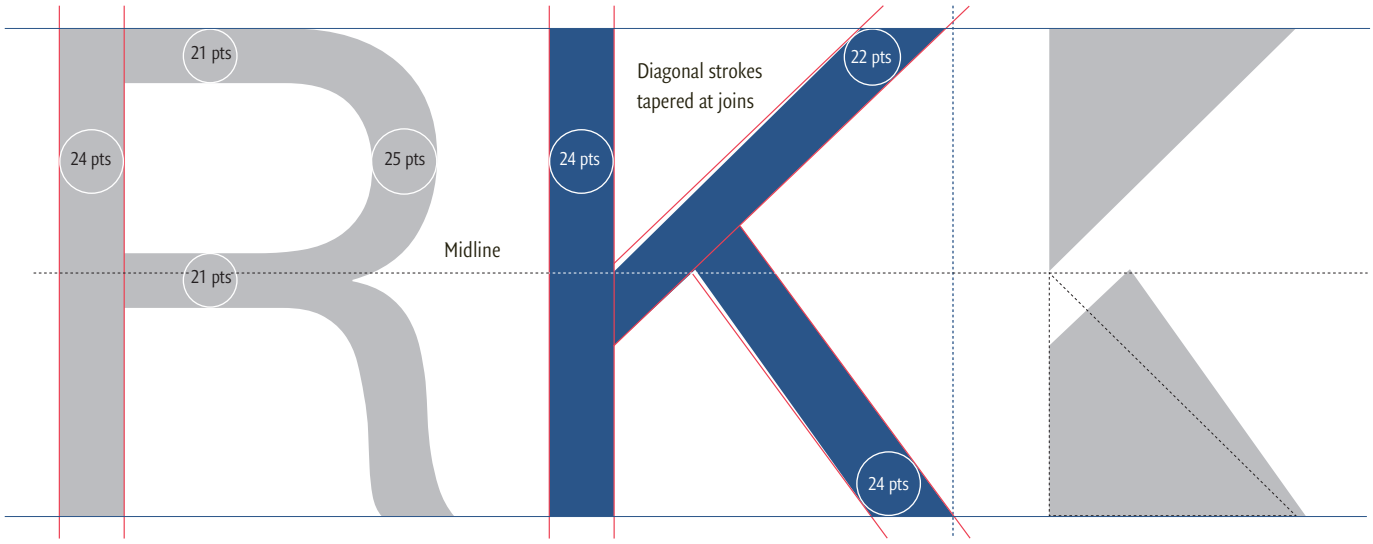
Bliss
(Medium)

Angles of the R and K vary

Diagonals overlap stem

Lower counter slightly larger than upper

Classic proportions; K narrower than O

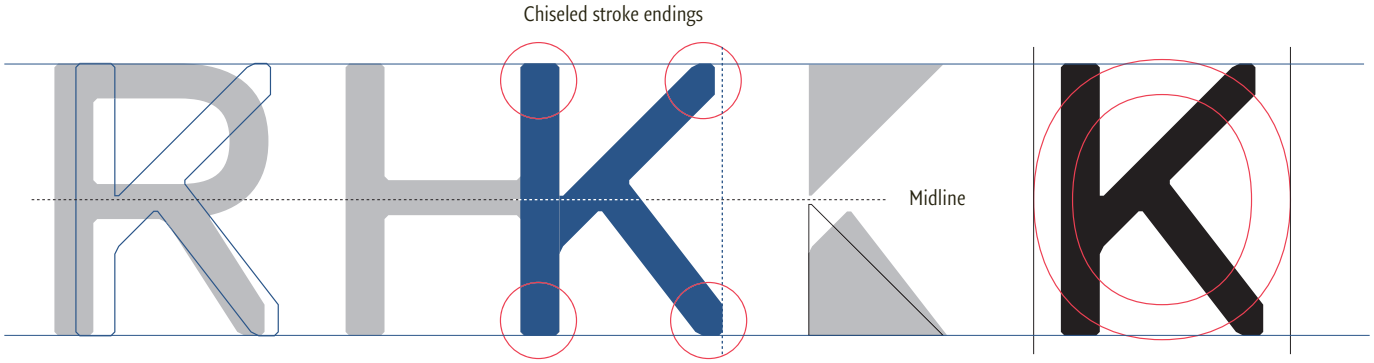


Helvetica Neue
(Regular)

Legs of the R and K vary in design

Lower diagonal extends
past upper diagonal

Lower counter larger
than upper counter

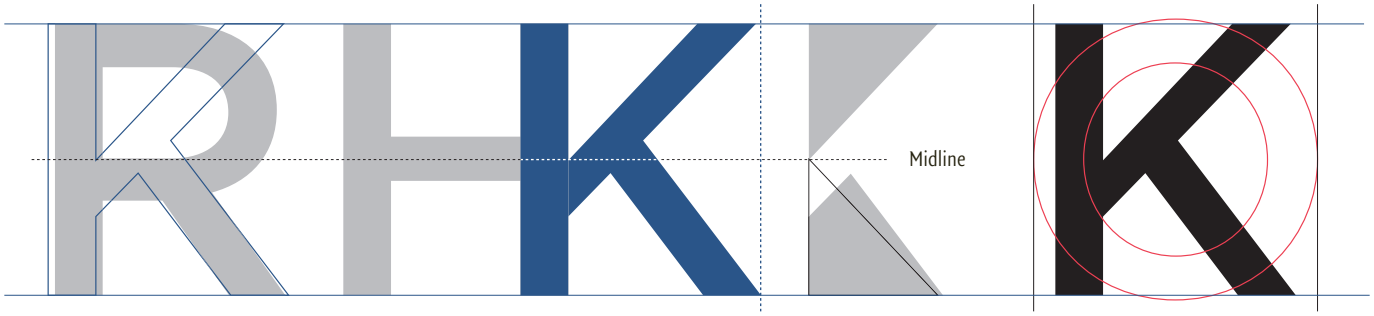


Replica
(Regular)

Angles of the R and K vary

Lower counter
larger than upper

Modern proportions;
K narrower than O



Gotham
(Medium)

Angles of the R and K vary subtly

Lower counter slightly
larger than upper

Geometric sans-serif
K narrower than O

Capital Z

The Z has two main structural variants. The conventional form has a wide diagonal and thin horizontals. The alternative is reversed, with a thin diagonal and wide horizontals.

The latter form of the Z is actually more calligraphically accurate. When holding a broad-nib pen in a normal writing position, the NE-to-SW diagonal stroke is narrow, and the horizontal strokes are wide. However, many designers find the resulting configuration visually frail—the center looks too thin to support the heavy top and bottom. Therefore, unless the typeface is strongly influenced by traditional calligraphy, most designers opt for the conventional model, which places the heaviest stroke in the center of the Z.

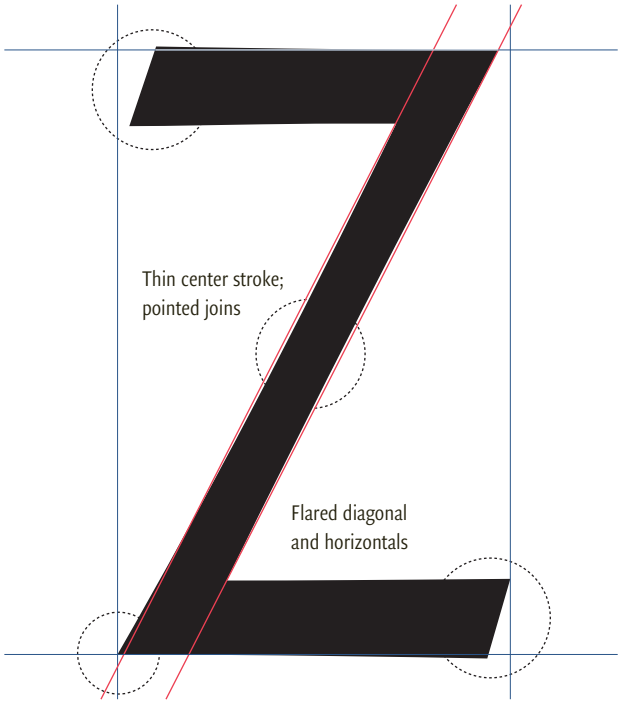
Regardless of the distribution of stroke weights, the Z is a medium-width letter. In typefaces with classic proportions, the Z is the width of two golden rectangles (see p. 64). In typefaces with modern proportions, the Z is slightly narrower than the O.

The base (the lower horizontal) of the Z should be kept wider than the top, since, as discussed previously, letters appear more stable when the bottom is larger. Note that the Z is not symmetrical; most Z forms lean slightly to the right. That is, the right side of the letter is almost aligned, but the left "nose" of the Z extends past the upper left serif.

The joins of the Z can be drawn as either sharp or blunted points. A pointed Z has a more aggressive visual quality and is often physically wider. Blunted ends can appear calligraphic, especially when the sheared ends are angled. When the blunted ends are large and square, the Z is more static and stable. Blunted ends are more often seen in slab serifs and sans serifs; pointed ends occur more frequently in classic (Venetian and Garalde) typestyles.

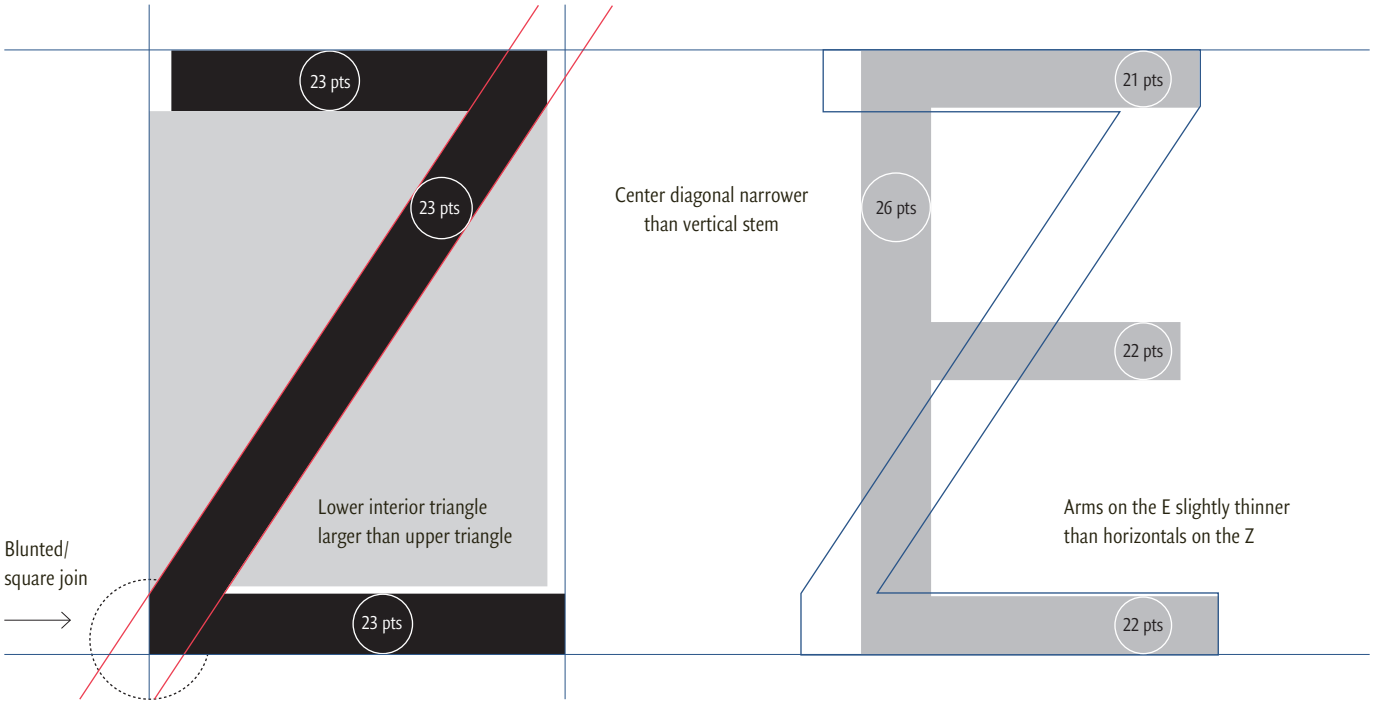
The serifs on the Z are generally related to the serifs on the E, L, and T. As in the E, the upper and lower serifs are not equal in size; the upper serif is smaller. While the serifs should feel consistent in their shape, angle, and degree of bracketing, they are typically not identical.

Joins of the Z may be pointed, blunted, or cropped.
Endings may differ in width from the normal horizontal thickness.
The angle of the blunted or cropped ending also varies.

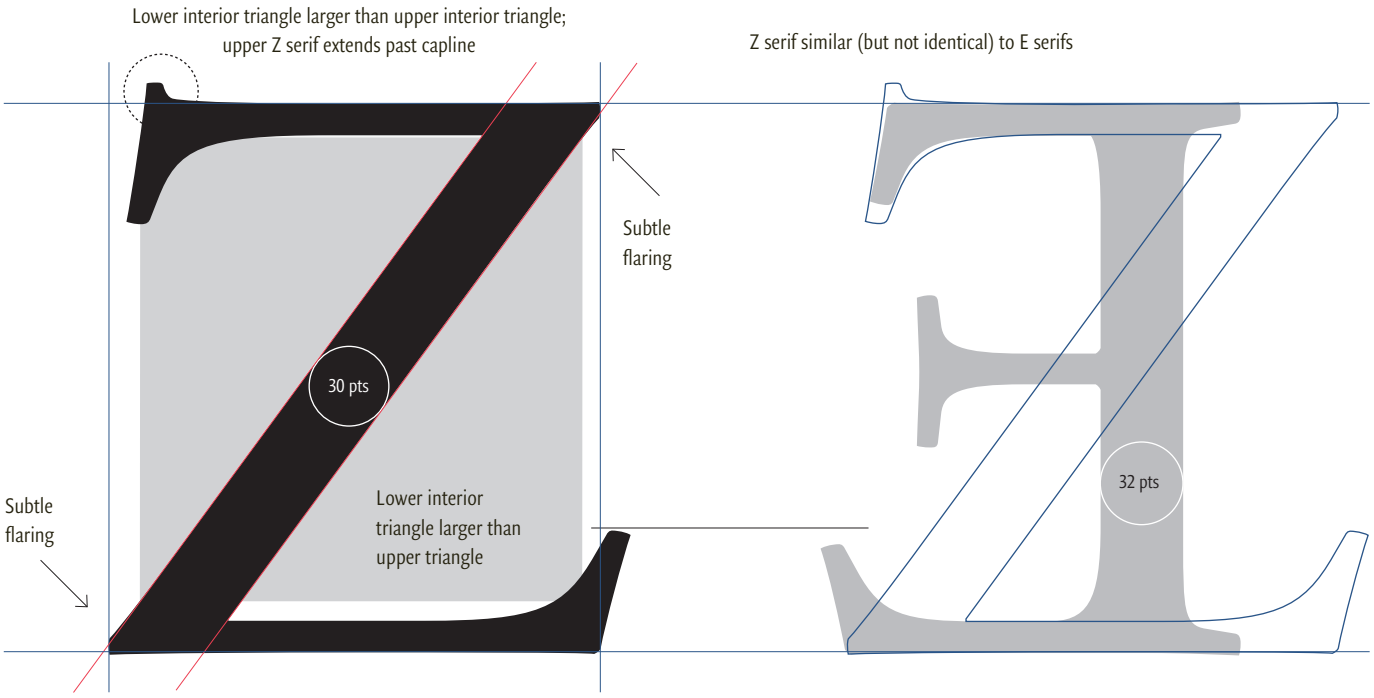


Lydian BT
(Roman)

Apolline
(Regular)

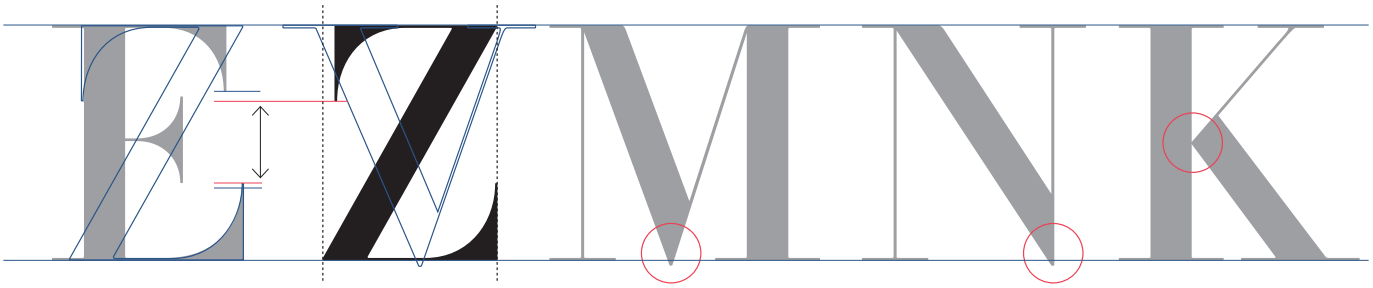


Fedra Sans
(Book)



Sabon Next
(Regular)

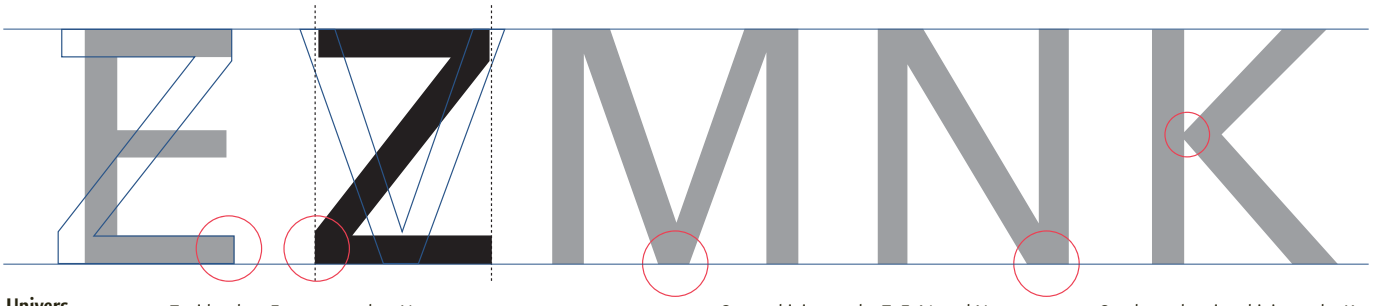
The Z is a combination letter that relates to both the E (horizontals and serifs) and other diagonal letters—especially the N, which also has a center diagonal. The pointed or blunted vertices on the Z, M, N, and K should be coherent (but not necessarily identical).



HTF Didot
(M42-Medium)

Z, E, and V similar in width;
Z serifs > E serifs

Pointed joins on the Z, M, N, and K

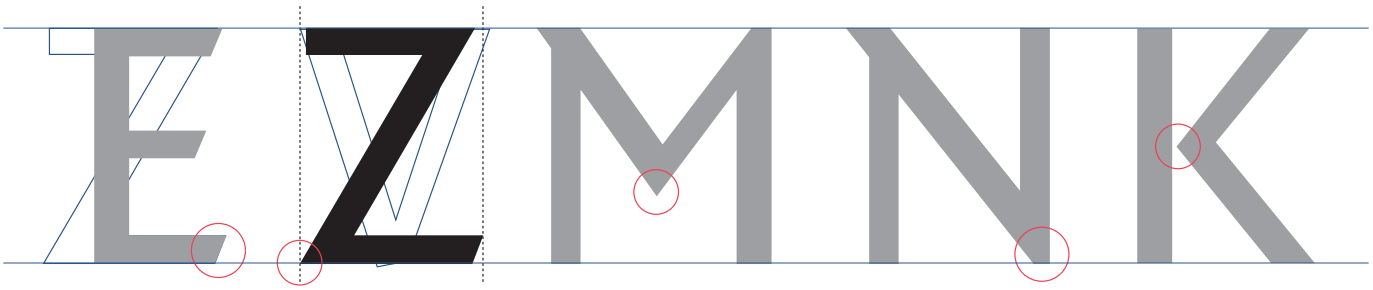


Univers
(55-Roman)

Z wider than E; narrower than V

Squared joins on the Z, E, M, and N

Overlapped, pointed join on the K



Quadraat Sans
(Regular)

Z and V similar in width;
Z wider than E

Pointed joins on the Z, M, and K; thinner squared join on the N

5

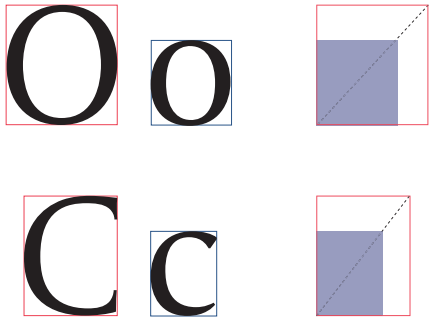
LOWER CASE

Lowercase Letters

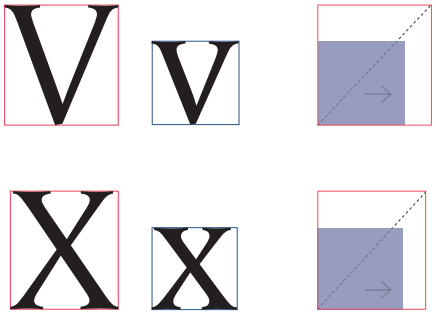
This book emphasizes text typefaces, and in this genre, the lowercase letters are more important than the capitals, because most publications intended for long-form reading (books, reports, newspapers, and so on) are set in sentence case. For the same reason, one could also argue that the lower case makes a larger contribution to the personality of a typeface—because we see more of it when reading.

However, when designing a typeface for the first time, it can be easier for students to start with the capitals rather than the lower case. The shapes of the capitals are more constrained—they have a uniform height, and their construction often follows specific "rules" (for example, classic proportions). Additionally, several letters have the same shape in both cases (O/o, C/c, S/s, V/v, W/w, X/x, Z/z), so designing the capitals first provides a bit of a learning scaffold into the lower case. Working through the capitals first may help students improve their drawing skills (and their visual acuity) before taking on more complex glyphs, such as the a and the g.

As in the previous section on capitals, this chapter organizes the lowercase letters into groups with similar shapes: round letters, square letters, round-square letters, diagonal letters, and so on. Besides the categories used previously for the upper case, there are a few new groups: branched letters (n, h, m, u, r); letters based on a single vertical stem (i, l) and hooked forms (j, f, and t).

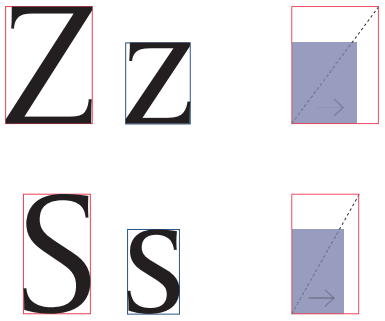


In Capitolium 2 (designed by Gerard Unger) the O/o and C/c have similar proportions



Lowercase v and x proportionally wider than upper case

Lowercase w proportionally wider than upper case



Lowercase z and s proportionally wider than upper case

LOWERCASE PROPORTIONS

In ancient Rome, lowercase letters did not exist; capitals were used for all communications: monumental inscriptions, legal contracts, correspondence, and books. Inscriptional lettering was crafted slowly and carefully with a brush and chisel, but the professional scribe wrote at greater speed with an ink pen. The combined pressures of time and tool gradually led scribes to modify the form of the inscriptional capitals into faster, more casual styles of calligraphy. Over several centuries, the half-uncial, the full-uncial, and the Carolingian minuscule styles appeared. After the invention of printing, these calligraphic scripts were further modified (again, over several centuries) to become the modern lower case.

This history explains the absence of classic proportions for the lowercase letters—there is no inscriptional model to follow. However, we can, in general, follow the proportions of the upper case, although the lowercase letters do tend to be slightly wider. Since the lower case is shorter, we need to increase width to recover interior space.

In general, thirteen letters have more or less the same "normal" width: o, b, d, p, q, g, n, h, u, k, v, x, y. Six letters (c, e, a, r, s, z) are narrower (to counteract their open sides, which lighten the letters). There are two wide letters (m, w), and four letters based on single vertical stems (i, j, f, t). Of course, within these groups, additional adjustments are needed, and these depend on 1) the overall design of the typeface and 2) the specific structure of the glyph.

Lowercase letters organized by shape

oce — Round forms

pbdq — Round-square

gsa — Round-diagonal

il — Vertical stems

tfj — Hooked forms

nhumr — Branched forms

vwyx — Diagonal forms

zk — Diagonal-square

Lowercase letters organized by proportion

obdpqgnhukvxy

Similar “normal” proportions

sc — Narrow letters

aze — Semi-narrow letters

mw — Wide letters

ijl — Single-stemmed

tfr — Wider (hooked) single stems

Lowercase letters organized by ascending and descending forms

l — (Single-stem)

bhkf — (Left)

d — (Right)

t — (Intermediate height)

pg — (Left)

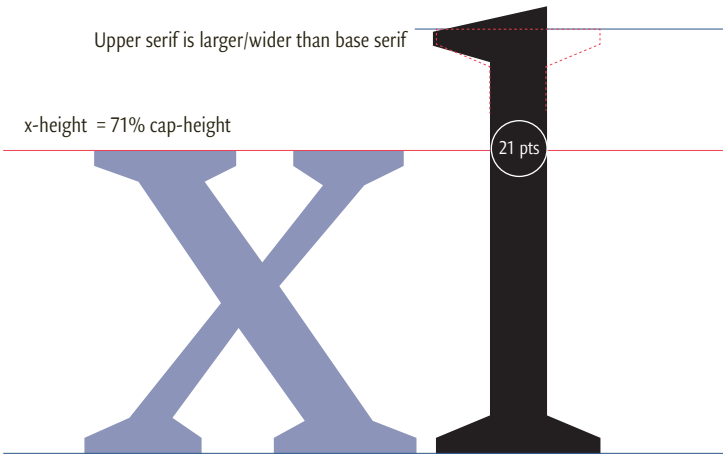
jqy — (Right)

Lowercase o and l

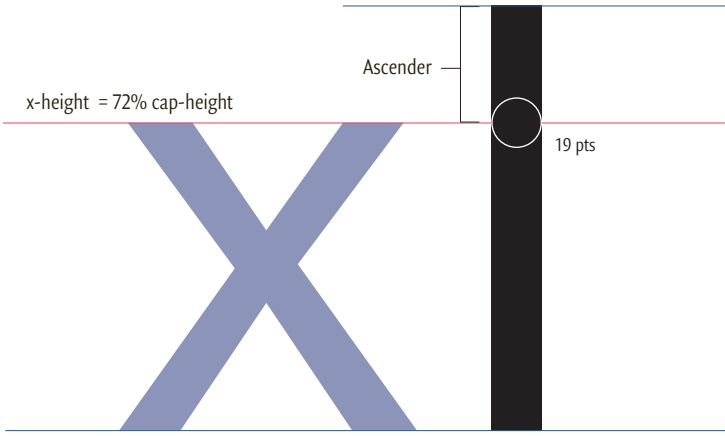
Type designers begin the lower case with control characters—glyphs that show the main stroke weights and character widths. In the upper case, the control characters are usually the O and the H. In the lower case, the control characters are typically the o and the n. However, it is possible to use the lowercase l as the control rather than the n. There are advantages and disadvantages to this substitution. Obviously, it is easier to draw the l; however, it can be difficult to see if a single vertical stem is the correct weight to match to the bowl of o. The n is a better form to match to the o, since both letters have similar width and interior space.

In any event, either the l or the n can show the normal stroke width for all lowercase stems. As described previously for the upper case, the curve of the o sets the maximum width for all variable-width strokes in the lower case (bowls, spines, loops, etc.).

Because the lowercase letters are shorter and smaller than the capitals, the weights of the l and o should be less than their uppercase counterparts (the I and O). Typically, the thick strokes of a letter (the vertical stems and maximum bowl weight) are reduced more than the thin strokes (the horizontal thickness). The specific degree of adjustment varies, but it is subtle—perhaps 4–9% in typeface with even color across the upper and the lower case. As discussed earlier (see p. 44), it is possible to deliberately make the capitals heavier than the lower case for emphasis, especially when reviving a historical model (see Big Caslon, p. 135). In this case, the adjustment may be larger—perhaps 15–25%.



Swift (Regular)



Helvetica Neue (Regular)

DETAILS OF THE LOWERCASE L

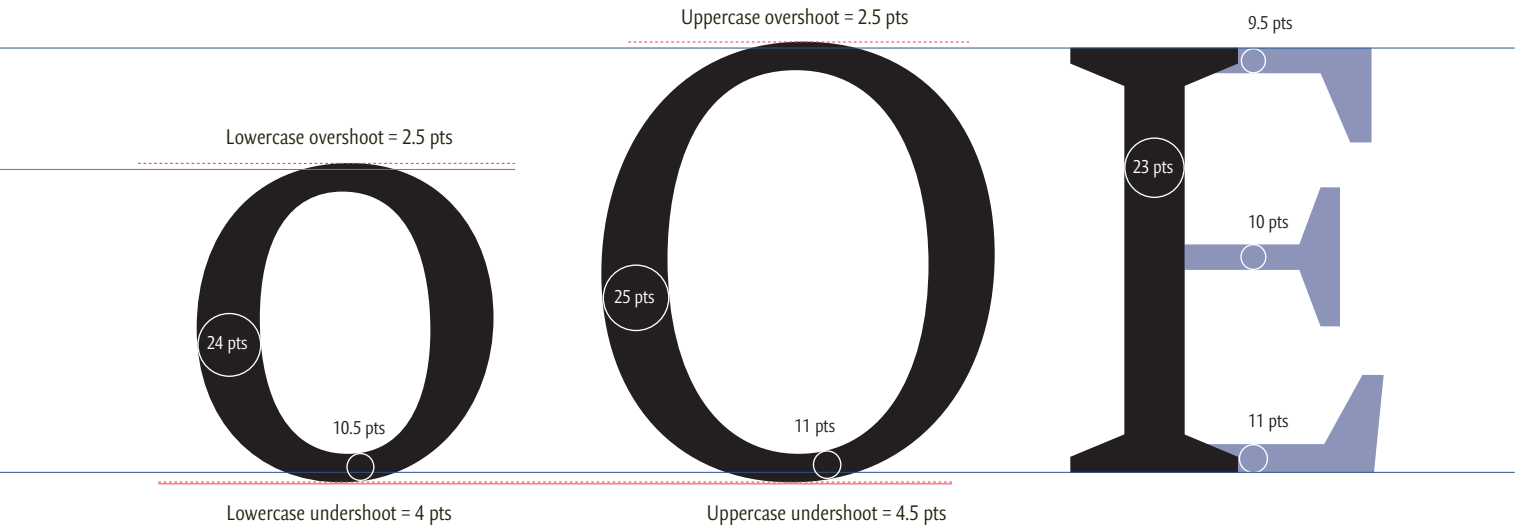
Serifs on the lower case should be drawn proportionally smaller than those on the upper case. Note that the upper serif on the lowercase l is a new design element. In Venetian and Garalde fonts, the upper serif is usually a crisp or rounded pen-formed wedge. However, as we progress chronologically through the transitional, Didone, and slab serif categories, the wedge slowly transforms, becoming flatter and more regular—in some cases, an unadorned horizontal stroke.

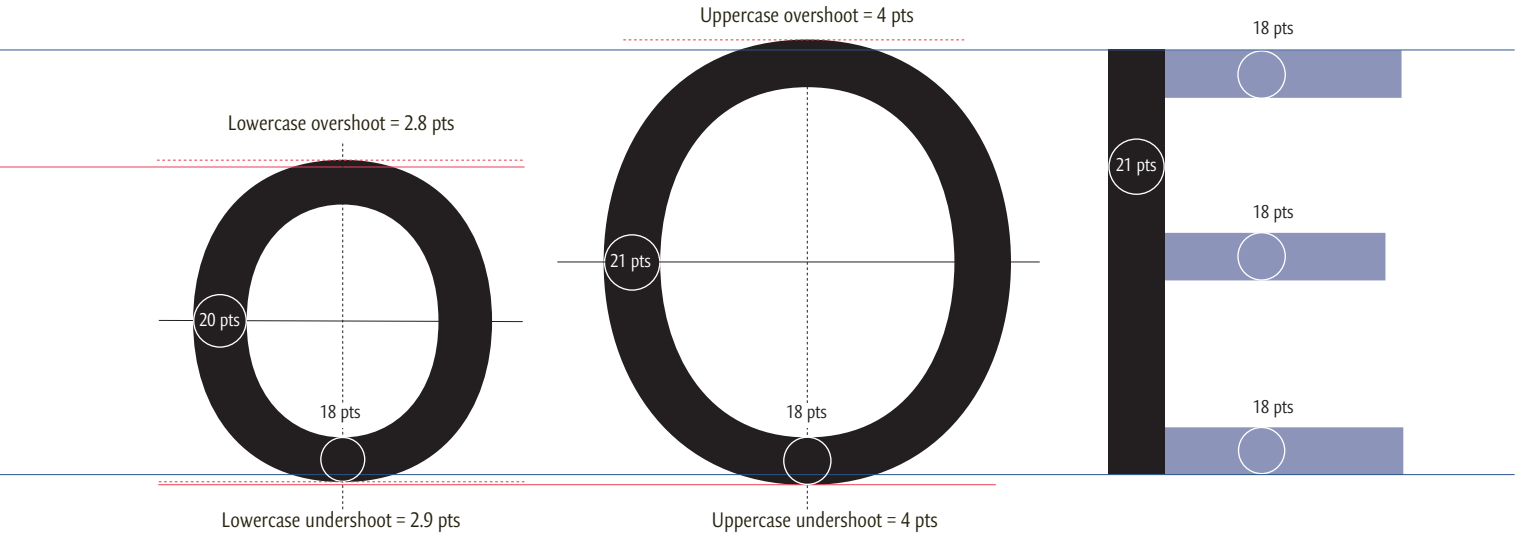
In the sans serif typestyle, the lowercase l can be a problematic letter, since its form is virtually identical to the capital I—just slightly thinner. In a humanist sans serif, one can distinguish the l from the I by adding a calligraphic detail—perhaps shearing the upper stem at an angle or adding a tail-like element to the base.

The lowercase l is our first ascending character. In a traditional text typeface, the ascenders are usually the same height as the capitals. In typefaces with tall x-heights, the ascenders can be made taller to improve legibility (for example, so an h does not become confused with an n). When the upper serif on an ascender is pointed, it should have overshoot, as discussed previously for other diagonal letters, such as the A (see p. 100).

ITC Galliard (Roman)

Bauer Bodoni (Roman)





Abril Display(Regular) **Clarendon Text** (Regular) **Questa Slab** (Regular) **Quadraat Sans** (Regular)

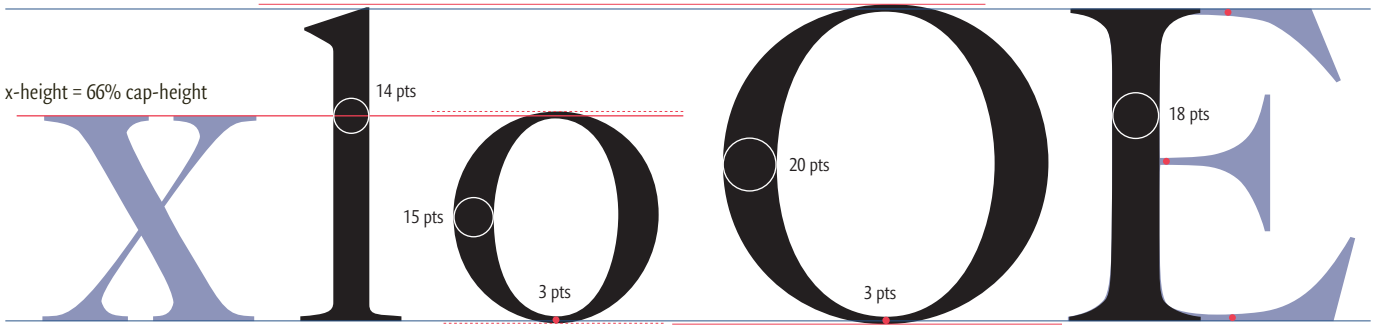
DETAILS OF THE LOWERCASE O

The lowercase o is a smaller version of the capital; its axis and general shape (what type designer Gerard Unger calls the "curve conduct") should match the capital. Ideally, the proportions of the capitals and lower case should be identical, but the lower case usually needs adjustment to achieve equal density at its shorter height (the x-height vs. cap-height). Specifically, if the capital O is narrow and upright (as in Ambroise), the lower case will need to be slightly wider. If the capital O is circular and wide (as in Bliss), the lower case will need to be slightly taller.

As in the upper case, the curves of the lowercase o should undershoot the baseline and overshoot the x-height. The undershoot line may be subtly shallower in the lower case (the goal is for the upper- and lowercase glyphs to optically align). The overshoot area above the x-height is flexible, but perhaps the most logical choice is to follow the proportions and symmetry of the upper case.

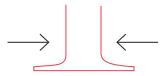
Top left, Ambroise (Regular). The lowercase o is proportionally wider than the uppercase O.

Lower left, Bliss (Regular). The lowercase o is proportionally taller than the uppercase O.

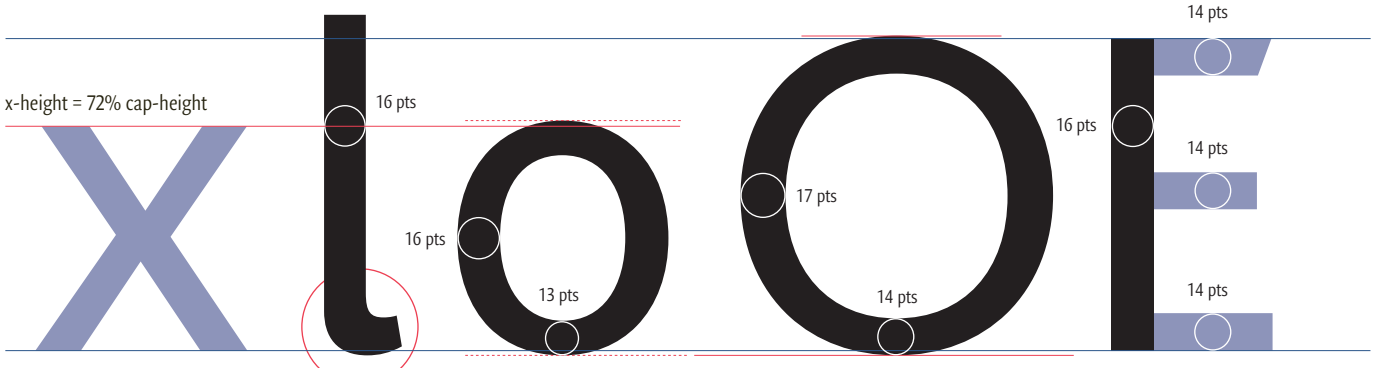


Big Caslon (Regular)

Capital undershoot > lowercase undershoot



Asymmetrical brackets



Bliss (Regular)

Hooked tail

Undershoot aligned

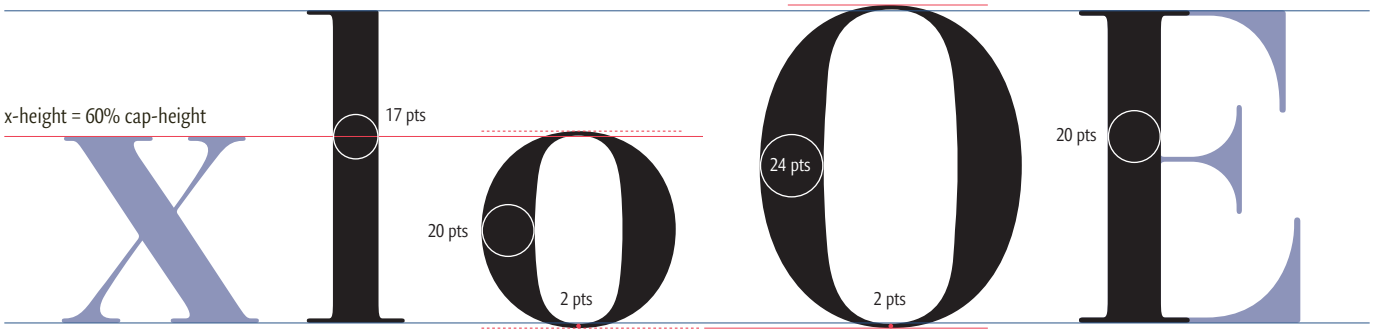
Big Caslon (Regular)

Zwölf Boxkämpfer Jagen Viktor
Über Den Großen Sylter Deich.
Le Brick Géant Que J'examine Pr
Du Wharf. The Quick Brown Fo
Jumped Over The Lazy Dogs. El
Veloz Murciélago Hindú Comía
Cardillo y Kiwi.

Franklin Gothic Medium (Regular)

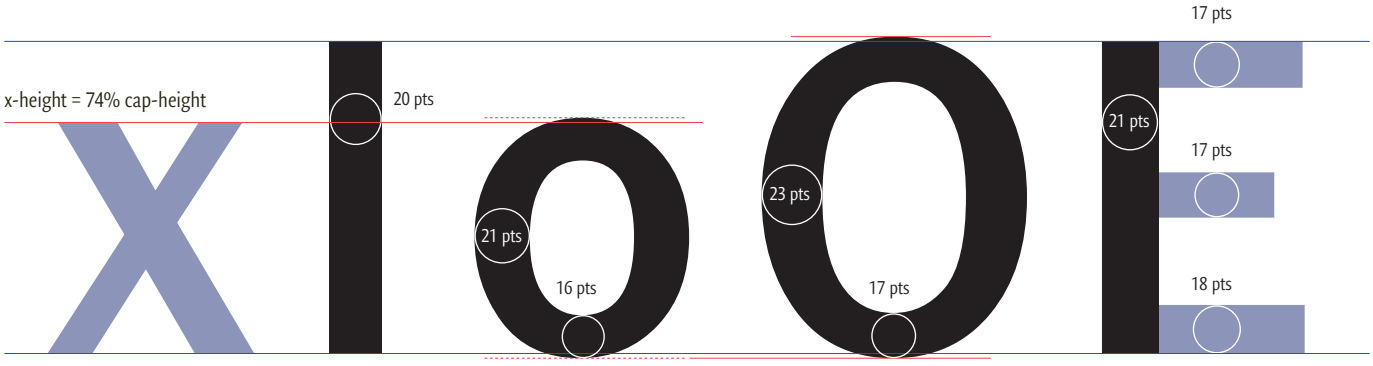
Zwölf Boxkämpfer Jagen Viktor
Quer Über Den Großen Sylter De
Voyez Le Brick Géant Que J'exar
Près Du Wharf. The Quick Brown
Fox Jumped Over The Lazy Dogs
Veloz Murciélago Hindú Comía F
Cardillo y Kiwi.

The capitals in Big Caslon are visibly darker than the lower case.
In Franklin Gothic the upper- and lower case are more similar in color.



Ambroise (Regular)

Undershoot aligned



Franklin Gothic (Medium)

Undershoot aligned

Lowercase d, q, b, and p

The d, q, b, and p share the same basic anatomy: They each have a bowl and a vertical stem. However, the letters are not identical.

HUMANIST VS. RATIONALIST CONSTRUCTION

In typefaces influenced by calligraphy (Venetian, Garalde, and humanist slab/sans serifs) the letters d, q, b, and p show evidence of broad-nib pen construction. That is, when drawing an o, the calligrapher draws two equal half-circles that connect across a tilted axis. When drawing the d and q, the calligrapher draws a left half-circle followed by a shorter arc, then finishes with the vertical ascender or descender. For the b and p, the process is reversed; the descender is drawn first, followed by a right half-circle and the shorter arc.

These differences in construction place the weights of the d and q in a different position (approximately 7 o'clock) from that of the b and p (approximately 1 o'clock). Additionally, there are different finishing details for each letter. The d, b, and p have head serifs on their ascenders (matching the l), but the q has a pointed spur. The d has a foot serif, but the b has a rounded base.

Some typefaces (especially rational designs with an upright axis) have symmetrical or almost symmetrical pairs. That is, the d is rotated to form the p, and the q is rotated to form the b. (Note: these letters should never be mirrored—the d cannot be flipped to create the b, nor the p flipped to create the q. Calligraphy permits rotation, but not reflection; mirroring forces bowl weights into illogical positions.) However, rotation is rarely satisfactory by itself; we still need to adjust the overall shape, width, and finishing details of each individual letter.

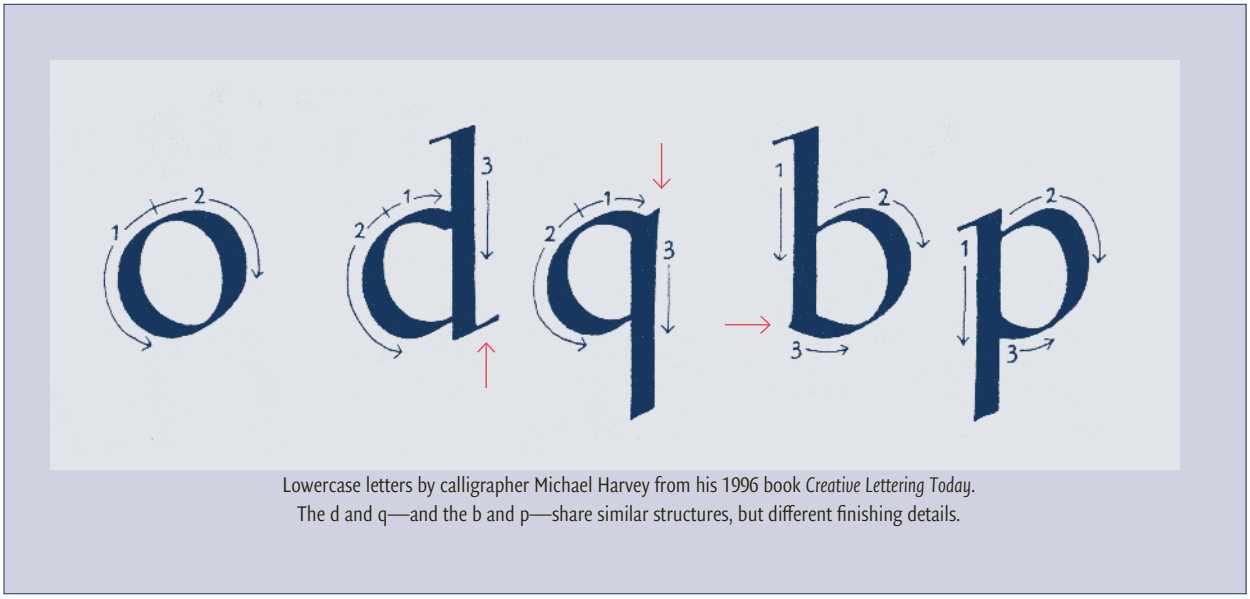
DESCENDERS AND ASCENDERS

The p and q introduce our first descenders. In many text typefaces, descenders and ascenders are equal in height (about 30–40% of the cap-height). However, if desired, descenders can be shorter—the b and d may be taller than the p and q—especially when the ascenders are taller than capitals. As described earlier (see p. 38), typefaces with short descenders need less leading and are therefore more efficient, because lines of type can be set more closely. However, descenders need to be long enough so that the p and q are distinct from the o.

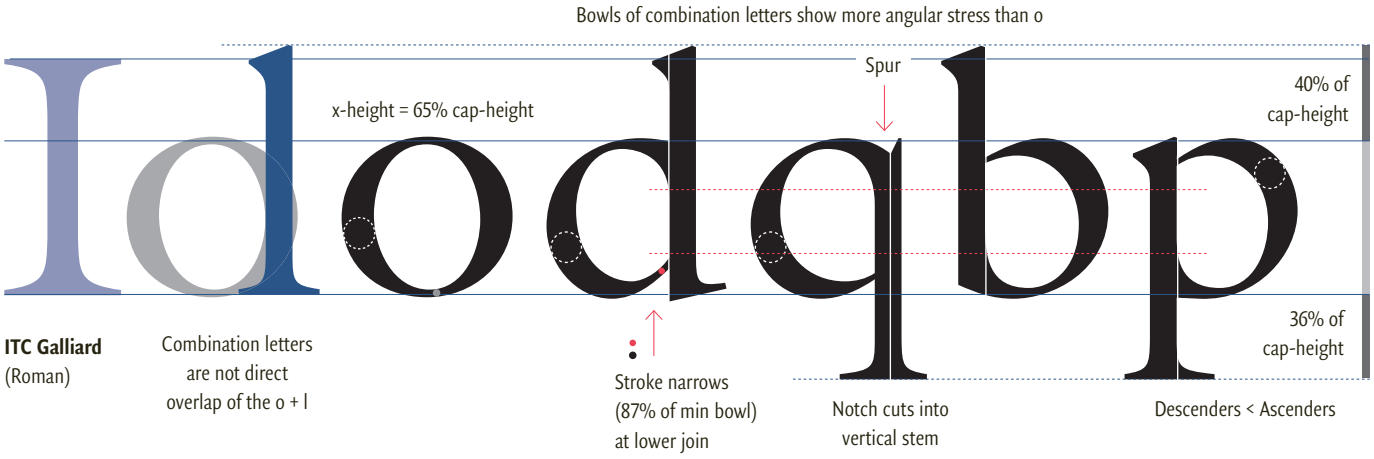
DESIGNING RELIEFS

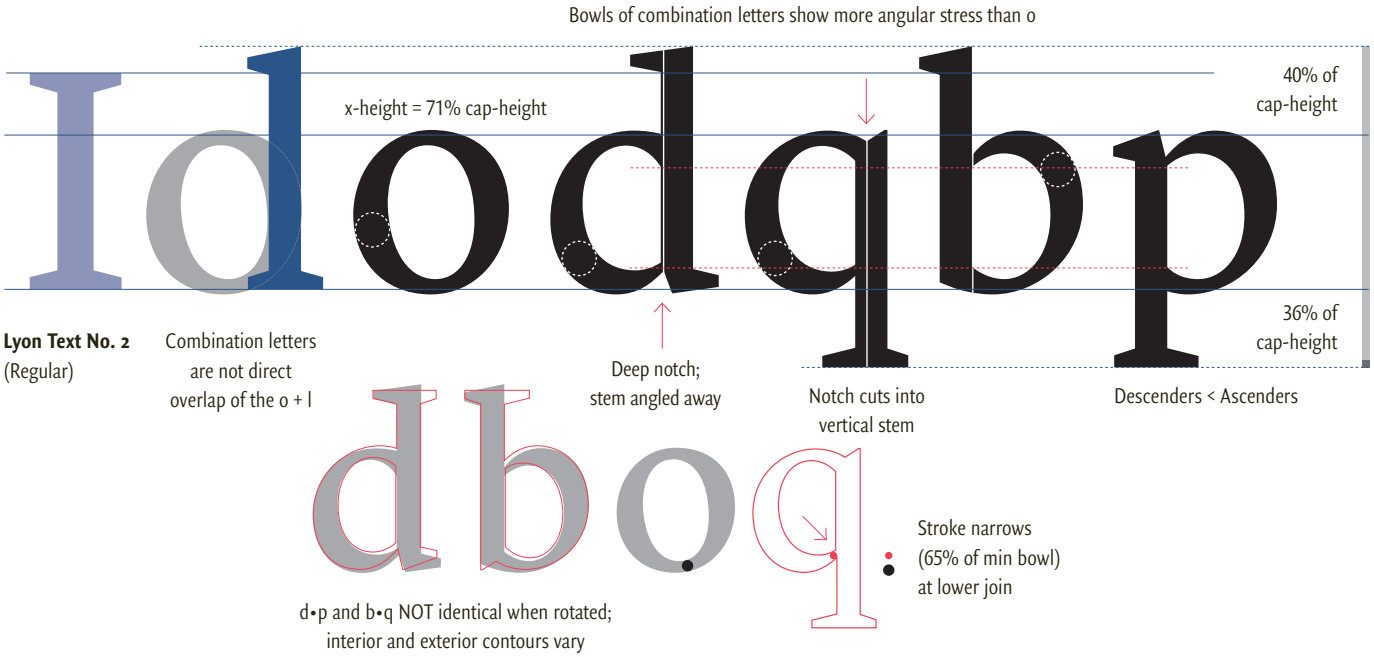
The open triangular notches at the top and bottom of the b, d, p, and q are called reliefs. These areas must be large enough to remain clear, even at small type sizes. To increase the size of reliefs, we can modify either the bowl or the stem. Specifically, the bowl can be redrawn to meet the stem at a steeper angle (see Galliard) and/or the thickness of the bowl can be narrowed to less than the normal minimum bowl weight. If these adjustments are insufficient, the stem can also be subtly shaved after the join (see Caecilia), and/or the bottom of the stem can be curved or angled away from the join with the bowl (see Lyon).

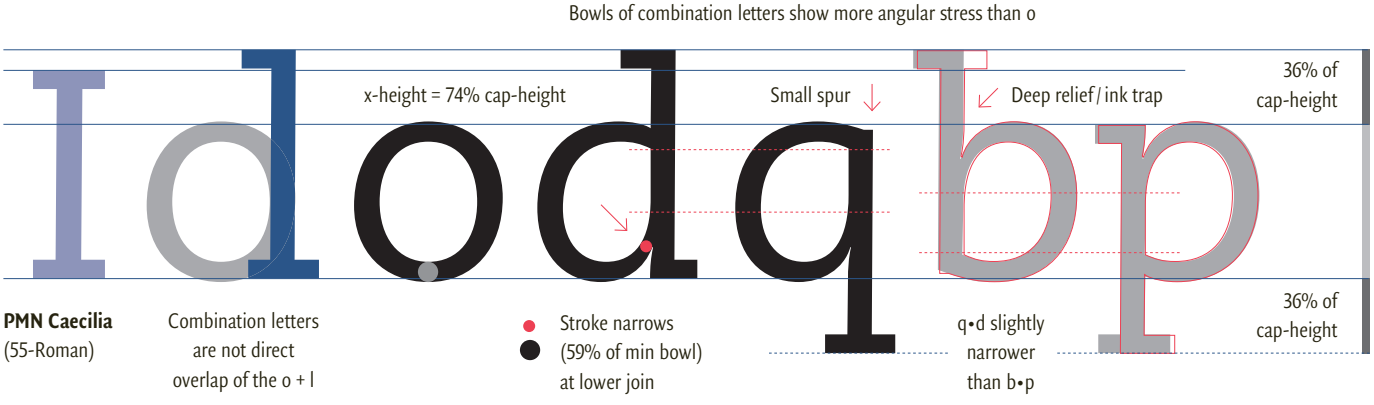
Reliefs tend to be more problematic in slab and sans serifs, because low contrast reduces open space, especially in bold or condensed types. Besides the methods of relief enlargement discussed above, one could more dramatically alter the stems, as shown in the q and b of Trianon (see p. 139).



Lowercase letters by calligrapher Michael Harvey from his 1996 book *Creative Lettering Today*.
The d and q—and the b and p—share similar structures, but different finishing details.


Bowls of combination letters show more angular stress than o
x-height = 65% cap-height
Spur
40% of cap-height
36% of cap-height
ITC Galliard (Roman)
Combination letters are not direct overlap of the o + l
Stroke narrows (87% of min bowl) at lower join
Notch cuts into vertical stem
Descenders < Ascenders


Bowls of combination letters show more angular stress than o
x-height = 71% cap-height
40% of cap-height
36% of cap-height
Lyon Text No. 2 (Regular)
Combination letters are not direct overlap of the o + l
Deep notch; stem angled away
Notch cuts into vertical stem
Descenders < Ascenders
Stroke narrows (65% of min bowl) at lower join
d•p and b•q NOT identical when rotated; interior and exterior contours vary

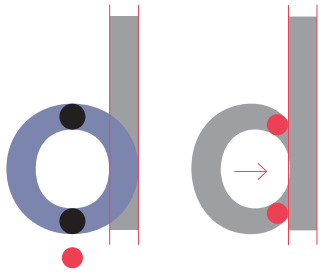

Bowls of combination letters show more angular stress than o
x-height = 74% cap-height
Small spur
Deep relief / ink trap
36% of cap-height
36% of cap-height
PMN Caecilia (55-Roman)
Combination letters are not direct overlap of the o + l
Stroke narrows (59% of min bowl) at lower join
q•d slightly narrower than b•p

SANS SERIF STROKE ENDINGS

In most sans serifs, the ascenders and descenders of the b, d, p, and q are simply squared off at the ends. However, if the overall design includes rounded or shaped stroke endings, those forms should reappear. For example, in humanist sans serif Quadraat, both the arms of the E as well as the ascenders and descenders end in sheared angles.

ADJUSTING COLOR

These four combination letters are, in general, difficult to design with even color, because their shorter, variable-weight bowls are directly adjacent to the even vertical stems. There are two possible adjustments: 1) We can "cheat" by slightly reducing the overall width of the vertical stem; or 2) just the counter of the letter can be shifted to erode the stem. However, the latter works only for combination letters that have round interior counterforms. When the interior counter has a straight side (i.e. shaped like a half-circle or teardrop), the visual cheat tends to become conspicuous (and therefore unacceptable).

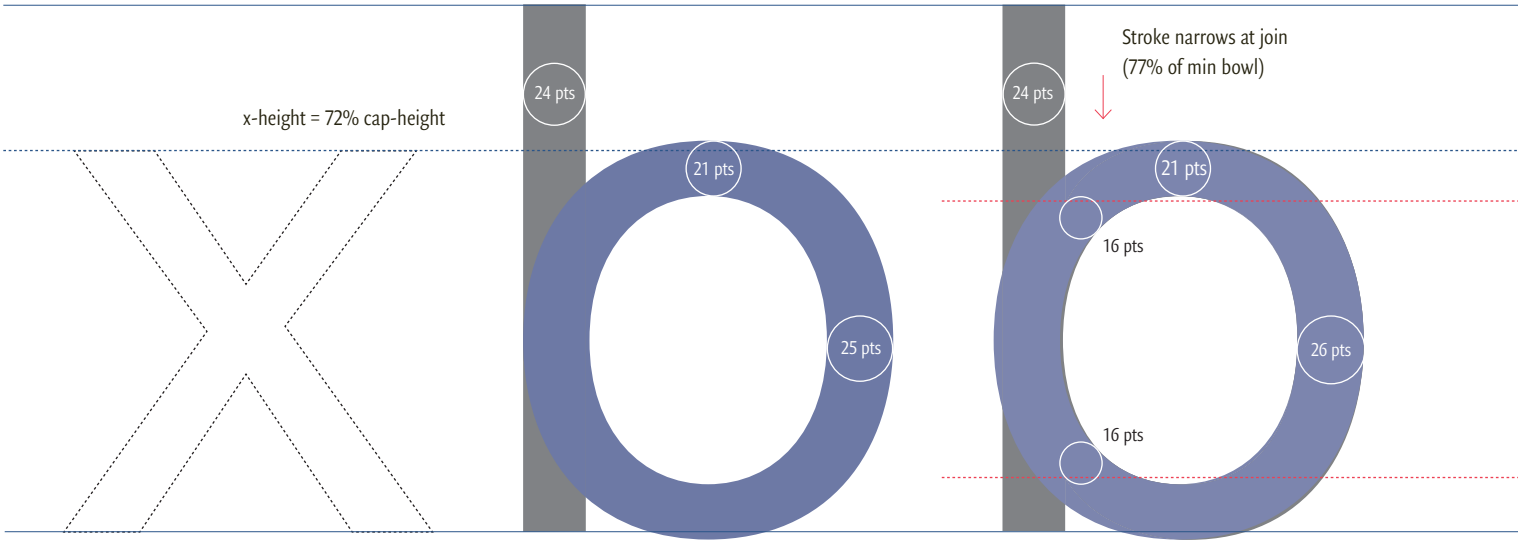


Right, Futura Paratype (Medium). The counter is shifted to erode the stem. The bowl stroke is reduced (81% of min bowl weight) at the join to the stem.

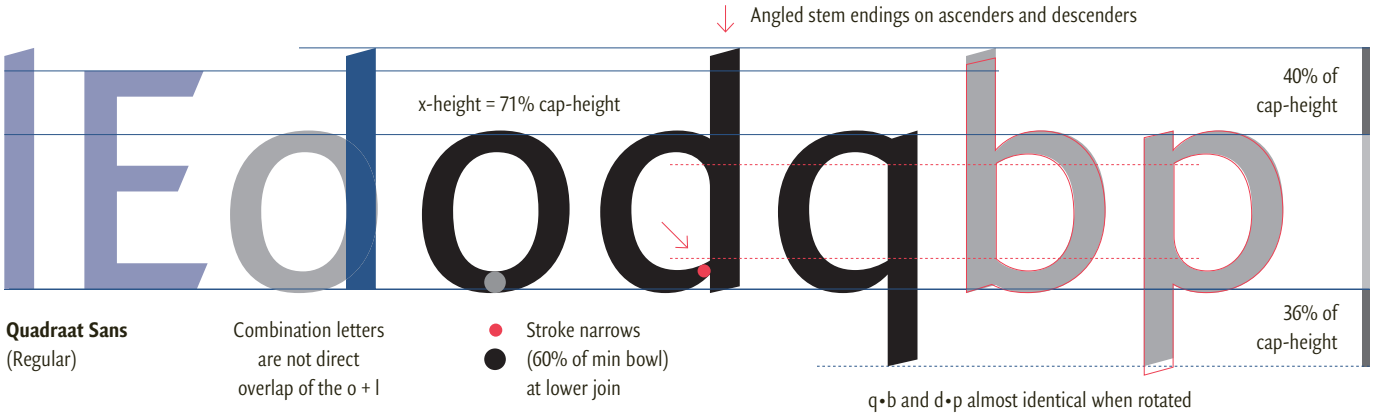
SPACING AND TESTING

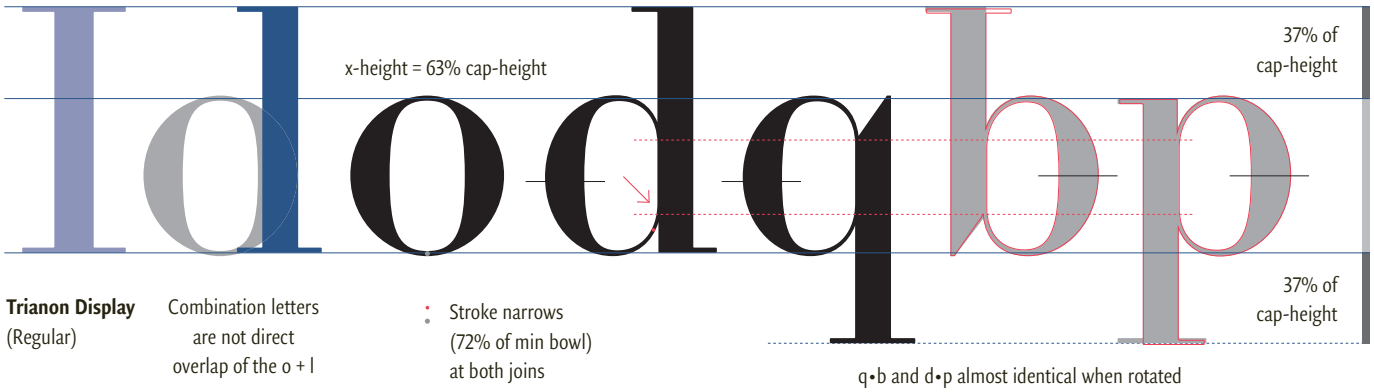
Once you have drawn the o, l, b, d, p, and q, add sidebearings (see p. 54) and check the spacing in test words. While the words that can be formed with these letters are somewhat limited, their regularity should make it easier to spot errors. At this time, you can also check if the upper- and lowercase letters have equal density by setting the same series of words in title case. The humanist sans serif Syntax is shown below:

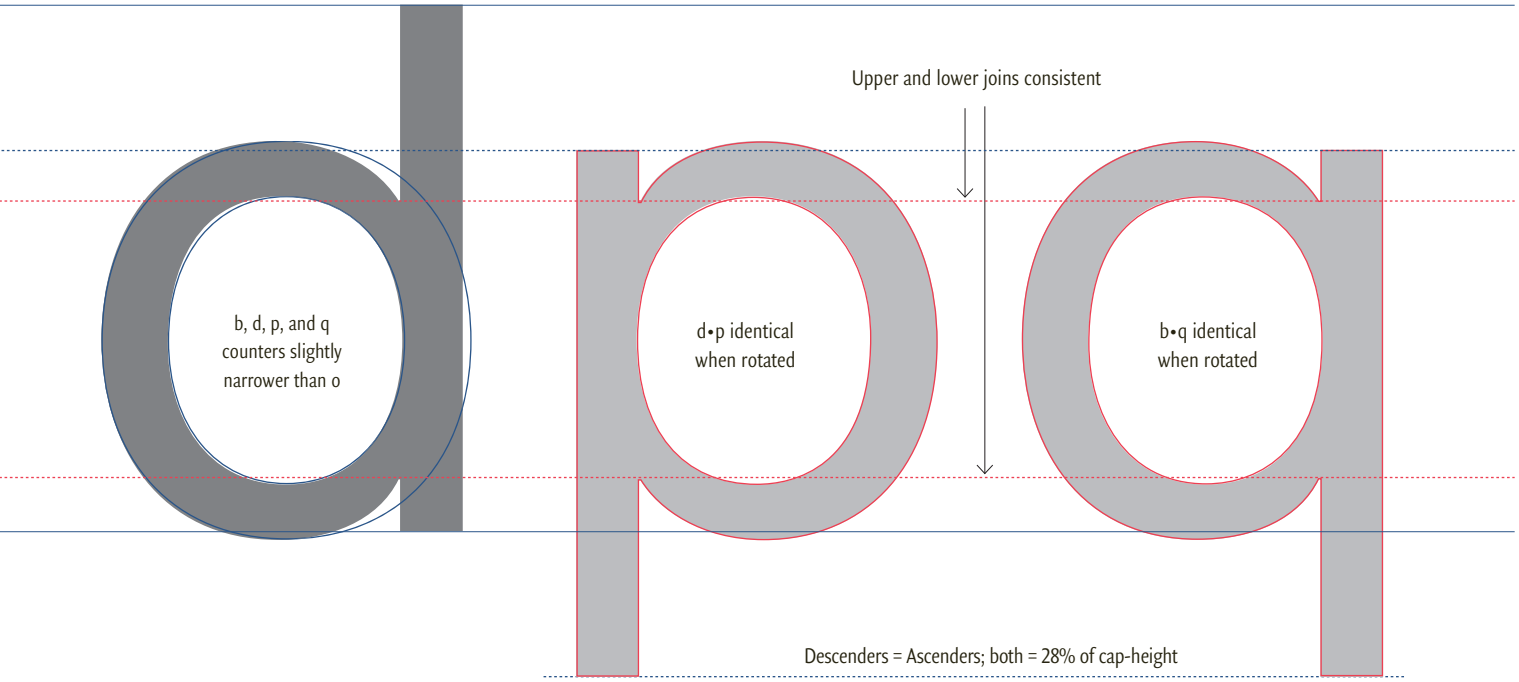
boob BOOB booboo BOOBOO do DO blob BLOB dodo DODO doll DOLL odd ODD bold BOLD bob BOB boo BOO bolo BOLO poll POLL loop LOOP lob LOB loll LOLL lop LOP pop POP plod PLOD plop PLOP old OLD dollop DOLLOP blood BLOOD polo POLO pod POD pool POOL poop POOP loop LOOP bod BOD



Helvetica Neue (Regular)


Angled stem endings on ascenders and descenders
x-height = 71% cap-height
40% of cap-height
36% of cap-height
Quadraat Sans (Regular)
Combination letters are not direct overlap of the o + l
Stroke narrows (60% of min bowl) at lower join
q•b and d•p almost identical when rotated


x-height = 63% cap-height
37% of cap-height
37% of cap-height
Trianon Display (Regular)
Combination letters are not direct overlap of the o + l
Stroke narrows (72% of min bowl) at both joins
q•b and d•p almost identical when rotated


Upper and lower joins consistent
b, d, p, and q counters slightly narrower than o
d•p identical when rotated
b•q identical when rotated
Descenders = Ascenders; both = 28% of cap-height

Lowercase e and c

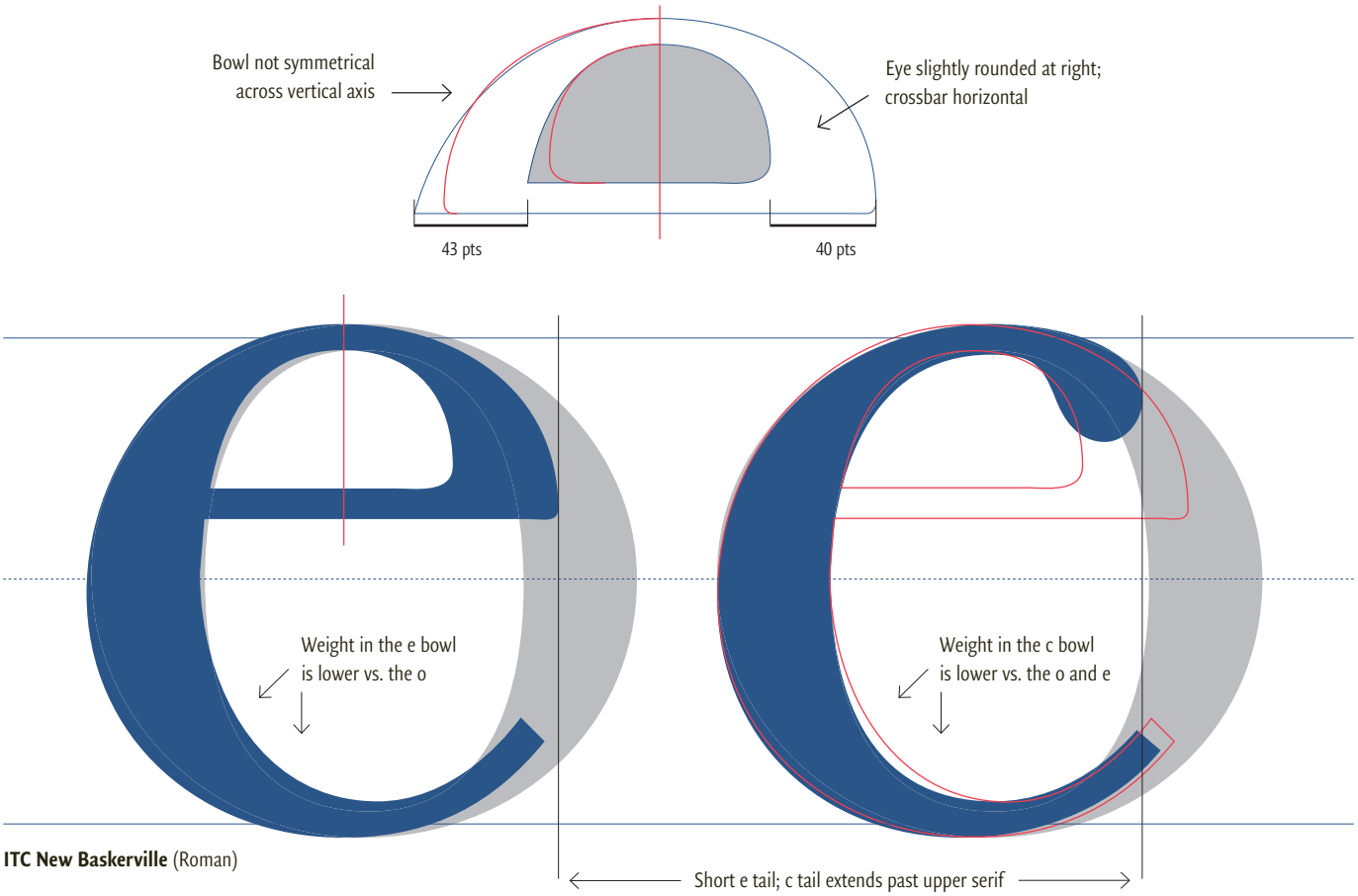
Although the e and the c are both related to the o, the bowls of the three letters are not identical. The issue is color: open sides reduce the density of the e and c. To darken the e, we narrow its overall width. The c requires even more reduction than the e, since its open side is larger. Note: In typefaces with calligraphic construction, the e and the c are naturally narrower than the o, since both letters are constructed with an initial half-circle followed by a shorter arc (and in the case of the e, the crossbar). However, some designers go further and draw the e and c as yet more condensed shapes overall.

The e has two unique features: the eye and the crossbar. Owing to calligraphic construction, the eye is not always symmetrical. The upper arc can be bracketed to the crossbar, creating a graceful, teardrop-shaped counter. Additionally, the crossbar may not be an even horizontal. In Venetian types, the crossbar is often tilted at the angle of stress and tapered at the join. Furthermore, the bar is higher in humanist typefaces (Venetian and Garalde) and lower in modern designs (transitional, Didone, slab serif, and sans serif). A higher bar emphasizes the horizontal direction and creates the illusion of a wider form. However, a lower crossbar can improve legibility by increasing the size of the eye.

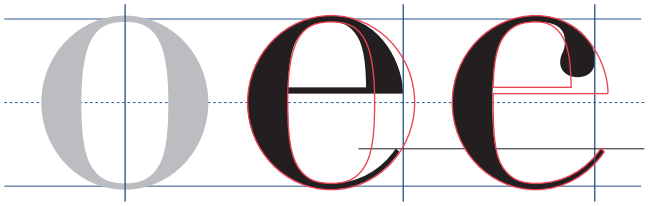
The bowl weights of the e and c may need subtle adjustment from the o. The weight is often drawn heavier in the c, because the open letter needs more density. In contrast, because the e is more complex, its bowl weight may need to be reduced. In some designs, the bowl weights of the e and the c move lower, subtly altering the angle of stress. As in the d, b, p, and q, due to calligraphic construction, the e and the c may have diagonal stress even if the axis of the O/o is upright.

In most fonts, the e and c have "tails" that can end in either a sharp or blunted point; the width of a blunted point is usually the thickness of a thin horizontal stroke width. The e and c have either "underbite" or "overbite." That is, their tails can extend past the top half of the letter, or be tucked under. The tail is not usually symmetric to the main curve; rather, the final arc may be steeper or flatter for static or dynamic balance. Often, tails of the e and c match; this helps the two letters relate.

Ideally, the curves, aperture, and proportions of the upper- and lowercase C/c are related. Given the crossbar, the aperture of the e will be more closed than the c, but the overall sense of openness should be similar across this pair of letters.

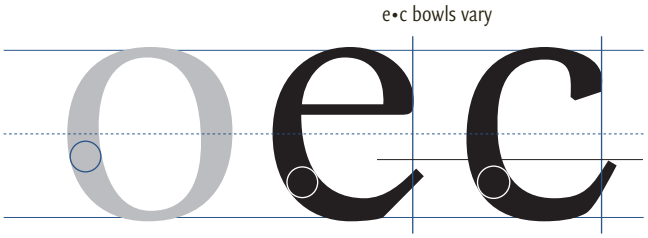


ITC New Baskerville (Roman)



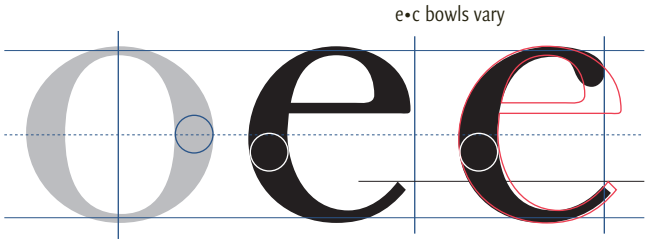
HTF Didot
(M16-Medium)

e•c bowls and tail are identical
All bowl weights at 9 o'clock



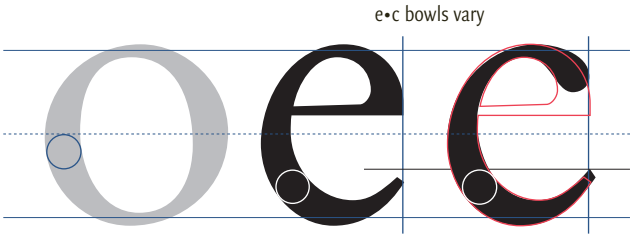
Trump Mediaeval
(Roman)

e•c have "underbite"
Bowl weight in e•c is lower than o



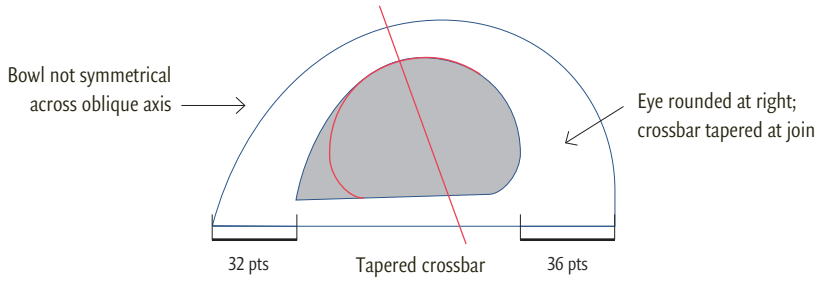
ITC New Baskerville
(Roman)

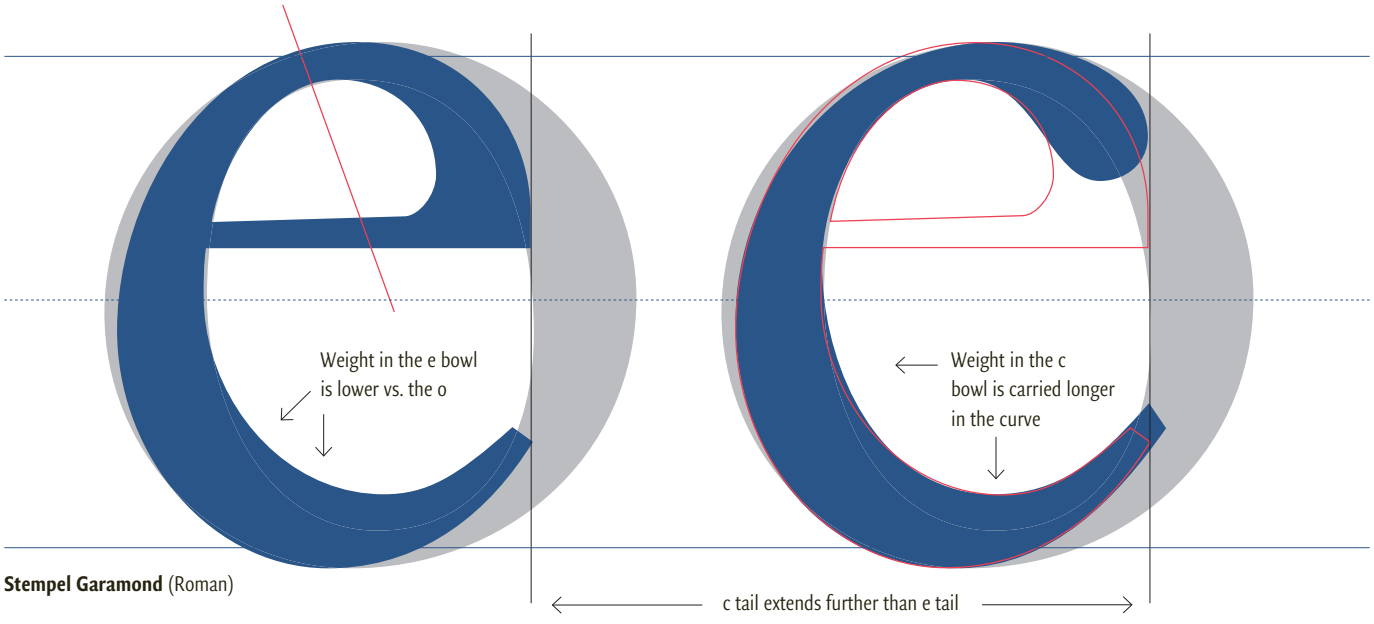
Tapered crossbar on e
Bowl weight in e•c is lower than o



Stempel Garamond
(Roman)

Tapered crossbar on e
Bowl weight in e•c is lower than o



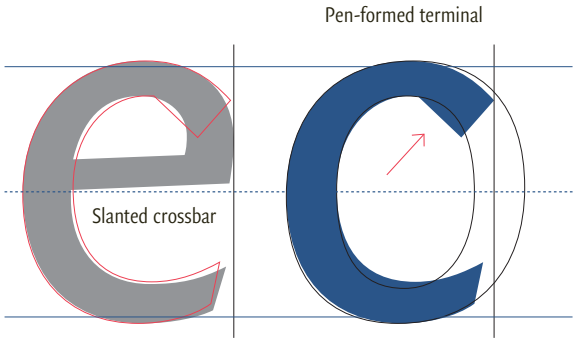


Stempel Garamond (Roman)

SERIF LOWERCASE C

The top of the lowercase c may have either a serif (matching the style of the upper case) or a terminal. The terminal of the c could relate to the terminal of the J (see p. 86). However, if the J has no terminal, the selection is open. In general, pen-shaped terminals reflect the calligraphic origins of Venetian designs; circular terminals balance the high contrast of Didones; and block forms match the square shape of slab serifs. An oval terminal is actually a softened pen-form, and therefore most common in Garalde and transitional typefaces.

Serif and terminal size vary widely. However, in general, the diameter of a terminal is similar to the maximum bowl thickness. Terminals (and serifs) tend to be larger in transitional, Didone, and slab serif fonts, because those typestyles need to fill the open space inside the bowl of the c in order to achieve even color.



Quadraat Sans
(Regular)

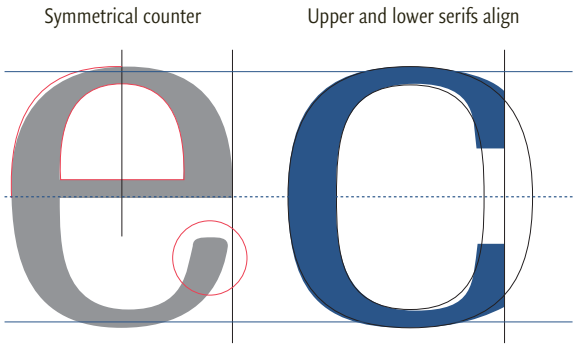
Open aperture;
upper terminal extends past tail

SPACING AND TESTING

It is best to check the color of the e and c before moving forward, in case the reduction in width from the o has been too large or too small. Ideally, test words mix the e/c with the o and d/b/p/q. Pay special attention to the "cl" combination; if spacing is too tight, this pair can be confused with the lowercase d. Additionally, you should check if the upper- and lowercase letters have equal density by setting the same series of words in title case.

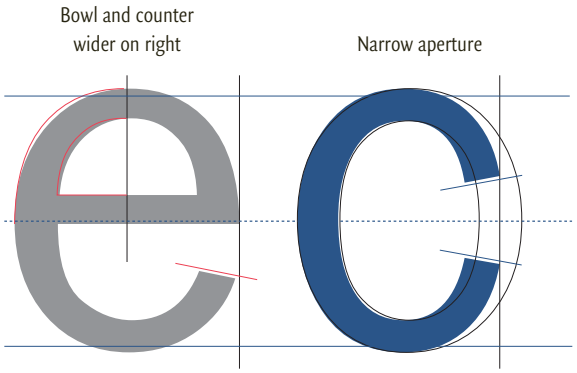
bocce, BOCCE, depeople, DEPEOPLE, eco, ECO, clodpole, CLODPOLE, bolded, BOLDED, beep, BEEP, ecole, ECOLE, celeb, CELEB, decoded, DECODED, cop, COP, cope, COPE, coded, CODED, cold, COLD, colocolo, COLOCOLO, pope, POPE, deeded, DEEDED, peel, PEEL, doped, DOPED, cobbled, COBBLED, code, CODE, coed, COED, POP, pop, CL, cl

Feijoa Display
(Regular)



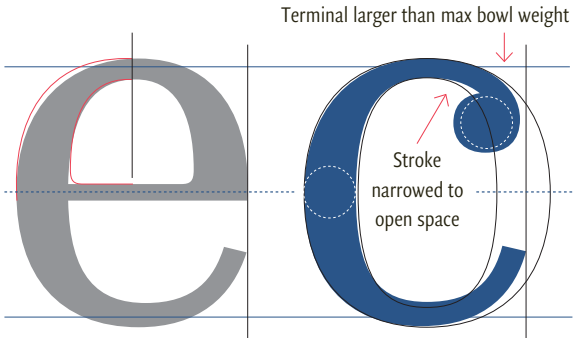
Melior
(Regular)

Unusual flared and
rounded tail on the e



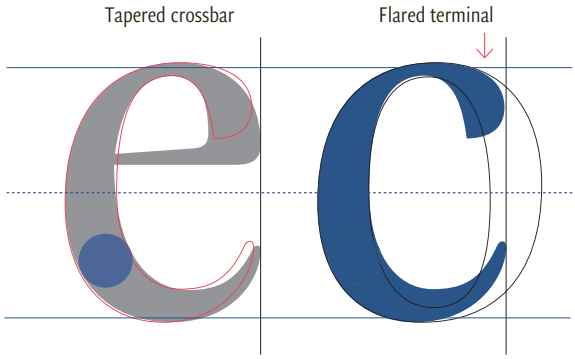
Franklin Gothic Book
(Regular)

Bowl ends sliced at similar angles



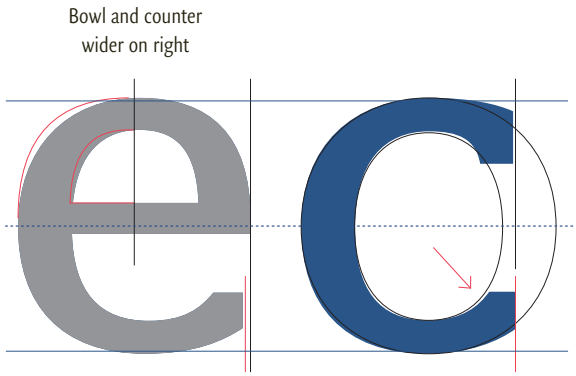
Eames Century Modern
(Regular)

Narrow aperture;
Tail extends past upper terminal



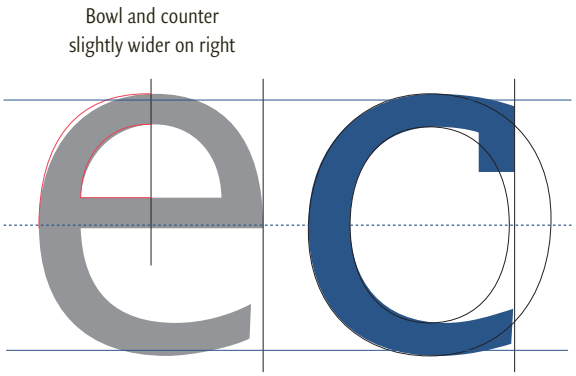
Feijoa Display
(Regular)

Bowl weight extends longer and lower on e•c vs. o;
c tail extends past upper terminal



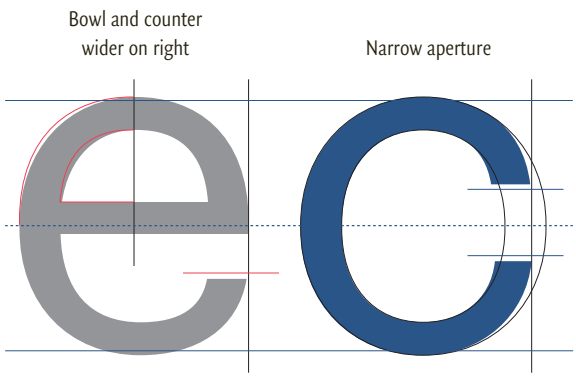
Stag
(Book)

Vertically sliced lower tails on e•c



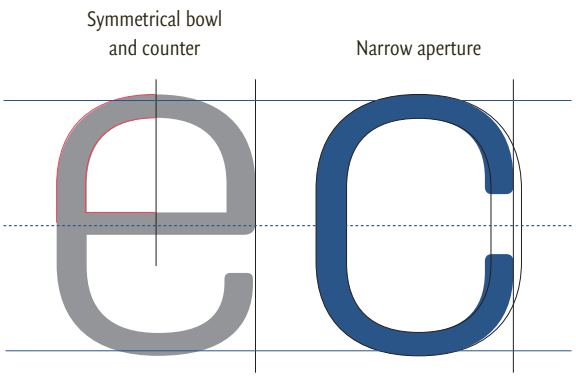
PMN Caecilia
(55-Roman)

Open aperture



Graphik
(Regular)

Consistent horizontal endings



Aglet Slab
(Light)

Straight vertical sides on e•c;
note visible bone effect;
rounded joins and stroke endings

Lowercase n, h, m, and u

The n, m, h, and u are a related set of branched forms. The n is the most important letter in the group, since its shape is the basis for the other glyphs. On the surface, the n seems simple to construct—just two verticals connected by an arch. However, there are a few details that require special attention.

First, the n should match the color of the lowercase o. Therefore, the counter of the n must be slightly narrower than the counter of the o. If both counters were of equal width, the n would be too light, since it has an open side at the base of the letter.

Next, the shoulder of the n must be drawn with appropriate weights. The arch is thinnest at the left, as it departs from the vertical stem. To open the join, this thin weight can be less than the normal minimum bowl weight. The maximum bowl weight in the arch of the n occurs anywhere between 2 and 3 o'clock. Placing the weight higher (at an angle) creates an elegant "thrust" shape—a calligraphic form with dynamic energy. The "thrust" n can occur even in typefaces without a tilted O/o (for example, as in Scala). Placing the weight in the vertical (at 3 o'clock) reinforces an upright axis (as in Didot). Note: when the weight is asymmetrical, in the shoulder, the maximum weight in the branch varies. It can be the normal vertical stem thickness, or slightly more.

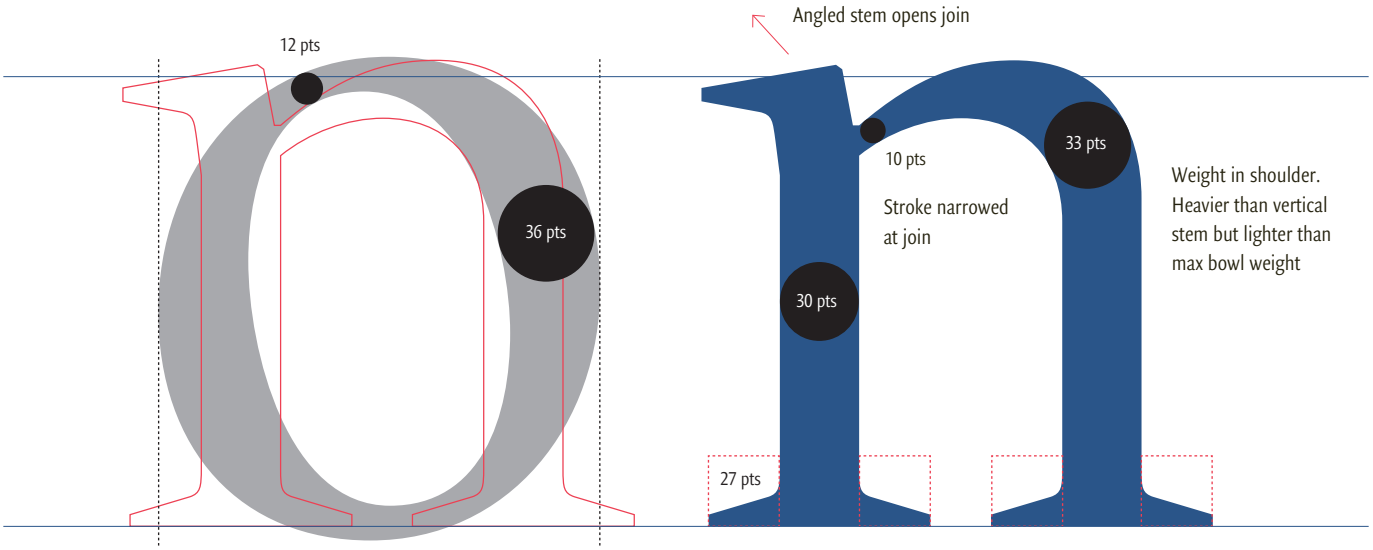
As in the round-straight combination letters, the n has an open notch at the upper left. The notch of the n is often deeper than that in the d, q, b, and p, since it separates two heavy verticals rather than a stem and a bowl. In some typefaces (particularly those based on calligraphy), the notch is further enlarged by tilting the top of the initial vertical stem (as in Le Monde, shown below).

Alternatively, in certain sans serif designs (often called "spurless" sans), the entire notch problem is eliminated, because the stem is deleted above the branch (as in Dax, p. 146). The resulting lowercase n and m are minimal and somewhat abstract.

In a serif typeface (especially slab serifs and bolder weights) the n may become too dark, due to the interior serifs. To prevent collisions, the inside serifs can be trimmed slightly shorter than the outside forms (as in Unit Slab, p. 147).

Once the n is designed, the h is simple—it is merely an n with an ascender. The m is also derived from the n. In classic typefaces, the m is usually constructed by connecting two n forms. However, the resulting letterform is rather wide. To optimize efficiency, the original n can first be condensed before being joined into the m (as in Quadraat Sans). To reduce congestion in a narrow m, the center serifs may be truncated or deleted on one or both sides.

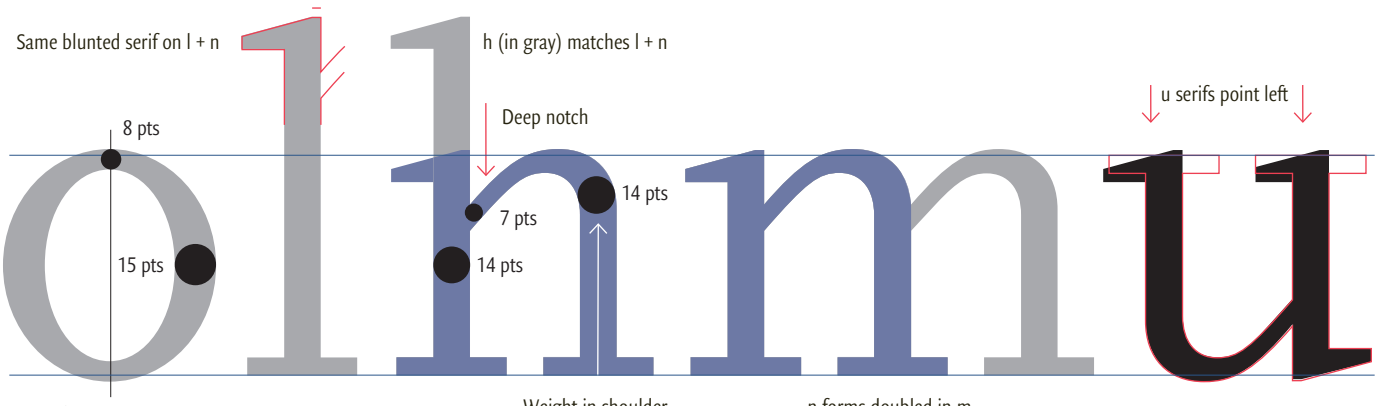
The u is our last form related to the n. To design the u, the n is turned upside down (rotated 180°—not flipped). Then, the upper serifs are adjusted so that they both point left, as in the lowercase l. Without the full interior serifs, the u may become too light (lighter than the n). To add color, the overall width of the u can be redrawn slightly narrower. In calligraphic typefaces, the bowl may also be adjusted to be subtly lower at the left and higher at the right for a more organic, dynamic balance.



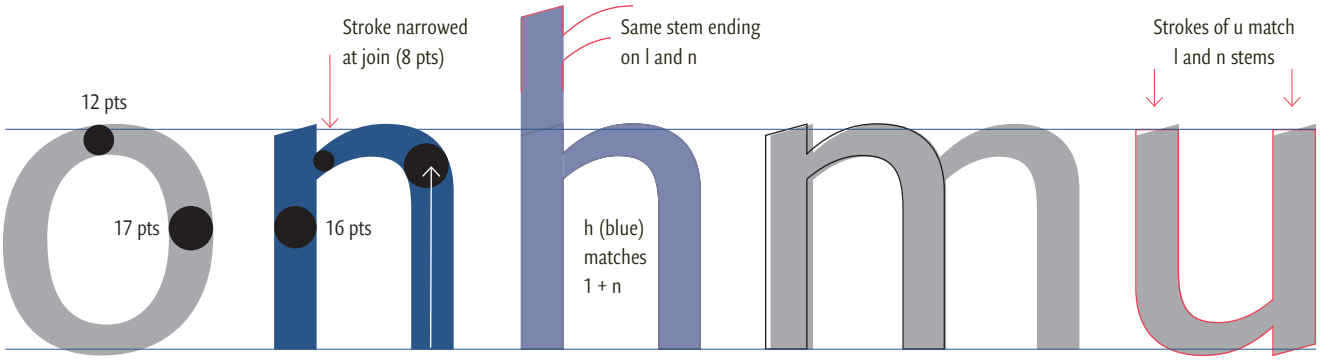
Le Monde Journal (Normal)

Counter of n is narrower than o

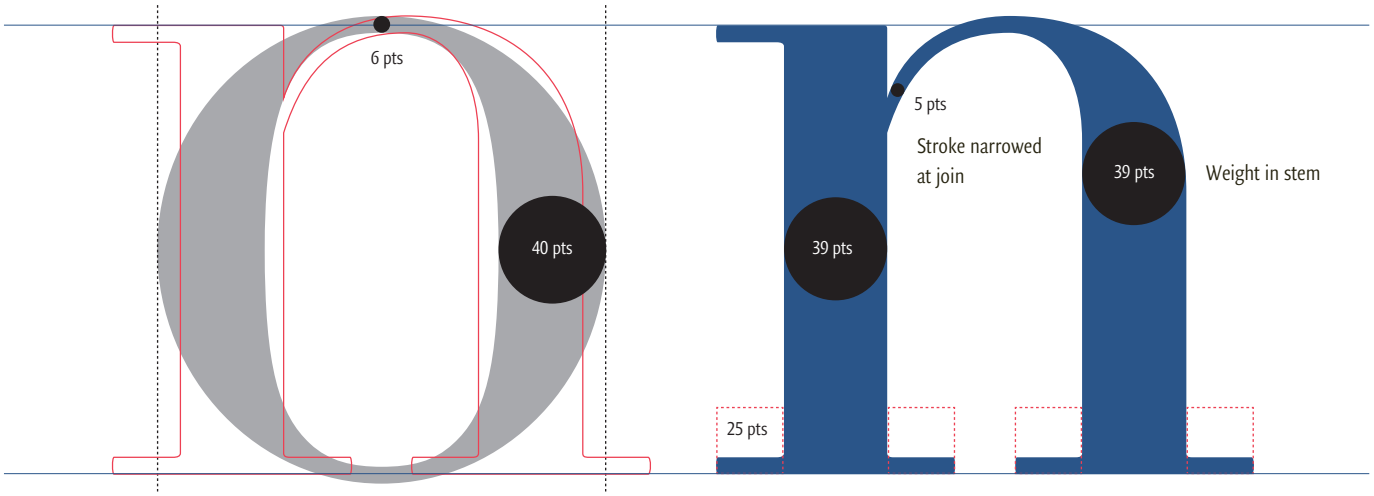
Symmetrical serifs



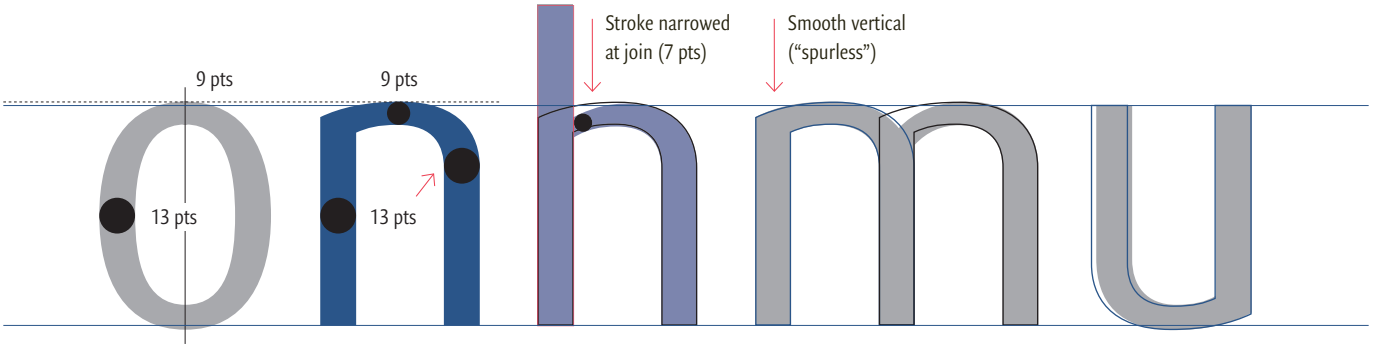
FF Scala
(Regular)



Quadraat Sans
(Regular)



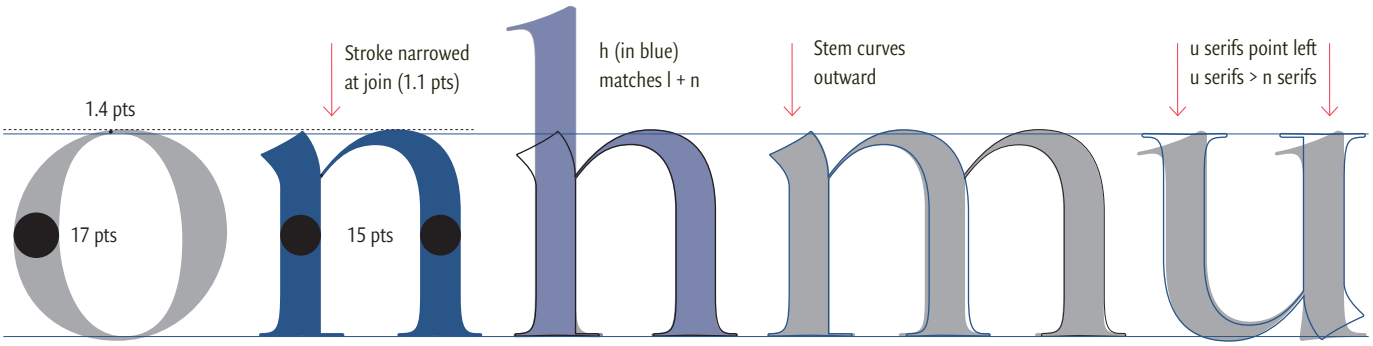
HTF Didot
(M16-Medium)



FF Dax
(Regular)

n forms doubled in m

u narrower than n



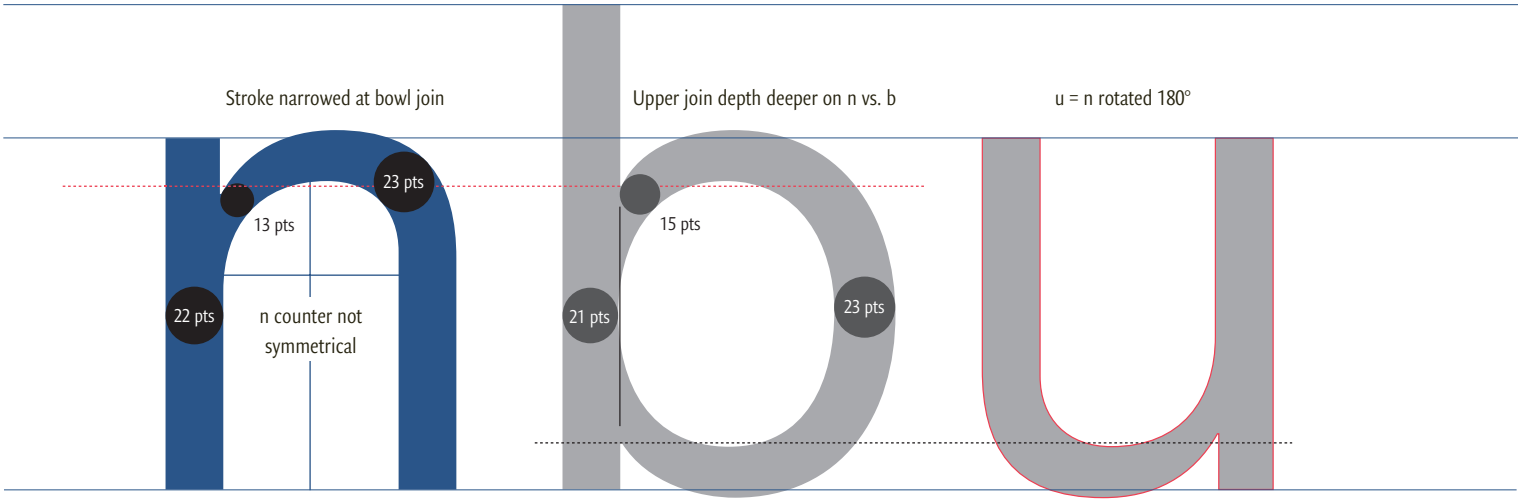
Ogg
(Medium)

Equal weight in both stems
(despite tilted o)

n form condensed in m

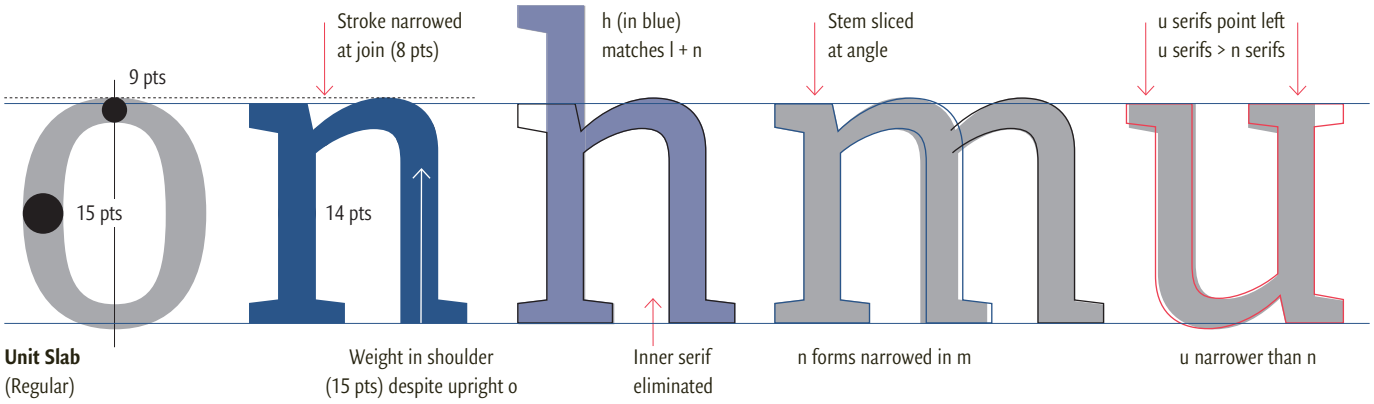
u slightly narrower than n

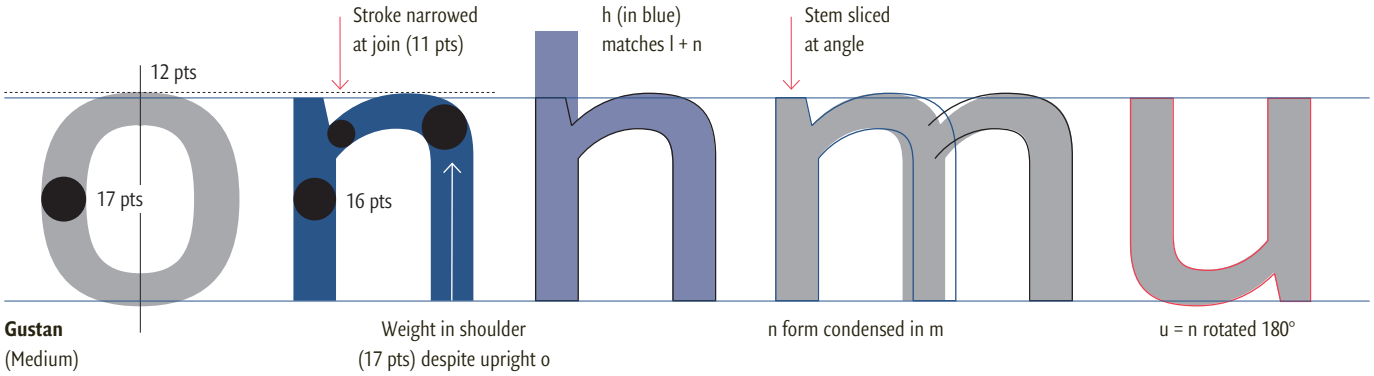
Shorter outer serif;
unbracketed interior serif

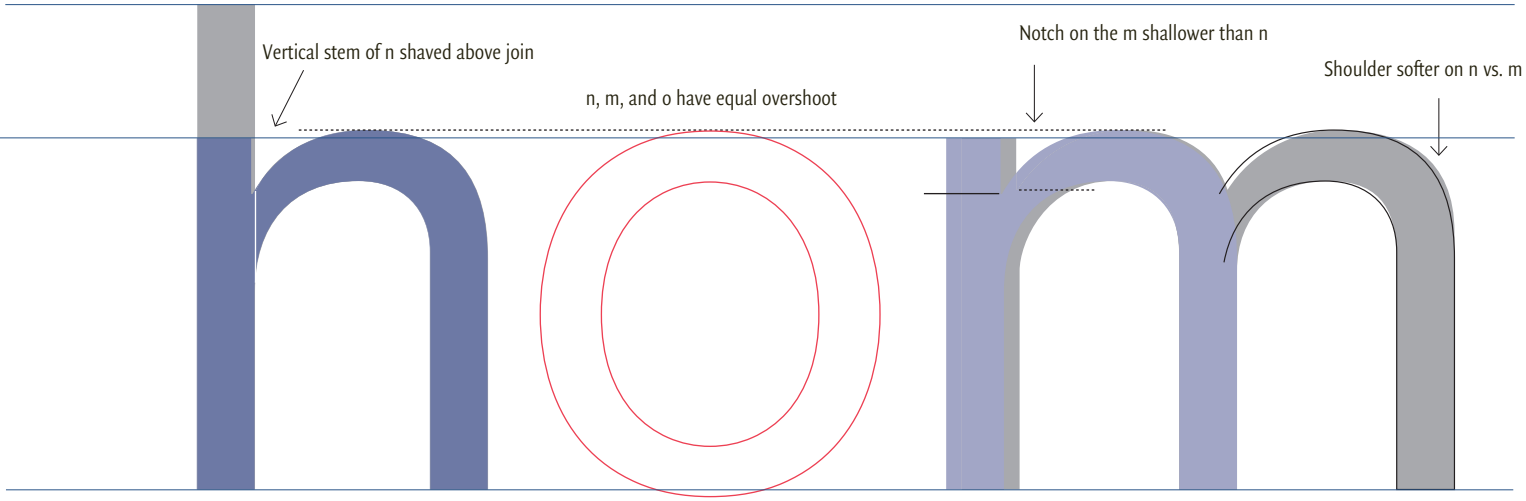


Helvetica Neue (Regular)

Lower join depth deeper on u vs. b


Stroke narrowed
at join (8 pts)
h (in blue)
matches l + n
Stem sliced
at angle
u serifs point left
u serifs > n serifs
9 pts
15 pts
14 pts
Unit Slab
(Regular)
Weight in shoulder
(15 pts) despite upright o
Inner serif
eliminated
n forms narrowed in m
u narrower than n

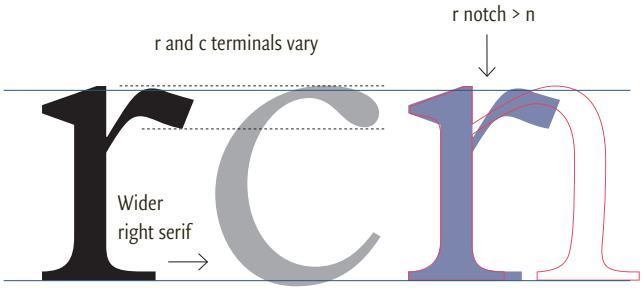

Stroke narrowed
at join (11 pts)
h (in blue)
matches l + n
Stem sliced
at angle
12 pts
17 pts
16 pts
Gustan
(Medium)
Weight in shoulder
(17 pts) despite upright o
n form condensed in m
u = n rotated 180°


Vertical stem of n shaved above join
n, m, and o have equal overshoot
Notch on the m shallower than n
Shoulder softer on n vs. m

Lowercase r

Like the n, the lowercase r is a branched letterform. However, the branches differ in two ways. First, the branch of the r is considerably deeper than that of the n. Lowering the join increases the size of the open notch at the top of the letter, which helps to prevent "spotting" (excess ink or color density) where the stem and branch meet. Second, the curve of the r is generally deeper and more dynamic than the branch of the n. Because the r is a narrow shape, the branch needs a more pronounced arch to look decisive.

Unfortunately, even with these adjustments, the r is a letter that tends to color unevenly. We can try to narrow the letter as much as possible to increase density; this also works to reduce the open area under the branch. We can also extend the inner foot serif to help fill this gap; this further helps to provide a counterbalancing weight to the arched branch.

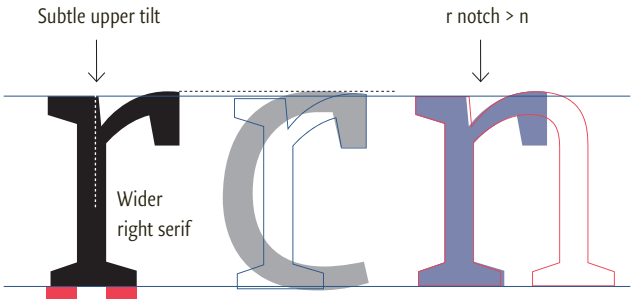


Bembo MT
(Regular)

r width = 66% of n

THE R TERMINAL

In a serif typeface, a terminal is usually appended to the end of the r to help fill the open space underneath the branch (and to visually weight the curve). This terminal typically follows the shape on the lowercase c. Terminal shapes are relatively consistent across typestyles. That is, calligraphic forms and softened ovals are the norm for Venetian, Garalde, and transitional fonts, while circular forms tend to be evident in Didones. Slab serifs vary; they can have either round terminals or serif-like block forms. Often, unbracketed slab serifs are treated like sans serifs—the branch of the r is sliced vertically, horizontally, or at an angle. This stroke ending relates to the c and other open glyphs (such as the s, see p. 150).



FF Olsen
(Light)

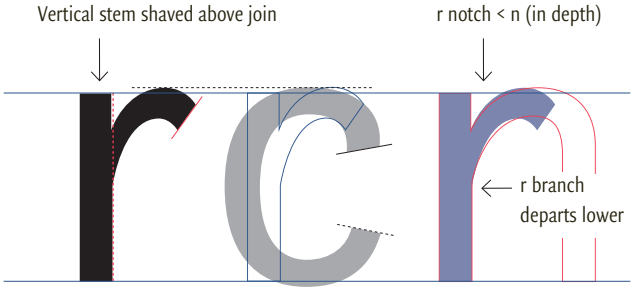
r width = 66% of n

SPACING AND TESTING

Before moving ahead, space and test the full set of branched letters (n, h, m, u, and r) by setting a series of words in both upper and lower case. The "rn" combination needs special attention; if spacing is too tight, this pair can look like a lowercase m.

churn, CHURN, horn, HORN, chrome, norm, NORM, CHROME, honor, HONOR, corner, on, ON, CORNER, menu, MENU, hue, HUE, err, ERR, concern, CONCERN, creme, CREME, poem, POEM, rumor, RUMOR, murmur, MURMUR, on, ON, coherence, COHERENCE, memo, MEMO, heron, HERON, commended, COMMENDED, me, ME, denounce, DENOUNCE

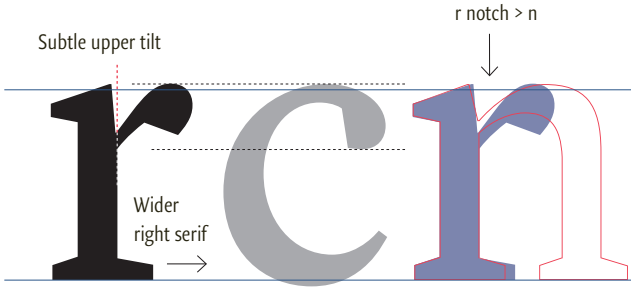
Grifo M (Regular)



Questa Sans
(Regular)

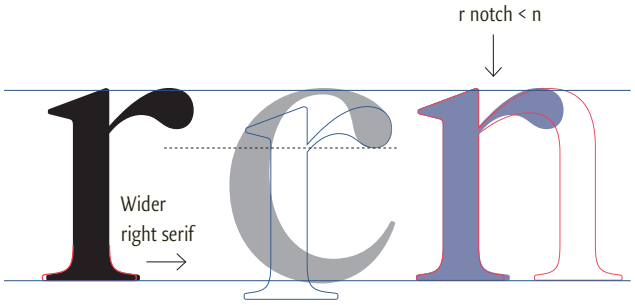
Angles on r and c vary

r width = 68% of n



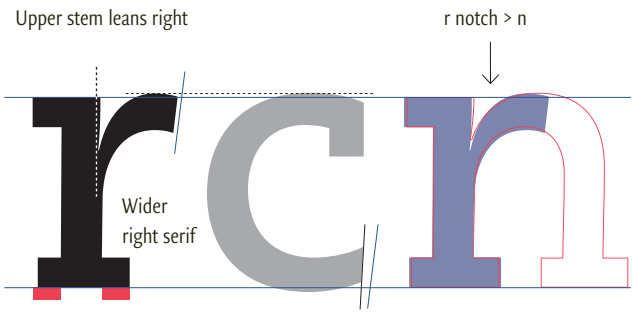
Lyon Text No. 2
(Regular)

r width = 66% of n



William Display
(Regular)

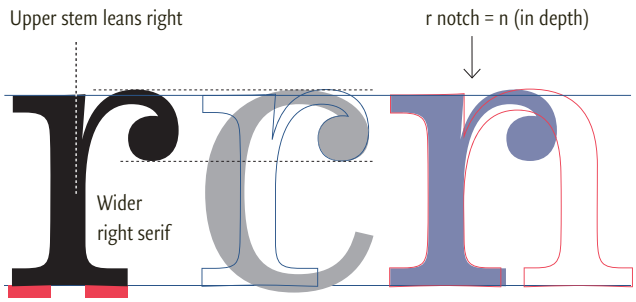
r width = 71% of n



PMN Caecilia
(55-Roman)

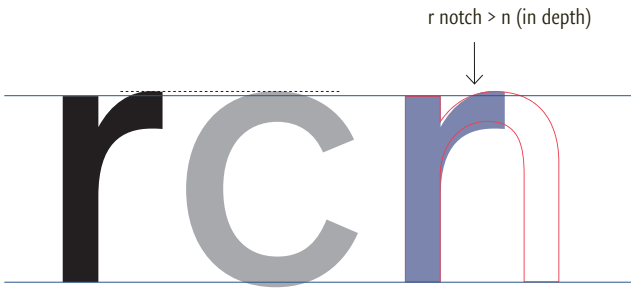
Angles on r and c vary

r width = 65% of n



Eames Century Modern
(Regular)

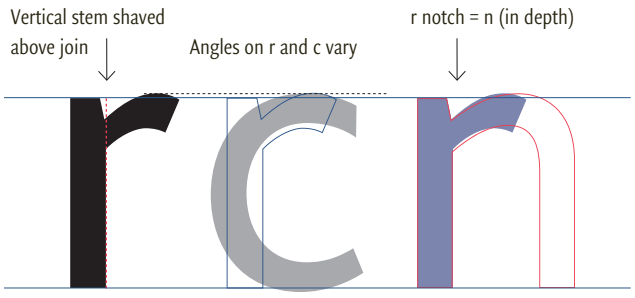
r width = 68% of n



FF Real Head
(Regular)

Angles on r and c vary

r width = 65% of n



Bliss
(Medium)

r width = 69% of n

Lowercase s

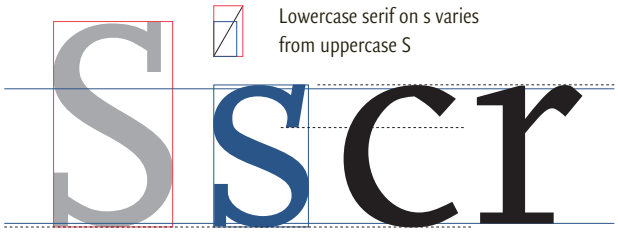
In many typefaces, the lowercase s is simply a shorter version of the capital. However, the lowercase s may need to be proportionally wider than the capital, because using lowercase stroke weights on a scaled-down S often makes the smaller letter too dark/dense.

The serifs on the lowercase s can follow the design of those on the capital S (for example, as in Galliard). More rarely, the s may have ball-shaped terminals that relate to the c and r. For example, ball-shaped terminals occur on the s in Archer and Cheltenham; Archer is particularly unusual in having ball-shaped terminals on the uppercase S (typically the capital S has beak-like serifs that follow the E, C, and G).

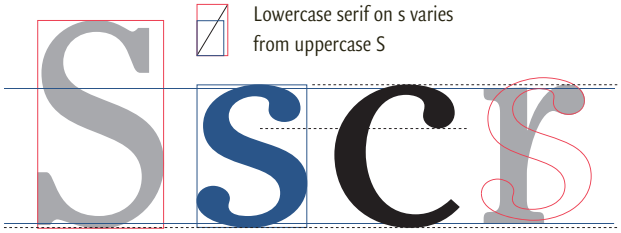
In sans serif designs, the lowercase s is often related to the c and r. That is, the strokes of the S/s can be sliced at angles consistent with these letters (for example, in Helvetica Neue, all letter strokes end with horizontal or vertical cuts). More unusually, a sans serif can have shaped endings, as in Strada. Grotesque sans serifs (such as Benton Sans) often have different angled endings; varied endings can enliven a typeface and add visual interest.

As discussed previously in the upper case, the curves of the s are difficult to draw. Below, from *Lettering for Advertising* by Mortimer Leach [1956], are three errors that often occur when constructing either a S or s: 1) The weight in the spine is not diminishing properly at the top and bottom; 2) The spine is drawn as a straight diagonal rather than an alternating curve; and 3) the serifs are too low (they are too far inside the letter).

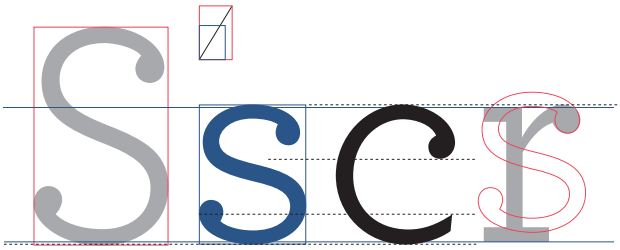
1 2 3



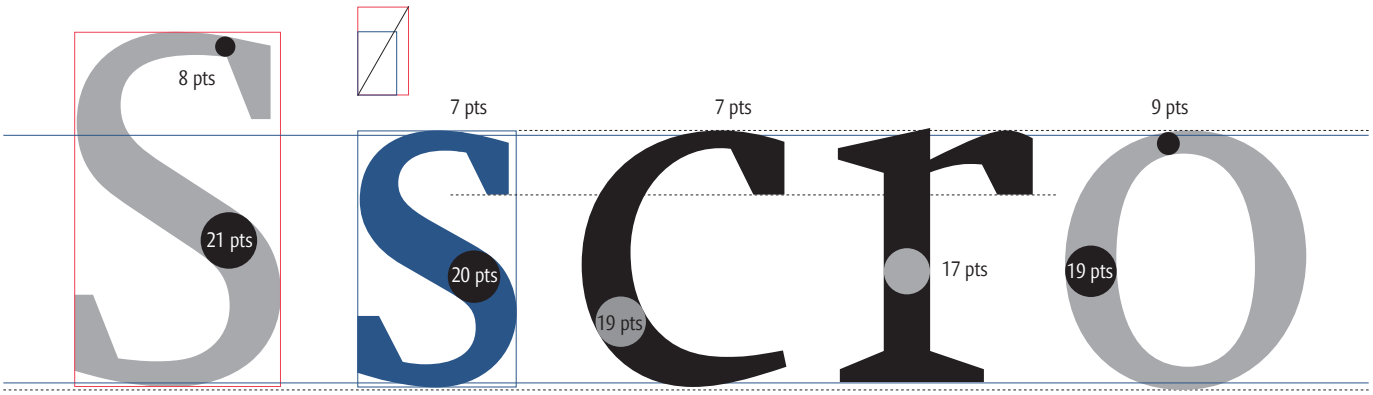
FF Scala (Regular) Variety in s, c, and r endings



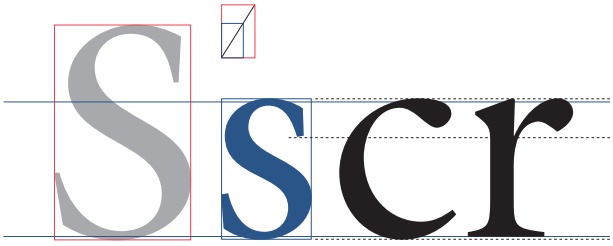
ITC Cheltenham (Book) Unity in s, c, and r endings



Archer (Book) Unity in S, s, c, and r endings



Swift (Regular)

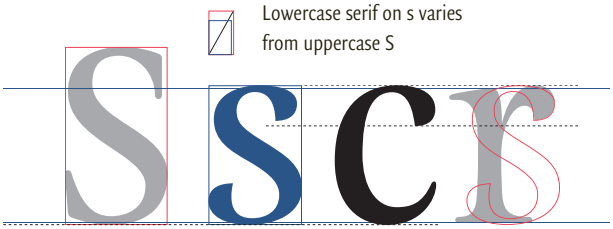


ITC Galliard
(Roman)

Variety in s, c, and r endings

Apollo MT
(Regular)

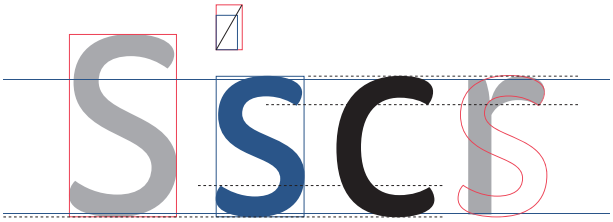
Unity in S, s, c, and r endings



Feijoa Display
(Regular)

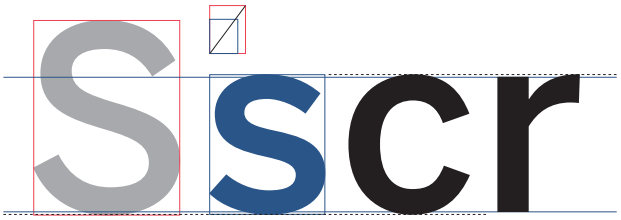
Unity in s, c, and r endings

Trianon Display
(Regular)



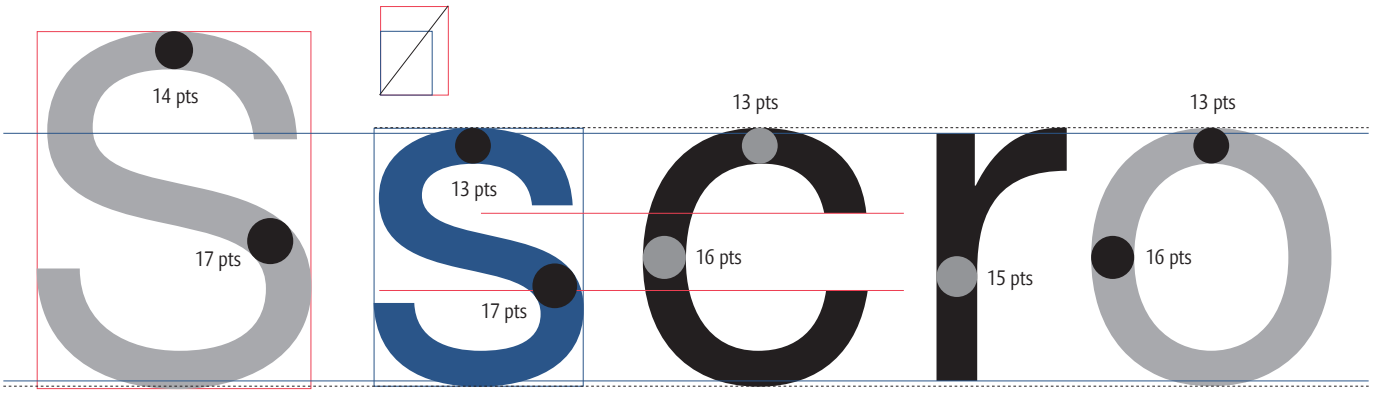
Strada
(Regular)

Unity in S, s, c, and r endings



Benton Sans
(Medium)

Variety in angles on S, s, c, and r endings



Helvetica Neue (Regular)

Lowercase a

The type designer Tobias Frere-Jones describes the lowercase a as a "perpetual oddball"—a letter that stands apart from the others owing to its unique structure.[1] He notes, "It appears over and over, potentially arguing with its neighbors in a word… Standing up, sweeping over, springing out, looping back, always with its feet on the ground—a designer has to be deep into the substance and spirit of a typeface to be able to draw this."

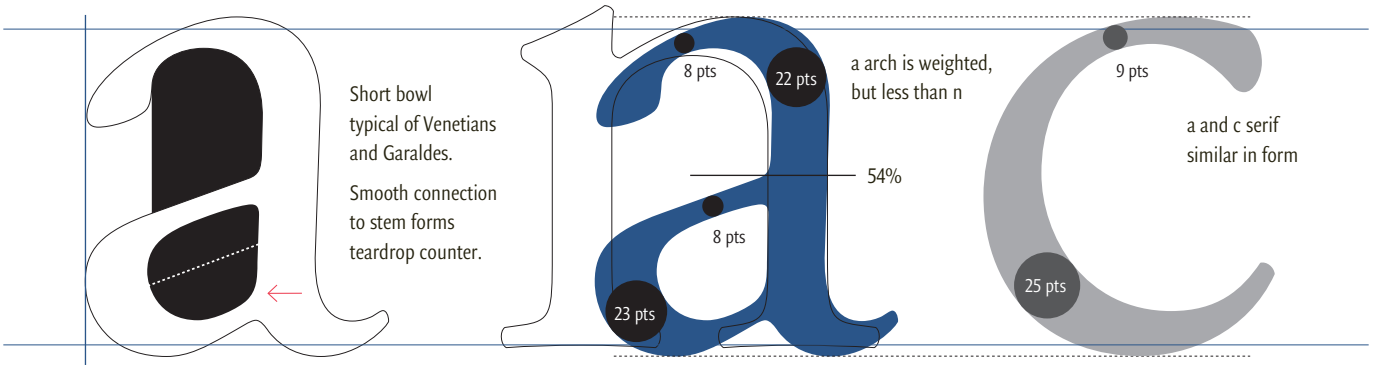
Because the a has an open side, it is a narrow letter. The goal is for the a to hold the same amount of negative space as the n (note: some of the space adjacent at the open side must be included in the overall estimation of interior space).

Across the range of typefaces sampled, the bowl of the lowercase a takes up 54–66% of the x-height. Generally speaking, there are three possible bowl shapes, and they are largely defined by the shape of the initial stroke as it departs from the stem: 1) A curved arc makes a circular bowl; 2) a straight horizontal creates a squarish bowl; and 3) a diagonal arc results in a teardrop bowl.

In typefaces with oblique stress, the widest part of the bowl occurs at an angle (approximately 7 o'clock). In upright typefaces, the maximum thickness can be angled, or at 9 o'clock. In either case, the bowl is thinnest where it joins the vertical stem.

Note that the arch of the a should be drawn in harmony with the bowl. A circular bowl looks best with a symmetrical arc; a square bowl requires a squarish curve; and a teardrop bowl needs a sloped shape. The length of the arch varies, but the bottom half of the a should be wider than the top. As in the n, the arch of the a may also be drawn with calligraphic thrust. However, because the a is a smaller, narrower form, the maximum weight in the arch is less than what appears in the shoulder of the n.

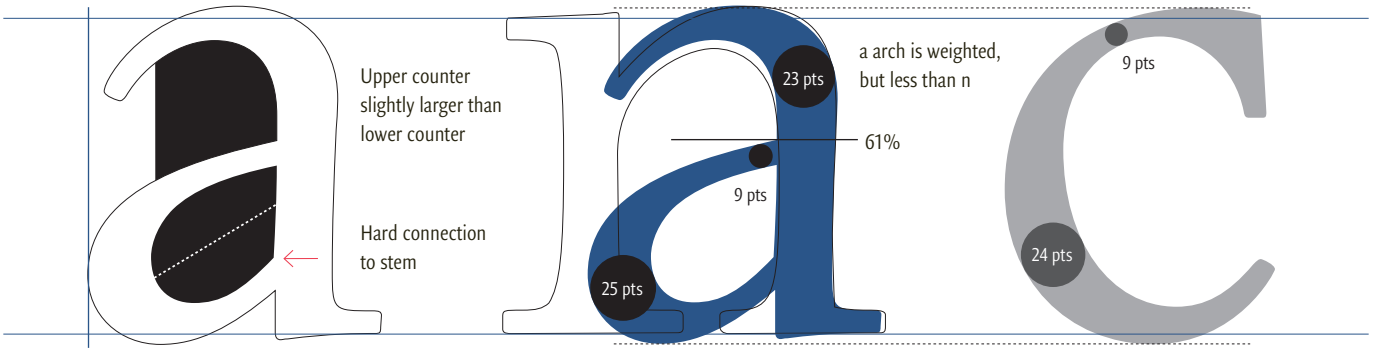
1 Heller, Steven, "15 Typographers Introduce Us to Their Favorite Letterforms," *Wired*, Condé Nast, 2016, wired.com/2016/01/14-typographers-introduce-us-to-their-favorite-letterforms/.



Adobe Garamond (Regular)

An angled bowl can appear to pull the letter forward, creating a left lean. Subtly tilting the vertical stem backward (to the right) can counteract this illusion.

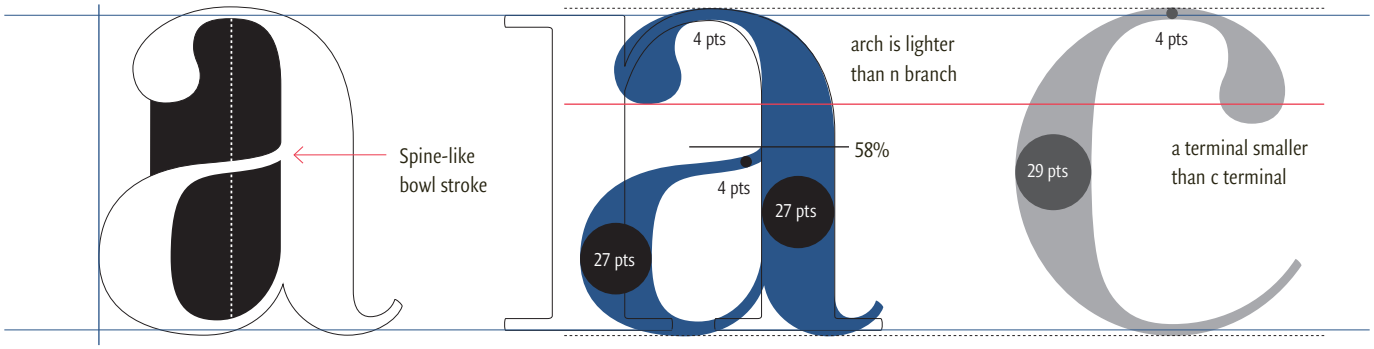
a/c overshoot and undershoot consistent



Apollo MT (Regular)

Vertical stem leans backward

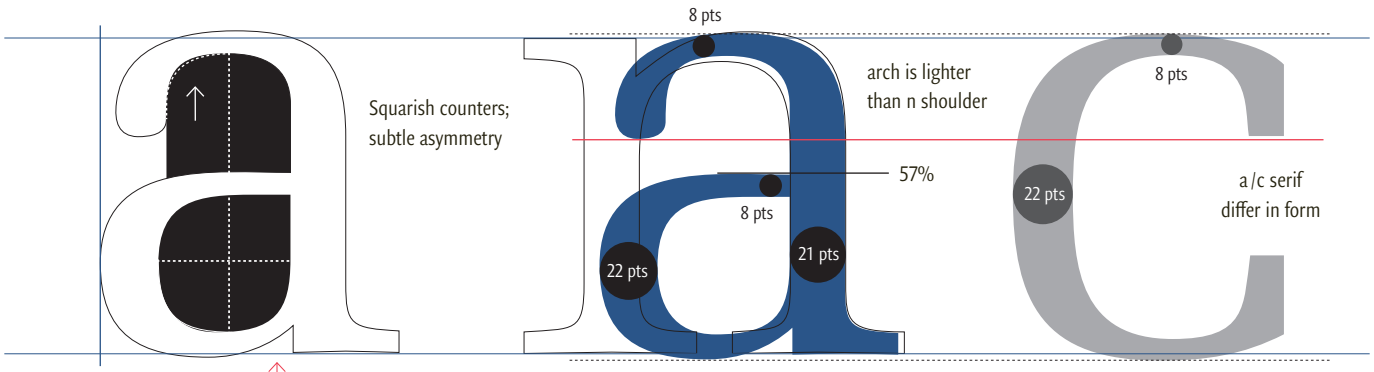
a/c overshoot and undershoot consistent



HTF Didot (M16-Medium)

Teardrop-shaped lower counter

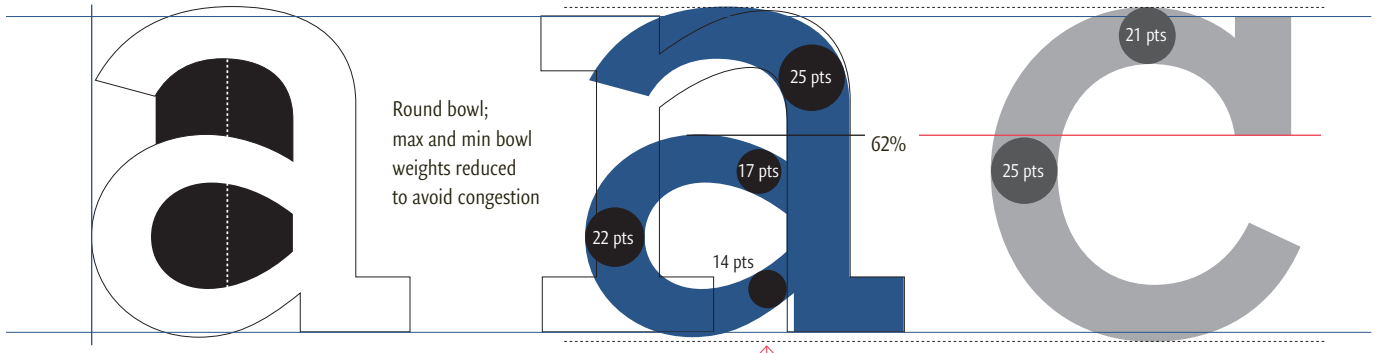
a/c overshoot and
undershoot consistent



Melior (Regular)

Small relief/notch

a/c overshoot and
undershoot consistent



Rockwell (Regular)

Strokes thinned
and stem cut away

a/c overshoot consistent;
a undershoot shallower than c

As in the d, q, b, and p, the relief at the base of the a must stay clear, even at small type sizes. The same strategies discussed earlier for the n can be employed here (see p. 144—i.e., shifting the counter, reducing the vertical stem thickness, and angling the stem outward).

SERIF LOWERCASE A

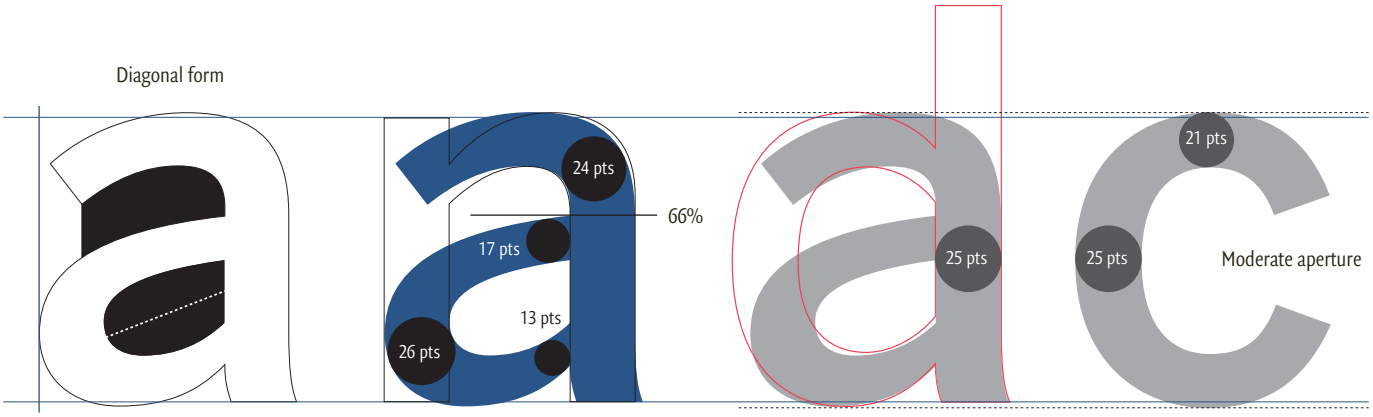
The arch of the a can either taper to a blunted point or be finished with a terminal. In bold fonts, a pointed ending is space-efficient, but in normal or light designs, a terminal can add visual interest and help fill the open space between the bowl and the arch. In general, the serifs or terminals of the a, c, and r are related.

The vertical stem of the a can end in either a curved tail or a flat foot. Tails are more common in Venetian and Garalde designs, since they are a vestige of connected, calligraphic script. Serifs are more common in rational designs with vertical stress; the foot serif on the a and d are usually related.

SANS SERIF LOWERCASE A

The sans serif a can be drawn as either a two-story (bicameral) humanist form or a simplified one-story letter. The double-story letter is common in humanist and grotesque sans serifs. The one-story a relates to the other combination letters (b, d, p, and q), and is well-suited to geometric sans serifs and neo-grotesques. However, the "ball-and-stick" structure is generally considered less legible, because its shape can be difficult to distinguish from the lowercase o. Still, the simpler form may be better for printing, because the smaller counters of the double-story a can clog, particularly when printed at small text sizes.

As with all sans serif letters, the angle of stroke endings are of particular importance. The cuts on the a should complement those on the s, c, and e. Horizontal, vertical, or 45 degree endings make sense for the rational construction of geometric sans serifs and neo-grotesques. In grotesques and humanist sans serifs, the angles of stroke endings can be more varied and organic.

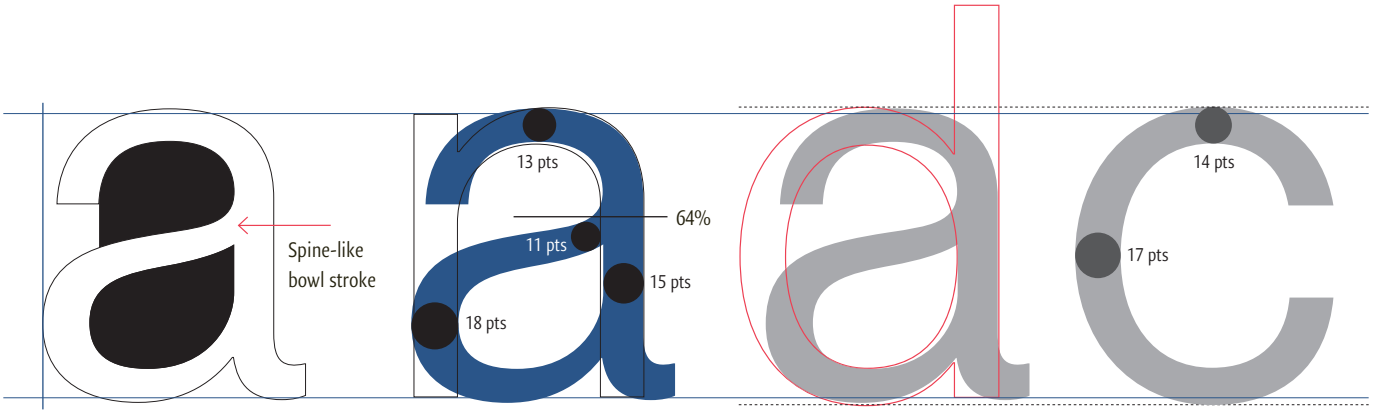


Benton Sans (Medium)

Strokes thinned at joins

a tail = d

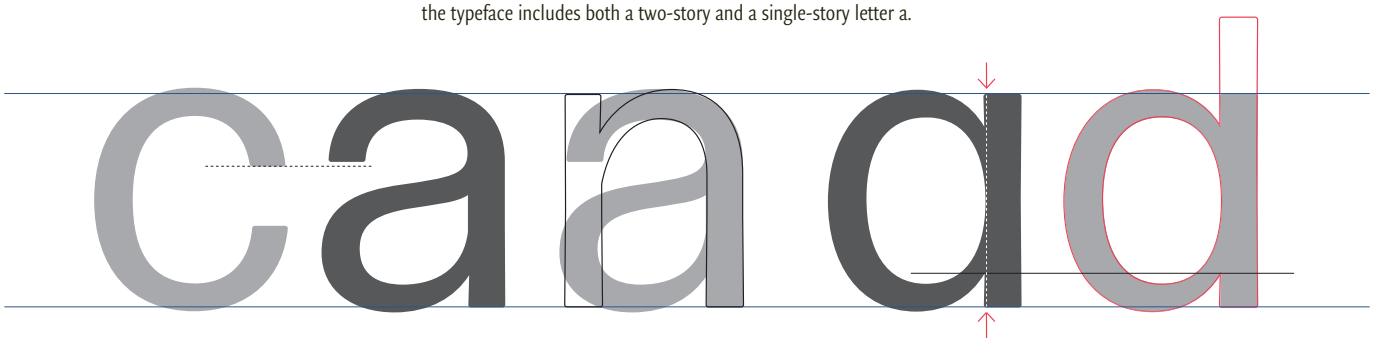
a/c overshoot and undershoot consistent



Neue Haas Grotesk Display (55-Roman)

Both the a and c have narrow, closed apertures; a/c overshoot and undershoot consistent

Forma, designed by David Jonathan Ross, shown below (in Banner/Regular);
the typeface includes both a two-story and a single-story letter a.

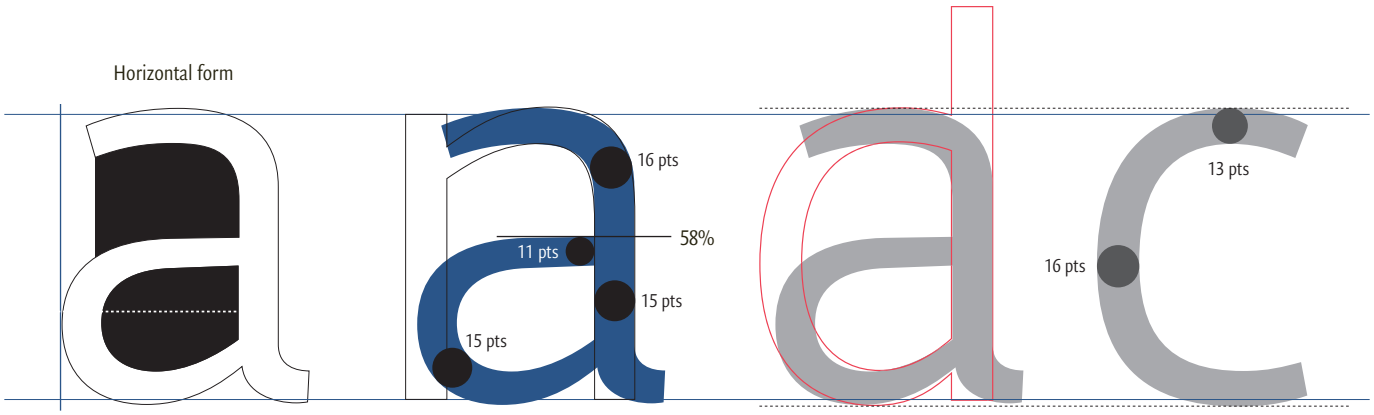


Double-story form;
horizontal cuts on c and a

Single-story form;
stem ends slightly flared

a matches d

Horizontal form

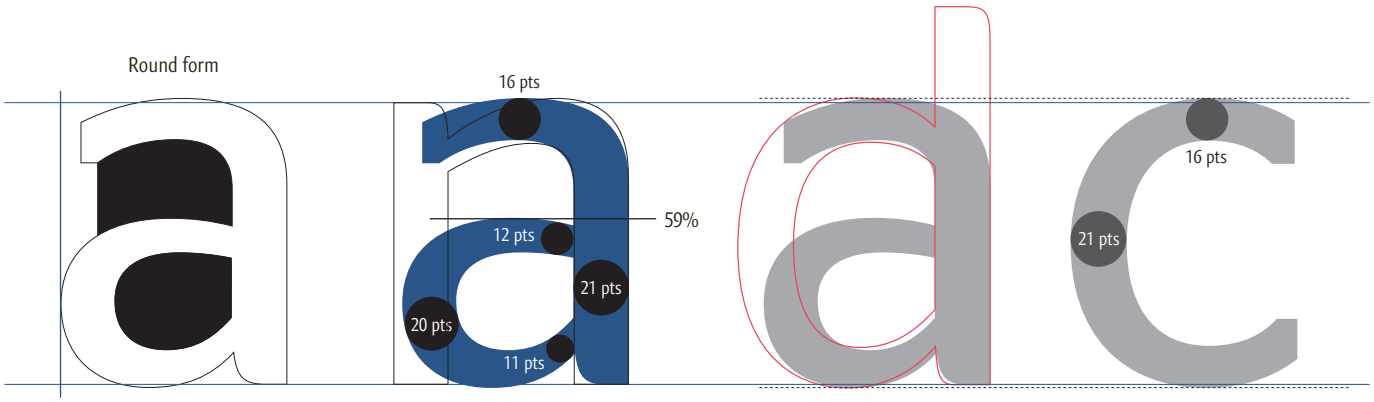


Fedra Sans (Book)

Vertical stem has slight lean backward

Both the a and c have wide, open apertures;
a/c overshoot and undershoot consistent

Round form



Stag Sans (Book)

Stem rounded
to enlarge relief

Both the a and c have wide, open apertures;
a/c overshoot and undershoot consistent

Lowercase g

The lowercase g is one of the most beautiful letters in the Roman alphabet. The double-storied form is rich with single and compound curves, creating a complex shape that is free and organic, yet structured and intelligent. It is these contrasting qualities that give the g its unique and expressive personality.

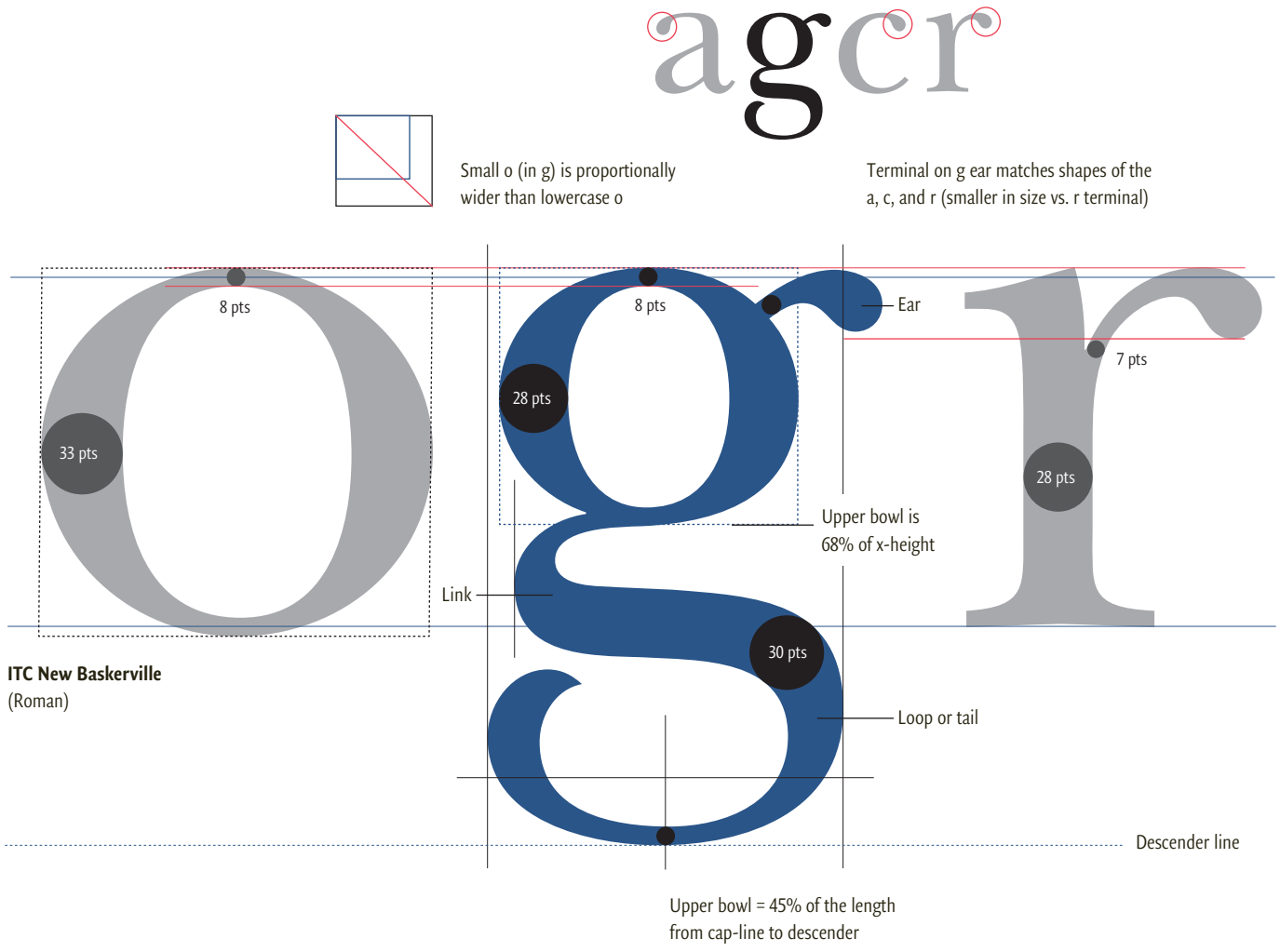
The binocular g has four distinct parts: an upper o, a transitional link, a lower loop, and a side "ear." The upper o is essentially a shorter version of the lowercase o (in the examples shown here, 68–78% of the x-height, or 44–54% of the length from cap-line to descender) and is therefore proportionally wider than the lowercase o. To prevent the g from becoming too dark, the upper o of the g is drawn with lighter stroke widths.

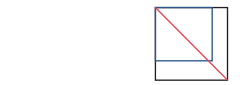
The link begins at the lower left of the upper o. As the link curves to the right, it increases from the minimum to the maximum stroke thickness. In Venetian and Garalde typefaces, the transition in weight may be abrupt, reflecting the sharp turn of a calligraphic pen. In transitional, Didone, slab serif, and sans serif typefaces, the transition is generally softer and more gradual.

The lower loop of the g has many variations and options. The heavy spine can descend either horizontally or diagonally. A horizontal generally creates a wider g; a diagonal allows the overall g to become more condensed.

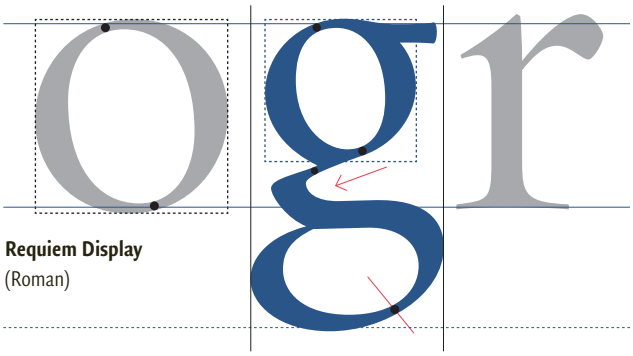
The loop may be open or fully enclosed. If open, the loop may be finished with a terminal or a blunted point. If closed, the angle of closure often relates to the angle of the link, creating a series of repeating forms on the left side of the letter. Note that the lower loop may be asymmetrical in structure and weight (as in Requiem, for example). That is, the thinnest part of the loop may occur at an angle rather than in the center—even in fonts with vertical stress.

The final element of the g is the ear. The ear extends from the upper right of the small o, at or near the x-height. The overall shape of the ear may be either curved or flat, horizontal, or upright (note that upright ears may require more leading). The ending of the ear is, in general, related to the terminal on the r and c. For efficient letter spacing, the ear should not extend too far past the lower loop.



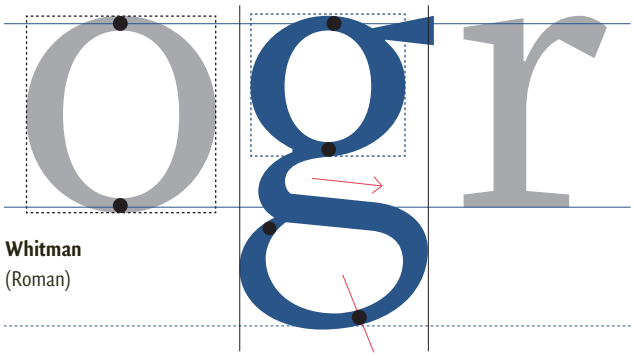


Upper o = 76% of x-height;
47% of capline to descender



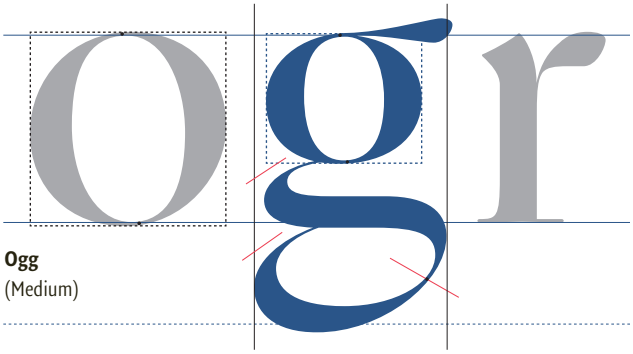
Requiem Display
(Roman)

Upper o = 77% of x-height;
47% of capline to descender



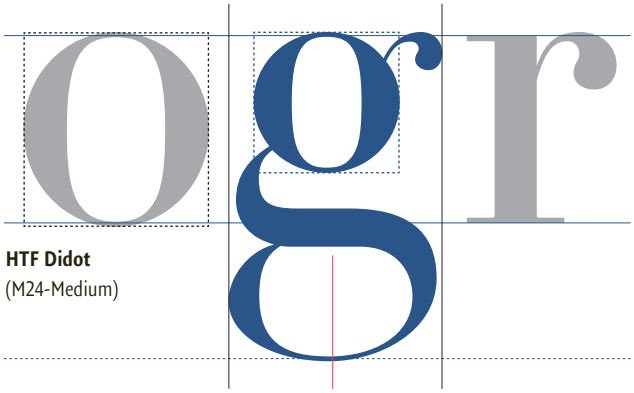
Whitman
(Roman)

Upper o = 69% of x-height;
54% of capline to descender



Ogg
(Medium)

Upper o = 78% of x-height;
44% of capline to descender

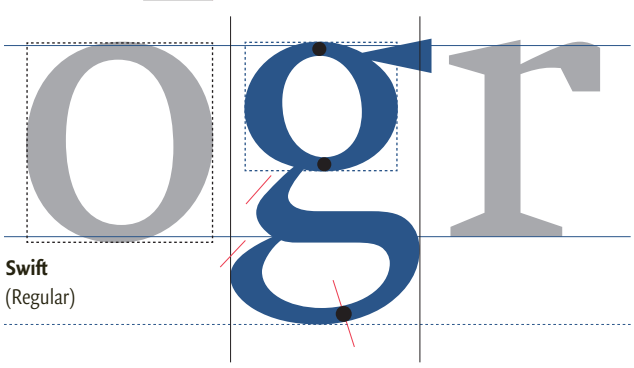


HTF Didot
(M24-Medium)

Upper o = 70% of x-height;
47% of capline to descender

Abril Display
(Regular)

Upper o = 70% of x-height;
47% of capline to descender



Swift
(Regular)

SANS SERIF LOWERCASE G

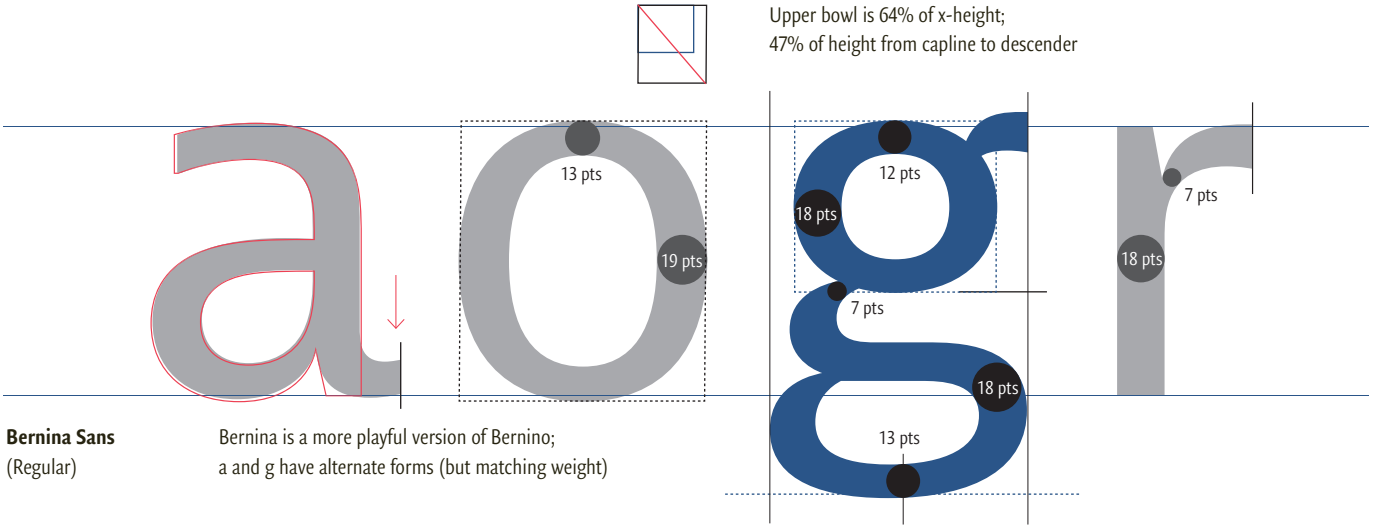
Classic grotesque typefaces (for example, American "Gothic" faces such as Trade Gothic, Franklin Gothic, and News Gothic) normally have a bicameral g, since they are essentially slab serif faces with the serifs cut off. However, geometric and neo-grotesques typically have a one-story g, because this structure reflects the modernist principles underlying their design: that forms should be reduced to their essentials. Contemporary sans serifs vary—as do slab serifs (as in Archer, shown opposite). Of course, using OpenType features, both styles of the g can be included in a font (as in the Bernini family, shown below).

The single-bowl version of the g is related to the other combination letters: d, q, p, and b (see p. 136). There are designs where the g matches the q, but with an extended tail. However, the upper bowl of the g is typically drawn shorter than the bowl of the q to increase space for the lower loop. The aperture of this lower loop should follows the enclosures on the c, e, and s.

SPACING AND TESTING

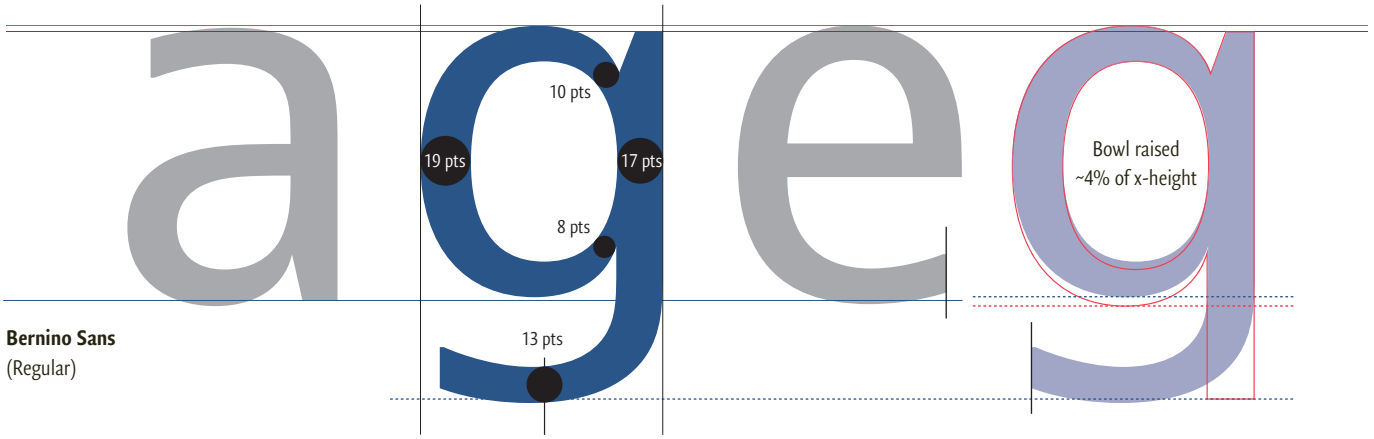
The bicameral g can easily become too dark, given the complexity of the structure. Set words that contain the g to check if the stroke weights match to the rest of the lower case. The typeface Scala Sans (Regular) is shown below:

boggle, agog, gaggle, dago, headlong, dagger, aged, glad, gold, hangdog, mange, badged, spangled, pager, dogs, longhead, mango, nags, beggar, gongs, phlegm, egos, agro, grosses, ogres, god, bodega, haggle, google, sage, hangs, madge, beggars, egal, phage, degas, lodges, lager, ogles, omega, anglepod, banged, pagoda, ragged, sponge, gargle, pegboard, argon

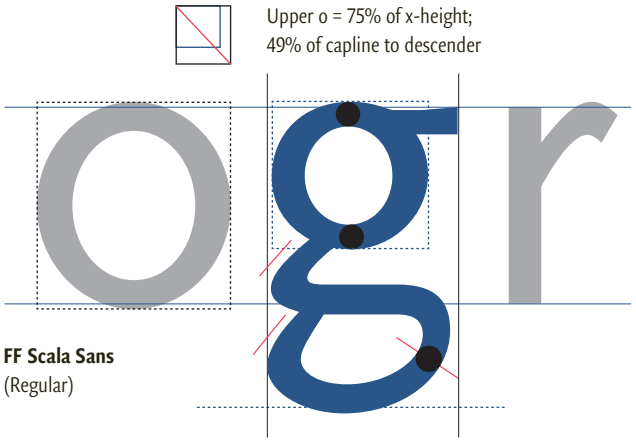


Bernina Sans
(Regular)

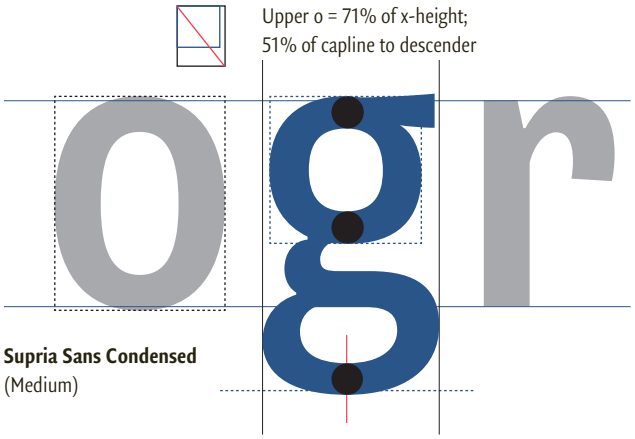
Bernina is a more playful version of Bernino;
a and g have alternate forms (but matching weight)



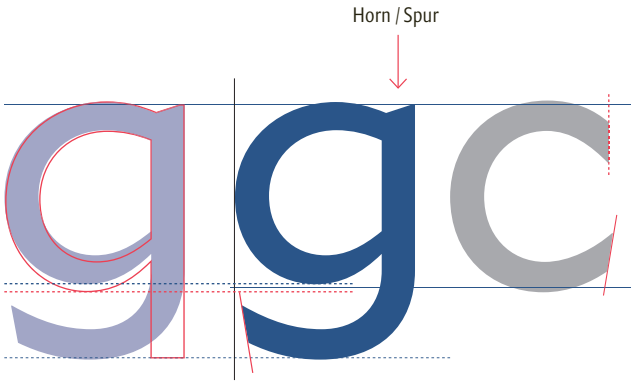
Bernino Sans
(Regular)



FF Scala Sans
(Regular)

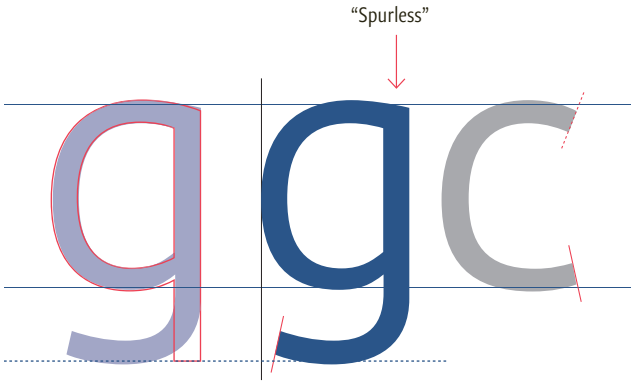


Supria Sans Condensed
(Medium)



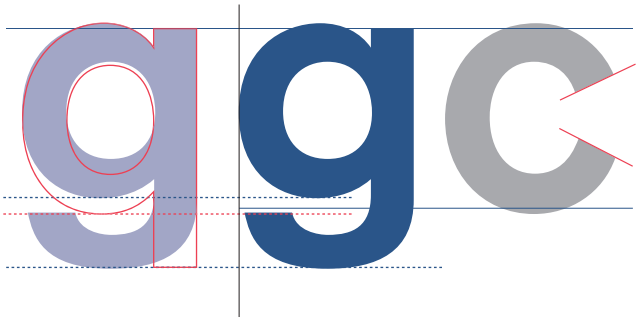
Mallory
(Book)

Bowl raised ~5% of x-height



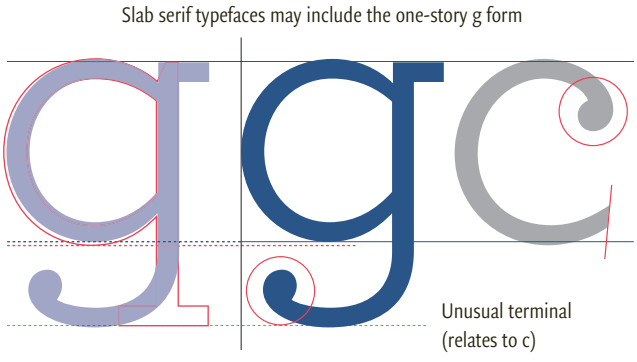
Fedra Sans
(Book)

Bowl of g and q almost aligned



Akidenz Grotesk
(Medium)

Bowl raised ~10% of x-height



Archer
(Book)

Bowl raised ~3% of x-height

Lowercase i and j

The i and the j are both single-stroke letters. The stem of the i is a short version of the lowercase l, while the j is an i with a descending hook. The dots on the i and j (also called "tittles") can be virtually any shape—circles, ovals, squares, rectangles, or diamonds; their size should optically match the weight of the base stem. This means that round or diamond dots should be slightly wider than the vertical stem. Square and rectangular dots can either directly match the width of the stem, or be drawn a bit wider (in text typefaces, dots are often more prominent).

In general, the dots of the i and j are centered over the base stems. However, in typefaces influenced by calligraphy, the dot is sometimes shifted to the right, as if the writer were quickly dashing off a note. The opposite can also occur in bold serif designs; designers sometimes place the dot in the visual center, which is slightly to the left (due to the shape of the serifs).

The normal placement for dots is at the capline. However, in a typeface with short x-height, dots can be positioned lower to better connect with the low stem. Conversely, in a typeface with tall x-height, dots can be raised above the capline to avoid congestion. In this case, aligning to the ascender height is logical—assuming the ascenders are above the capline.

Once the shape and alignment of the dots is resolved, we turn to the hook of the j. Unlike the uppercase J, the lowercase j must descend (the lowercase j cannot sit on the baseline). To avoid spacing problems, most designers draw the curve so it fits beneath the previous letter. Ideally, the curve and terminals (or stroke endings) of the J/j are related. Additionally, the terminal and/or stroke endings on the j relates to those on the c, r, and a.

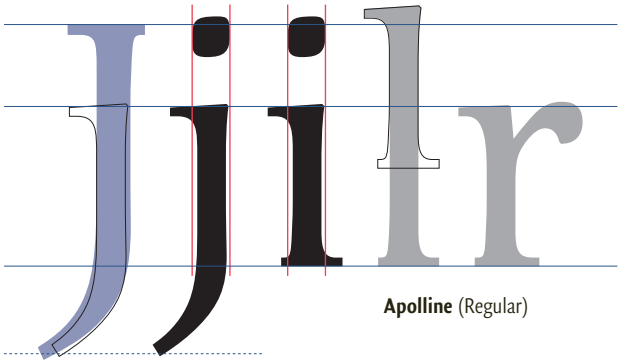
jcra | jcra

Above left, William. Above right, Mallory.
The terminals and stroke endings on the j relate to the c, r, and a.

SANS SERIF LOWERCASE I AND J

In monospaced fonts, or fonts designed for challenging viewing conditions (such as signage, or low-resolution screens), the i and j may have short serif-like crossbars added to their vertical stems. In monospaced fonts, these horizontals are needed to extend the letters to the standard width. In signage types, the horizontals are used to make the i and the j more distinct (that is, different from the l and the I) and therefore more legible. In contrast, in geometric sans serifs, the j can be reduced to a plain vertical stem—no hook (see Futura). While this is elegant (and well aligned with the goal of geometric abstraction), such a minimal letterform is more difficult to recognize and decode in text.

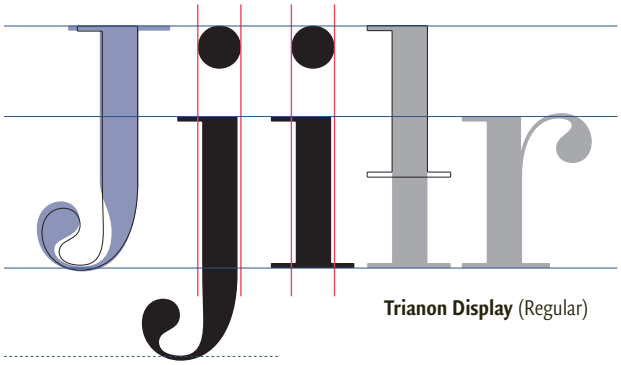
Squarish dots centered over stems;
height above capline



Apolline (Regular)

Similar (but not identical) hooks

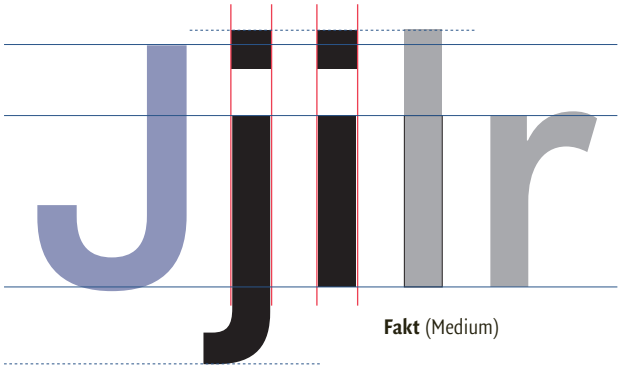
Round dots centered over stems;
height at capline



Trianon Display (Regular)

Similar (but not identical) hooks

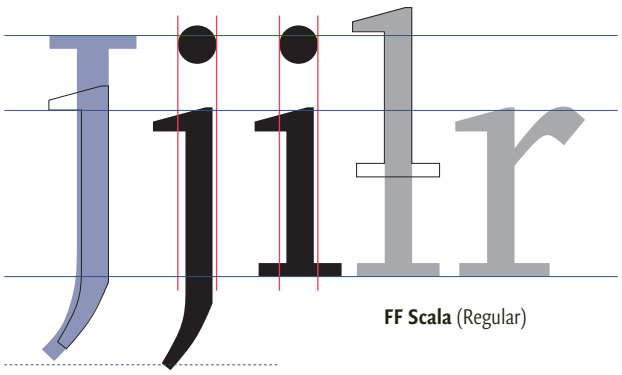
Rectangular (wide) dots centered over stems;
height at ascender line



Fakt (Medium)

Upper- and lowercase j forms vary

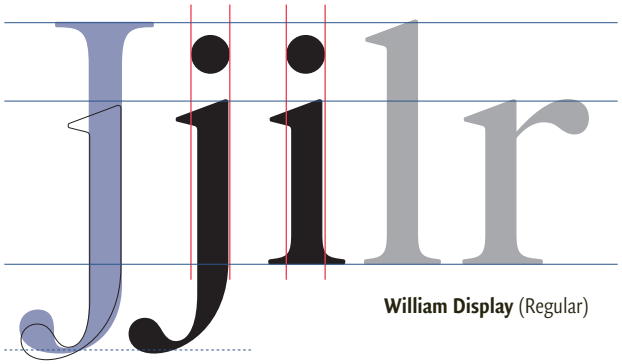
Round dots shifted over serifs;
height above capline



FF Scala (Regular)

Similar (but not identical) hooks;
lowercase j has longer descender

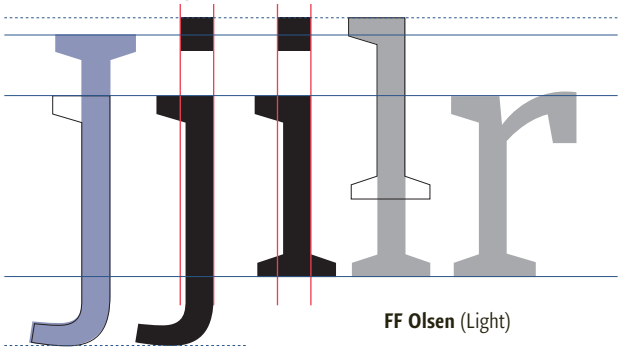
Round dots shifted over serifs;
height below capline



William Display (Regular)

Similar (but not identical) hooks

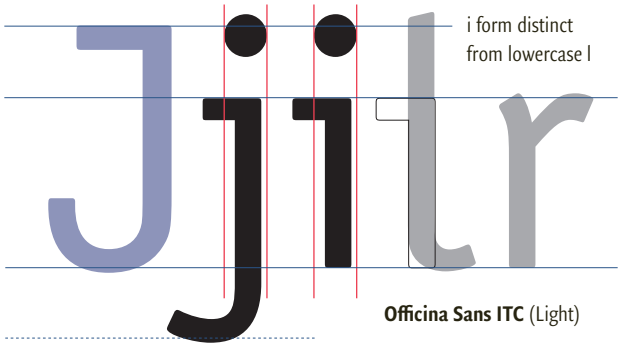
Square dots shifted over serifs;
height at ascender line



FF Olsen (Light)

Lowercase j follows upper case,
but with reduced weight

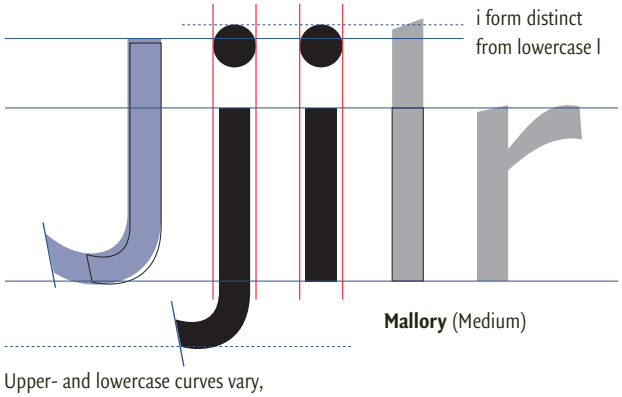
Round dots shifted over serifs;
height above capline



Officina Sans ITC (Light)

Upper- and lowercase j forms vary

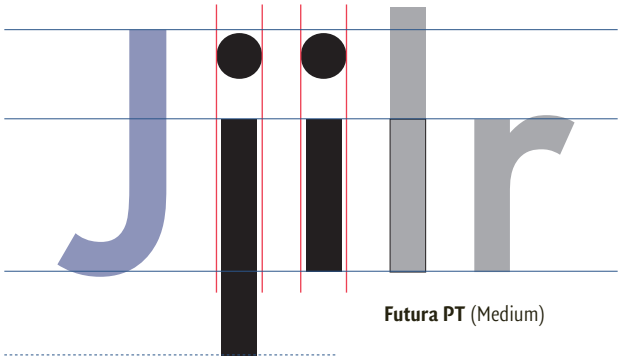
Round dots centered over stems;
height at ascender line



Mallory (Medium)

Upper- and lowercase curves vary,
but angles of stroke endings match

Round dots centered over stems;
height below capline



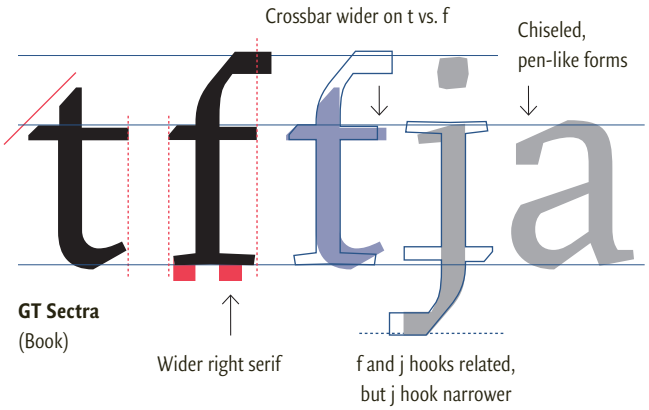
Futura PT (Medium)

Upper- and lowercase j forms vary

Lowercase f and t

The f and the t are the only lowercase letters with crossbars. These crossbars are asymmetric (the right side is longer than the left). In general, both bars are "hung" at or near the x-height. If necessary, (i.e., in typefaces with tall x-heights) the crossbar of the f can be moved down to provide more space for the hook.

The most critical element of the lowercase f is, of course, the upper hook. The f and the j can have a similar shape to their hooks, but the j is typically narrower. Note that the f often appears top-heavy, owing to the weight of the upper hook. Extending the right foot serif can help counterbalance the letter and help fill the open space under the ascender.



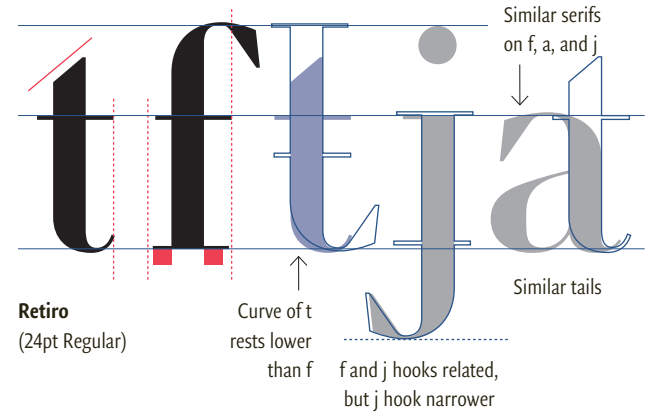
LOWERCASE T

The t is the only lowercase letter at an intermediate height between the x-height and cap-height. The tip of the t (the portion above the crossbar) is one to two vertical stroke widths above the x-height.

In serif fonts, the tip of the t may be connected to the crossbar with a diagonal or curved stroke. The diagonal stroke is a vestige of calligraphy; when the crossbar joins the top of the vertical downstroke, a triangle of filled ink forms. Unfortunately, this triangle creates a dark spot in text. Therefore, some designers remove the excess weight by carving out a curved bracket.

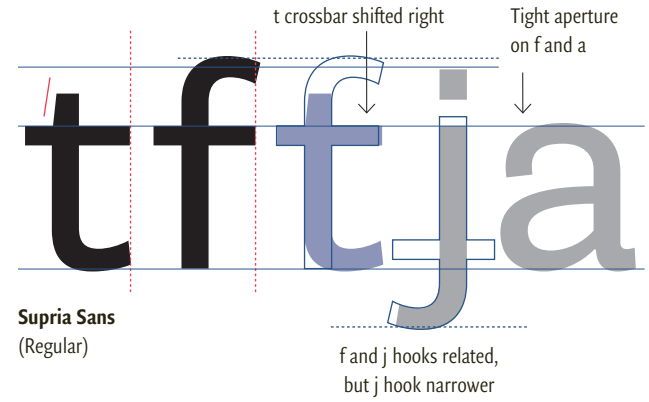
Most sans serif typefaces lack this curved bracket. However, the tip of the t (and sometimes the left crossbar) may be sheared at an angle as a hint to calligraphy, especially in humanist sans serifs (see Brix Slab and Supria Sans in the diagrams opposite).

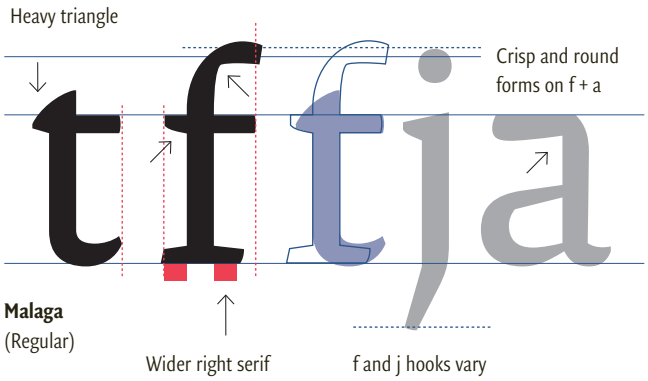
Like the a, the stem of the t is usually finished with a curved tail. For efficient letterspacing, the tail should not extend too far to the right. In geometric sans serifs, the t may be a simple cross, in keeping with the minimal spirit of typestyle. Of course, using the OpenType font format, designers have the option of including several variations of the lowercase t with different tail lengths or tail forms. For example, Gedau Gothic, designed by Natascha Dell and Karl-Friedrich Oetzbach of FontFarm, has three different t forms:

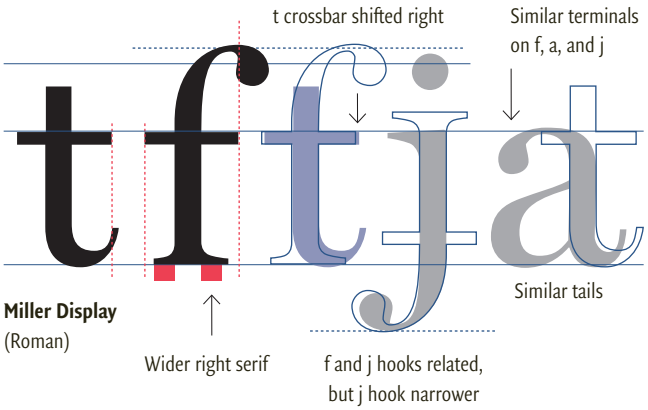


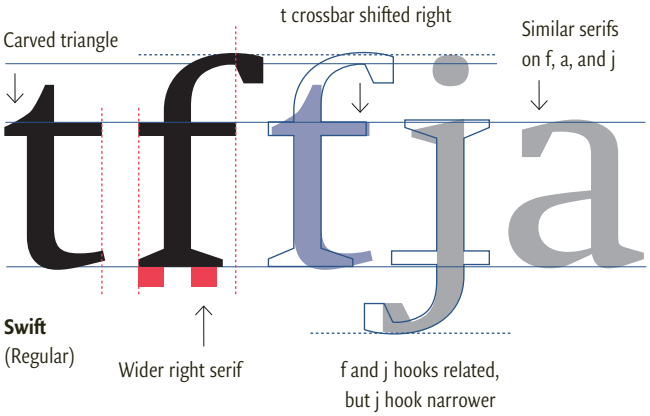
the testament
the testament
the testament

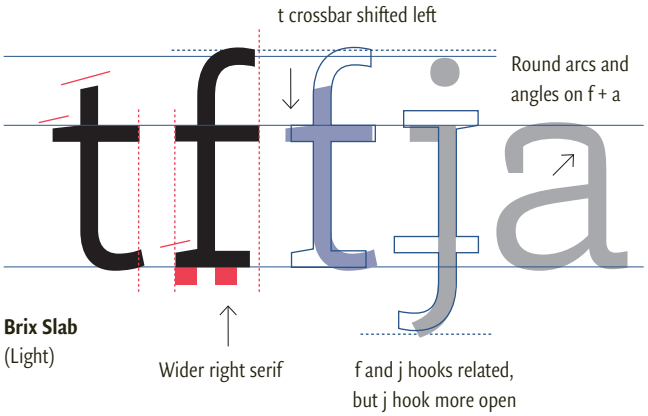
Above, Gedau Gothic by Natascha Dell and Karl-Friedrich Oetzbach. The typeface has three different lowercase t letterforms.

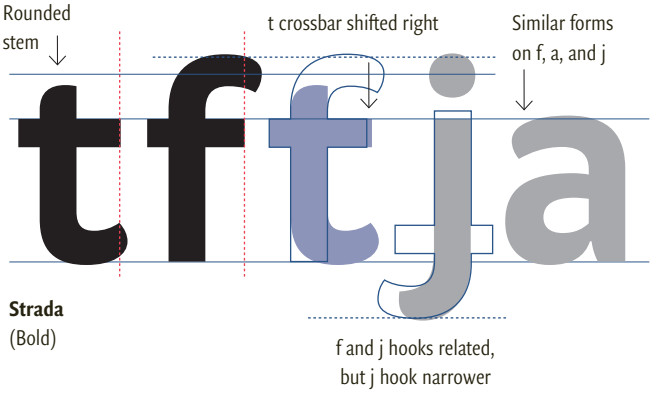


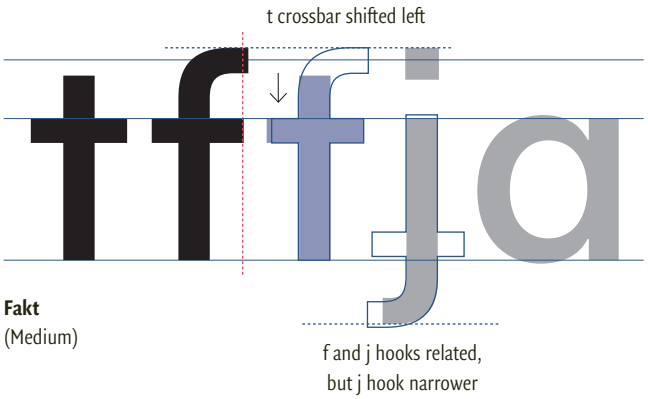

Heavy triangle
Crisp and round forms on f + a
tftja
Malaga
(Regular)
Wider right serif
f and j hooks vary


t crossbar shifted right
Similar terminals on f, a, and j
tftja
Similar tails
Miller Display
(Roman)
Wider right serif
f and j hooks related, but j hook narrower


Carved triangle
t crossbar shifted right
Similar serifs on f, a, and j
tftja
Swift
(Regular)
Wider right serif
f and j hooks related, but j hook narrower


t crossbar shifted left
Round arcs and angles on f + a
tftja
Brix Slab
(Light)
Wider right serif
f and j hooks related, but j hook more open


Rounded stem
t crossbar shifted right
Similar forms on f, a, and j
tftja
Strada
(Bold)
f and j hooks related, but j hook narrower


t crossbar shifted left
tftja
Fakt
(Medium)
f and j hooks related, but j hook narrower

STANDARD F LIGATURES

Unfortunately, the hook of the f tends to collide with letters that follow. To avoid this problem, one can draw the f with a narrow curve. However, a narrow f may be non-optimal for your typeface. For example, serif fonts need more width to accommodate their terminal, and extended fonts need a wide f to match their overall proportions. In these cases, it's best to design specific ligatures for the most troublesome combinations: fi, fj, ft, fl, ff, ffl, and ffi (these ligatures are called "standard" ligatures, because they are functional—as opposed to discretionary ligatures, which are more decorative). For the fi and fj ligatures, the hook of the f is often redrawn to "reach over" and dot the i and j. In the ff ligatures, the hooks can be drawn as repeating or increasing forms. The fl ligature is still an overlap of the two ascenders, but the overlap is reshaped into a more refined, deliberate form.

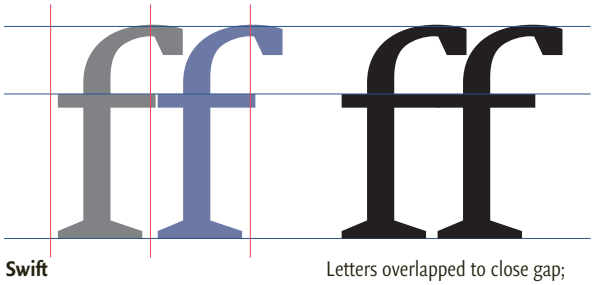
fi fj ft fl ff

Above, the font Amplitude (in bold), designed by Christian Schwartz.
The narrow f avoids collisions with letters that follow.

SPACING AND TESTING

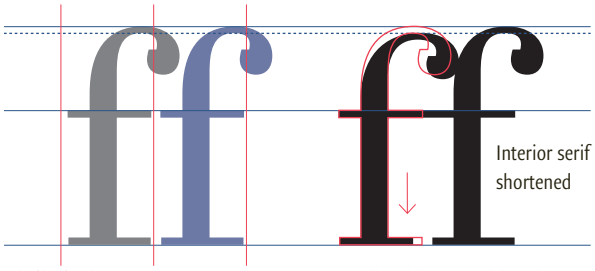
The single-stemmed glyphs i, j, l, f, t, and r are difficult to space correctly, because they do not have interior counters. When their sidebearings are too tight, these letters create dark spots in text. However, when their sidebearings are too loose, a lighter pattern emerges in comparison to other letters. To check spacing and density, set words that contain multiple verticals: Illinois, illicit, filial, brilliant, million, jilted, tranquil, efface, mill, baffle, fluid, affluent, off, thrift, fjord, muffle, scofflaw, ruffle, sniffling, affiliate, etc. Words that place the i between consonants are also useful tests of density: minimum, blini, alibi, inhibit, ici, idiom, unified, rigid, biding, liaise, tibia, digital, etc. Below, the typeface Big Caslon by Matthew Carter is shown:

illness, brilliant, million, baffle, ruffle, inhibit, illicit, jilted, thrift, efficient, filial, flight, efface, fjord, limits, initial, indifferent, fluid, nihilist, milia, lilies, minimum, blini, alibi, ici, idiom, finite, biding, acidic, rigid, libido, aspiring, pacific, iris, opioid, lipid, critic, raisin, biting, cities, litigate, kitties, fittings



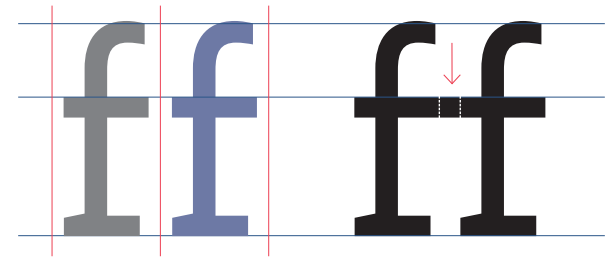
Swift
(Regular)

Letters overlapped to close gap;
overall width reduced (98%)



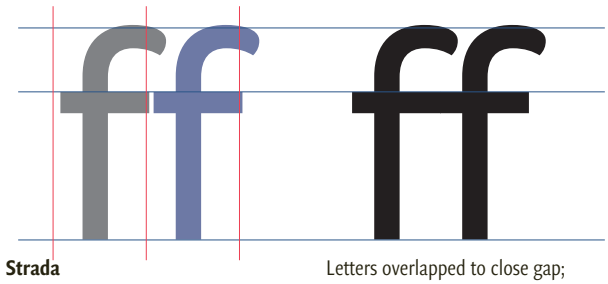
Abril Display
(Regular)

Overall width reduced (94%)



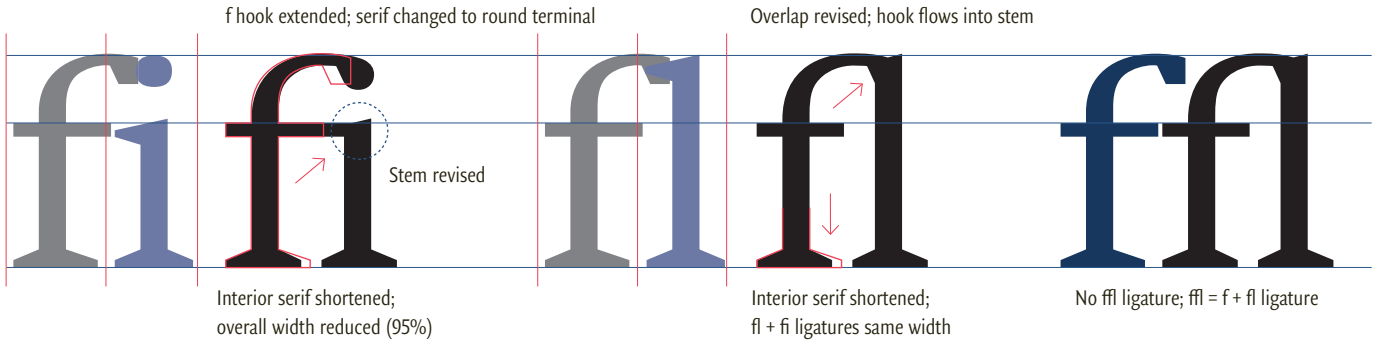
Brix Slab
(Regular)

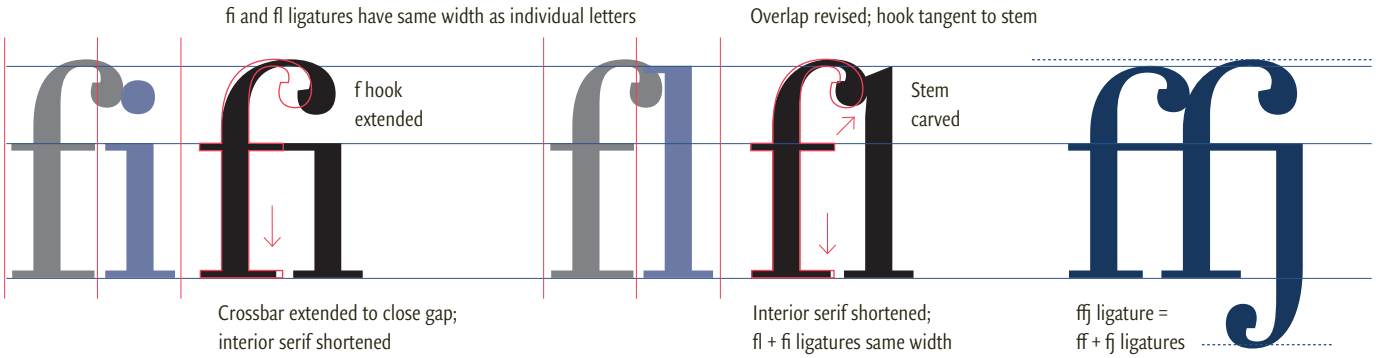
Crossbars extended to close gap;
overall width same as f + f

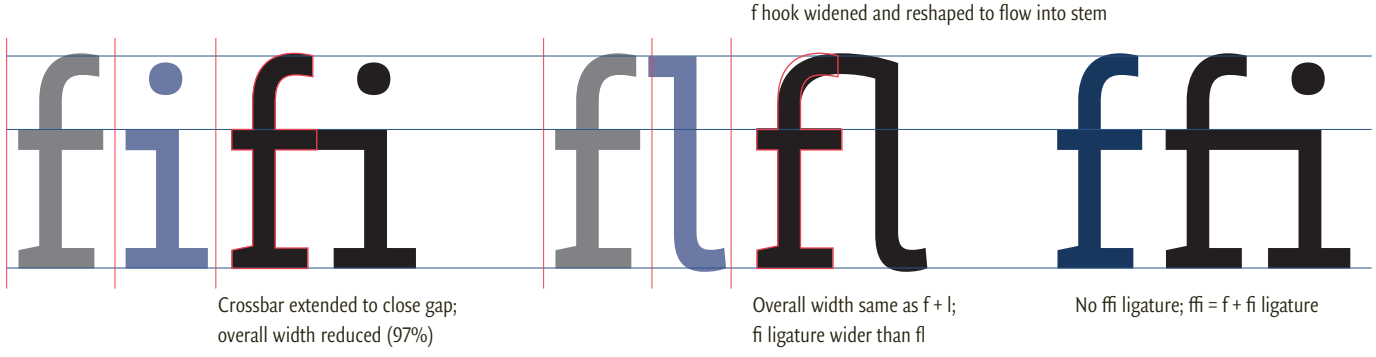


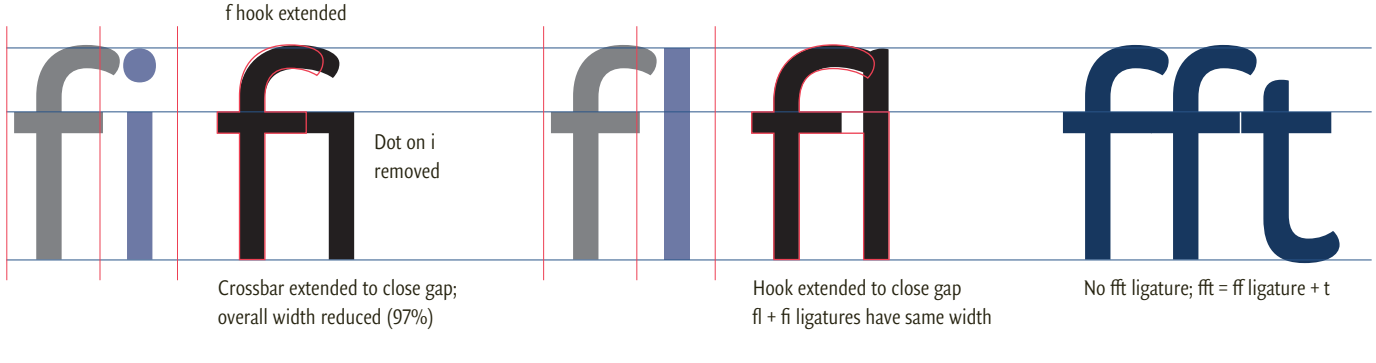
Strada
(Regular)

Letters overlapped to close gap;
overall width reduced (97%)


f hook extended; serif changed to round terminal
Overlap revised; hook flows into stem
Stem revised
Interior serif shortened;
overall width reduced (95%)
Interior serif shortened;
fl + fi ligatures same width
No ffl ligature; ffl = f + fl ligature


fi and fl ligatures have same width as individual letters
Overlap revised; hook tangent to stem
f hook
extended
Stem
carved
Crossbar extended to close gap;
interior serif shortened
Interior serif shortened;
fl + fi ligatures same width
ffj ligature =
ff + fj ligatures


f hook widened and reshaped to flow into stem
Crossbar extended to close gap;
overall width reduced (97%)
Overall width same as f + l;
fi ligature wider than fl
No ffi ligature; ffi = f + fi ligature


f hook extended
Dot on i
removed
Crossbar extended to close gap;
overall width reduced (97%)
Hook extended to close gap
fl + fi ligatures have same width
No fft ligature; fft = ff ligature + t

Lowercase v, w, and y

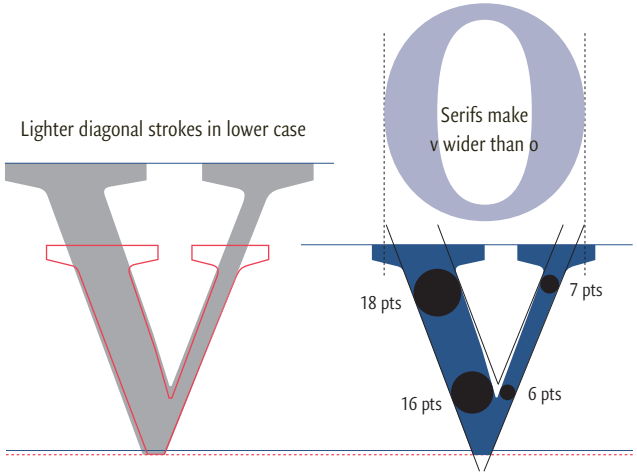
The lowercase v, w, and y are a set of closely related letters. As in the upper case, the v is the primary building block. In general, the v follows the design of its uppercase counterpart. As before, the v is about the same width as the o, although the serifs may extend further outward.

The lowercase w also follows the design of the capital; that is, the angles of the W and w are often similar or identical. However, the expanded and overlapped version of the W (with crossed arms) is rarely seen in the lower case, since there is far less room for a central counter at the shorter x-height. Therefore, in typefaces with this capital W structure, the upper- and lowercase W will likely not match. Similarly, many designers eliminate the center serif on the lowercase w to avoid creating a dark spot. Although structural consistency is desirable, even color is generally considered more important (at least in text typefaces).

The structure of the upper- and lowercase W may not match.
In Questa Slab (top) the center serif has been removed.
In Malaga (below) the center serif is maintained.

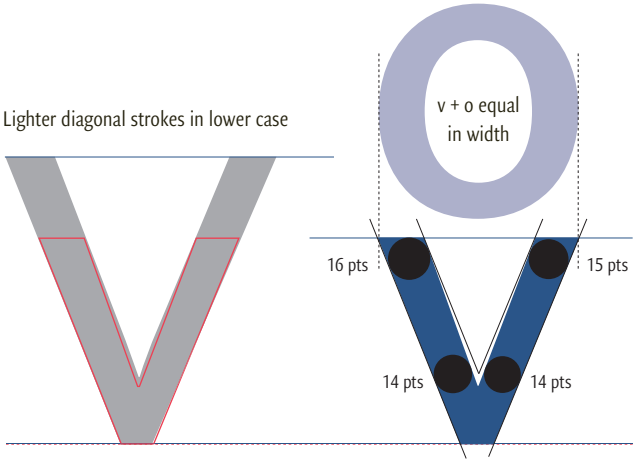
As discussed previously (see p. 100), diagonal strokes tend to look heavier than verticals of the same width. To compensate for this optical illusion, many designers begin the heavy diagonals of the v and w with the vertical stroke thickness, then taper to less at the vertex (approximately 86–95%). This strategy helps the v look optically equal to other glyphs, and prevents the vertex from clogging and becoming too dark.

The lowercase w requires more adjustment, because the letter is more complex. In Bliss and Nexus, the weights of the second and third strokes of the w are reduced in order to ease congestion and lighten color. In Harriet, only the heavy third stroke needs to be reduced, since the thin diagonals are less problematic (Harriet has higher contrast than either Bliss or Nexus).



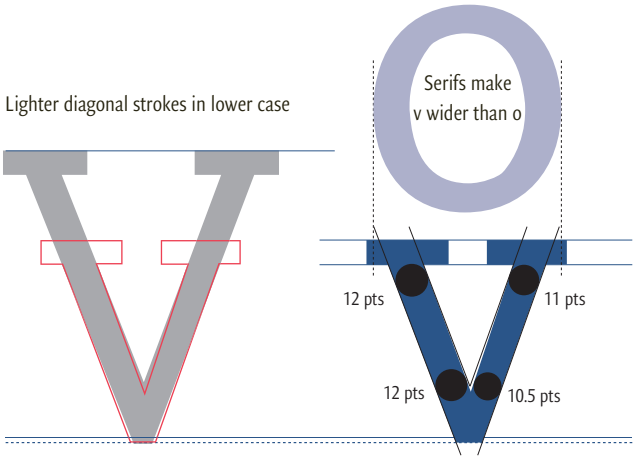
Harriet Text
(Medium)

Diagonals tapered to open join



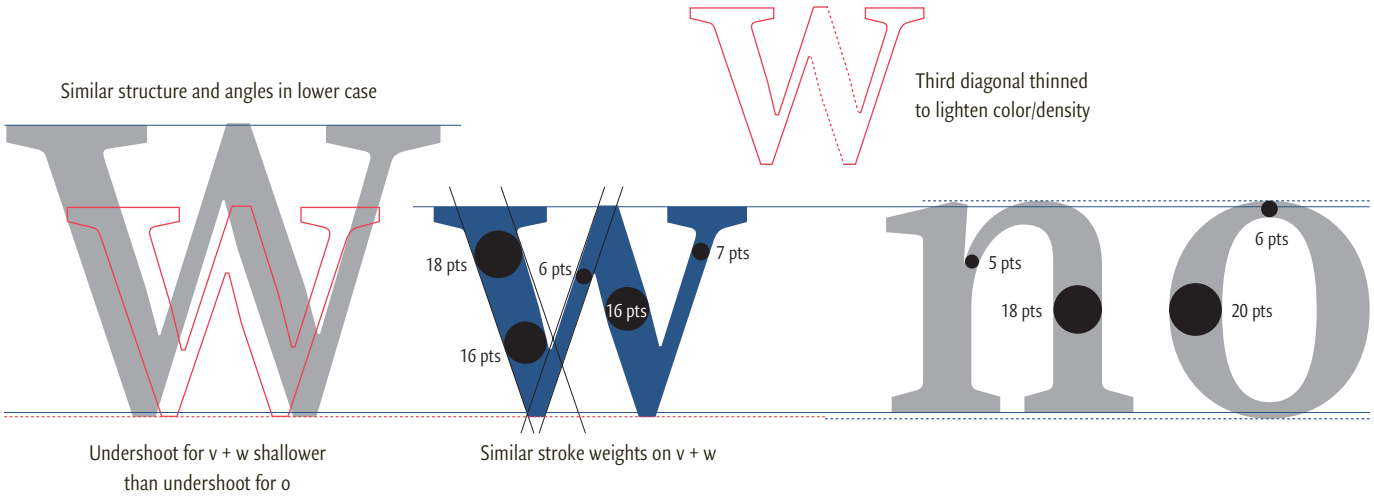
Bliss
(Medium)

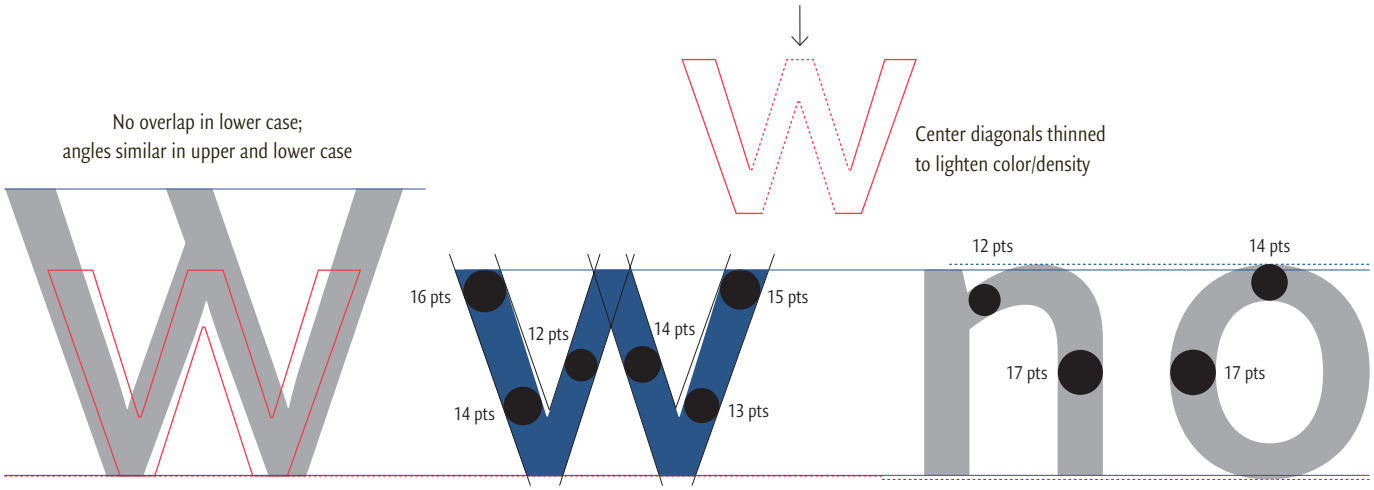
Diagonals tapered to open join

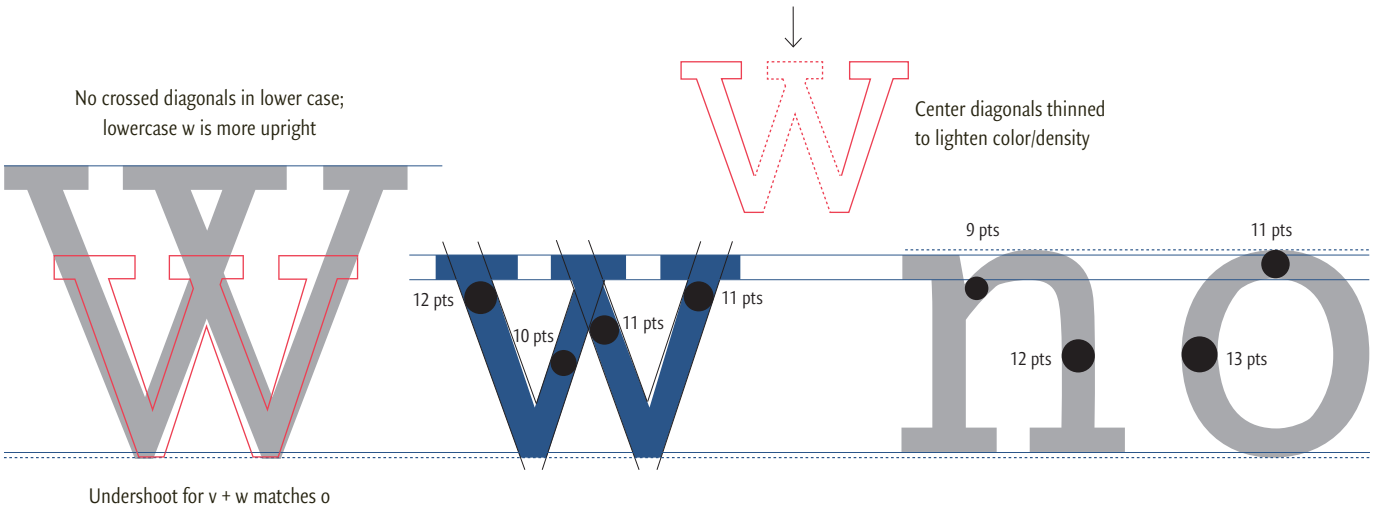


Nexus Mix
(Regular)

Subtle tapering at join


Similar structure and angles in lower case
Third diagonal thinned to lighten color/density
18 pts
6 pts
7 pts
16 pts
16 pts
5 pts
18 pts
6 pts
20 pts
Undershoot for v + w shallower than undershoot for o
Similar stroke weights on v + w


No overlap in lower case; angles similar in upper and lower case
Center diagonals thinned to lighten color/density
16 pts
12 pts
14 pts
15 pts
14 pts
13 pts
12 pts
14 pts
17 pts
17 pts
Undershoot for v + w shallower than undershoot for o


No crossed diagonals in lower case; lowercase w is more upright
Center diagonals thinned to lighten color/density
12 pts
10 pts
11 pts
11 pts
9 pts
12 pts
11 pts
13 pts
Undershoot for v + w matches o

LOWERCASE Y

The y can be derived from the v, because the tail of the y flows from the right diagonal. However, the y may be drawn wider to lighten the letter (which can become congested at the join). If more space is needed, the vertex can be raised slightly above the baseline (as in Eames Century Modern).

Traditionally, the tail is either a straight diagonal or a left-facing curve. For efficient spacing, the tail should end at or before the left outer edge of the letter. Of course, there are alternate y forms, such as a vertical tail (as in Ambroise) and a u-shaped, script-like y (as in Bree).

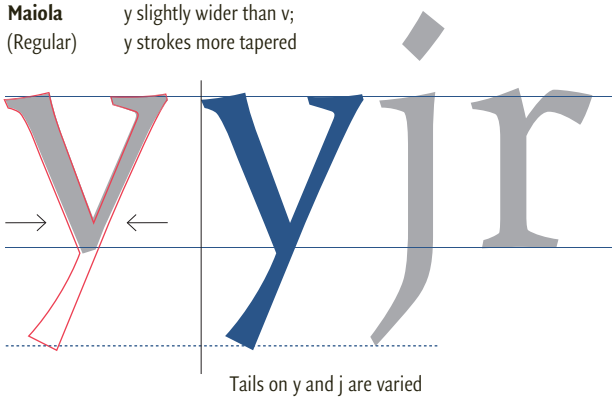
In a serif typeface, the tail of the y usually ends with a finishing element—for example, a flare, terminal, or serif. The ending is critical for designs with high contrast, because the terminal adds much-needed weight to the lighter, right-hand side of the y.

curvy

Two alternate forms for the lowercase y:
In Bree Serif (top) the y has a script-like u form.
In Ambroise (below) the y has a vertical tail.

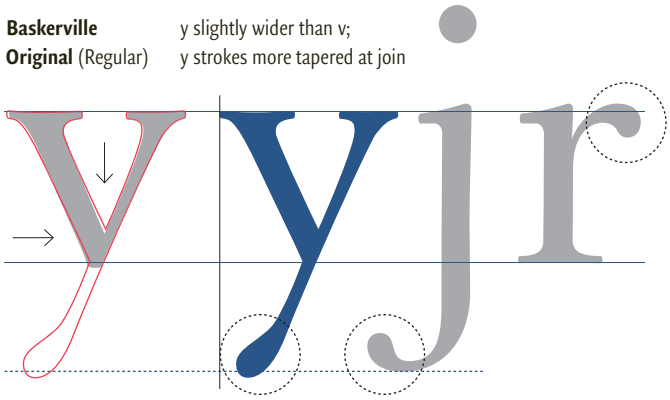
curvy

Maiola (Regular) — y slightly wider than v; y strokes more tapered



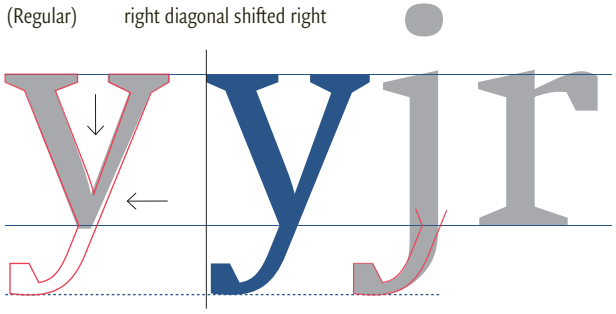
Tails on y and j are varied

Baskerville Original (Regular) — y slightly wider than v; y strokes more tapered at join



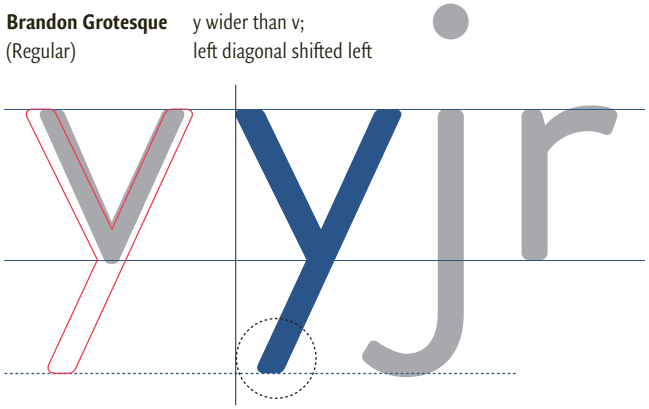
Teardrop terminals on y, j and r

Swift (Regular) — y slightly wider than v; right diagonal shifted right



Matching serifs on y and j; related (but larger) from on r

Brandon Grotesque (Regular) — y wider than v; left diagonal shifted left



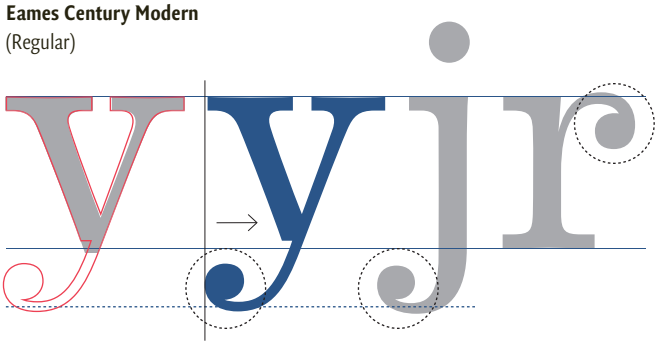
All strokes have consistent rounding/bevels

SPACING AND TESTING

After the y is completed, you can typeset "etaoin shrdlu cmfwyp"—a nonsense phrase that lists, in order, the frequency of the eighteen most common letters in the modern English language. Of course, letter frequency varies (for example, in French the phrase would be "elaoin sdrétu cmfhyp"). If you have been following the sequence in this book, you also have six extra letters (b, p, q, g, j, and v). Therefore, you can finally begin to set text in full sentences, as long as you avoid the k, x, and z. For example, an excerpt from *The Crystal Goblet* (an essay on typography by Beatrice Warde) is set at right in Usual, a typeface designed by Rui Abreu:

Imagine that you have before you a flagon of wine. You may choose your own favorite vintage for this imaginary demonstration, so that it be a deep shimmering crimson in color. You have two goblets before you. One is of solid gold, wrought in the most exquisite patterns. The other is of crystal-clear glass, thin as a bubble, and as transparent. Pour and drink; and according to your choice of goblet, I shall know whether or not you are a connoisseur of wine. For if you have no feelings about wine one way or the other, you will want the sensation of drinking the stuff out of

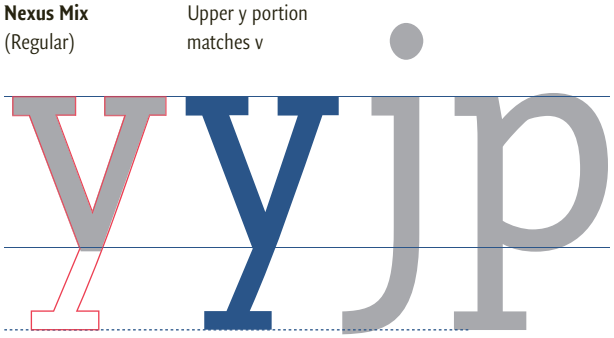
Eames Century Modern
(Regular)



Raised vertex on y;
ball terminals on y, j, and r

Nexus Mix
(Regular)

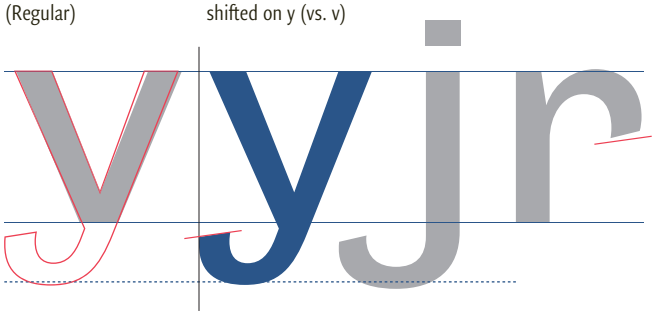
Upper y portion
matches v



Symmetrical serif on y tail
(matches design of p descender)

Campaign
(Regular)

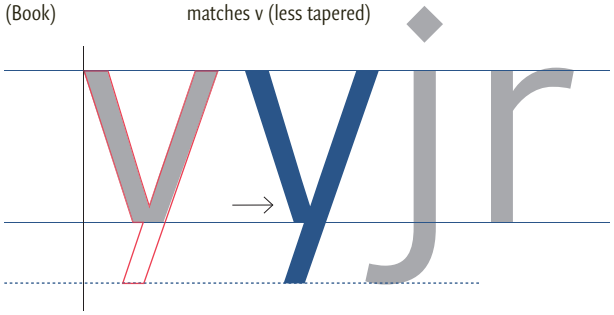
Angle of right diagonal
shifted on y (vs. v)



Tail forms of the y and j relate to r
(angle of cut is not identical)

Fedra Sans
(Book)

Upper y portion almost
matches v (less tapered)



Notch at vertex of y

Lowercase k

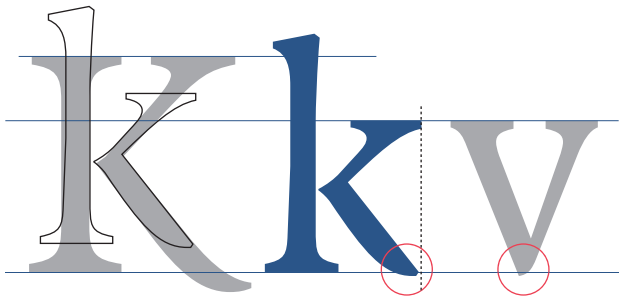
Unlike the capital letter, the lowercase k has an ascending stem. However, we have the same structural options as in the upper case: a single or double junction, either joined to the stem or separated by an open gap. Some fonts, such as Fakt, offer both structures as alternate glyphs (note that these glyphs respond to the a and y). There are also unusual script-like rounded forms for the k, as in Campaign (shown on the opposite page).

Kopiyka | Kopiyka

Fakt by Thomas Thiemich offers alternate glyphs for several letters, including the k .

Most designers prefer to keep the joins of the K and k consistent across the upper and lower case (so that the letters have either a single or a double junction, but not a mix of these structures). However, because the reduction from cap-height to x-height widens the proportions of the lowercase letter, the angles of the arm and/or leg may need to vary between the upper- and lowercase k. Small adjustments in angle are acceptable, but widely divergent stroke directions can look awkward. It may be preferable to mix structures across cases; decisively different arm and leg shapes may look better than clear misalignments.

As the diagonal arm and leg assembly shifts from the cap-height to the x-height, the interior of the lowercase k can become congested. As discussed previously for the capital K (see p. 122), 1) the diagonal strokes of the k can be tapered, or 2) the join can be disconnected. In a serif font, space can also be recovered by shortening or removing the inner leg serif.

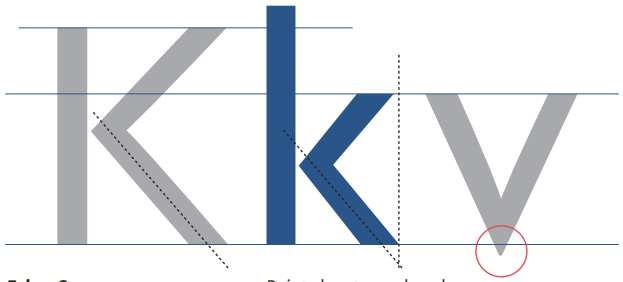


Quadraat (Regular)

Short leg/tail on k; rounded ends on k and v

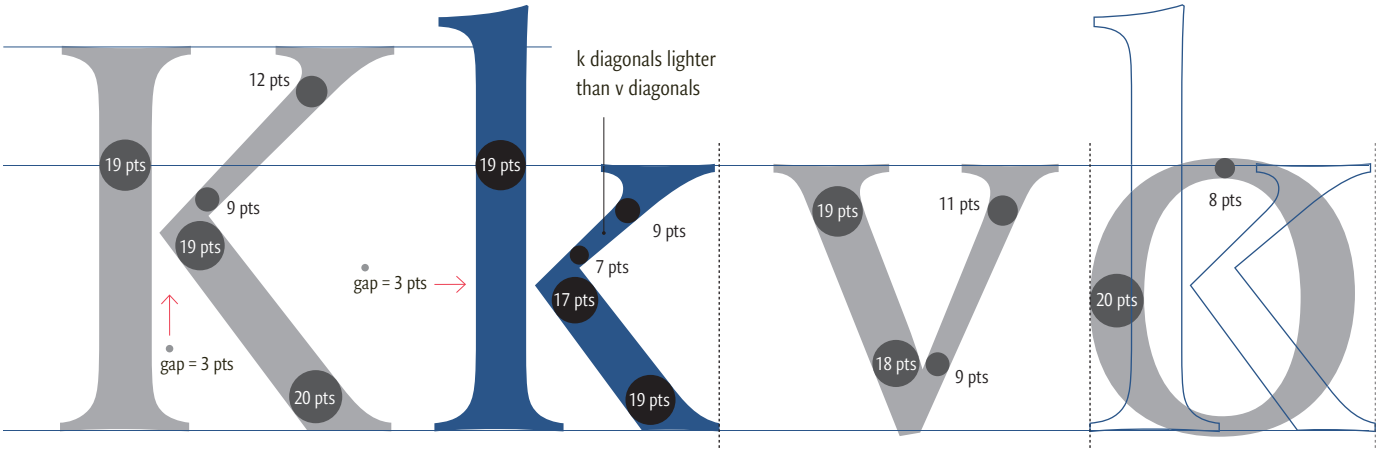
Bembo MT (Regular)

Lowercase k has straight arms and legs



Faber Sans (65–Kraeftig)

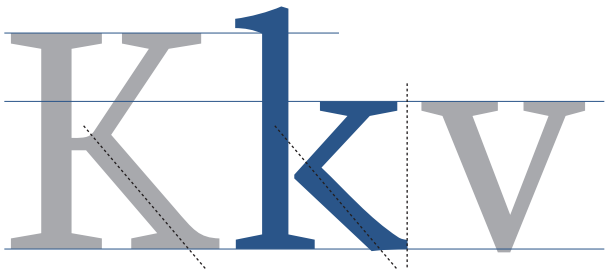
Pointed vertex on k and v



Capitolium 2 (Regular)

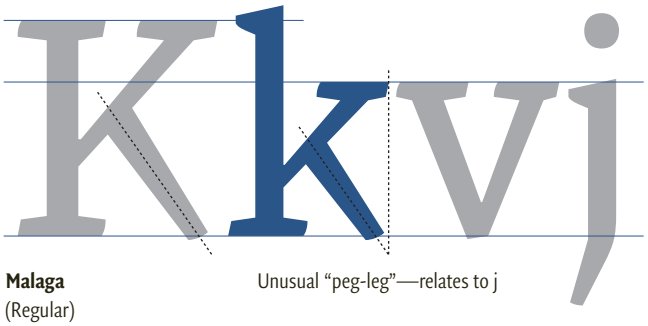
Upper and lower case have single-junction structure

With serifs, the k is wider than the o



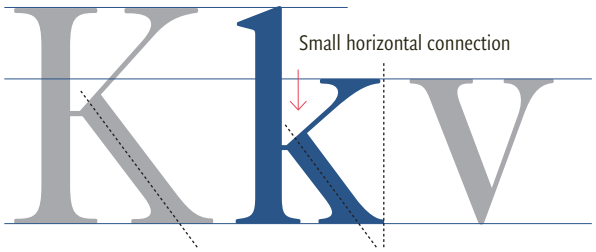
Trump Mediaeval (Roman)

Lowercase k has gap (not crossbar); lower leg lacks inner serif

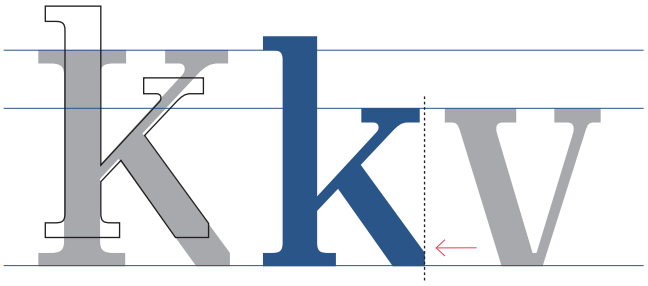


Malaga (Regular)

Unusual "peg-leg"—relates to j

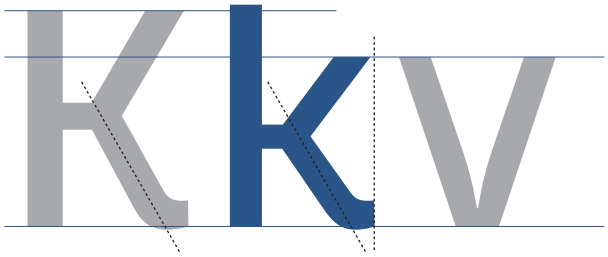


William Display (Regular)



Algebra Display No. 2 (Regular)

Blunted / cropped legs

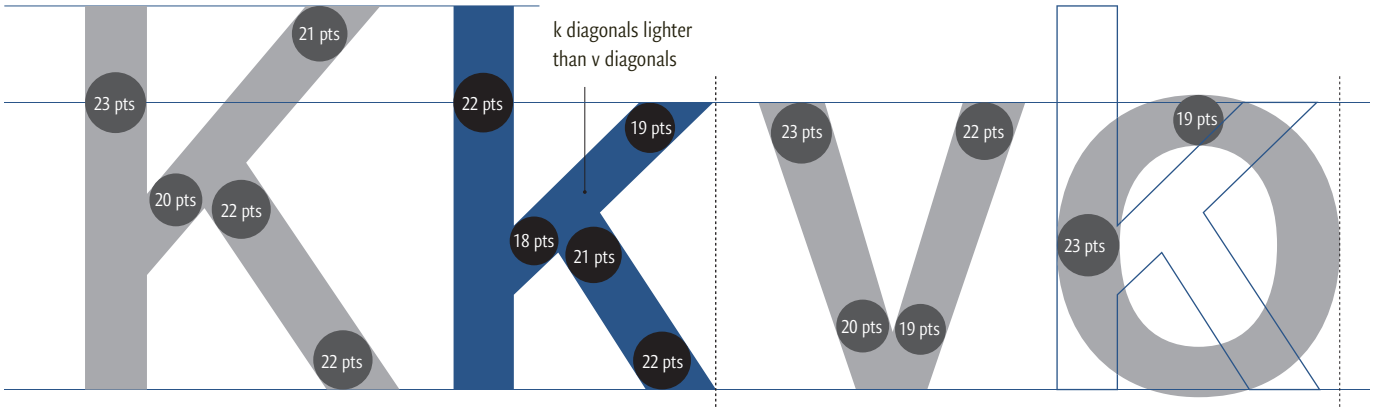


Klint (Medium)

Unusual curved leg

Campaign (Regular)

Unusual script-like form



FF Real Head (Book)

Upper and lower case have double-junction structure

Without serifs, the o is narrower than the k

Lowercase x and z

The lowercase x and z are typically shorter versions of their uppercase counterparts (see pp. 108, 126). In fonts with calligraphic influence (such as Maiola and Apolline), the lowercase x and z can exhibit script-like features—for example, the x may have curved legs and/or the z may have a thin center stroke.

Zz Xx oxidize

Above, Feijoa (designed by Kris Sowersby).
The z has a thin center and curved horizontals.

Because the x and z are more complex than the v, their diagonal strokes are usually slightly lighter in weight. Additionally, note that the angles of the x and z usually need to be modified slightly from those of their uppercase counterparts, because the reduction from capital-height to x-height changes the overall proportions.

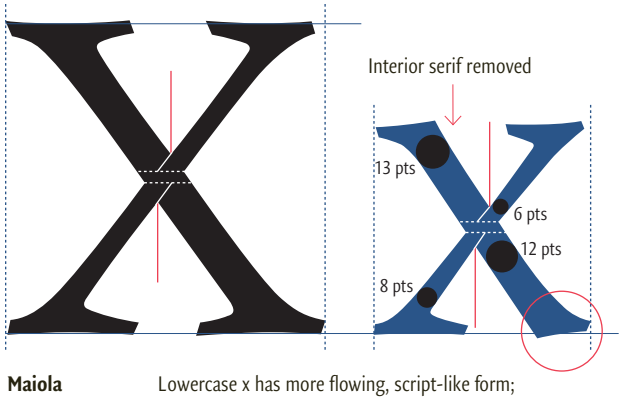
In a serif typeface, the counters of the upper- and lowercase X and x form arrow-like shapes. In a sans serif, the counters are simple triangles. The counterforms are more noticeable in bold fonts, thanks to figure–ground reversal (the white of the counters is the figure, while the black of the letterstrokes is the ground). One can focus on relating and/or aligning these negative shapes to make the letterform coherent.

vywx

Above, Ziggurat (Black). Note the repeating arrow-like counterforms.

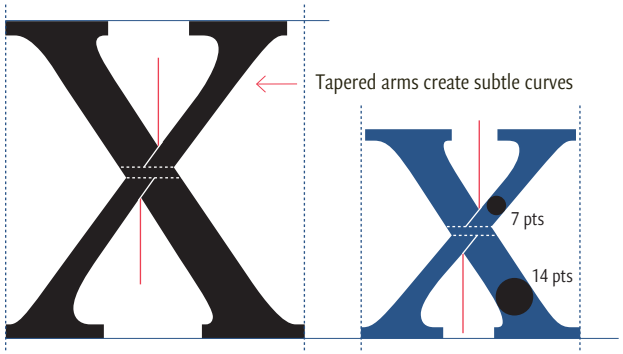
SPACING AND TESTING

The x and z are our final diagonal letters in the lower case. To check density and spacing, set words that begin with the x and z as well as words that position the x and z between other letters: amaze, apex, axel, analyze, buzz, fritz, zephyr, zoo, zeal, wax, wizard, breeze, blaze, lexicon, flax, luxe, maximize, matzo, fixit, seize, vizier, axe, context, axiom, epoxy, expert, hydroxyzine, peroxide, taxidermy, texturize, ozone, tuxedo, prizes, tweezed, seltzer, zygote, coaxing, snooze, schmaltz, hex, remix, sexton, boxers, dioxin, and anxious.



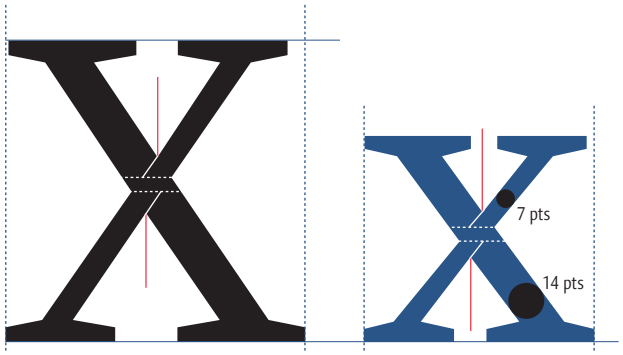
Maiola
(Regular)

Lowercase x has more flowing, script-like form; stroke weights of the x slightly less than v



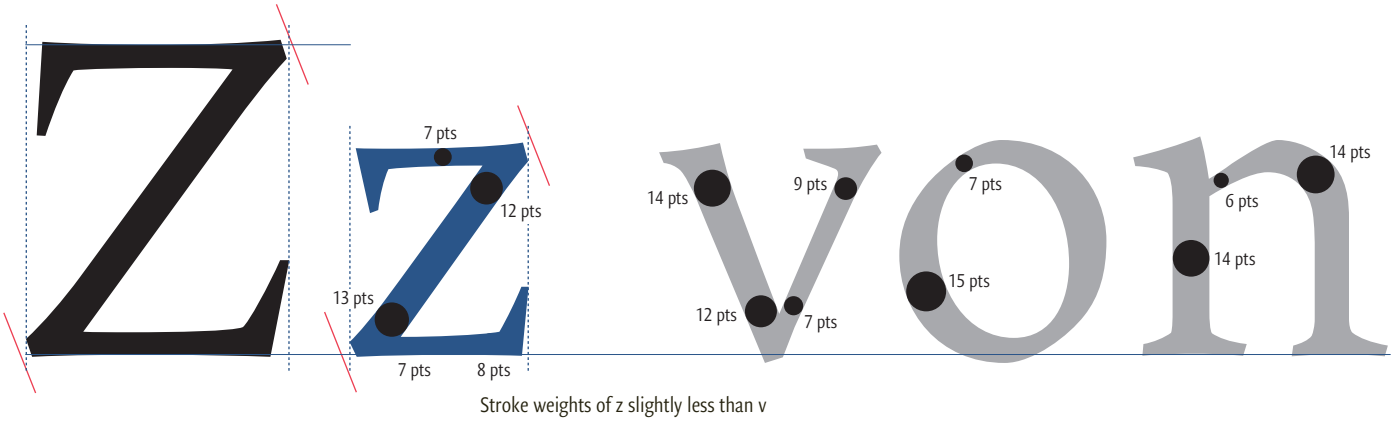
Apolline
(Regular)

Upper- and lowercase X/x have shifted arms

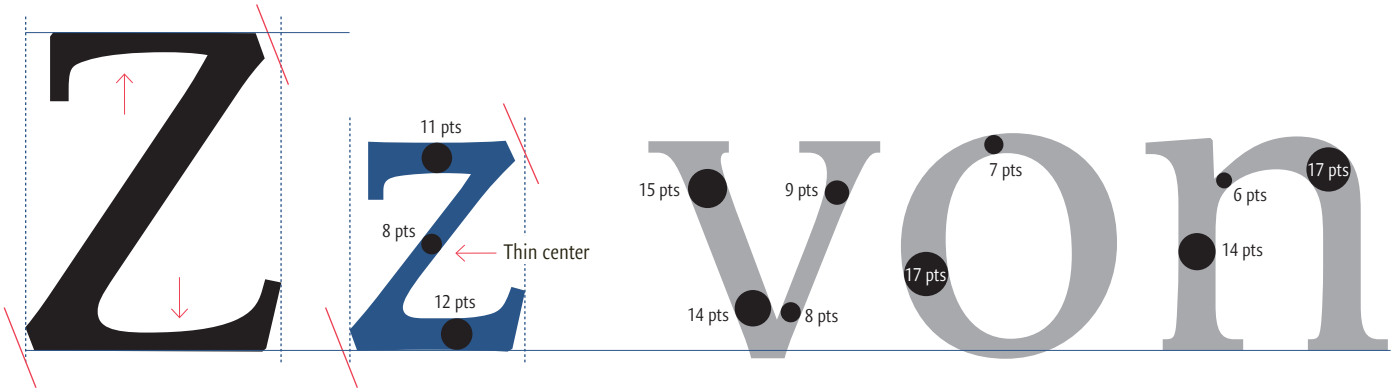


Trump Mediaeval
(Roman)

Lower stroke contrast; shift in arms is subtle

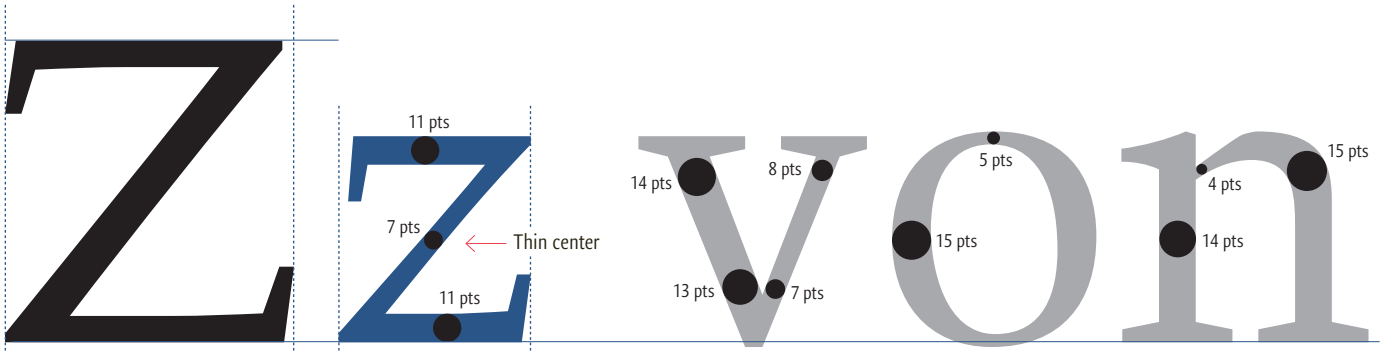


Stroke weights of z slightly less than v

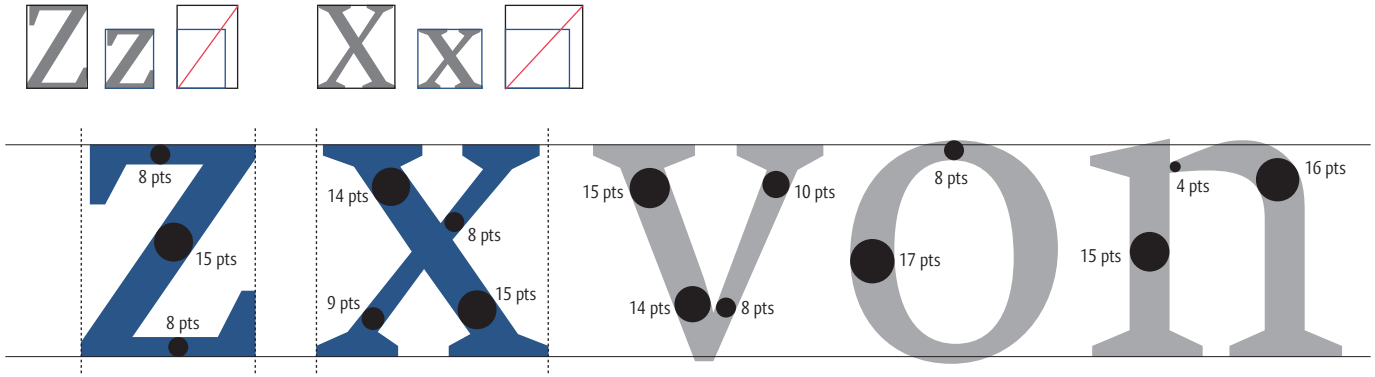


Bracketed horizontals
relate to tapered x arms

Stroke weights of z slightly less than v

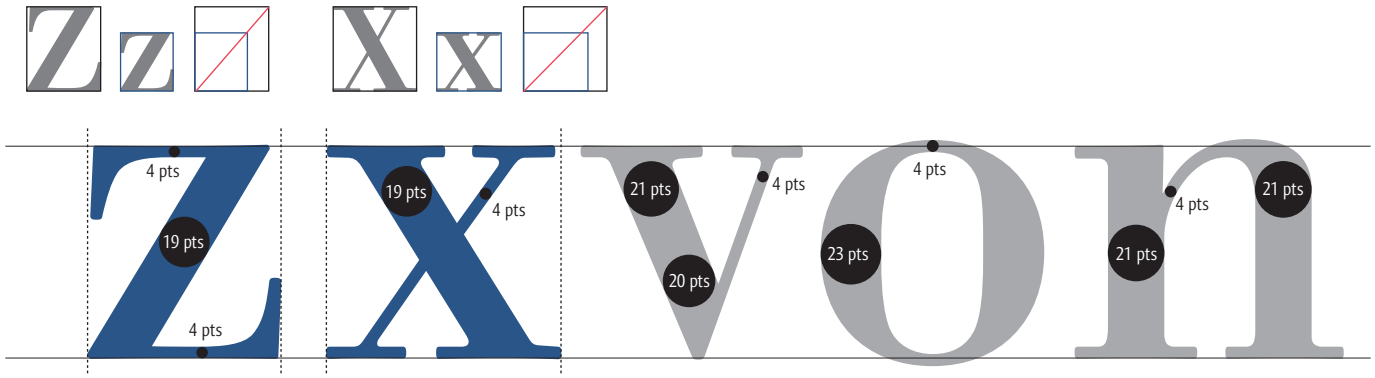


Stroke weights of z slightly less than v



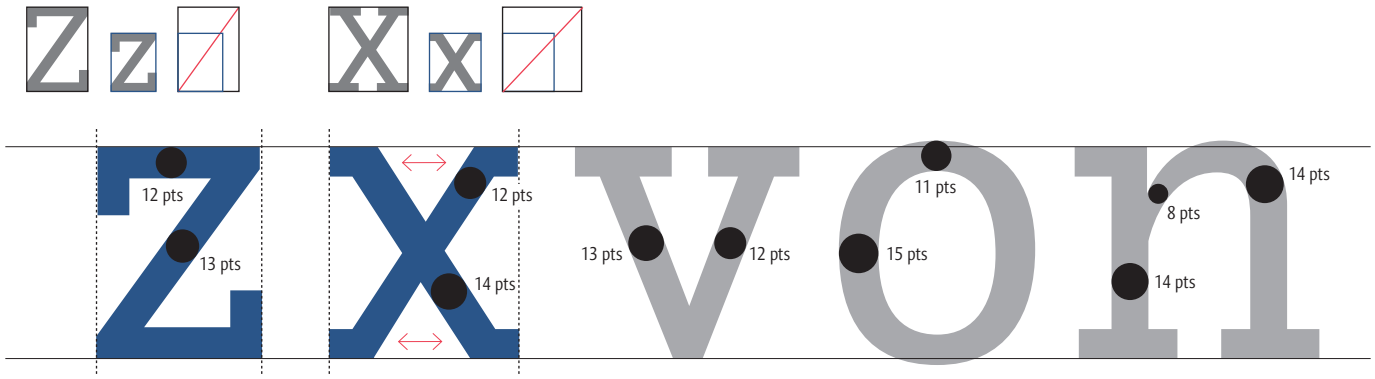
Swift
(Regular)

Light diagonal of x slightly less than v;
center diagonal of z slightly darker than v



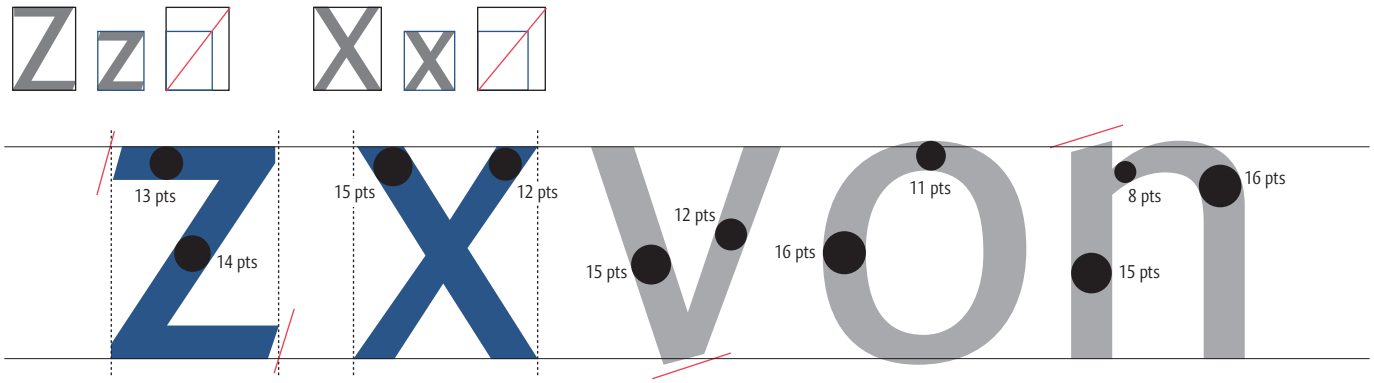
Walbaum
(18pt-Medium)

Center diagonal of z and x slightly lighter than v



Questa Slab
(Regular)

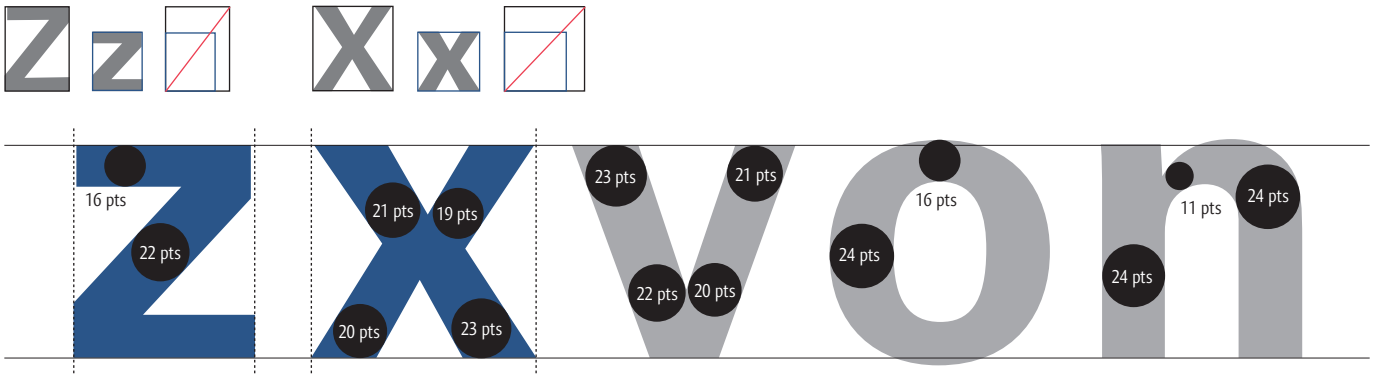
Interior serifs removed;
center diagonal of x slightly lighter than v



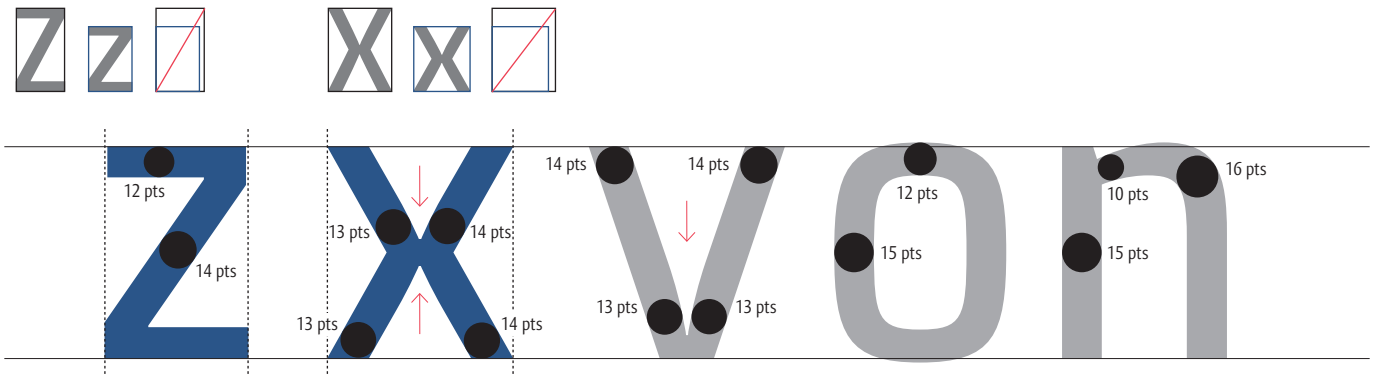
Quadraat Sans
(Regular)

The z has lower contrast than the v

Diagonal stroke endings on a, v, and n



Univers
(65-Bold)



Klint
(Medium)

Unusual splayed form;
upper and lower ink traps on x and v

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6

NUMBERS

Oldstyle and Modern Figures

The letters of our modern alphabet stem from the ancient Roman civilization, but the numbers are Indian in origin. Note that the term "Arabic" is a misnomer when referring to numerals. Numeric figures originated in India in the third century BCE, and were later introduced to Europe in the tenth century by merchants trading with Arabia. This book uses the term "Hindu–Arabic" to more precisely refer to the origin of numbers.

The Romans used a complex combination of letters instead of numbers, but this system was awkward, to say the least, for any purpose other than monumental inscriptions. Because the calligraphic traditions of the East are quite different from those in the West, the Hindu–Arabic numerals have a different structure and rhythm from Latin letterforms. For example, the 1 and the 7 have very large open spaces, and the 8 is particularly complex. From a design standpoint, this can make it difficult to integrate figures into a font of type.

By the mid-1500s, the use of Hindu–Arabic numbers was fairly standard throughout Europe—largely thanks to the development of the printing press and the subsequent distribution of consistent printed materials. However, most printers had a single set of figures that they used with all of their typefaces. The first typographer to refine numeral design was the sixteenth-century French type designer Claude Garamond. Garamond is credited with developing the first set of figures that specifically complemented a font of type.

Garamond's numbers were intended for use within text, and therefore had ascenders and descenders, as well as similar proportions to the lowercase letters. This style is known today as "text figures" (also called old-style figures or lowercase numbers) and is still in use. Text figures may be drawn at or slightly taller than the x-height (increased height may avoid confusion between letters and figures of the same shape—such as the zero and the lowercase o, for example). Similarly, the descenders of text figures can be shorter than those on the letters. In most fonts, the 0, 1, and 2 are short, medial figures; the 3, 4, 5, 7, and 9 descend, and the 6 and 8 ascend. However, these alignments are not standard. In the most common variation, the 3 and 5 are also ascending.

In the eighteenth century, the Industrial Revolution changed the landscape for type design. To meet the needs of new clients and media, printers created the taller numbers known as modern, lining, or ranging figures (the latter terms stem from the alignment—or arrangement—of the numbers amongst the capital letters). These figures are also frequently referred to as "uppercase" or "capital" numbers.

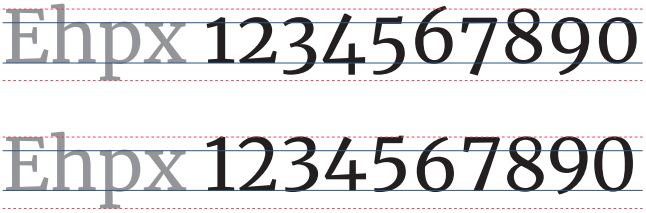
Lining figures may be the same height as the capitals, or slightly shorter (and lighter) than the uppercase letters to prevent them from overly dominating in text. At the time of their invention, the larger bodies of these figures were thought to improve legibility. However, research done by Miles Tinker in 1930 has since proven otherwise; text figures are actually easier to read, both singly and in groups.[1] From a visual point of view, many designers prefer text figures for their formal variety.

Still, modern figures have their place. Their increased height is more harmonious with the uppercase letters, and their uniform appearance works well to reduce visual clutter. For example, columns of phone numbers, stock market data, and price lists generally look clearer and more attractive when set with lining numerals.

These and other specialized applications that use numbers in unique ways make an excellent argument for designing multiple types of numbers to include in a font. Unfortunately, when mechanical typesetting was introduced in the late 1800s, old-style numbers were often omitted from typefaces to save time and money. During this period, old-style figures were less fashionable, so most fonts included only lining numerals.

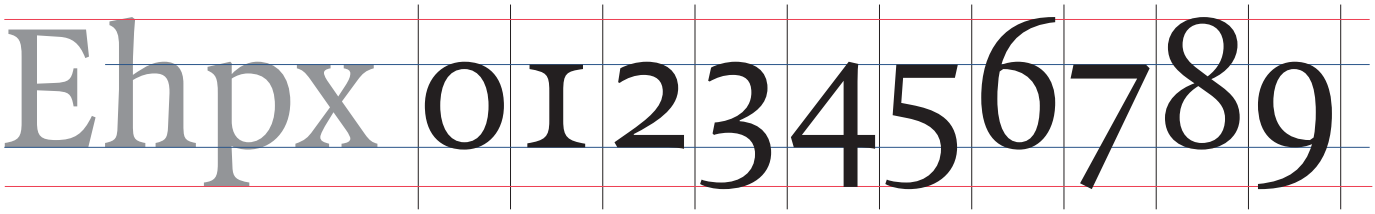
Times and fashions change—and today, the OpenType format now makes it easier to include several sets of figures in a single font. Today, a well-crafted digital typeface will contain four styles of figures: upper and lower case, with both proportional and tabular spacing. Proportional figures have varying widths according to their natural shape (for example, the 1 is the narrowest, while the 8 is the widest). Tabular numbers (also called monospaced) are, as the name suggests, designed for tables. Each number fits within an en-space so that numbers align when stacked.

There are also typefaces that have "hybrid figures"—numbers with short ascenders and descenders, and a height somewhere between the capitals and the lower case. Below, hybrid and lining figures are shown from Merriweather (designed by Eben Sorkin).

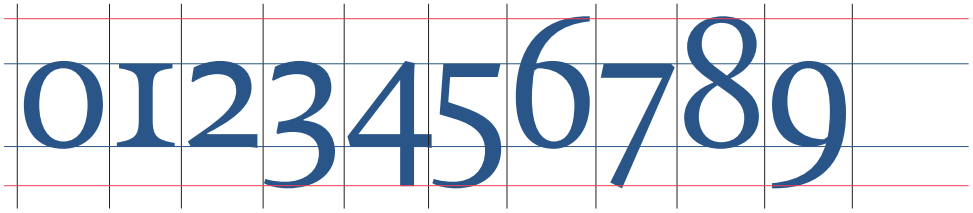


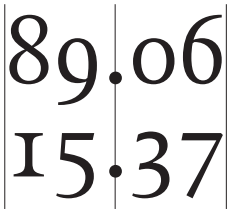
Hybrid figures have less variation than true text figures but are not as uniform as lining figures. Some designers criticize hybrid figures for having an indecisive appearance, but others have embraced the format as an effective visual compromise.

1 Tinker, Miles A., "The Relative Legibility of Modern and Old Style Numerals," *Journal of Experimental Psychology*, 1930, Vol. 13, pp. 453–461.

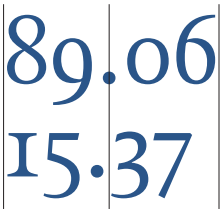


Quadraat includes both tabular (above) and proportional (right) old-style figures that have ascenders and descenders.

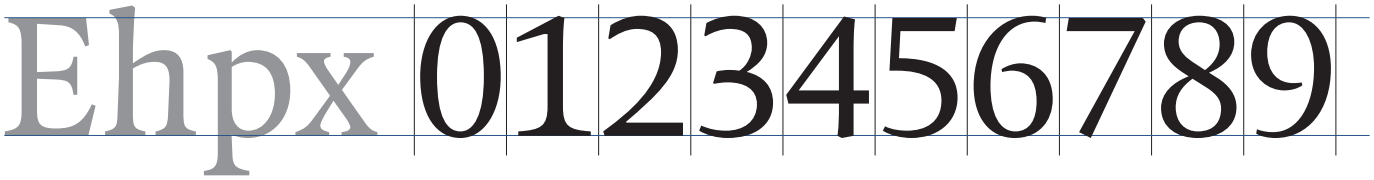




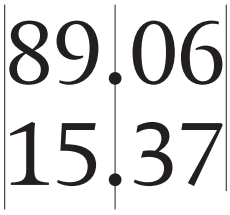
Tabular figures have equal widths that align.



Proportional figures have varying widths.



Quadraat also includes both tabular (above) and proportional (right) lining figures that match the height of the capitals.



The bottom row of figures has looser spacing (vs. the top).

The 8, 9, 0, and 6 are the widest figures; the 1, 5, 3, and 7 are the narrowest.

Numbers 0 and 1

The zero is a challenging figure to design, because it can easily be confused with the capital or lowercase O/o. The type designer Charles Bigelow describes the problem succinctly: "Despite exponential increases of computing power over the past half-century, at least one problem involving ones and zeroes has defied easy solution: how to shape the graphical forms of numeral 'o' (zero) and the capital letter 'O' (Oh) so a human reader can easily distinguish between them."

This quote comes from his insightful and gently humorous paper (entitled "Oh, oh, zero!"), in which Bigelow reviews the many solutions proposed by both type designers and computer programmers to address this problem.[2] The main ideas can be summarized as: 1) adding a loop or similar flourish to the top of the upper- and lowercase O/o; 2) adding a slash or dot to the zero; or 3) changing the shape of either the O/o or the zero.

The first idea (adding a new element to the letters O/o) has generated some interest, but such a large change in convention faces significant opposition—or, at minimum, a lengthy time to widespread acceptance. Some typefaces do employ the second option: adding a slash or dot to the zero. Below, Suisse Int'l Mono (Bold) has a slashed zero while Input Sans (Regular) has a dot:

0123456789 Olio_01
0123456789 Olio_01

However, note that a modified zero often has alternate meanings. For example, an encircled dot ⊙ is a character in several non-Latin languages, and the zero with a slash (∅) is used by mathematicians as a symbol for "empty set." Furthermore, the Ø and ø are letters in certain Scandinavian languages, including Danish and Norwegian.

Therefore, most designers resort to the last option: distinguishing the zero by changing its shape. For the uppercase zero, we generally draw the number both narrower and lighter than the capital O. That is, the stroke weights of the modern zero match the lower case, or fall between the upper- and lowercase letters.

Changes to the shape of the lowercase zero are often more dramatic. In Garalde typefaces, the old-style zero may be drawn to look like a monoline circle. In actuality, however, the form is not usually a true monoline (see Big Caslon, opposite). The strokes often have subtle contrast, and the overall proportion is more vertical (taller than a true circle).

Alternatively, the lowercase zero can be drawn with horizontal emphasis, resulting in a kind of lozenge shape. In some typefaces, the usual stroke contrast is reversed, so that the lighter strokes are at the sides, rather than the top and bottom. Yet another variation occurs in Didone typefaces, where one side of the zero is drawn as a monoline (without the characteristic swelling).

Olio_01_01
Olio_01_01

Top: In Stempel Garamond (Roman) the old-style and lining zeros have reverse contrast. Bottom: In Questa Grande (Regular) the old-style and lining zeros are asymmetric.

A final strategy for altering the zero involves adjustment to height. The modern zero may be drawn shorter than the capitals, and the old-style zero may be drawn taller than the x-height. Having the zero at a unique height further helps to distinguish it from the O/o.

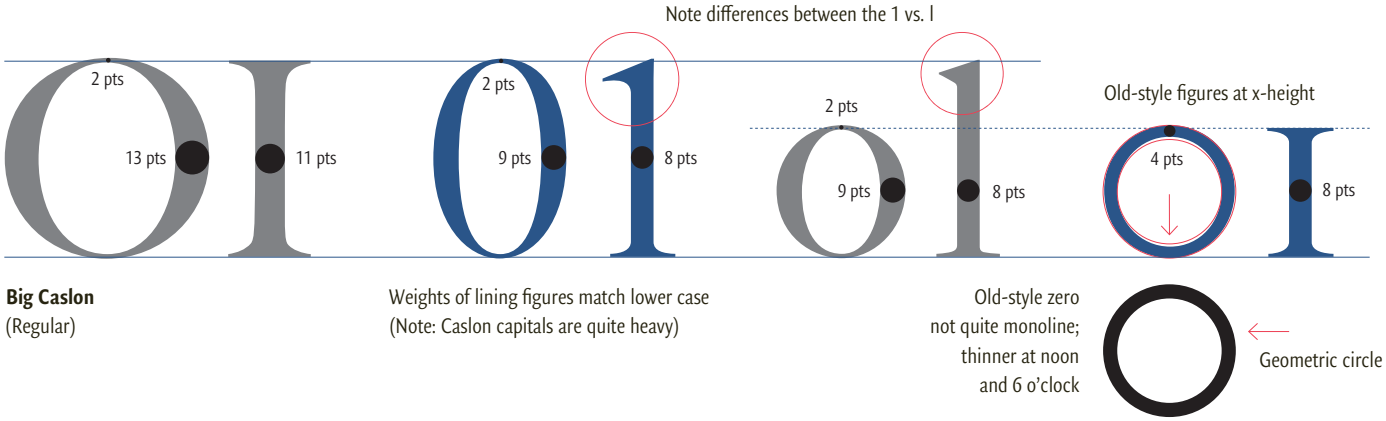
NUMBER ONE

Note that the uppercase one is not a lowercase letter l. The top of the number has a larger, left-facing flag. The tip of this flag may be pointed or blunted, and the extension may be horizontal, diagonal, or curved. In serif typestyles, the base of the one often has long foot serifs. In sans serifs, these serifs may be eliminated or revised into a horizontal baseline crossbar.

In lowercase figures, the one has two main variants: 1) a small Roman numeral, with upper and lower crossbars or 2) a shorter version of the uppercase figure. In the latter scenario, the pointed flag of the one can be redrawn to better suit the wider proportions of the lower case.

The design of the one has developed for functional rather than esthetic reasons. The flag, foot serifs, and crossbar make the figure more distinct and therefore more legible. These features also make the number wider, and therefore help the figure work as a tabular (monospaced) character. As mentioned earlier, tabular figures need to occupy the same width (an en-space) in order to align in tables. Extending the top and bottom of the single-stemmed one helps to expand its narrow structure.

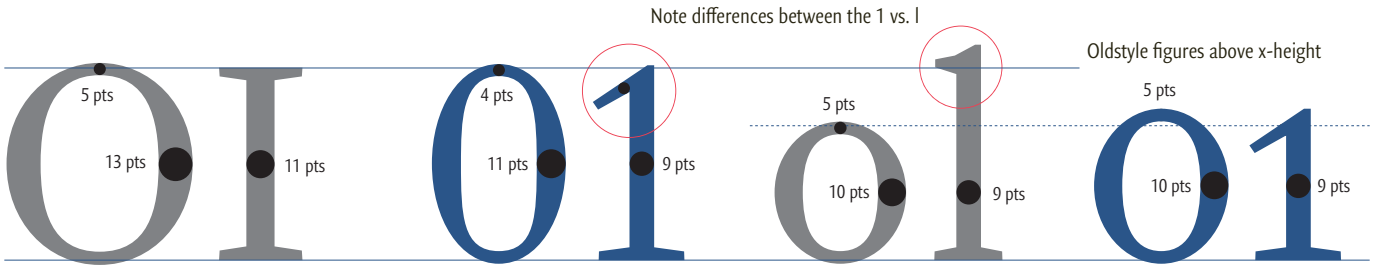
2 Bigelow, Charles, "Oh, oh, zero," *TUGboat*, 2013, Vol. 34, No. 2, pp. 168–181. tug.org/TUGboat/tb34-2/tb107bigelow-zero.pdf.



Big Caslon
(Regular)

Weights of lining figures match lower case
(Note: Caslon capitals are quite heavy)

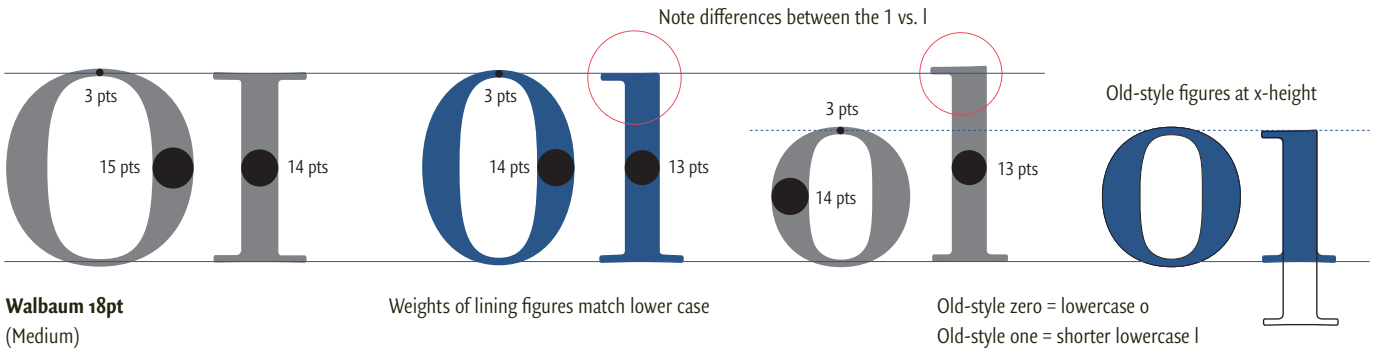
Old-style zero
not quite monoline;
thinner at noon
and 6 o'clock



Rosart
(Regular)

Weights of lining figure zero fall between
the uppercase and lowercase O/o

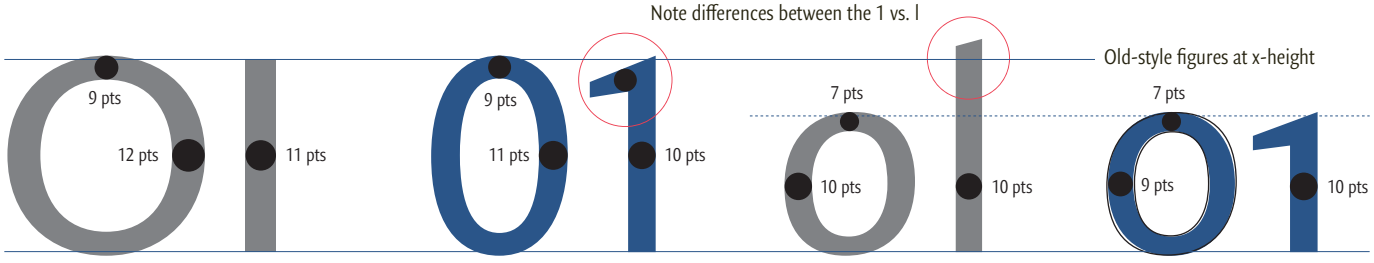
Old-style figures match the weights of the lower case



Walbaum 18pt
(Medium)

Weights of lining figures match lower case

Old-style zero = lowercase o
Old-style one = shorter lowercase l



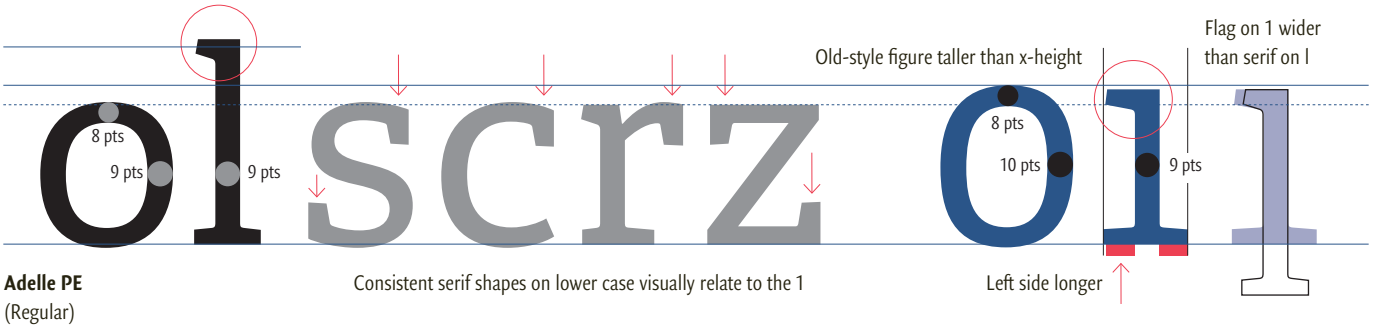
Quadraat Sans Pro
(Regular)

Weights of lining figure zero fall between
the uppercase and lowercase O/o

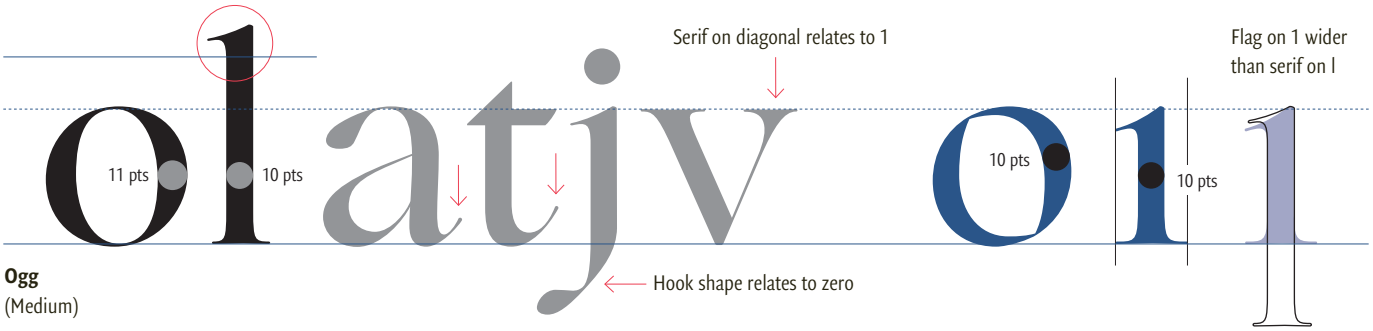
Old-style zero has less angular stress than lowercase o

As in all of the numbers, the key design challenge is shaping the figures so that they are coherent with the Roman letterforms. Below are shown three different approaches. In Adelle, the shape of the one is clearly unified with the slab serifs on other letters (both upper and lower case). In Ogg, perhaps the one can be said to relate to the tails, extended thin strokes, and the beak serifs. In Strada, the brush-like stroke endings help to provide continuity between the lowercase letters and the one.

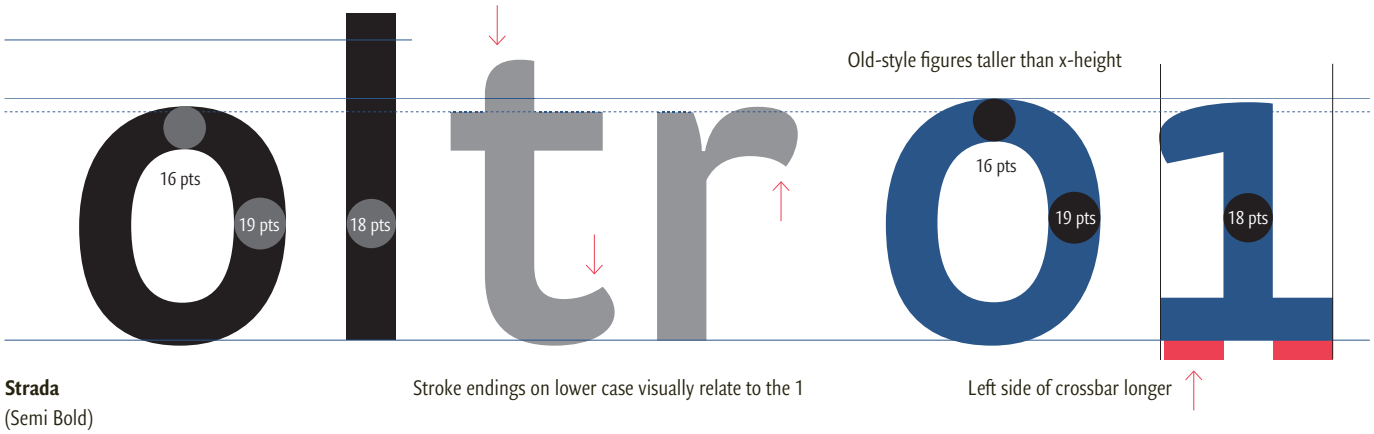
On the other hand, designers can take the opposite approach. That is, rather than forcing a connection between glyphs that are fundamentally different, one could embrace the figures as an opportunity to explore different forms and add visual variety to a font. For example, Champion Gothic (shown at right in "Full Middleweight") has a playful and distinctive number one. There are no other numbers or letters with this curved feature.



Adelle PE
(Regular)



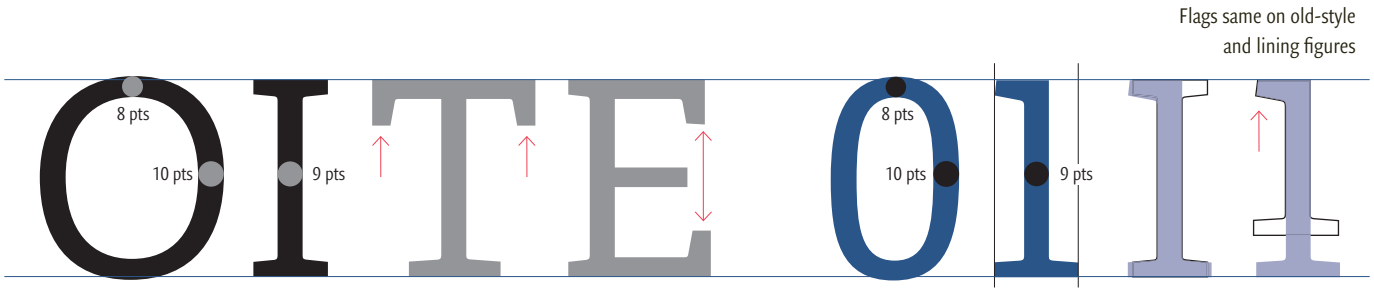
Ogg
(Medium)

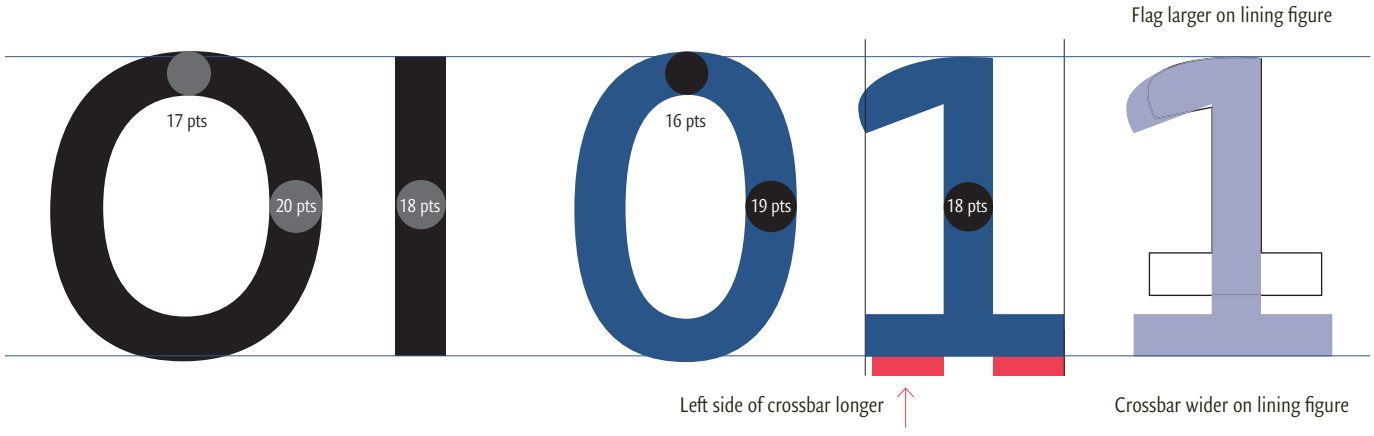


Strada
(Semi Bold)

Ol oliacgr_0123456789

The one in Champion Gothic (by Jonathan Hoefler) has a distinctive curved feature—a Victorian detail not present in the other numbers or lowercase letters.





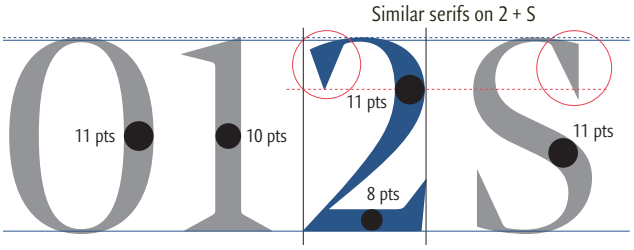
Number 2

Both the aligning and old-style two have the same basic structure: an upper hook attached to a horizontal or curved base. However, the old-style two is shorter; it is a medial number that matches the height of the lowercase zero (including overshoot). In serif typestyles, the hook and the base are usually finished with a terminal and/or serif. In sans serifs, the stroke endings should be cut at an angle that relates to the stem endings on the letters.

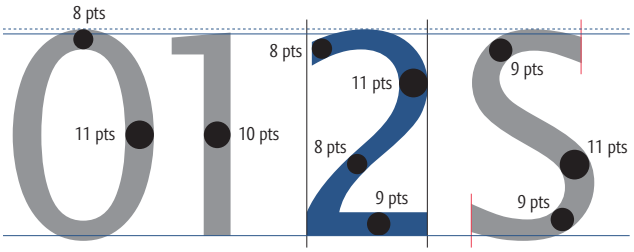
The hook has two structural possibilities: a straight diagonal or a curling spine. In either form, the heaviest part of the curve can be placed at either an angle (1 to 2 o'clock) or in the vertical center (3 o'clock). The aperture of the hook should be consistent with similar open bowls in the S/s and C/c, and e/a.

In general, the maximum weight in the hook of the two is the same as the maximum bowl weight in the zero. However, when the two is a curled form, the spine may need to be thinned so that the two does not become darker than the (more open) zero. The thin bowl weight of the two is typically the same as the minimum bowl weight of the zero, but this weight can be reduced to open the join with the horizontal base stroke.

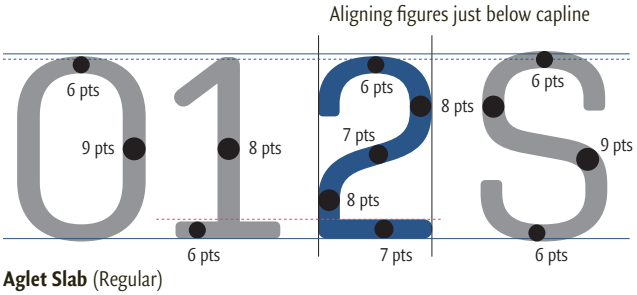
For optimum stability, the base of the two should be drawn wider than the upper hook. Note that this lower base is a heavy stroke even though it is horizontal. The base stroke can be drawn slightly thinner than the normal vertical stroke width to compensate for optical gain (as described earlier, horizontals look thicker than verticals of the same width). Reduction of the lower stroke base can help to reduce congestion at the join.



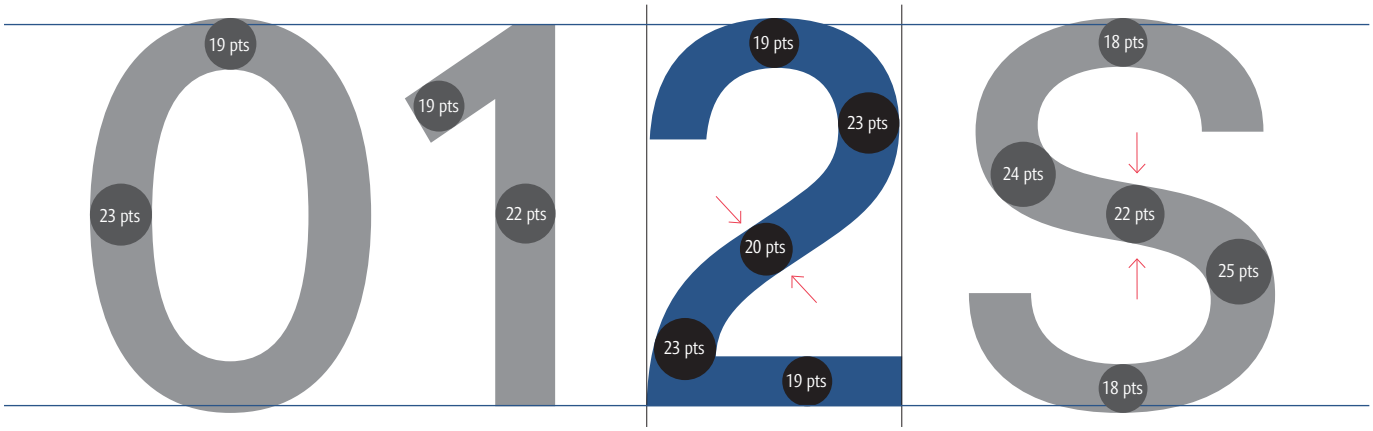
Noe Display (Regular)



Lucida Sans (Regular)

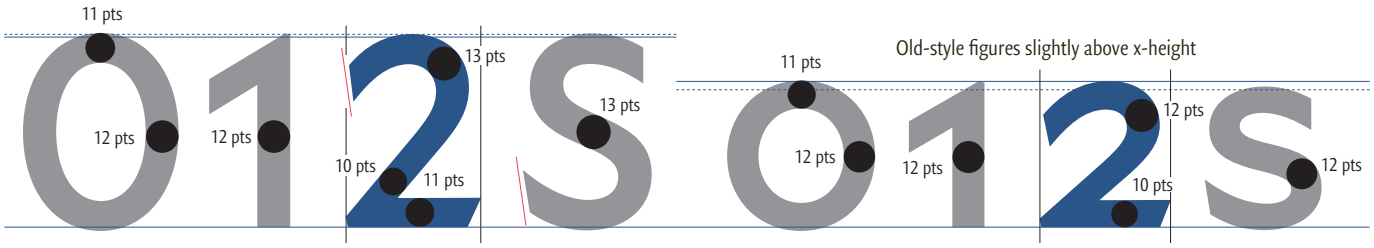


Aglet Slab (Regular)

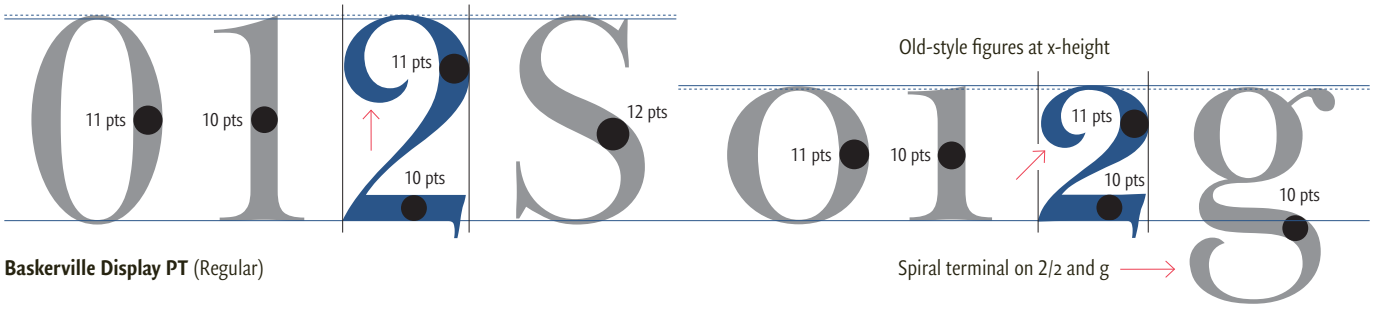


Fakt (Medium)

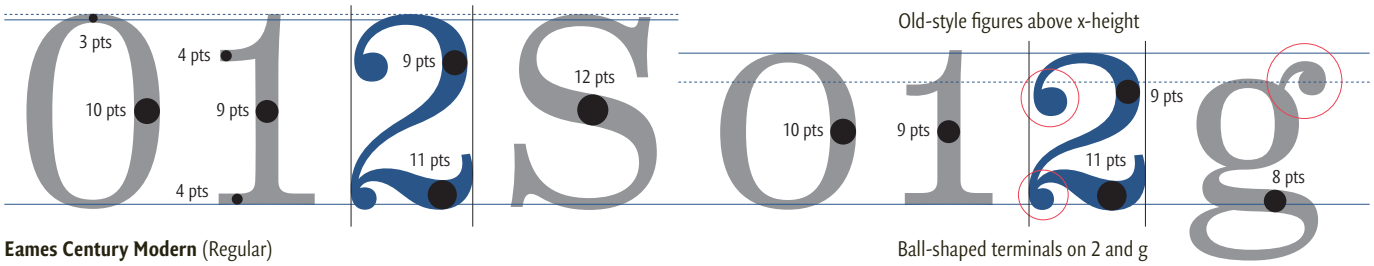
Center of 2 and S are thinned; max weight at corners of spine



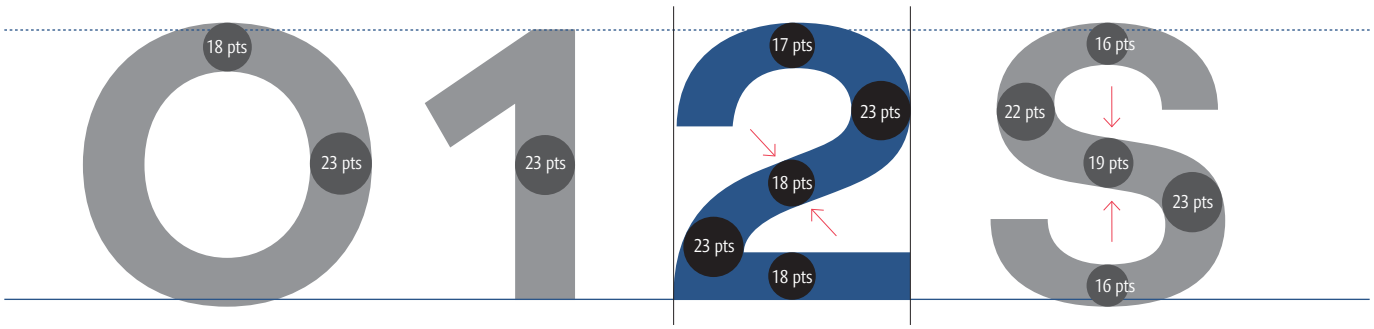
Mallory (Medium)



Baskerville Display PT (Regular)



Eames Century Modern (Regular)



Old-style figures at x-height

Center of 2 and s are thinned; max weight at corners of spine

Numbers 3 and 5

The three and the five are both descending figures (in the lower case) with open bowls. The stress and aperture of the bowls should be related, but are not necessarily identical. The bowl of the five is usually larger (both taller and wider), since the upper half of the figure is less complex.

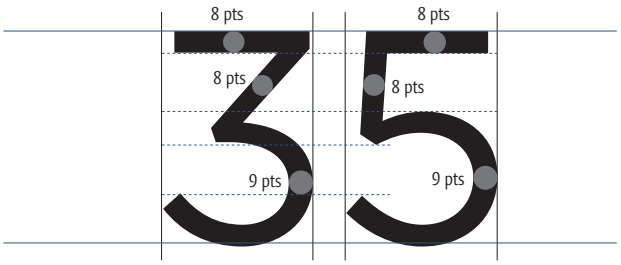
Typically the three is drawn as two round, stacked bowls. As in all the double-story glyphs, the lower bowl is larger. However, the three is sometimes drawn with an upper diagonal (as in Geneo, Gotham, and Walbaum). Some designers consider this form of the three to be more calligraphically correct, but others describe it as fussy and outdated. The z-shape does help connect the three to other diagonal glyphs (such as the four and seven).

The number five also has its variations. The upper horizontal stroke (called the flag) may be straight or curved; the connecting stem may be vertical or diagonal; and the join between the stem and the bowl may be blunted or pointed. The weight of the flag does not necessarily match the horizontal base stroke on the number two; it can be darker or lighter as needed to match the density of other figures and letters.

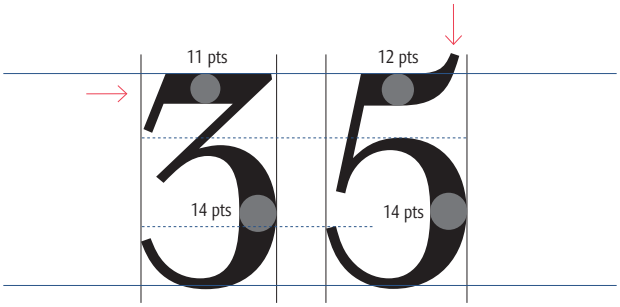
In serif types, the three and five may be finished with upper serifs or terminals. The central overlapping strokes of the three are usually left plain, but they can be expanded into a subtle bulb (see Baskerville).

In sans serifs, the endings of the three and five should be cut at angles that are congruent with other numbers and open bowl letters (such as the C/c, S/s, a, g, r, etc.) It may be necessary to thin letter strokes at the joins in bold or low-contrast designs.

In typefaces with higher x-heights, the three and five may be identical in both the upper and the lower case. However, when the numbers are constrained to short x-heights, the design may need to be revised to conserve space. Of course, designing alternate lowercase numbers is also a good opportunity to add visual variety (for delight and/or functionality) to a typeface.

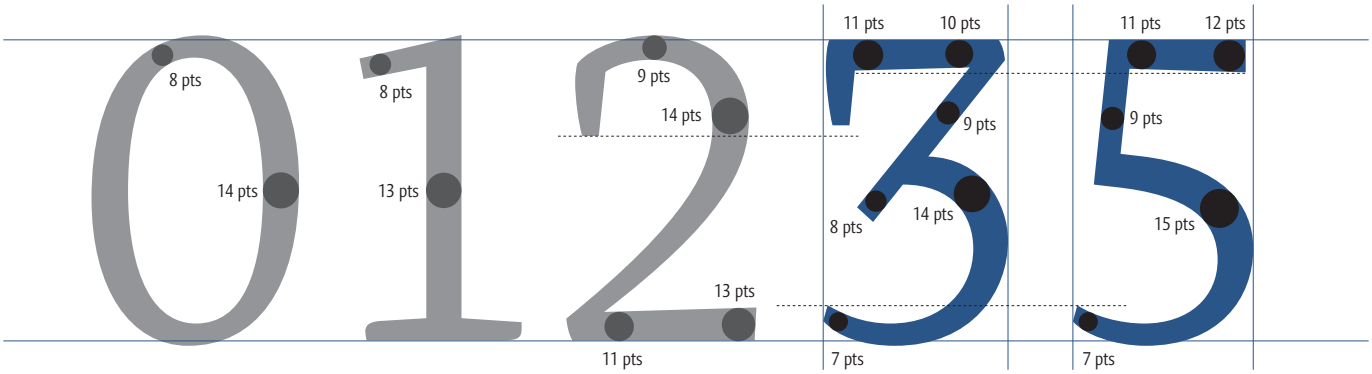


Gotham (Book)

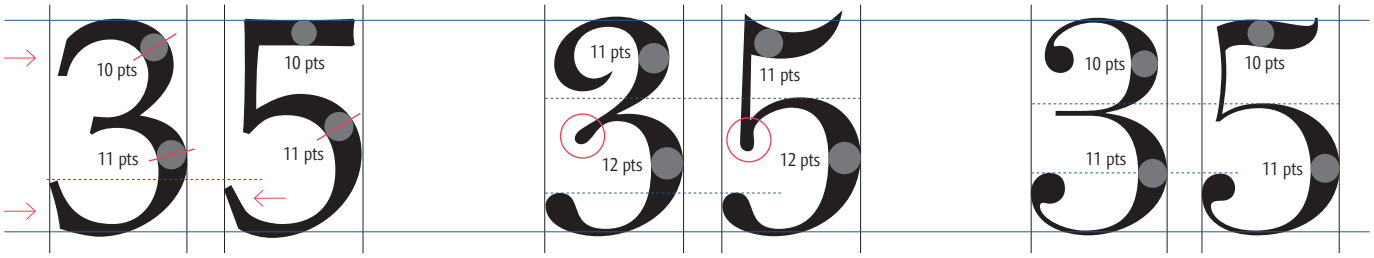


Walbaum (18pts-Medium)

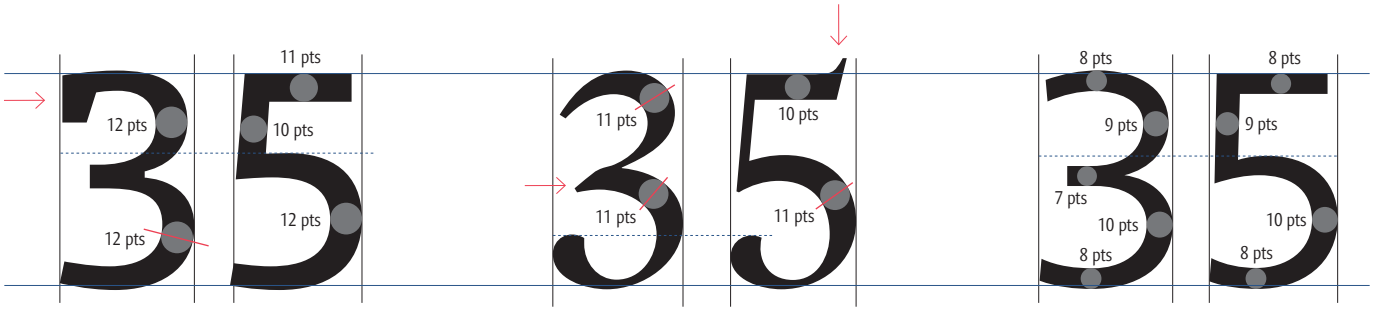
Above, Quadraat (Regular). The old-style figures are drawn more narrowly than the uppercase numbers.



Geneo
(Regular)



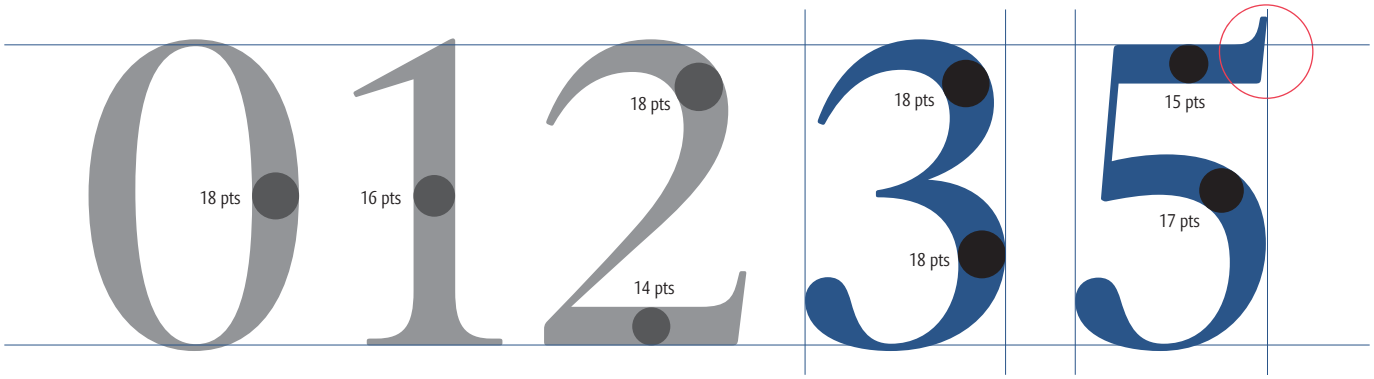
Palatino (Regular) **ITC New Baskerville** (Roman) **Bauer Bodoni** (Roman)



FF Olsen (Regular) **ITC Galliard** (Roman) **Frutiger** (Light)

35 qor2 35 35

Above, William Display (Regular). The old-style figures have shorter descenders than the lower case letters; they also have more lean (steeper angles) than the lining figures.



William Display
(Regular)

Number 4

There are only three elements in the number four: a vertical stem, a diagonal, and a horizontal crossbar. The vertical stem simply corresponds to the number one. However, the diagonal and crossbar have several variations—they can be thick, thin or intermediate in weight. The diagonal can be straight, bowed, or flared—and connected or disconnected from the crossbar and stem.

The resulting stroke endings of the four also have several alternatives. In sans serifs, the ends may be cut vertically or at an angle. In serif typefaces, bracketed or unbracketed serifs can be placed in three possible locations: at the end of the crossbar, at the tip of the apex, or at the base of the vertical stem.

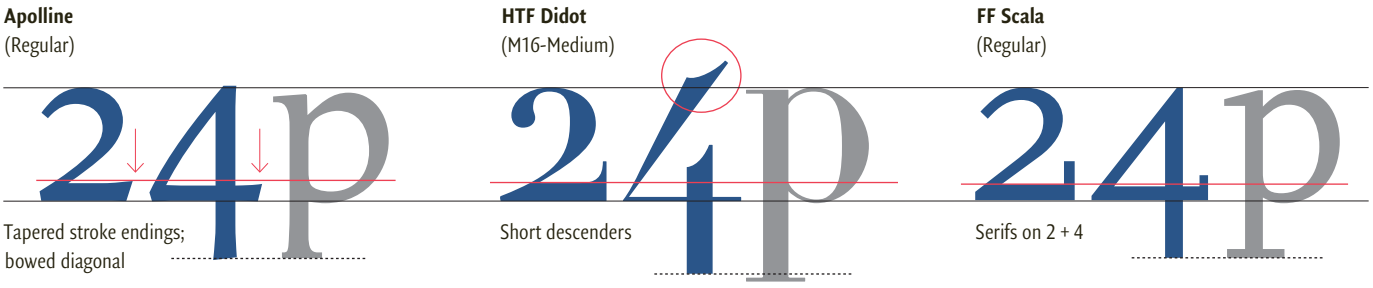
In general, the upper- and lowercase figure four share the same structure, but the lowercase version descends. Because the smaller text figure has less interior space, it may be necessary to change serif placement and/or reconfigure the structure to be lighter and more open.

Understanding and thinking through these many options can be overwhelming. Perhaps it is best to focus on a single objective. Because the four has a triangular structure, the number can appear smaller (more closed) and less even in color than other figures.

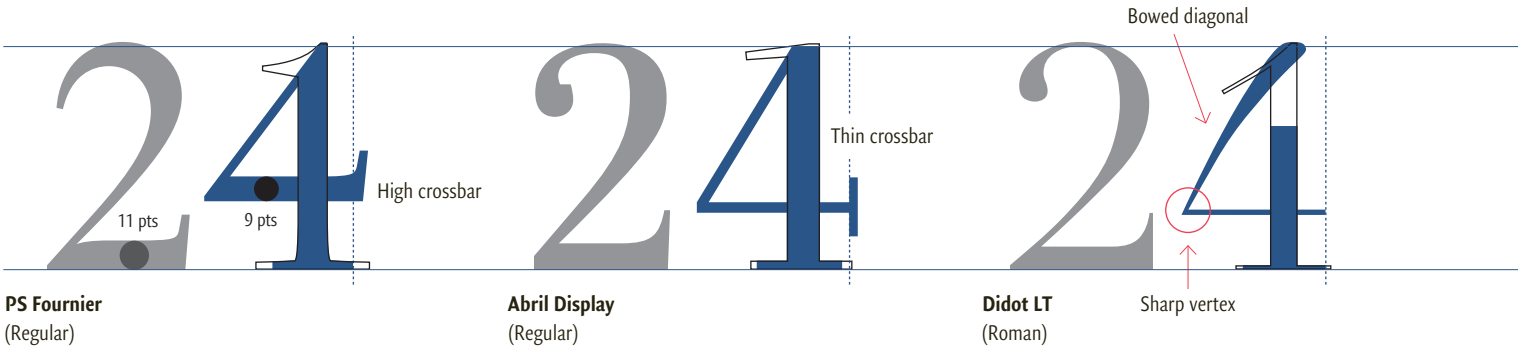
To open the four, we can enlarge the overall form by drawing it wider or taller. We can also try an alternative structure (that is, change the assembly of the diagonal and crossbar).

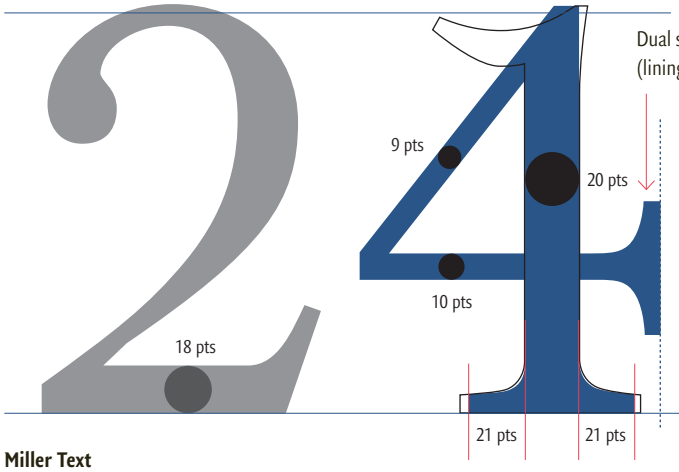
To even the color of the four, we can increase or decrease the weights of the diagonal and the crossbar. We cannot change the thickness of vertical stem, because that should match the stem on the number one.

Therefore, in summary, the various options described here are simply different means toward the same end: a figure four that matches the density of the other numbers. Ideally, the aperture of the four should also relate to the other open numbers (the figures two, three, and five).



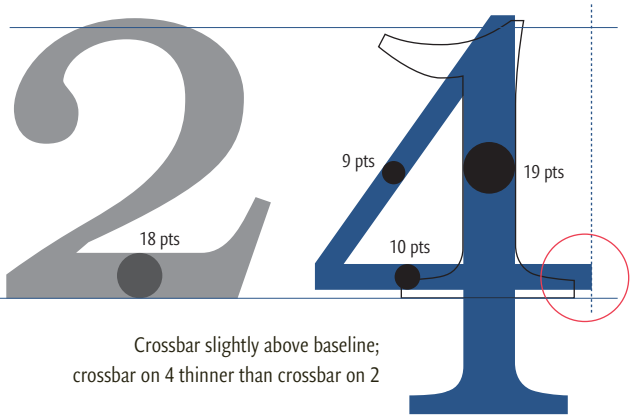
The crossbar of the four rests directly on the baseline; this crossbar may be thinner than the crossbar of the two.
The old-style four descends, but its depth may be shorter than the descenders on the lowercase letters.



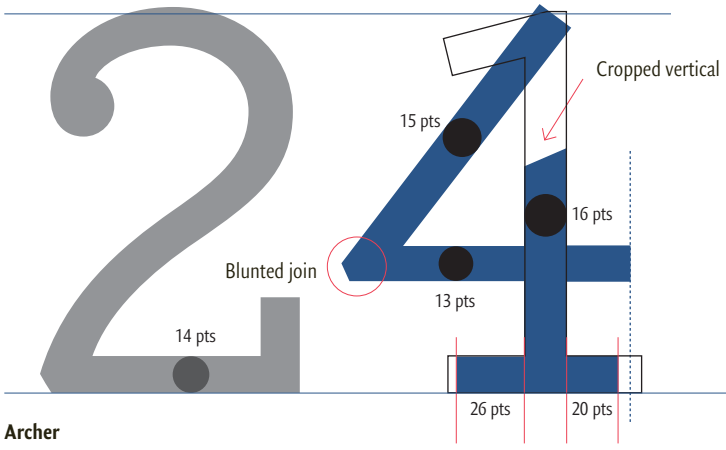


Miller Text
(Roman)

Symmetrical serifs

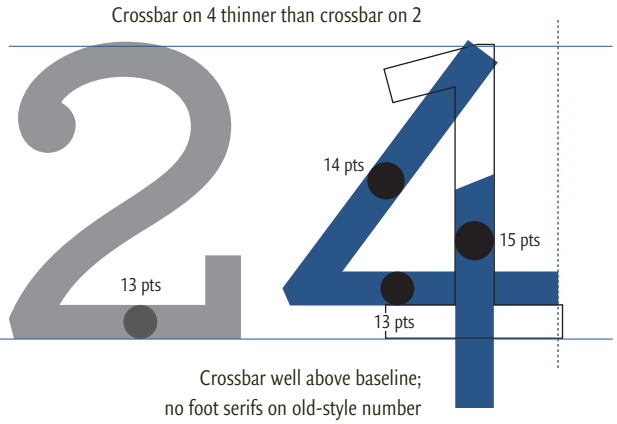


Crossbar slightly above baseline;
crossbar on 4 thinner than crossbar on 2

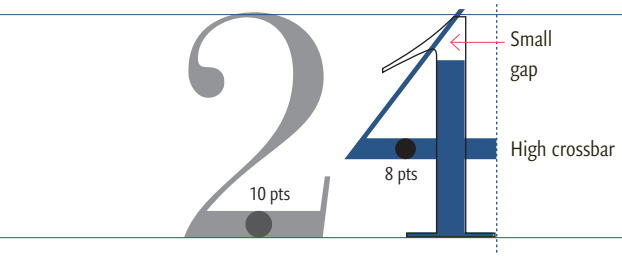


Archer
(Medium)

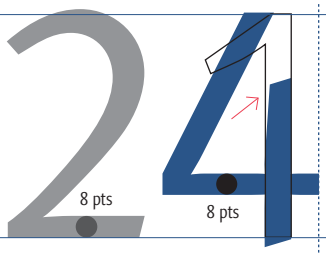
Asymmetrical serifs



Crossbar well above baseline;
no foot serifs on old-style number

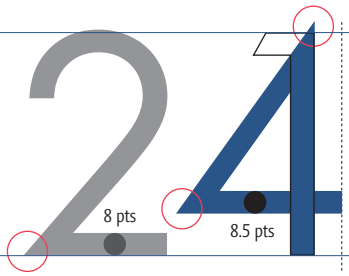


Bauer Bodoni
(Roman)



FF Meta
(Normal)

Tapered vertical stem



Futura PT
(Book)

Sharp joins

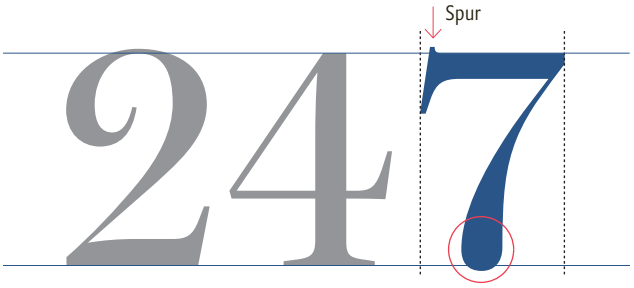
Number 7

The key design issue for the seven is physical balance—the stem must be shaped to support the heavy horizontal top. There are two main structures: 1) positioning the stem in the optical center of the glyph (as in Harriet) or 2) extending the stem to the far left (as in Futura).

In most serif typefaces, the crossbar of the seven is drawn as a heavy horizontal, and the diagonal as a thin-to-thick stroke. In sans serif designs, the horizontal is sometimes drawn with the thin weight while the diagonal is heavy (see Mallory and Interstate).

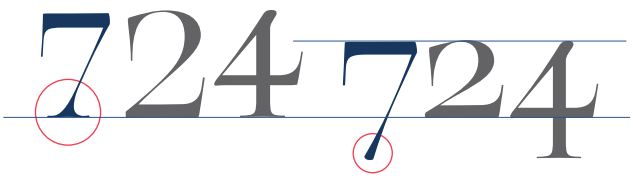
Because of its wide open sides, the seven can appear too light in comparison to the other numbers. We can add mass by subtly thickening the crossbar and/or flaring the stem stroke at the base; the addition of serifs and/or terminals can also increase density.

Typically the upper- and lowercase seven share the same basic structure, but the lowercase version descends. However, if the old-style figure is substantially shorter than the lining figure, it may be necessary to either change the serif/terminal placements, or otherwise modify the design to fit within the allotted space.



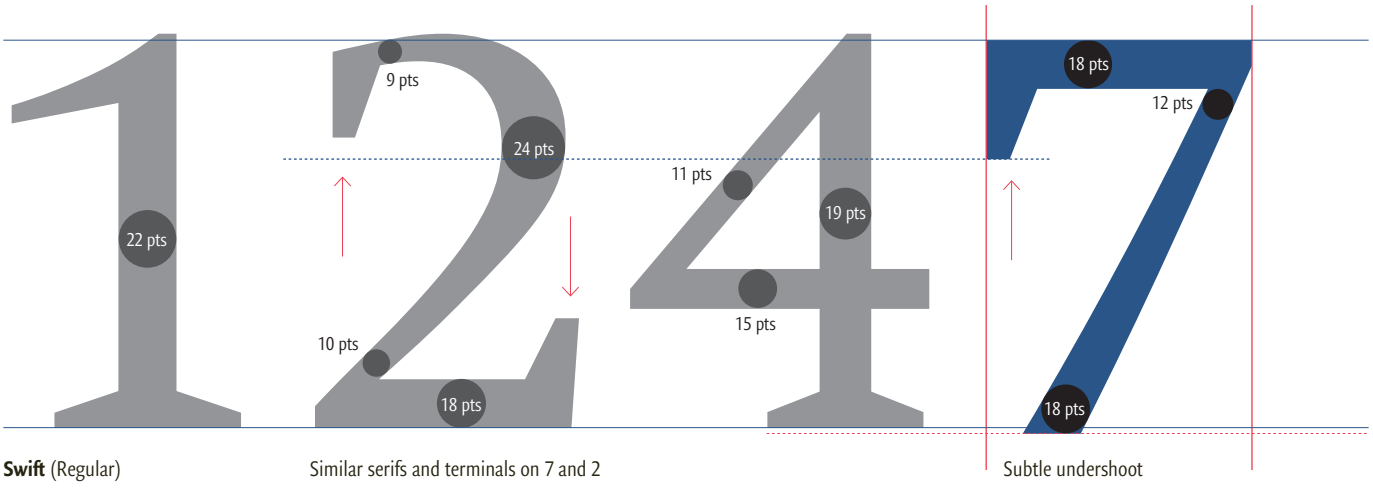
Harriet Display (Regular) Flared and rounded stem ending

Clarendon (Roman) Curved horizontals on 7 and 2

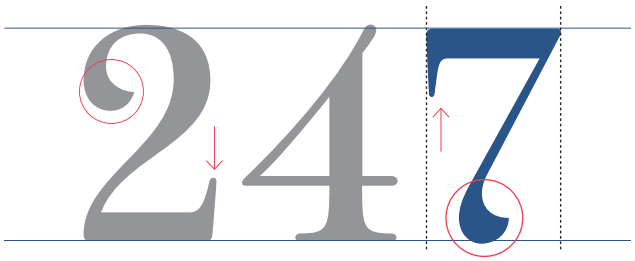


Above, Ogg (Medium). The lining seven has a foot serif, but the old-style figure ends with a terminal.

Questa Grande (Bold) Unusual horizontal serif

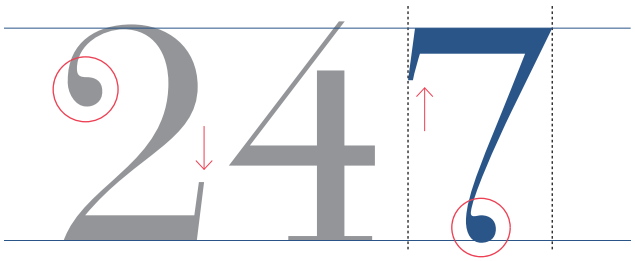


Swift (Regular) Similar serifs and terminals on 7 and 2 Subtle undershoot



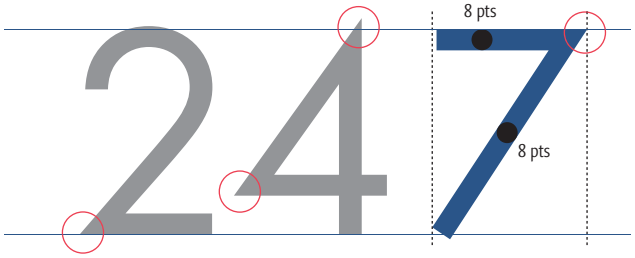
Feijoa Display (Regular)

Similar serifs and terminals on 7 and 2



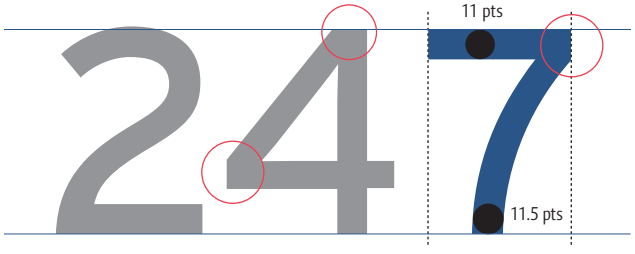
Bauer Bodoni (Roman)

Similar serifs and terminals on 7 and 2



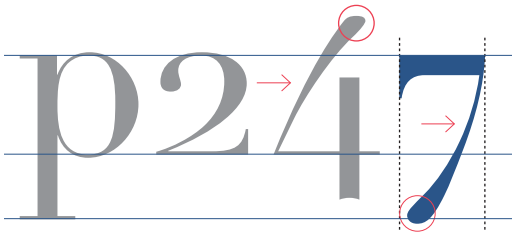
Futura PT (Book)

Consistent pointed joins;
diagonal = horizontal



Interstate (Regular)

Consistent wide joins; diagonal heavier
than horizontal at the base



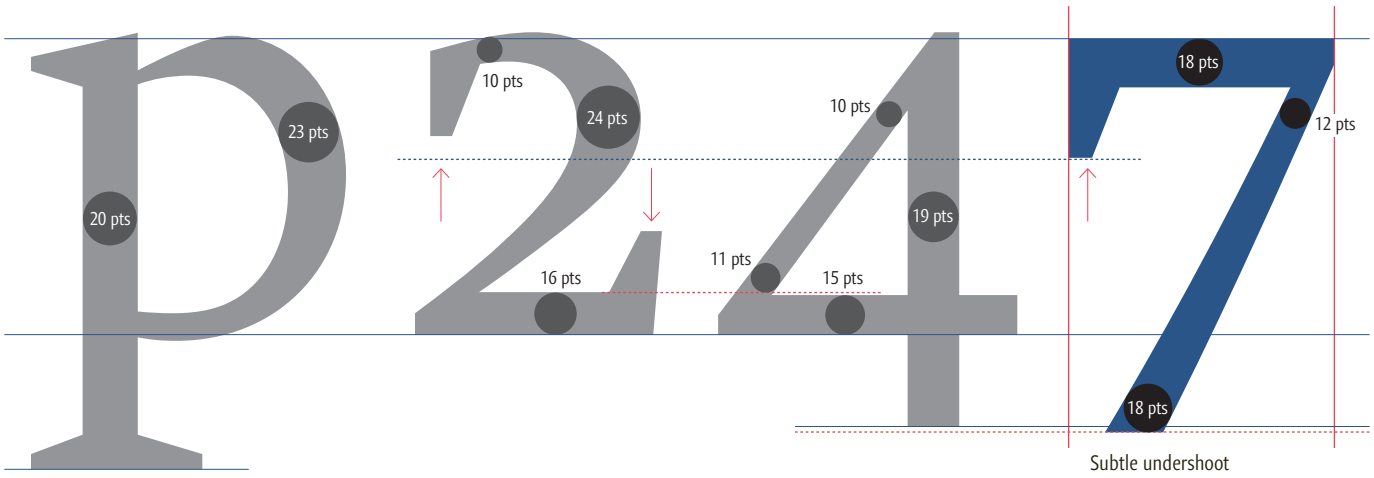
Didot LT (Roman)

Unusual convex stem (relates to curved four)

Mallory (Medium)

Angular stem endings;
diagonal heavier than horizontal

The horizontal stroke of the 7 is heavier than those on the 2 and 4



Subtle undershoot

Numbers 6 and 9

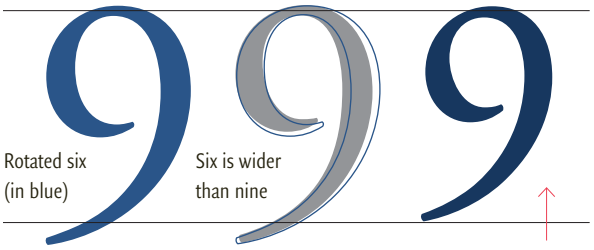
The six and the nine are sometimes drawn as identical, inverted forms, especially in the upper case. However, because the lower half of a number should be larger than the upper half, designers sometimes make bowl of the six larger than the bowl of the nine. However, this is not a hard and fast rule; the bowl of the nine is sometimes enlarged (as in Mallory) to create a cheerful and robust (albeit top-heavy) form.

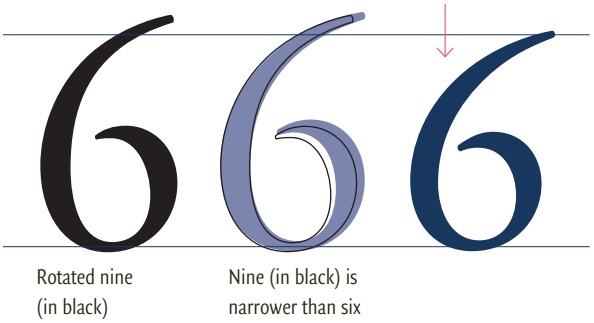
In the old style figures, as in the combination letters b, d, p, and q (see page 136), the bowls of the six and the nine are not identical to the zero. The bowls of both numbers are smaller to leave room for the upper and lower stems. Additionally (again, as in the combination letters) the weight in the bowls may shift to have more oblique emphasis.

Furthermore, as discussed in the P, R, and K (see pp. 92, 122) the bowls of the six and nine can be disconnected. Practically speaking, disconnection prevents the clogging at the join. However, disconnection can be a visual stylistic feature as well (of course, the disconnection should occur throughout the typeface, not just in these two numbers).

The stems of the six and nine counterbalance and prevent the bowls from visually "falling over." Generally speaking, humanist typefaces have figures with dynamic balance; the stems of the six and nine are often drawn as diagonal arcs. In contrast, rational types usually have static and fairly enclosed forms, with arcs that are symmetrical with vertical stress. As discussed previously (for the two, three and five) the aperture of all figures should be consistent with letters.

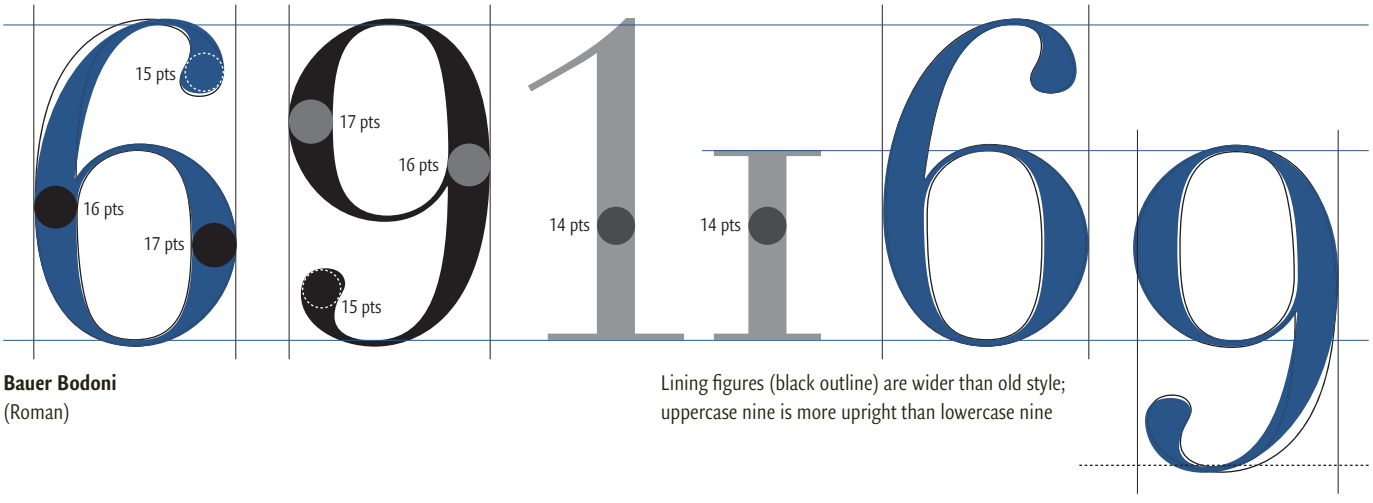
In serif designs, the stems of the six and nine can be pointed or finished with a circular terminals. In sans serifs, stems should be cut at an angle that relates to other stroke endings in both the figures and letters of the typeface.





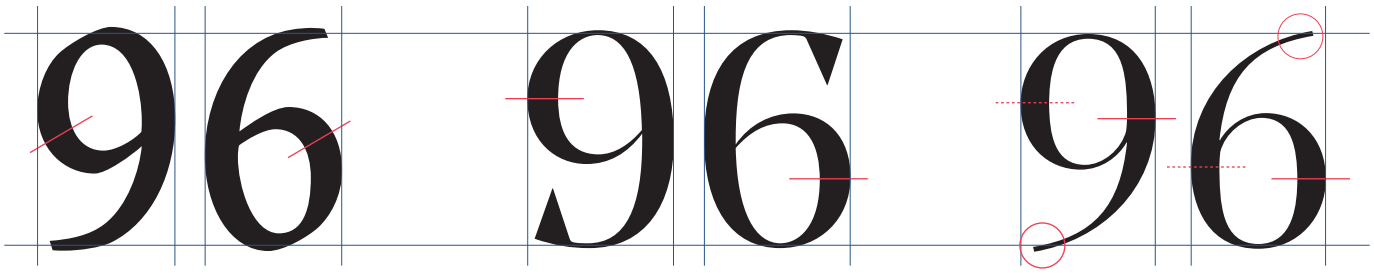
Adobe Garamond (Regular) shown above and below.
Disconnected bowls taper to rounded points.

Nine (rotated, in black outline) is more upright than six



Bauer Bodoni
(Roman)

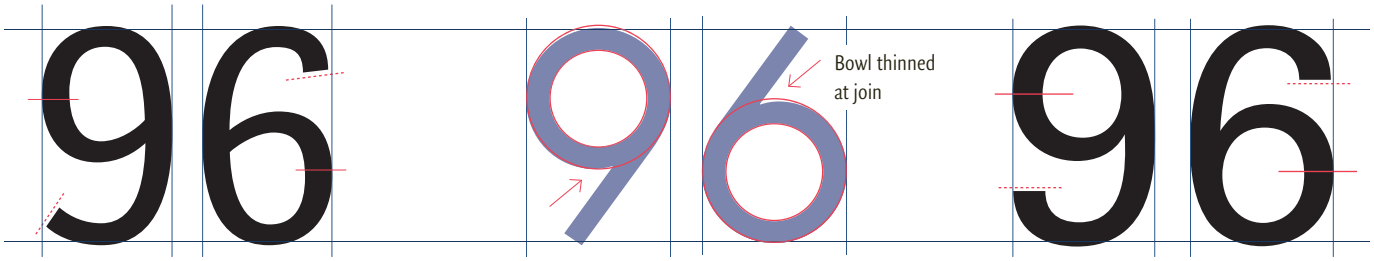
Lining figures (black outline) are wider than old style;
uppercase nine is more upright than lowercase nine



Maiola (Book) Calligraphic bowl shapes

Noe Display (Regular) Teardrop counters

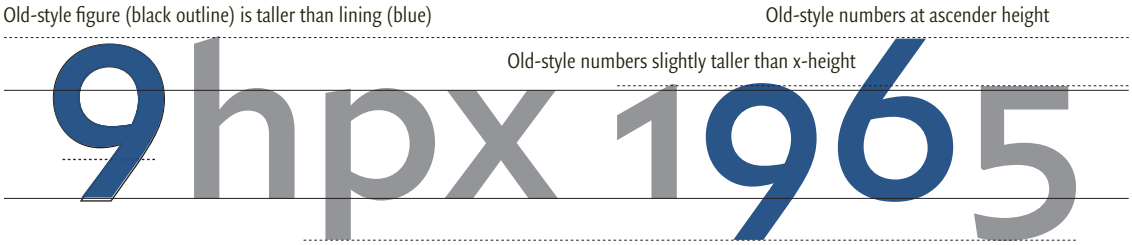
Bauer Bodoni (Roman) Hairline endings

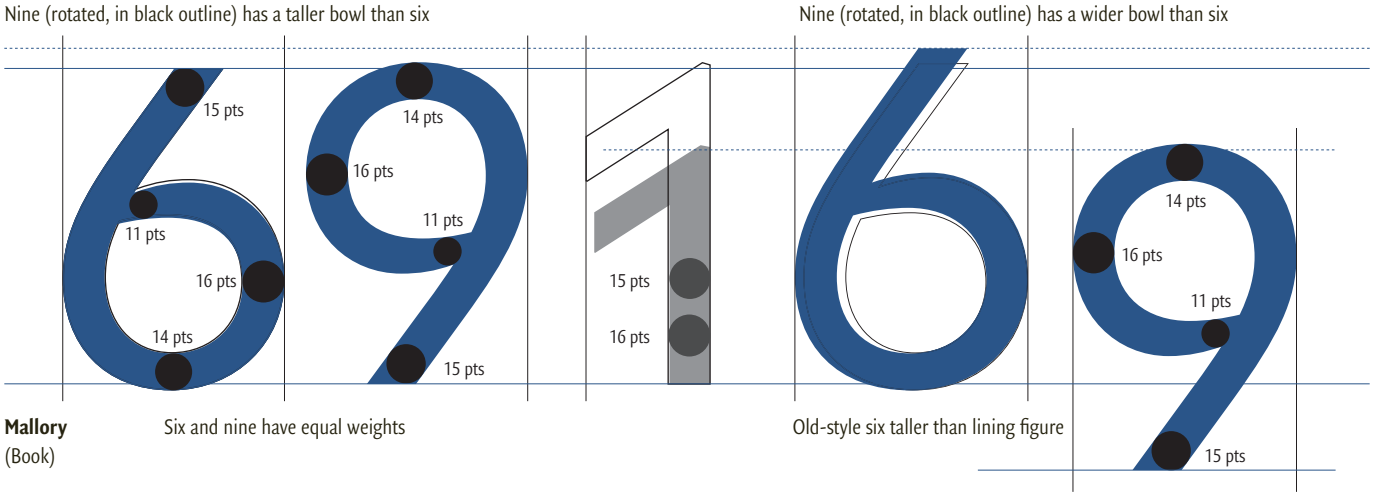


Adelle (Regular) Tight aperture; diagonal cuts

Futura PT (Book) Six counter = circle; bowl and counter of nine is more horizontal

Univers (55-Roman) Oval counters; horizontal cuts





Mallory (Book) Six and nine have equal weights

Old-style six taller than lining figure

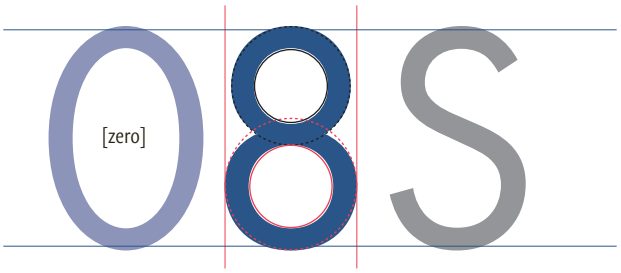
Number 8

There are two main design variations for the figure eight: a structure made from two stacked ovals, or an s-shaped curve bound by supporting arcs. The symmetry of the first form suits the rationality and vertical stress of sans serif fonts; the second form is more traditional and therefore more common in typefaces with humanist or calligraphic influences.

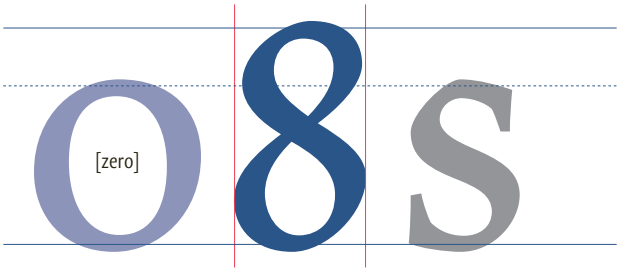
In the traditional s-shape form of the eight, the maximum weight usually occurs in the center of the spine. The resulting asymmetrical form is, in the opinion of many designers, the most graceful solution. The elegance derives in large part from the delicate teardrop shapes of the number counters; they have a unique quality of animated repose.

Note that the supporting curves of the traditional eight may be disconnected from the main spine or staggered, as in the letter X (see p. 108). Offsetting these arcs makes the overall figure wider and emphasizes the teardrop shapes of the counters. The degree of offset varies: It may be subtle (just enough to give the illusion of a continuous stroke) or dramatic (with the offset intended as an obvious design feature).

In some serif typefaces, the weights in the traditional s-shape of the eight are reversed, forming an unusual figure with a "wasp waist." In this variation, the spine becomes a thin stroke, and weight moves to the corners of the bowls. This form of the eight is useful in bold or condensed typefaces, since it is substantially lighter and more open in the center.

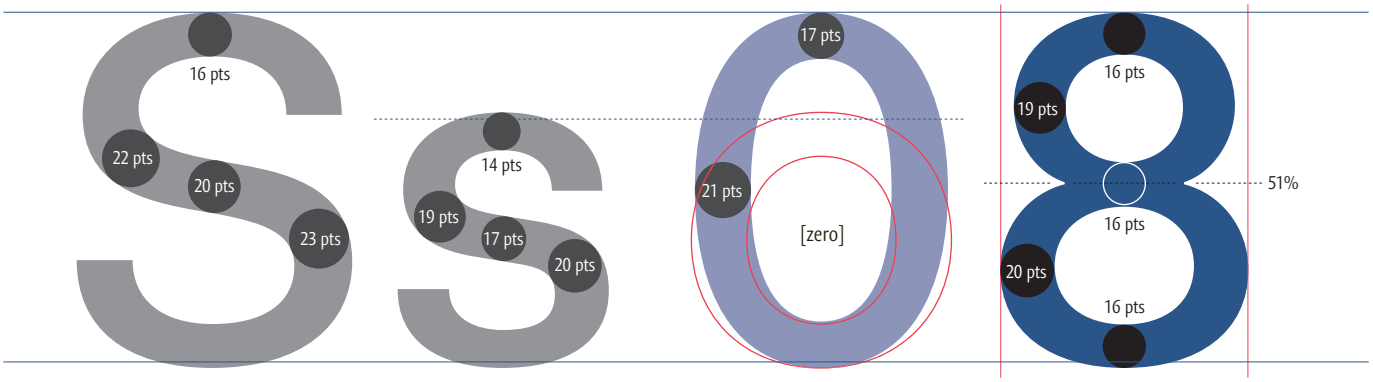


Futura PT (Book) Eight based on geometric circles



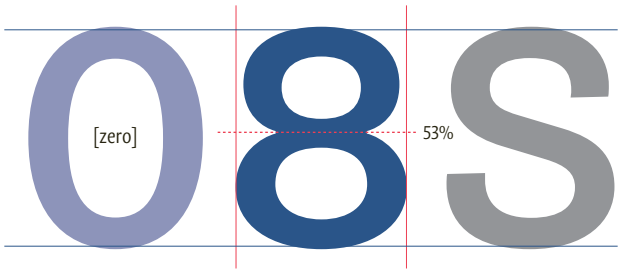
Maiola (Book) Calligraphic form; strokes subtly offset

Feijoa (shown above) has an interesting and unusual disconnected 8 that is clearly related to the S/s.

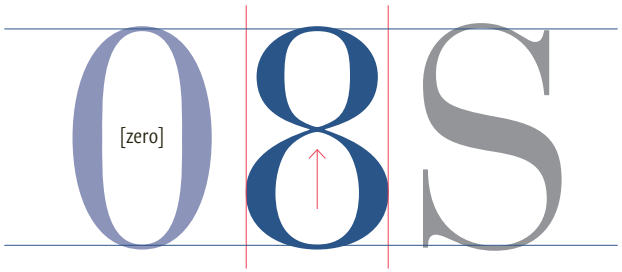


Fakt (Medium)

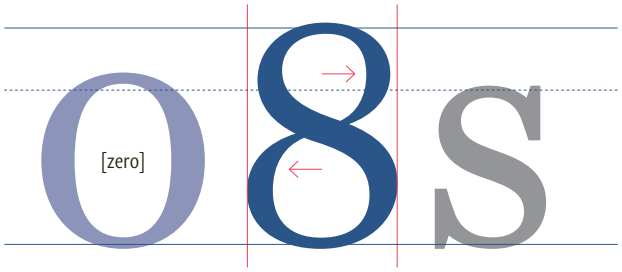
The same eight is used for both lining and old-style figures.



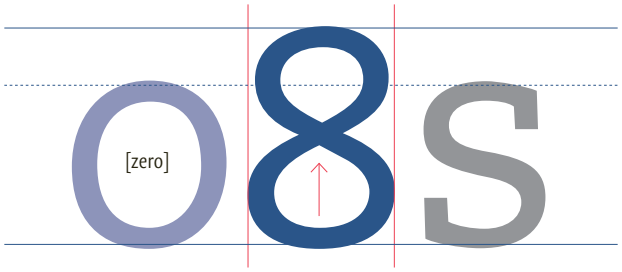
Supria Sans (Medium) Wide stacked form



Bauer Bodoni (Roman) Thin waist



Harriet Text (Regular) Offset strokes

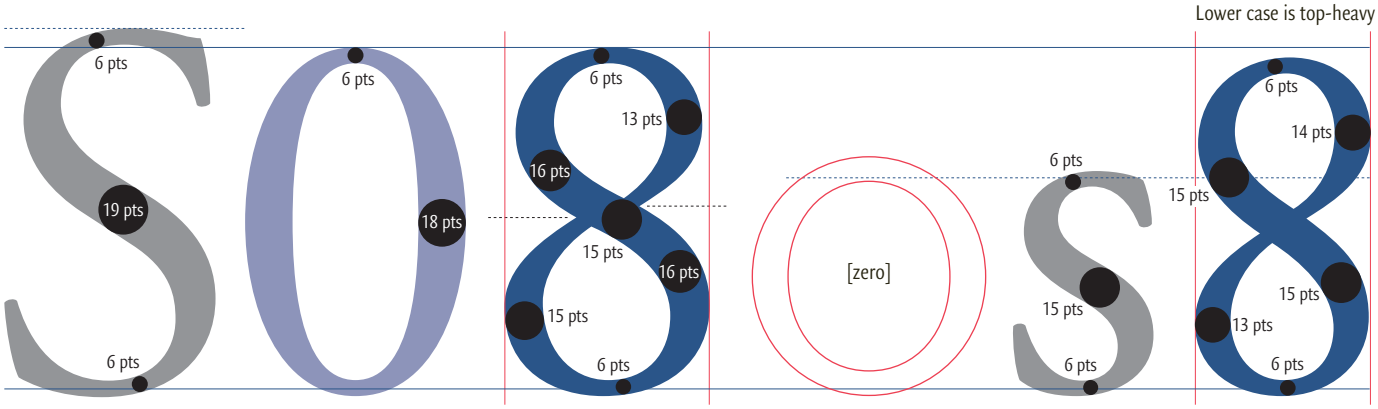


PMN Caecilia (55-Roman) Thin waist

The lining figure (black outline) is slightly taller than the old style.

Above, Freight Sans. The form of the eight is related to the S/s.

Lower case is top-heavy



Adobe Garamond (Regular)

The uppercase figure (above left) is heavier and taller than the lowercase figure (above right)

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7

PUNCTUATION

The Evolution of Punctuation

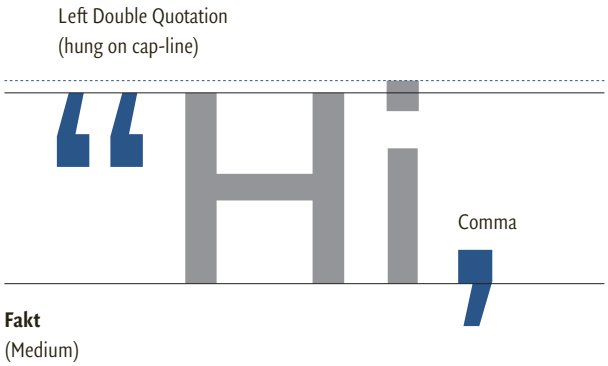
The punctuation that we use today is a relatively new and complex system. The earliest form of punctuation was invented by the Greek scholar and playwright Aristophanes (448–385 BCE). Aristophanes used a single dot to indicate different vocal pauses. The distinctio (a dot at the capital-height) marked the longest break, while the media distinctio (a centered dot) marked the shortest. The sub-distinctio (a dot at the baseline) indicated an intermediate rest.

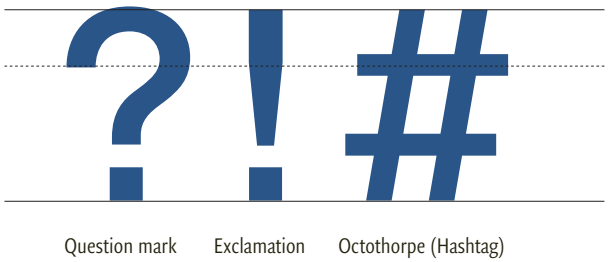
Sadly, Aristophanes' method was not widely embraced during his lifetime. The use of punctuation dots was not common until the seventh century CE, well after the fall of the Roman Empire. While advances in punctuation seem unlikely during the Middle Ages (an era infamous for its intellectual apathy and overall lack of literacy), Charlemagne, King of the Franks from 768 and Holy Roman Emperor from 800 to 814, spearheaded a revival of learning known as the Carolingian Renaissance. Charlemagne's minister of education, the English deacon and scholar Alcuin of York, promoted stricter standards in writing and punctuation. Alcuin (like Aristophanes) also advocated the use of a baseline dot (called the comma) to indicate a short pause; a middle dot (called the colon) for a medium pause; and a high dot (called the periodos) for the longest break.

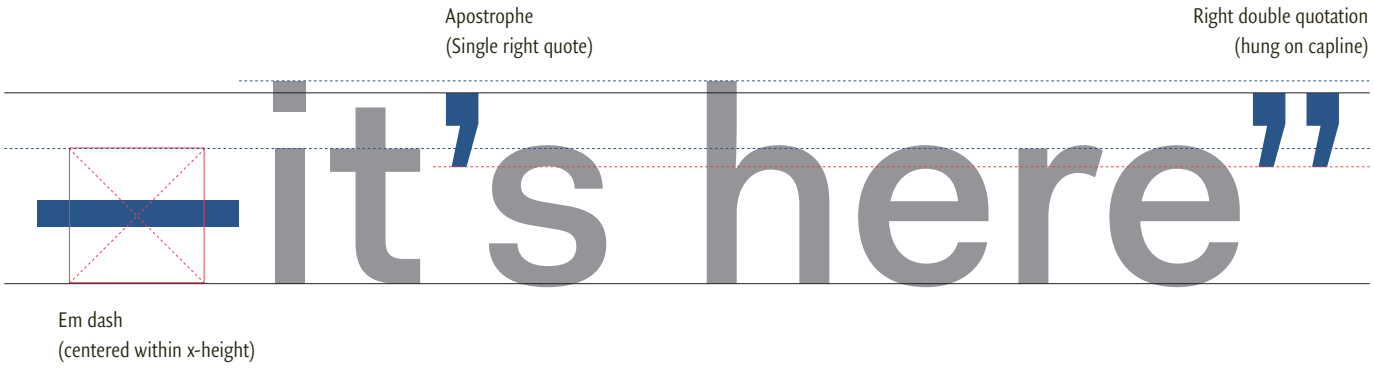
The next major advancement in punctuation occurred more than seven centuries later, through the work of the Renaissance typographer and printer Aldus Manutius. Manutius introduced new forms of punctuation: He used a diagonal slash (called the virgule) for the comma, and he invented both the double-dot colon and the semicolon. Aldus also wrote and published a groundbreaking punctuation handbook, *Interpungendi Ratio*. This work was remarkable in that punctuation was, for the first time, defined syntactically—as a support for grammatical structure rather than a guide to elocution. A colon was used to end sentences, and the period was used to end paragraphs. The semicolon was used in three ways: as a true semicolon (to separate independent but related clauses); as a modern period (ending sentences); and as a comma.

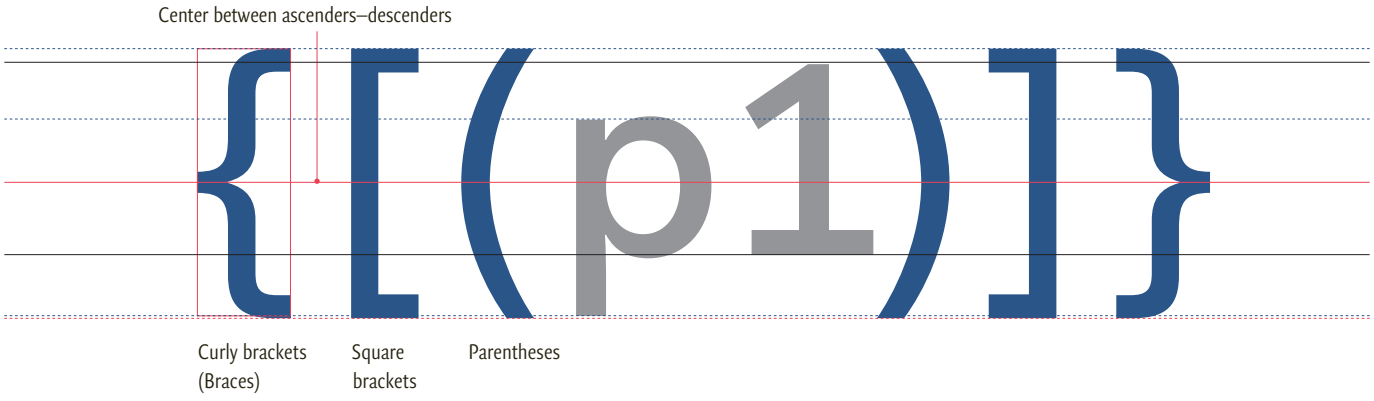
After Manutius, printers continued to bear the primary responsibility for defining punctuation—both its form and function. In the sixteenth, seventeenth, and eighteenth centuries, the question mark, the exclamation point, quotation marks, dashes, and apostrophes appeared. The virgule was discarded for being too similar to the lowercase l, and the modern comma was established. The invention of printing was critical to the standardization of punctuation. Printing established norms through the demonstration and dissemination of a consistent pattern of use.

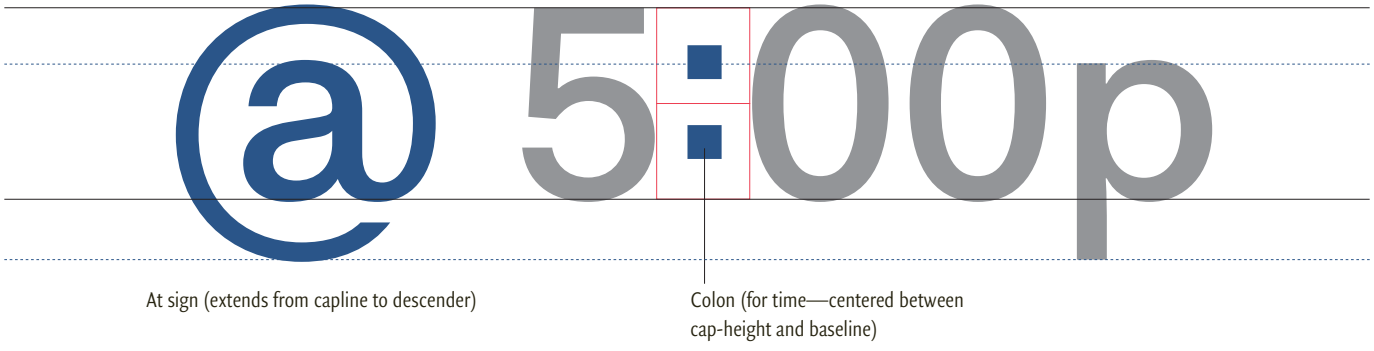
Today, punctuation, like language itself, continues to evolve. In the most recent typographic standards, there are over two dozen forms of punctuation—and specific marks, such as the hashtag, continue to be modified for new purposes. Still, however novel the shape of punctuation becomes, its primary purpose remains the same: to organize and clarify thought.






Apostrophe
(Single right quote)
Right double quotation
(hung on capline)
it’s here”
Em dash
(centered within x-height)


Center between ascenders–descenders
{[(p1)]}
Curly brackets
(Braces)
Square
brackets
Parentheses


@ 5:00p
At sign (extends from capline to descender)
Colon (for time—centered between
cap-height and baseline)

Period, Comma, Colon and Semicolon

Despite their simplicity, these four glyphs can have significant impact on the personality of a typeface. Ideally, their shapes complement and reinforce the overall design. Typically, the period has the same shape as the dot of the i. In a text face, the period is slightly larger than the dot to ensure visibility at small size. In a display face, the period can be slightly smaller, since display types are usually set large. If in doubt, better to err by making these marks bigger rather than smaller, since the difference between a comma and a period can be relatively subtle.

The head of the comma is normally identical to the period, but it can be sculpted to add visual interest. Modification to the head often impacts the transition to the tail; this transition can be gradual or abrupt. The comma's tail also has its options: It may be curved or angular, and it may terminate in a sharp or a blunted point. In general, the height of the comma is about two periods tall (it may be slightly more or less, depending on the overall design).

Once the period and comma are designed, the colon and semicolon can be constructed. The higher period is placed at or near the x-height, and the lower period or comma is centered below. If the result is too dark, either component can be subtly reduced in size. A well-crafted font should include an alternate colon optimized for use with capitals and lining figures. When supported by software (such as Adobe Creative Cloud), the OpenType font format allows the alternates to automatically substitute in the correct context.

Title : Subtitle 12:30

Title : Subtitle 12:30

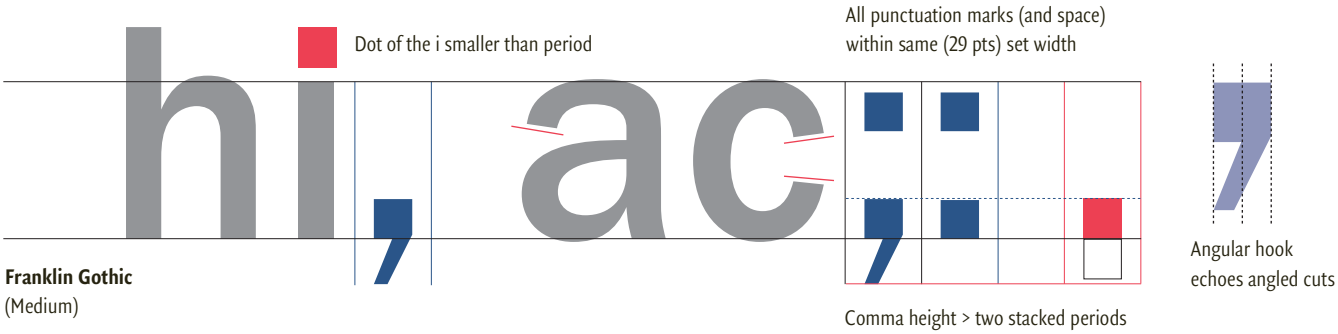
Fakt (Medium) with the incorrect colon for 12:30 (top).
The lower line shows the correct typesetting.

hi, ac;:

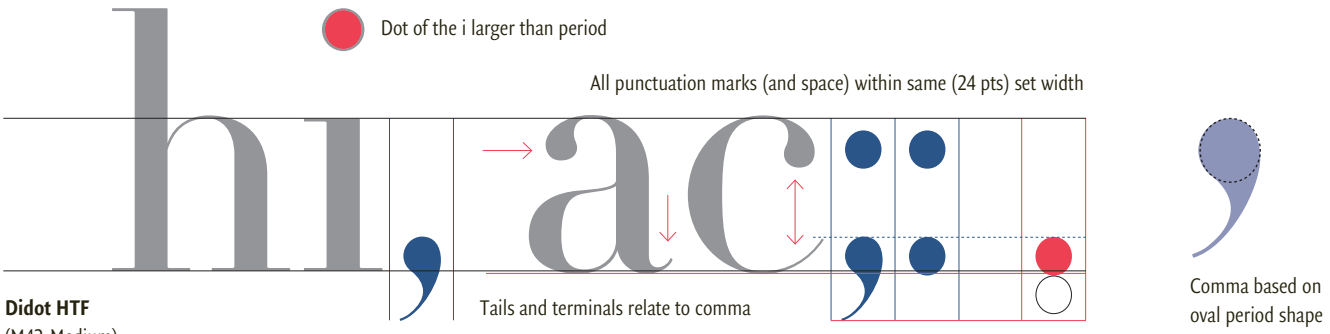
hi, ac;:

hi, ac;:

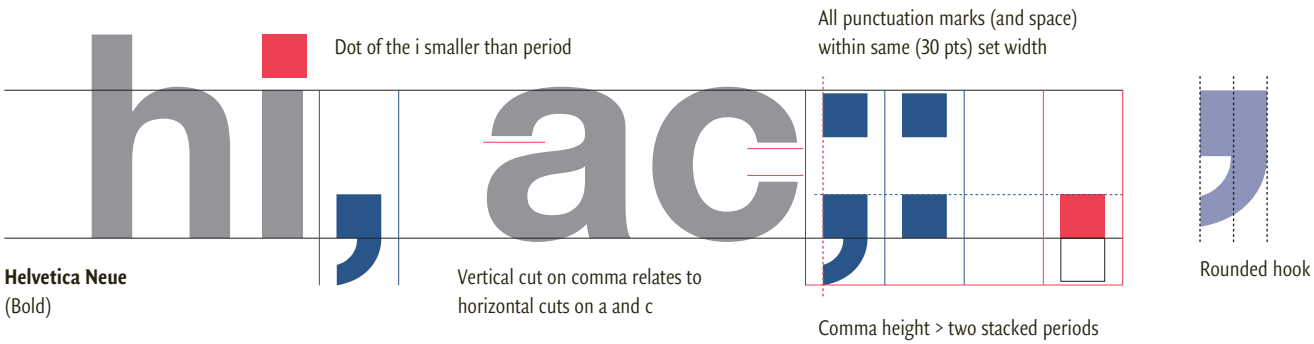
Covik Sans (Regular), Questa Grande (Bold), and Omnes (Medium).
Unusual commas reflect the terminals and shapes in the letters.



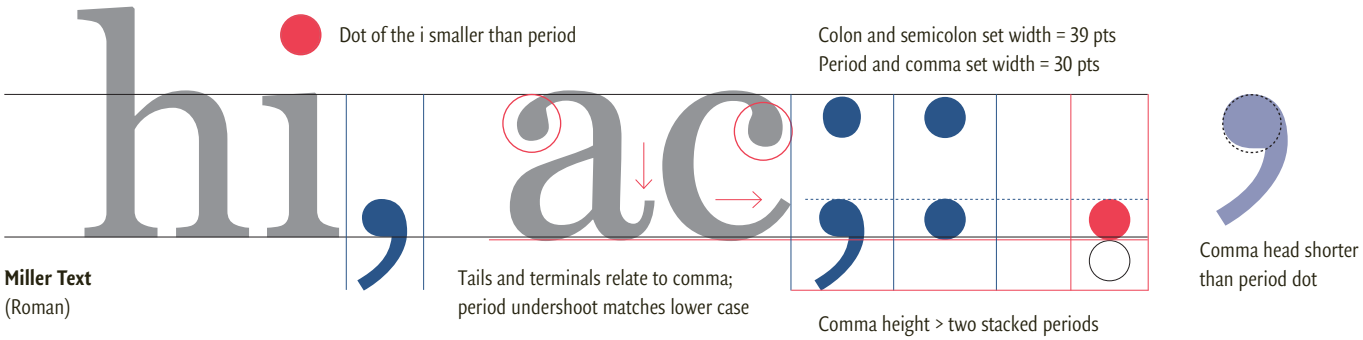
Franklin Gothic
(Medium)



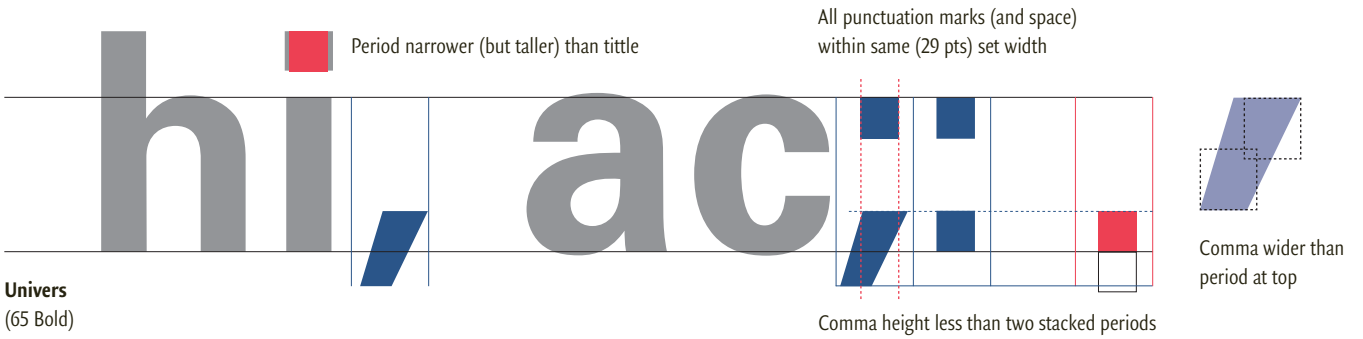
Didot HTF
(M42-Medium)



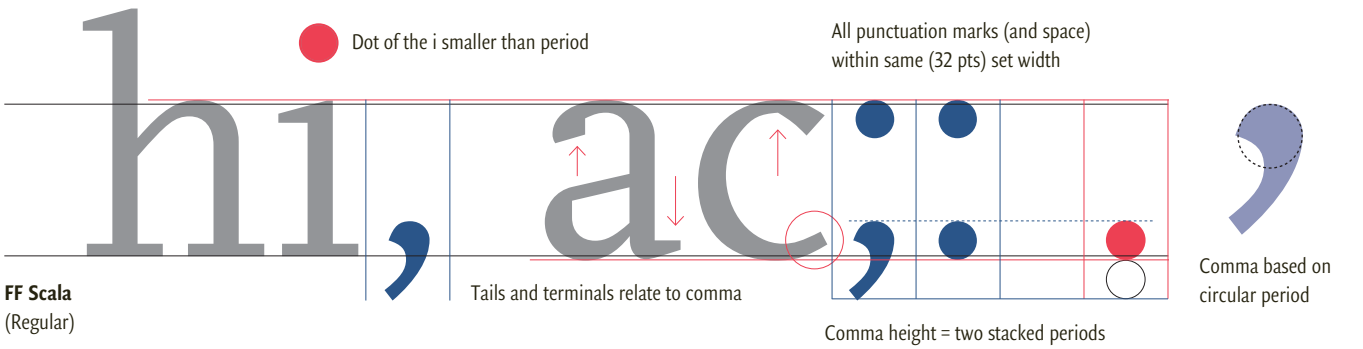
Helvetica Neue
(Bold)



Miller Text
(Roman)



Univers
(65 Bold)



FF Scala
(Regular)

Quotation Marks and Apostrophe

The single quote usually has the same basic form as the comma. However, a quote is often drawn smaller to facilitate letterspacing. A thinner quote can be set tighter (this is helpful in contractions) and avoids collisions with overhead accents. The normal configuration is “6” for the opening, and “9” for the closing. The apostrophe is the same character as the right single quote (the “9”).

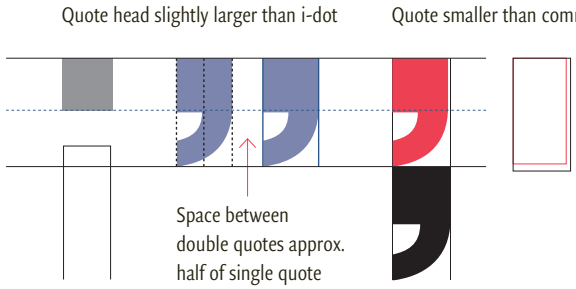
The double quotation mark is actually older than the single quote. The original mark was called the “double comma” and was used to distinguish sentences of special importance. In the early years of letterpress printing, the double comma was made by literally shifting and rotating pairs of commas. A true quotation mark (cast on a single metal body) may not have existed until Bodoni’s time (the late 1700s). For foundries, it may have been an issue of economy rather than style—it was cheaper and easier to make do with double commas, especially because the type cases of the time did not always have a slot for this extra character.

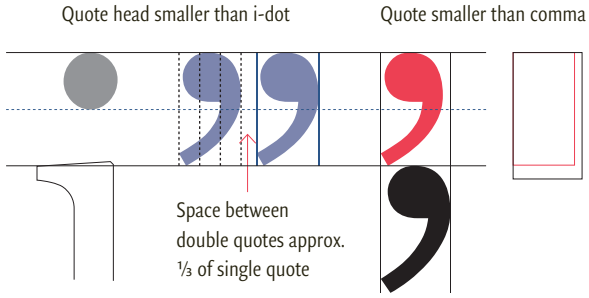
Although digital typesetting now provides a specific key and code point for double quotations, the form remains the same: a pair of commas. As in the single quotes, the glyph can be adjusted for better spacing—and the normal configuration is still “66” and “99” (although there are top-heavy “droopy quotes”).

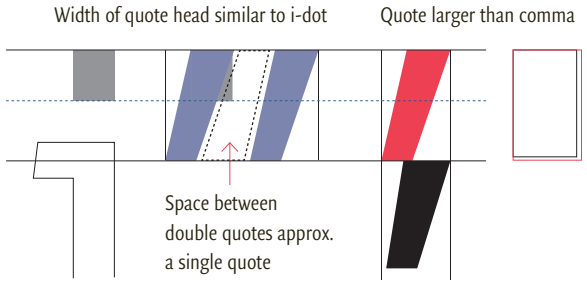
Single quotes, double quotes, and the apostrophe are hung at either the capline or the ascender line, whichever is higher. These glyphs do require overshoot for optical alignment.

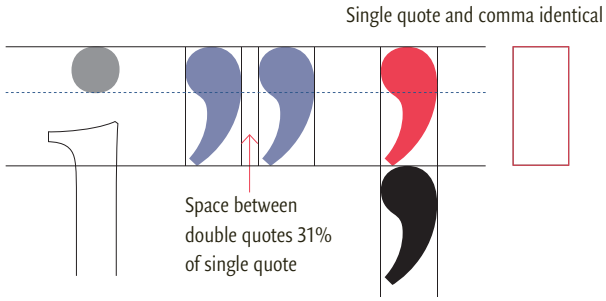
Note that the single quote and double quotation mark should not be confused with the prime or double prime (which indicate feet and inches) or worse, the acute or double acute (which are diacritics). True quotation marks show direction and enclosure, and are therefore called curly quotes, book quotes, and smart quotes (the latter after the “intelligent software” that automatically sets punctuation according to context).

Type designers should realize that quoting standards do vary considerably around the globe. In some languages, the first quote is the “99” character, and it is placed on the baseline rather than the capline. In French and Italian, angle quotes are the norm; these are also called chevrons, duck’s feet, French quotes, and guillemets (after the French inventor and punchcutter Guillaume Le Bé). Also, the British standard uses single quotes whereas the Americans use double. Additionally, there is an European convention where quotation marks can be dispensed with altogether. Instead, speech is indicated by an em dash—an elegant, minimalist solution.



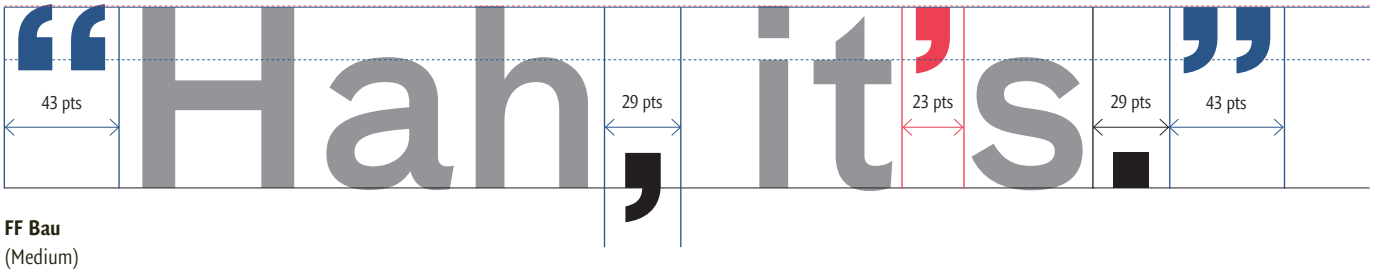






Quotes hung at cap-height

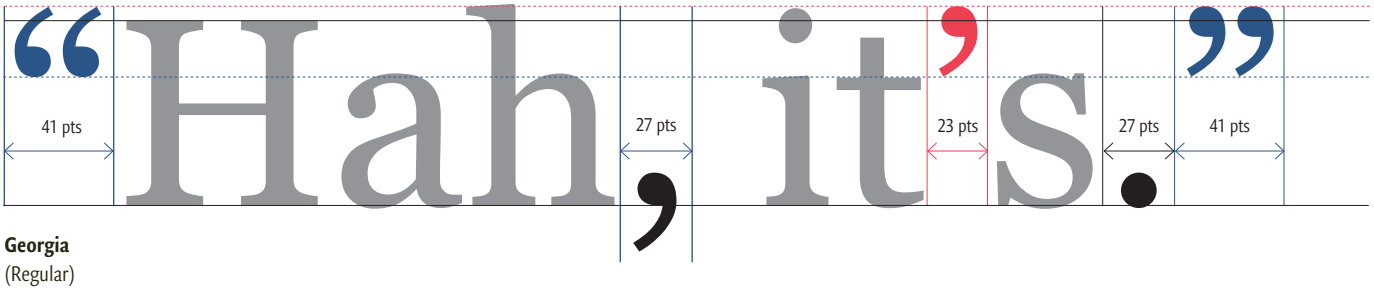
Single quote has narrower set width than comma



FF Bau
(Medium)

Quotes hung at ascender line

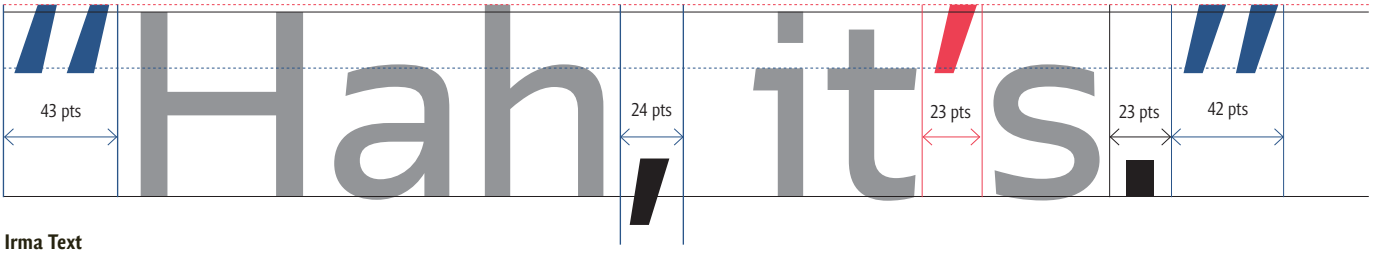
Single quote has narrower set width than comma



Georgia
(Regular)

Quotes hung at ascender line

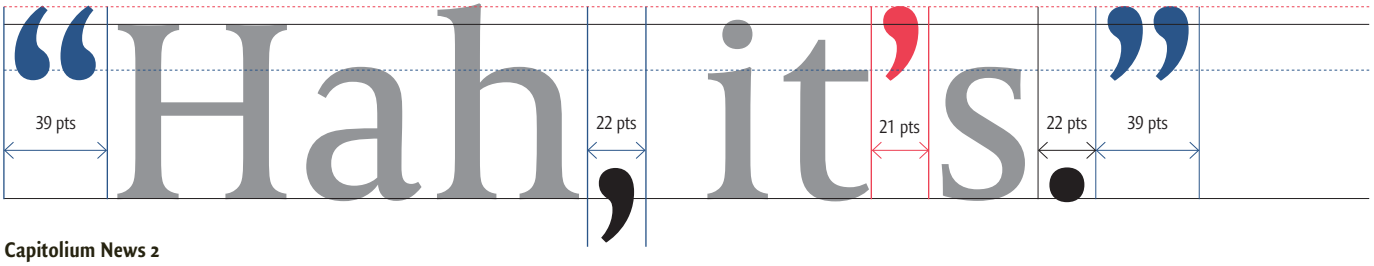
Closing quote slightly narrower than opening quote



Irma Text
(Medium)

Quotes hung at ascender line

Comma and quote are identical, but quote has narrower set width



Capitolium News 2
(Regular)

Question and Exclamation Marks

The question and exclamation marks are recent inventions in punctuation; the former originated in the sixteenth century, while the latter evolved in the seventeenth and eighteenth centuries. Both marks stem from Latin terms: the question from quaestio (to ask), and the exclamation from io (joy). The question mark was originally written as a Q over an o, and the exclamation was an uppercase I written over an o. After centuries of this practice, both ligatures gradually evolved into the modern forms we use today.

The exclamation point has two parts. The upper portion is usually a vertical stroke that tapers from the maximum bowl width to a sharp or blunted point, but there are alternate designs (including straight and elliptical variations). The top of the exclamation mark may be flat, rounded, or angled to match the other endings or terminals in a typeface.

The width of the question mark is roughly half of the capital O. There are two main forms: the shape of an upside-down S (the designer Nick Shinn calls this variation the "furled form") and the form of an open hook. The furled form has a tighter aperture, with the maximum weight in the spine (as in the S/s).

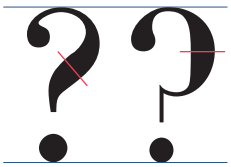
The shape of the hook is often similar to the bowl of the two. The hook may end in either a straight vertical or a diagonal (which can also be curled). The maximum weight can be in the vertical center (at 3 o'clock), at an angle (at 2 o'clock), or moved into the spine. Placing the weight at 3 o'clock is most common in typefaces with an upright axis; typefaces with oblique stress usually have asymmetrical bowls or weighted spines.

In a serif typeface, the top of the hook may be finished with a serif or terminal. The lower half of the hook can be structured to match the exclamation point (as in Swift), but the hook can also curve or flare at different angles (as in Bliss).

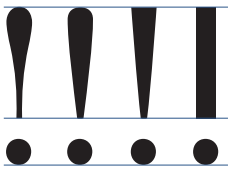
When the stem of the question mark is straight, it is usually centered directly over the dot, so that the hook of the question mark is offset to the right. When the stem of the question mark is curved, the dot is more often aligned to the visual center.

The dot is often the same size as the period, but it can be reduced for lighter color when necessary. The space above the dot ranges between a half and a full period width. The gap is often larger in the exclamation point than in the question mark, since the vertical form of the exclamation tends to optically merge.

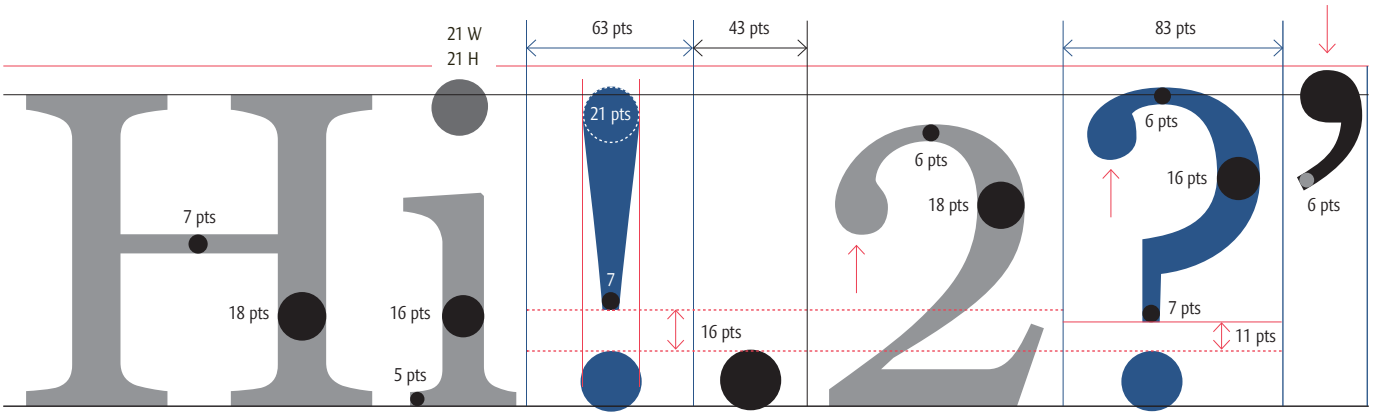
In general, the question mark and exclamation point are optically aligned to the cap-height (even when ascenders are taller than capitals). As always, rounded forms (the hook of the question mark, and rounded exclamation points) require overshoot, but square forms can rest on the baseline and capline.



Left, Bodoni. The furled form, weight in the diagonal spine.
Right, Didot. The hook form, with weight in the center of the bowl.



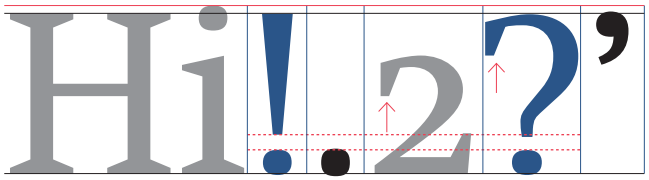
Four exclamation stem variations.
The top and sides may be rounded, tapered, or straight.



Miller Text
(Roman)

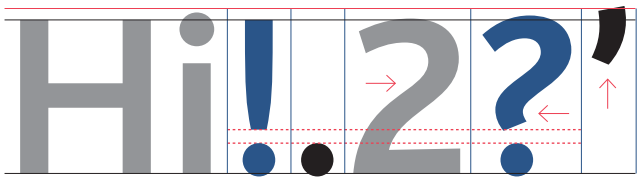
Similar ball shapes
on the 2, ?, and quote

Similar serifs on 2 and ?



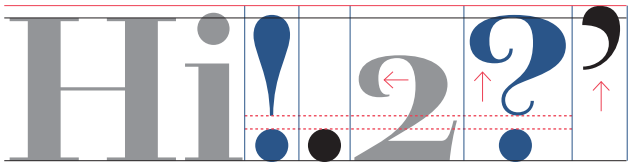
Swift
(Regular)

Period > Exclamation dot



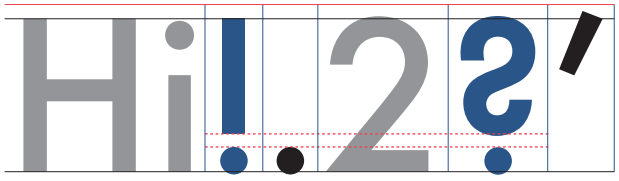
Bliss
(Bold)

Similar shapes on 2, ?, and quote



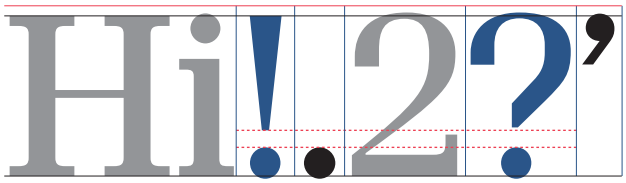
Questa Grande
(Bold)

Similar shapes on the 2, ?, and quote



Futura PT
(Medium)

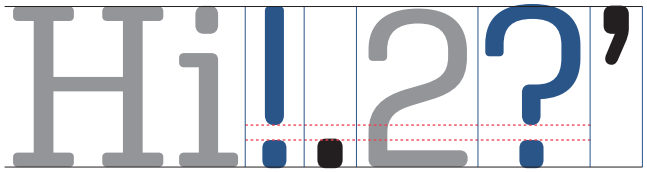
Unique S-shaped question mark



Algebra Display No. 2
(Regular)

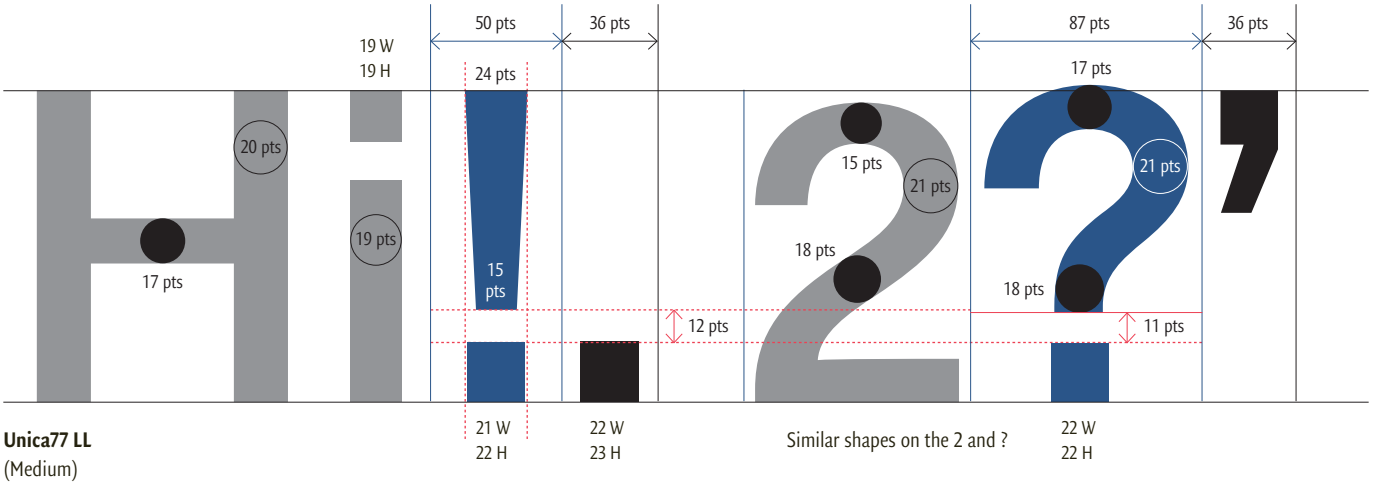
Stemless question mark

Squarish question mark



Aglet Slab
(Regular)

Period > Exclamation dot



Unica77 LL
(Medium)

Similar shapes on the 2 and ?

Hyphen and En/Em Dashes

Historically, the widths of the hyphen and dashes are fractions of an em. An em is a unit equal to the point size; for example, an em in a 16-point typeface is 16 points wide. The hyphen is a quarter em, the en dash is half an em, and the em dash is (of course) a full em. In the official Unicode standards, this is still noted as the preferred design[1] (see Sabon, which follows these guidelines).

However, type is set tighter today than in the past, and therefore many designers adjust these glyphs to be shorter, especially in sans-serif typefaces. In general, the hyphen is roughly the width of the lowercase i, but this varies. The goal is to make the hyphen long enough to clearly join or separate words, but not so long that it can be confused with an en dash. In humanist designs, the hyphen may show calligraphic influence; it may be subtly shaped, curved, or angular, as in Quadraat, shown below:

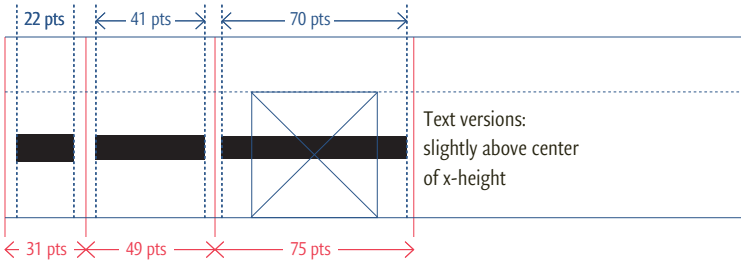
The en and em measures were so named because traditionally, the capital N and M fit within these spaces. Some designers do use these letters to set widths for the en and em dashes. However, there are alternate methods, such as using the width of the capital H for the em dash, or making the em dash the same width as two tabular figures, so that the em dash can be substituted for decimals (e.g. 10.00 becomes 10—). In these cases, note that the en dash is still half the width of the em dash.

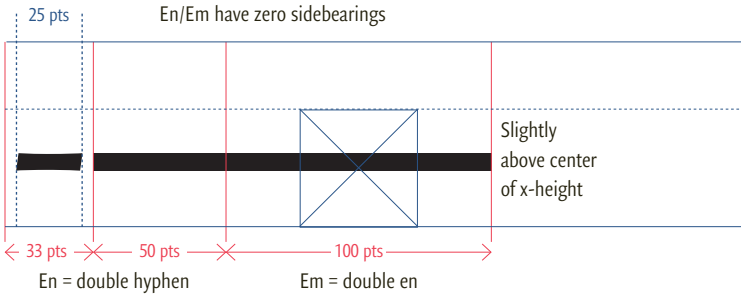
Usually, the default position for hyphens and dashes is to have them optically centered in text; this means they are centered on the x-height or slightly higher. Ideally, a font should include an alternate set positioned higher for use with capitals and lining figures. When supported by software (such as Adobe InDesign), the OpenType font format allows the correct alternate to automatically substitute in the appropriate context.

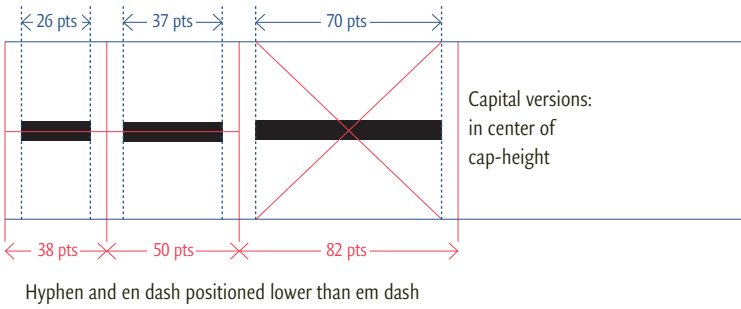
Historically, en and em dashes are set with zero sidebearings, so that they can be typed continuously to create solid lines. Without sidebearings, the typesetter needs to enter their own spaces before and after a dash. However, since en and em dashes are often shorter today, many designers do include narrow sidebearings in their dash characters (see Irma and Usual on these pages).

In *The Form of the Book* [1975], author and designer Jan Tschichold noted that dashes should be drawn with the weight of the crossbar on the lowercase e. However, in most typefaces (including his own typeface, Sabon) this rule is not followed. The hyphen is sometimes given more weight than the dashes, because, as a small character, it often needs more mass to be visible at small size.

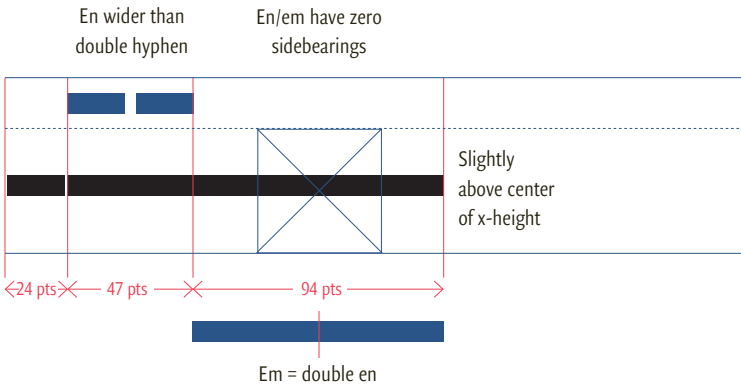
1 "Character Design Standards – Punctuation for Latin Typography," 19 Dec 2017, docs.microsoft.com/en-us/typography/develop/character-design-standards/punctuation#hyphens-horizontal-bars-and-dashes.

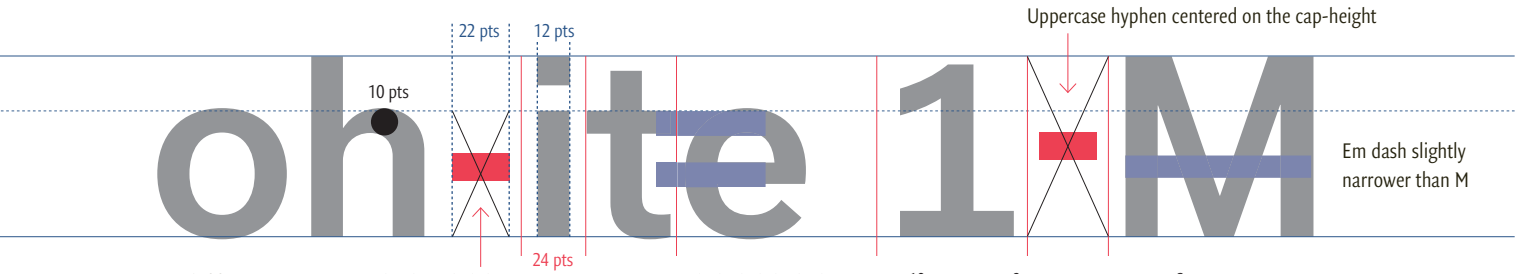






Hyphen and en dash positioned lower than em dash



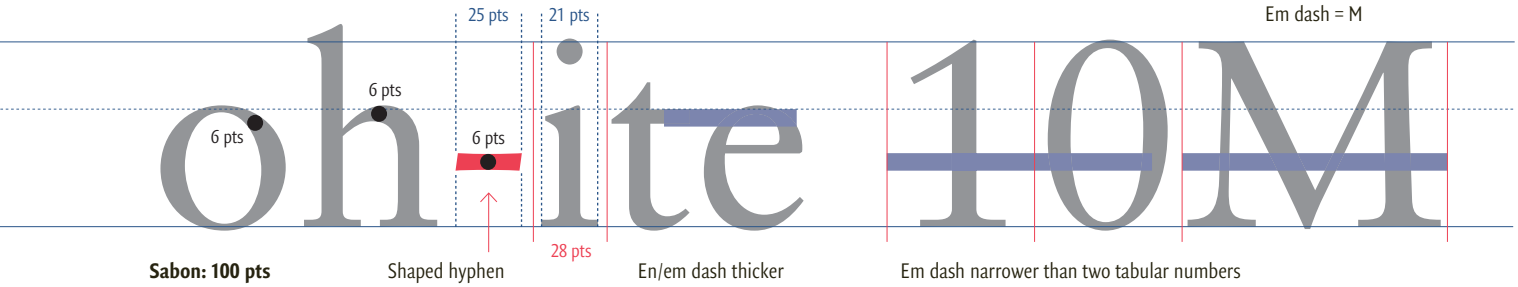


Usual: 88 pts
(Medium)

Text hyphen slightly above center of x-height

En/em dash slightly thicker than e and t crossbars

Hyphen and dash vary in weight



Sabon: 100 pts
(Roman)

Shaped hyphen

En/em dash thicker than e and t crossbars

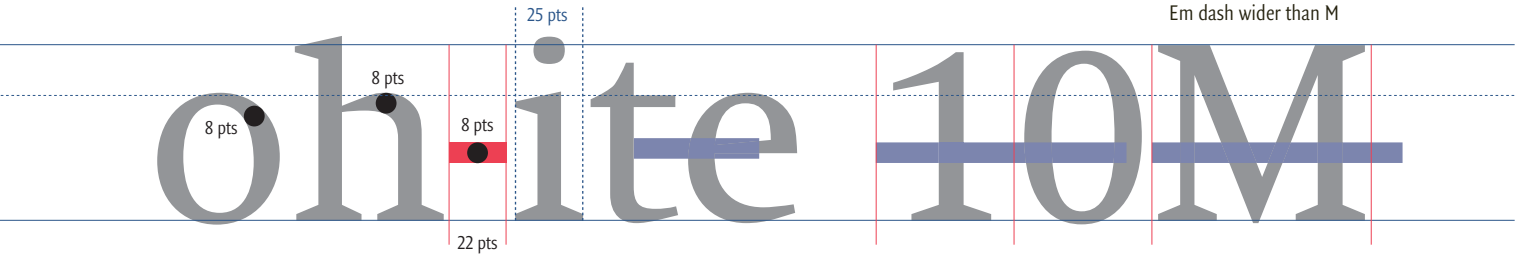
Em dash narrower than two tabular numbers
(Sabon does not have uppercase alternates)

Irma Text: 83 pts
(Medium)

Text hyphen slightly above center of x-height

En/em dash slightly heavier than e crossbar, but lighter than t

Em dash wider than M



Swift: 94 pts
(Regular)

En/em dash thicker than e and t crossbars

Em dash narrower than two tabular numbers
(Swift does not have uppercase alternates)

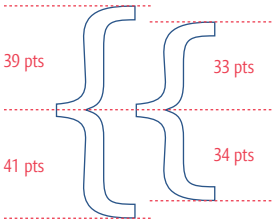
Parentheses, Brackets, and Braces

The parentheses, brackets, and braces come in pairs, but only one glyph needs to be designed. The left and right glyphs are the same character, simply reversed.

In general, the horizontal and vertical stroke thickness of the brackets are both slightly less than the weights in the letters. The maximum weight of the parentheses is usually slightly more than the vertical bracket thickness, since these are curved forms with variable thickness. The maximum weight in the braces varies according to the design. Braces that are more vertical need less expansion, since their stroke variation is less. Alternatively, there are monoline (or almost monoline) designs (see Miller and Grifo). These light designs are more common in Didone and other high-contrast display typefaces.

Often the parentheses and brackets have the same (or close to the same) character advance. That is, the overall width of the character (including sidebearings) is similar. There are, of course, exceptions, but generally, both the parentheses and brackets are drawn narrowly to save space. Their shape—and their stroke endings—should relate to other glyphs in the typeface.

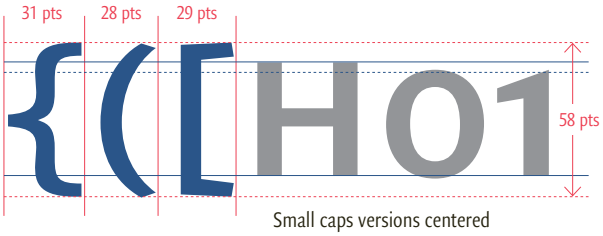
Note that the braces are not necessarily symmetrical. The difference is subtle, but the upper portion may be shorter than the lower due to calligraphic construction, or for optical balance.



Left, the text and capital versions of braces from Quadraat Sans. The braces are not symmetrical.

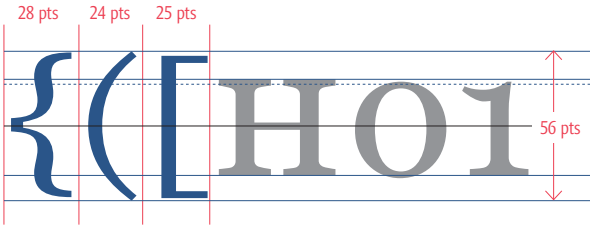
Ideally, a font of type contains multiple sets of parentheses, brackets, and braces. The default version is usually the text version, which needs to enclose both the upper and lower case. In practice, this means that parentheses, brackets, and braces are usually hung slightly above the ascenders, and extend to the descender line, or somewhat above the descender line.

Besides this text version, a capital version is also needed to enclose uppercase letters and lining figures. In some fonts, the text version of these glyphs is simply repositioned higher for use with the capitals (as in Miller) but designers may prefer to redraw the full set at the optimal height (as in Quadraat Sans). In typefaces that include small caps, yet another set of these glyphs can be designed to be centered around that character height. When supported by software (such as in Adobe Illustrator) the OpenType font format allows the correct version of parentheses, brackets, and braces to be substituted automatically.



Quadraat Sans Small Caps
(DemiBold)

Small caps versions centered over small cap-height.



Miller Text Small Caps
(Roman)

Small caps versions centered over optical center of small cap-height.

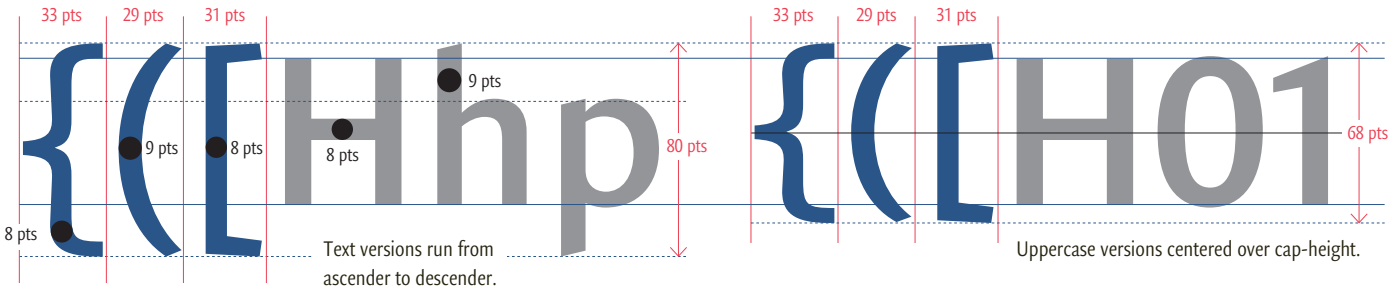
{handgloves}

The braces of HTF Didot (M42 Medium) are particularly beautiful.

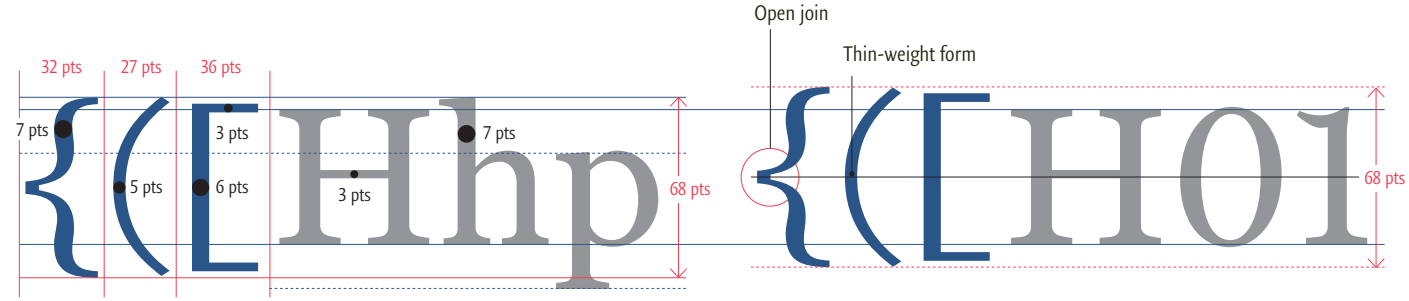
{([handgloves])}

Grifo (Regular) has thin brackets and parentheses, but heavier braces.

In Strada (Regular) the endings on the parentheses match the brush-like endings on the open, curved letters.



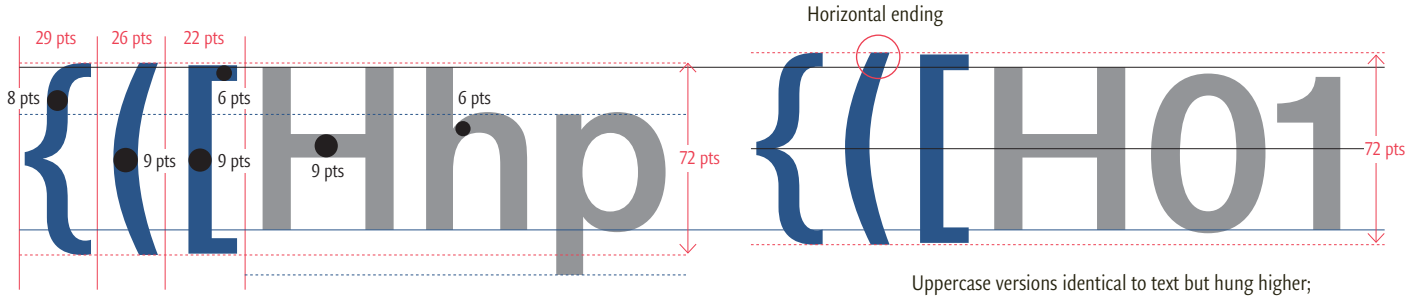
Quadraat Sans
(DemiBold)



Miller Text
(Roman)

Text versions hung from ascender height.
Braces taller than parentheses; parentheses taller than brackets.

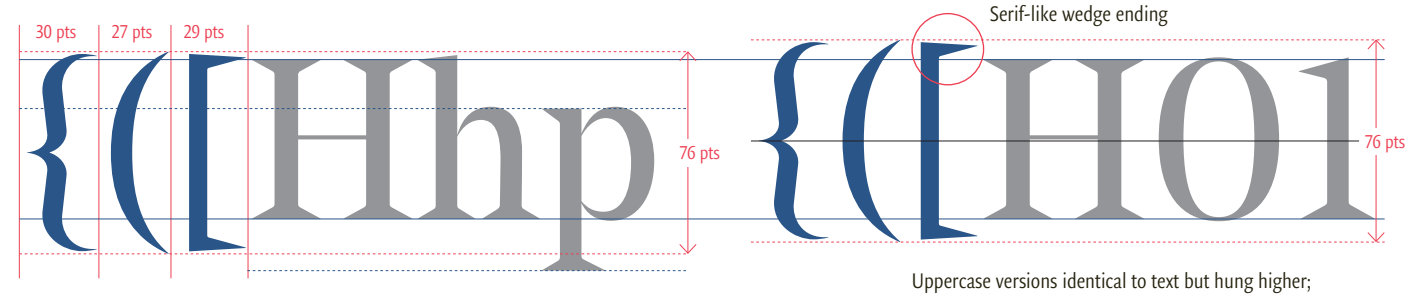
Uppercase versions identical to text but hung higher; centered over cap-height.



Unica77 LL
(Medium)

Text versions hung slightly above ascender height.
Braces and parentheses aligned; both taller than brackets.

Uppercase versions identical to text but hung higher; centered over cap-height.



Noe Display
(Regular)

Text versions hung slightly above ascender height.
Braces and parentheses aligned; both taller than brackets.

Uppercase versions identical to text but hung higher; centered over cap-height.

@ sign

Computer programmer Ray Tomlinson is credited for reviving the @ sign. In the 1970s, Tomlinson needed a little-used symbol to separate the name of a user from their machine to enable email exchange between people on different host computers. His selection of the @ lifted the symbol from obscurity into common use.

The origin of the @ is not entirely known. One theory is that historically, scribes found it quicker and easier to shorten the word ad (meaning "at the rate of") by looping the d around the a. This practice may have eventually resulted in the encircled cursive form that is common today.

Because of its density, the @ is difficult to design, especially in bold or condensed fonts. While the overall color of the @ should match the density of the lowercase letters, the a and the surrounding stroke are often drawn with lighter stroke weights.

To further reduce the density of the @ sign, the symbol can be drawn fairly large; the examples here range between 73 and 100% of the distance from descender to capline (with the a between 66 and 100% in height). Since single-story a has a large counter, it is lighter and more open (but possibly less distinct) when reduced in size than the humanist double-story a.

chris@ecorp.com

chris@ecorp.com

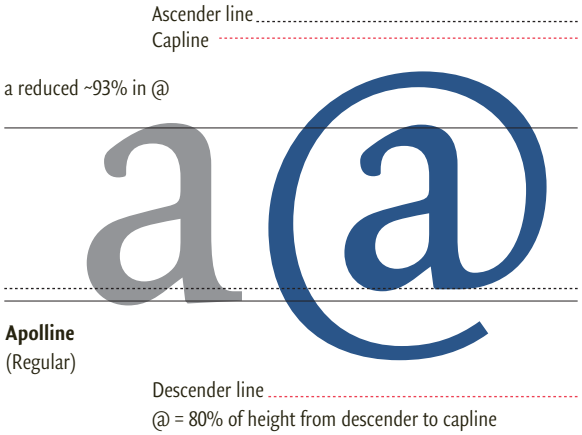
Above, Fakt (Medium). Below, Parisine Plus (regular).
The larger @ is lighter and more open, but possibly less distinct.

Perhaps because it is narrower, many @ signs use a simpler italic a rather than the roman (upright) letter. For example, in Harriet Display (Roman), the @ sign is based on the italic a:

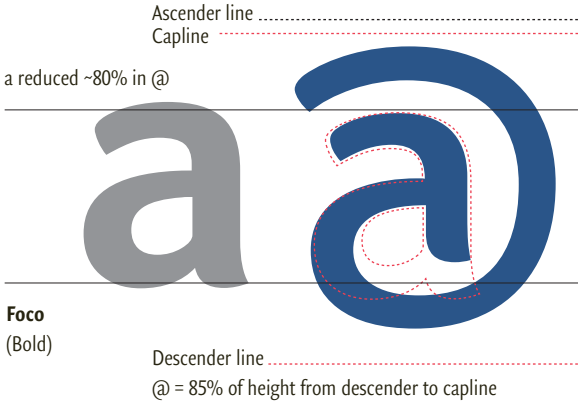
@a*a*

We can further lighten the @ sign by leaving the surrounding ring open. Traditionally, the gap is at the lower right corner, but there are variations where the ring extends from the branch of the a (as in Ambroise) or from the main bowl (as in Foco). Given the contemporary context and widespread understanding of the meaning of the @ sign, designers have ample freedom to draw the symbol as desired.

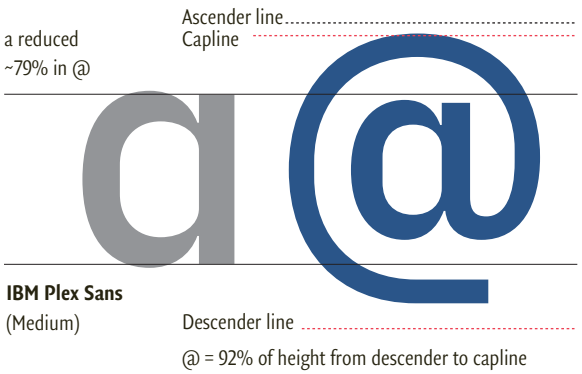
chris@ecorp.com



chris@ecorp.com



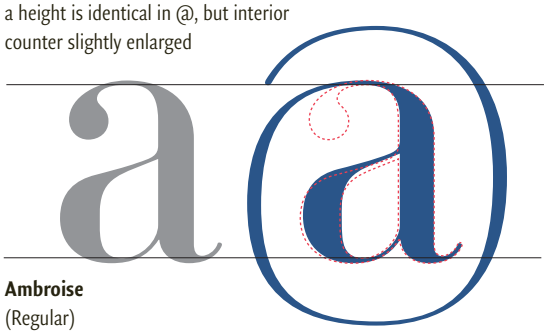
chris@ecorp.com



chris@ecorp.com

Capline

a height is identical in @, but interior counter slightly enlarged



Ambroise
(Regular)

Descender line

@ = 73% of height from descender to capline

chris@ecorp.com

Capline

a reduced ~66% in @

Sansa Normal
(Regular)

Descender line

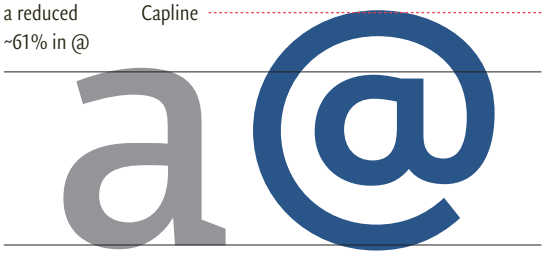
@ = 91% of height from descender to capline

chris@ecorp.com

Ascender line

Capline

a reduced ~61% in @



FF Olsen
(Regular)

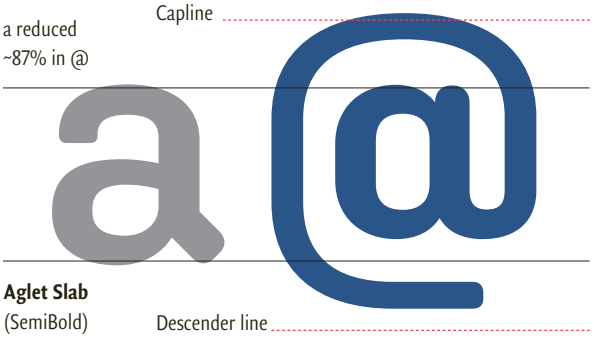
Descender line

@ = 80% of height from descender to capline

chris@ecorp.com

Capline

a reduced ~87% in @



Aglet Slab
(SemiBold)

Descender line

@ = 95% of height from descender to capline

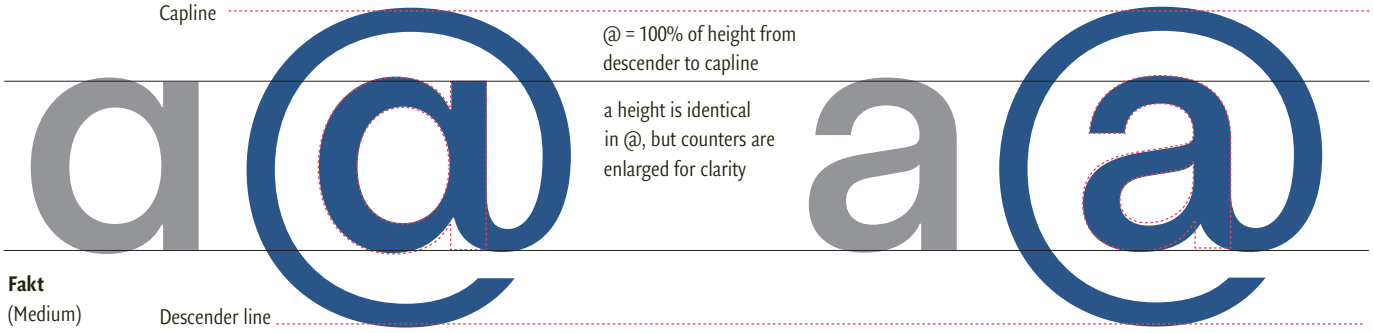
chris@ecorp.com ⟷ Fakt has two variations on the a and @ signs ⟷ chris@ecorp.com

Ascender line

Capline

@ = 100% of height from descender to capline

a height is identical in @, but counters are enlarged for clarity



Fakt
(Medium)

Descender line

Pound Sign (Hashtag / Octothorpe)

Historically, a pound was an ancient Roman unit of measurement named the "libra pondo," or "pound weight." This term was abbreviated as "lb" with an overscore (the line was used to avoid confusion with the number one). Eventually this combination of strokes evolved into the pound sign that we use today.

According to Keith Houston, author of *Shady Characters: The Secret Life of Punctuation, Symbols and Other Typographical Marks* [2013], Bell Laboratories was responsible for popularizing the pound sign. At that time, the standard layout for "touch-tone" (push-button) phones included two rarely used buttons on either side of the zero. Bell needed to place symbols on those buttons so that the users could control menus and select other phone services. They opted to place the asterisk on the right, and the pound sign on the left.

The pound sign is also called an octothorpe. This term is derived from "octo" (meaning eight) and "thorpe" (meaning village). In *The Elements of Typographic Style* [2001], author Robert Bringhurst notes that the octothorpe is a traditional symbol for village, as it literally visualizes eight fields around a central square.

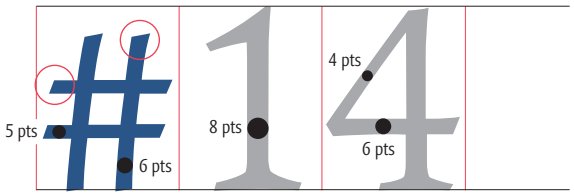
More recently, the pound (or octothorpe) was popularized on Twitter for use in "hashtags"—labels used to identify theme(s) in conversation threads. The term comes from the British name for the pound or octothorpe, which is "hash."

Because the pound sign was originally used to denote weight, its design is related to numbers. In most typefaces, the pound sign is centered in the same character width as a tabular figure. Because there are both modern and old-style tabular numbers, many fonts have two pound signs—a taller version at the capital-height, and a shorter version at the x-height (or at the height of the lower-case figures). However, there are typefaces that have a single intermediate hashtag that is used for all figures.

As in the @ sign, the challenge with the pound sign is complexity. To open the symbol, the stroke widths are usually drawn with slightly less weight than is normally used on the numbers. In some fonts (especially Didones and other high-contrast designs) the hashtag is drawn with only thin strokes (as in Eames Century Modern). However, most designers strive to make the contrast of the pound sign match that of the numbers.

Besides these constraints, the design of the pound sign can be quite varied. Logically, typefaces with oblique stress should have an angular hashtag, while upright types have an orthogonal design. The strokes of the symbol can be drawn with calligraphic contrast, and their ends can be flared or cut at angles to match other glyphs.

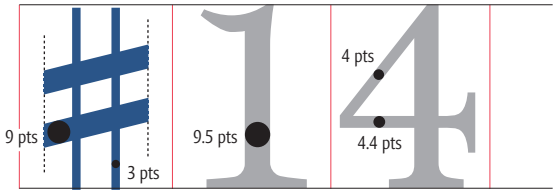
Unusual curved form; angled stroke endings



Maiola
(Regular)

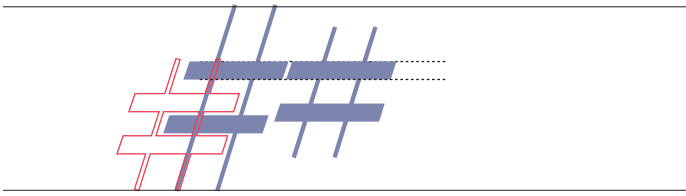
Stroke widths of the pound sign lighter than the numbers

Verticals are straight; horizontals angled

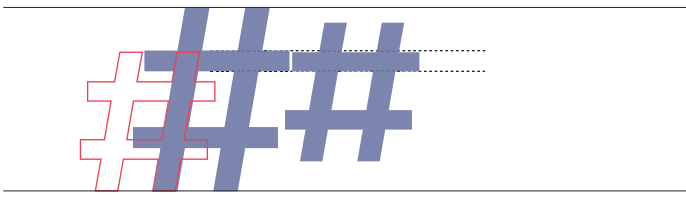


Miller Text
(Roman)

Stroke widths of the pound sign lighter than the numbers

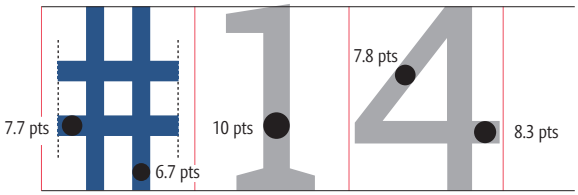


Stroke widths identical on capital and lower case; pattern closer on lower case



Stroke widths lighter on lower case; pattern closer on lower case

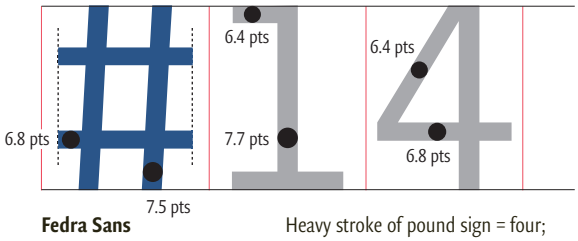
Fully upright orthogonal form; narrow inner box



FF Olsen
(Regular)

Stroke widths of the pound sign slightly lighter than four

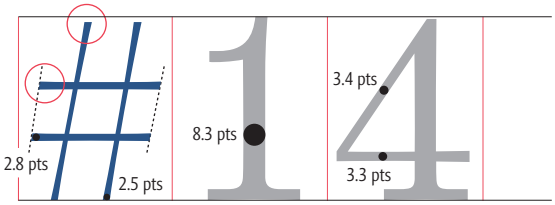
Wide inner box; horizontals centered in character width



Fedra Sans
(Book)

Heavy stroke of pound sign = four; light stroke width is heavier

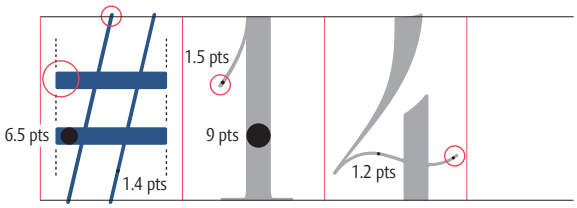
Flared stroke endings



Eames Century Modern
(Regular)

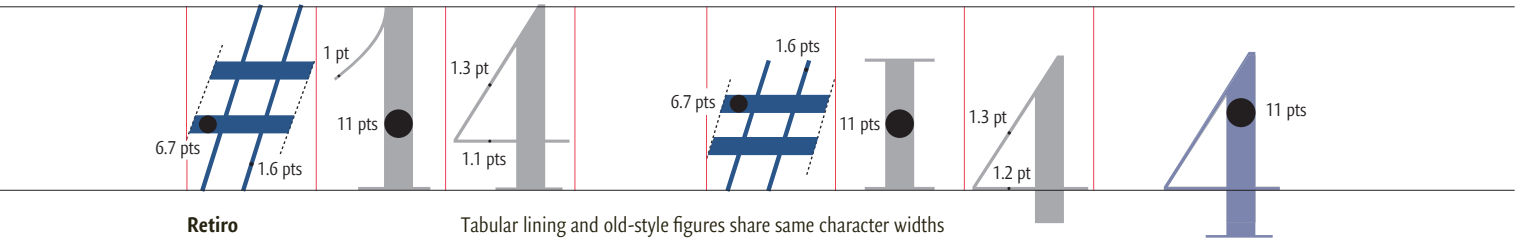
Stroke widths of the pound sign lighter than four

Rounded stroke endings;
horizontals centered in character width



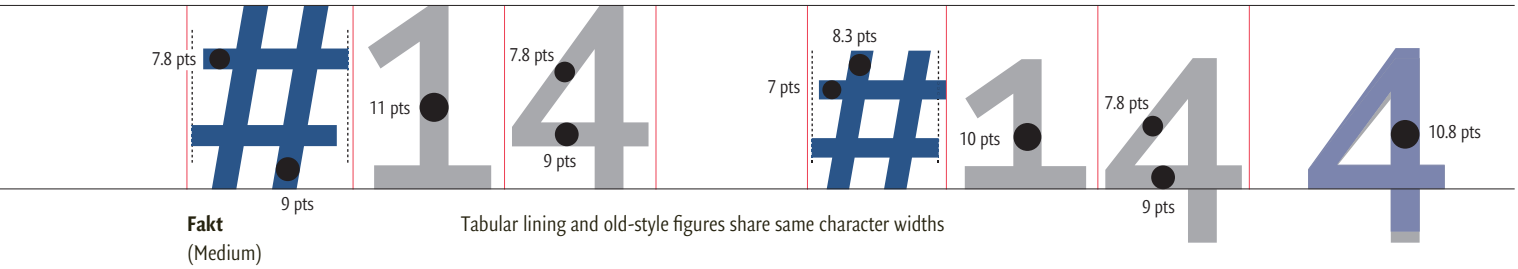
Ambroise
(Regular)

Contrast of the pound sign relates to the numbers



Retiro
(24-Regular)

Tabular lining and old-style figures share same character widths



Fakt
(Medium)

Tabular lining and old-style figures share same character widths

Ampersand

The ampersand is a stylized ligature of the letters e and t that represents the Latin word et, which means "and." Typically, ampersands are used in titles and proper names rather than as a general substitute for the word "and," because the symbol implies connected concepts (as in "Fish & Chips") or a collaborative partnership (as in "Ben & Jerry's").

There are many forms of the ampersand, but perhaps they can be broadly organized into two categories: the "et" version and the "reverse-s" version. The "et" version is more commonly seen in italic fonts; it may use either an upper- or lowercase E/e and T/t.

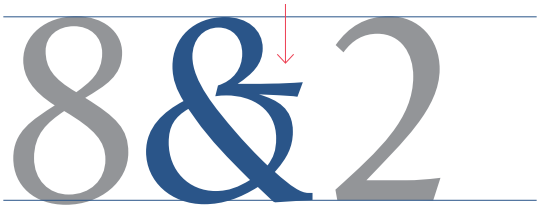
Left, Miller Display (Roman). Right, Fedra Sans (Book).
Both are alternate ampersands in the "et" form.

The reverse-s version varies considerably. The most common construction has a curved spine that is similar to the number eight. The shape of the central diagonal may be related to the bowl of the number two, or to the tail of the R. The upper and lower loops may be open or connected; when open, the ends can be shaped or finished with terminals. Traditionally, the lower loop has a short horizontal bar, but this can be modified or omitted entirely.

Left, Harriet Display (Regular). Right, Abril Display (Regular).
Both ampersands have terminals that relate to the lower case.

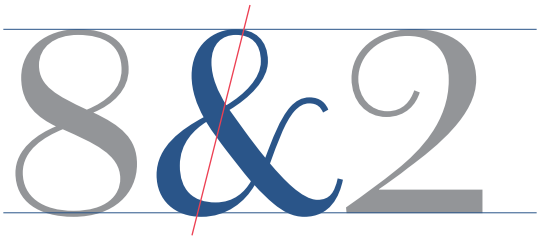
The ampersand typically extends from the capline to the baseline (and has overshoot). The symbol is generally drawn with the same stroke weights as the lowercase letters, but its weights can be adjusted so the design matches the overall tonal value of text.

The ampersand is a perennial favorite of type designers. The typographer Jan Tschichold wrote an entire book on ampersands (*The Ampersand: Its Origin and Development* [1953]) that showcased 288 examples. As noted by type designer Bruno Maag (founder of the type design company Dalton Maag) "I love the ampersand—it's a beautiful character, although some font designs do make a hash of it. I love the ornamental beauty of it and I love that there are hardly any rules as to what it has to look like."



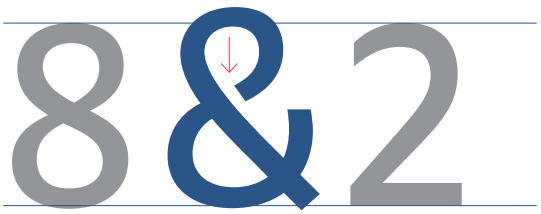
Apolline
(Regular)

Unusual connected form



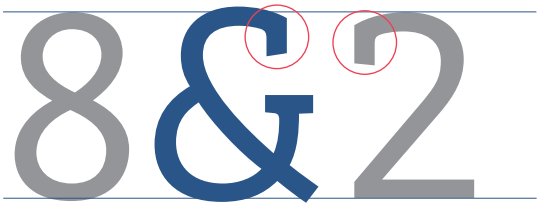
Chiswick Sans
(Regular)

Forward posture; open curved ends



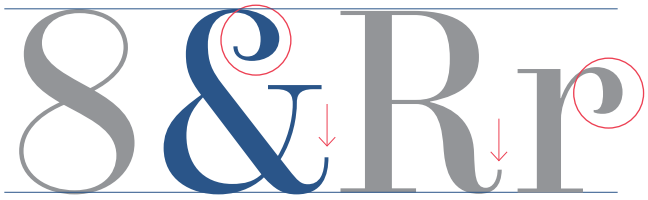
Riga
(Regular)

Upper loop aligned but not connected



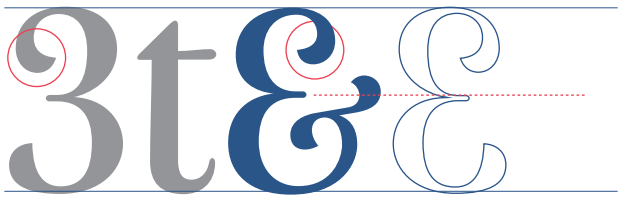
Bree Serif
(Light)

Structure leans slightly to the right;
two stacked loops rather than a spine



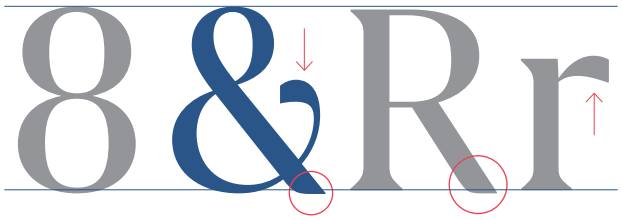
Questa Grande
(Regular)

Related tail and terminal forms



Feijoa Display
(Regular)

Similar terminals; ampersand more upright than reversed three

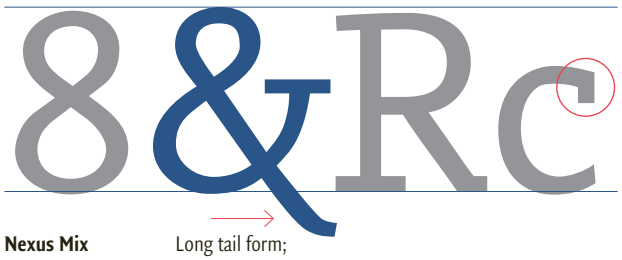


Grifo
(Medium)

Related tail and terminal forms

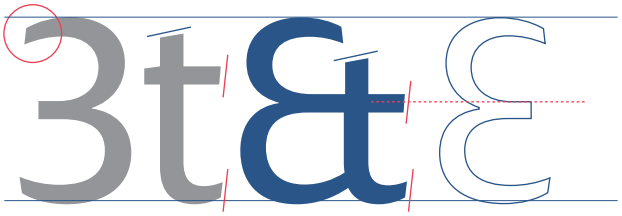
Retiro
(Regular 24pt)

Similar serif and tail forms



Nexus Mix
(Regular)

Long tail form;
horizontal bar relates to slab serifs

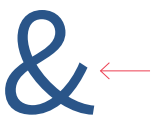


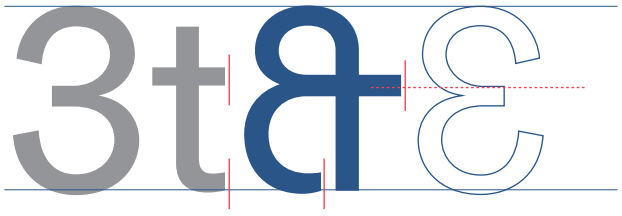
Ardoise
(Regular)

Similar stroke endings; ampersand more upright than reversed three

Fedra Sans
(Book)

Similar curving tail forms;
Fedra includes an alternate version with an upper arm:





Gerstner Programme
(Regular)

Unusual connected form;
central join higher than on reversed three

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8

DIACRITICAL MARKS

Overview of Diacritical Marks

Type designers naturally specialize in the characters of their native language. However, this inclination places American and British designers at a disadvantage, since English lacks diacritical marks. In the United States, only a few foreign loanwords retain accents and even these are slowly falling from favor.

Fortunately, over the past decade, far more information is now available on how to correctly design diacritics in other languages. One of the most comprehensive resources is designer Filip Blažek's Diacritics Wiki, an editable online database covering the design of accents.[1] Central European diacritics are discussed at length in *The Insects Project* by the Czech, Hungarian, and Slovak designers Palo Bálik, Filip Blažek, and Robert Kravjanszki.[2] Still another reference is Victor Gaultney's 2002 thesis, *Problems of Diacritic Design for Latin Script Text Faces* (University of Reading).

One way to expand beyond these sources is to study accents "in the wild." Toward this end, designers can view (and contribute to) the Fancy Diacritics Flickr group, a photo collection of unconventional, non-standard diacritics.[3] In his 2017 ATypI presentation, American type designer David Jonathan Ross described how traveling and seeing vernacular versions of diacritical marks can help non-native type designers better understand the boundaries of accent design in another culture.[4]

However, despite greater awareness and increased information, it is still difficult for many designers (including myself) to determine which aspects of a diacritic are essential to communication and which are simply artifacts of manufacturing or personal style. Diacritic design is complicated by cultural preferences; ideals of form vary over time, even within limited geographic areas. These preferences affect both general concerns (such as relative size) and details (angle and positioning.) For many accents, there is no single uniform standard; ideally, custom sets would be designed for specific languages or environments.

Given these constraints, the following is merely an overview of the most common accents: the acute and grave, the circumflex, the umlaut, the diaeresis, the tilde, and the cedilla. The eszett is also covered, although it is a ligature rather than a diacritic. Some of the type samples shown here have limited customization (a single accent is used for both the upper and lower case), but others have a unique accent for the specific letter being modified.

1 Blažek, Filip, *Diacritics Project@Typo.cz*, diacritics.typo.cz.

2 Bálik, Palo, et al, "Problems of Diacritic Design for Central European Languages," *The Insects Project*, Agnieszka Małecka and Zofia Oslislo (eds.), 2016, theinsectsproject.eu.

3 flickr.com/groups/fancy-diacritics/.

4 Ross, David Jonathan, "How *Not* to Draw Accents – David Jonathan Ross – ATypI 2017," 16 Sep 2017, youtube.com/watch?v=-N--5Wg-2p4.

Apolline (Regular)

ITC Galliard (Roman)

Gotham (Book)

Univers (55-Roman)

HTF Didot (M42-Medium)

Clarendon (Light)

Acute and Grave

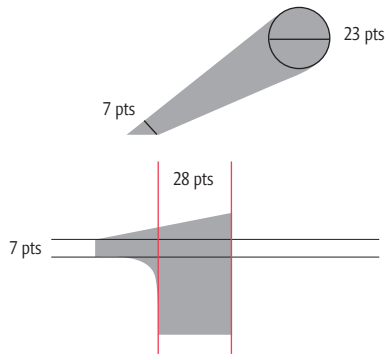
The acute and grave appear in several languages; they may signify either a change in pitch (rising or falling tones), specific emphasis (on a normally unstressed letter), or an invisible consonant. For example, the acute in the French word étudiant indicates that there used to be an s after the e (as in the archaic spelling, estudiant).

These two accents are, of course, related—the forms are identical but reversed. The basic shape is a light diagonal stroke. The heavier end is 50–90% of the lowercase vertical stem width; this end may be rounded to match other terminals or endings in the typeface. The thin end is shaped into a sharp, blunted, or rounded point.

The slope of the acute and the grave varies widely. In the early years of printing, both diacritics were drawn fairly upright. Later developments in both type design and typography (higher x-heights and tighter typesetting) diminished the vertical space available for these accents, forcing more horizontal configurations.

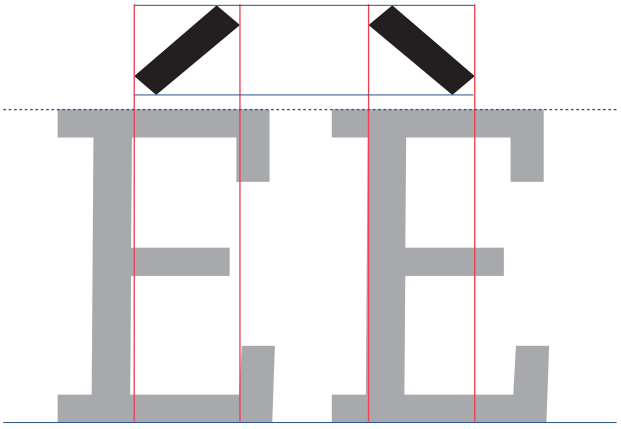
However, if the acute can be drawn more vertically, that may be more efficient, because of its similarity to the Polish kreska—a smaller and more vertical form. Some designers draw the acute so that it works as both a kreska and an acute, thus eliminating the need for a separate Polish character. Note that these hybrid solutions have sometimes been criticized as being "neither here nor there"—that is, satisfying neither language nor culture.

For the horizontal position, both the acute and the grave are asymmetric: The acute tends to be slightly right aligned, while the grave leans to the left. The vertical position for the acute and grave hovers just above the letter. The gap in between the accent and the capital may be narrower than in the lower case to save space (and to avoid collisions with descenders). If still more room is needed, a shorter and/or flatter acute/grave can be designed for use with uppercase glyphs.



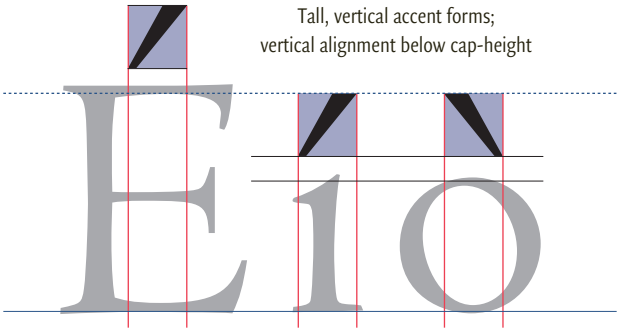
ITC New Baskerville, above.
The head of the acute is 82% of the lowercase stem width.

The acute leans to the right and the grave leans to the left.
Endings are left square at the top and bottom of the accent.



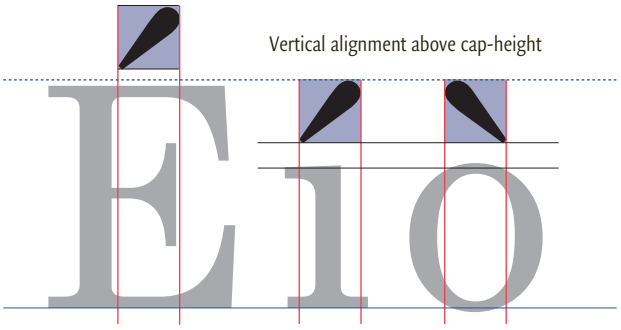
PMN Caecilia
(55-Roman)

Tall, vertical accent forms;
vertical alignment below cap-height



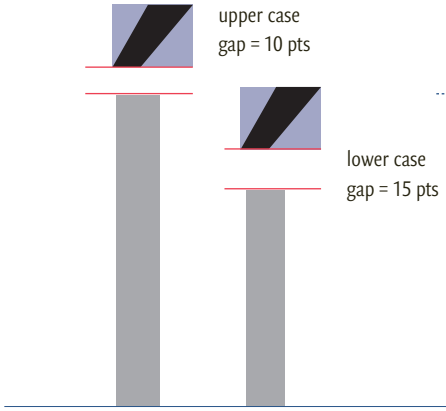
Centaur MT
(Regular)

Vertical alignment above cap-height

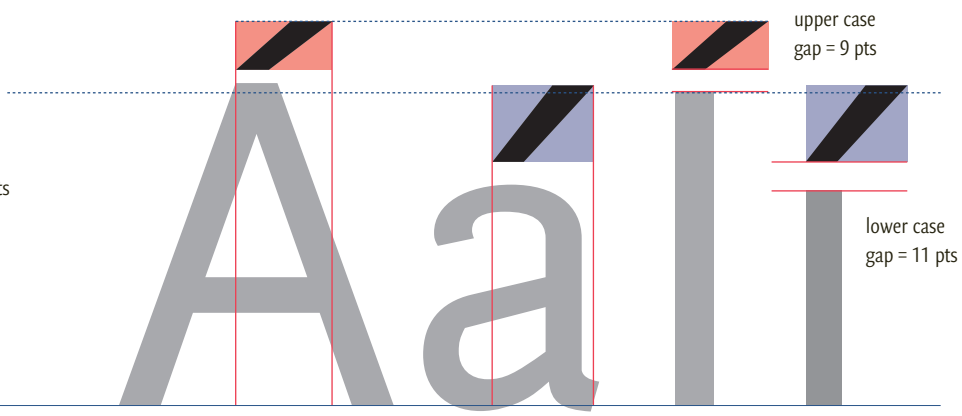


Century Schoolbook
(Regular)

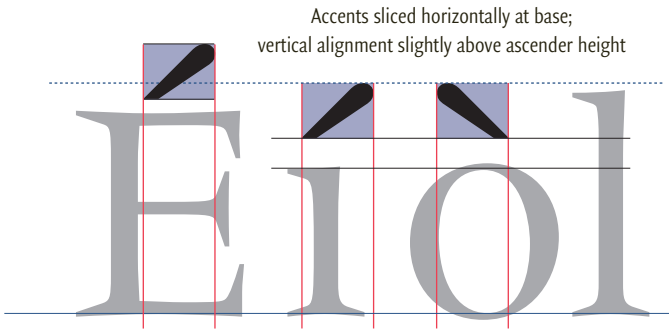
Uppercase accents are often shorter than the lower case to save space (as in Scala).
Additionally, the gap under the uppercase accent can be reduced (as in Univers).



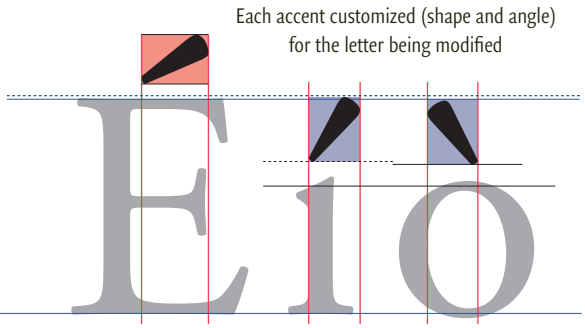
Univers
(55-Roman)



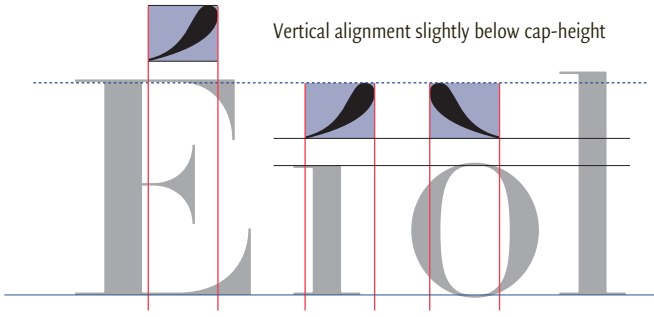
FF Scala Sans
(Regular)



Méridien
(Roman)

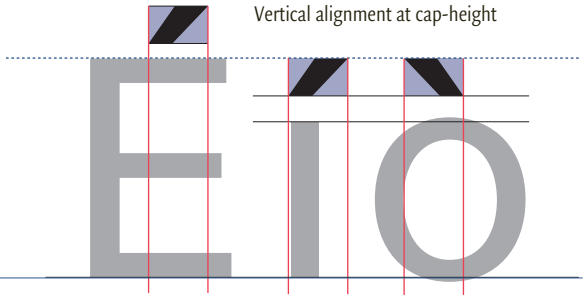


Adobe Garamond
(Regular)



HTF Didot
(M42-Medium)

Unusual curved forms



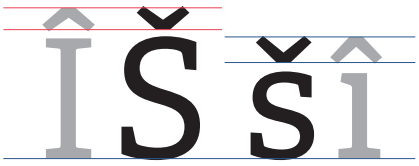
Unica77 LL
(Regular)

Circumflex

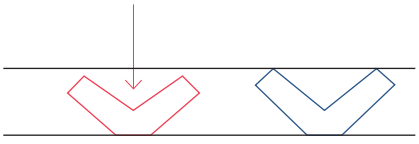
The circumflex is a bent bar placed above a letter, usually a vowel. The accent indicates changes in tone or length, contraction, or the disappearance of a letter. For example, in French, the circumflex marks the former presence of the letter s (as in *hôpital*, hospital, and *forêt*, forest). In ancient Greek, the circumflex modified the length and stress of the vowel. Interestingly, in eighteenth-century Britain, the circumflex was used as an abbreviation for "-ough," so that "thô" was the equivalent of "though" and "brôt" the equivalent of "brought." Although this practice did not lead to spelling simplifications, it did foreshadow the modern abbreviations that are now common in email and other digital communications.

Perhaps one way to imagine an appropriate circumflex would be to overlap the acute and grave into an upside-down v-shape. Of course, the slope and stroke weights of the acute and grave would need to be adjusted to control the width and density of the final mark. As discussed previously for the acute and grave, a flatter circumflex may be designed for use with the capitals.

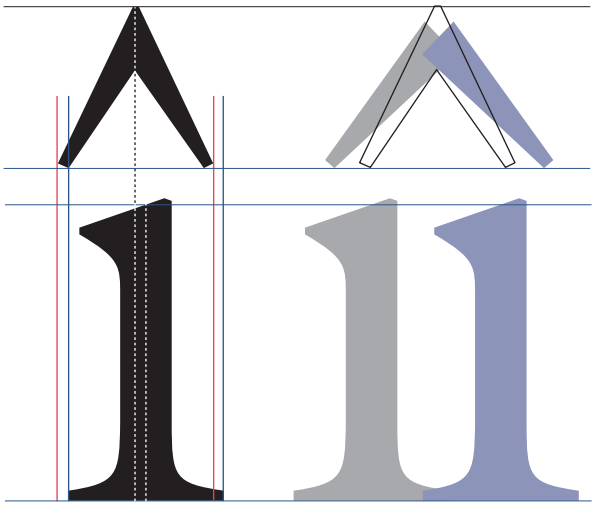
The circumflex is unique in that its inverted form is sometimes used for the caron (also called a wedge or háček, which means "little hook")—although this is suboptimal, because a caron would seldom have a pointed bottom. The caron occurs mostly in Slavic and Baltic languages, although it is also used in the transliteration of Arabic languages and the romanization of Asian dialects (for example, to indicate one of four tones in Hanyu Pinyin). However, note that there is an additional version of the háček (resembling a small apostrophe) that is used with ď, ľ, Ľ, and ť.



Above, Adelle PE (Pan-European). The caron is an inverted circumflex.
Note that the uppercase diacriticals are shorter than the lower case.



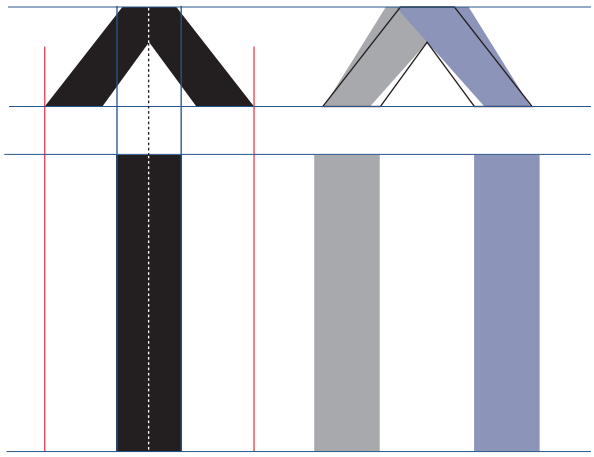
Circumflex is taller and steeper than the acute/grave



ITC Galliard
(Roman)

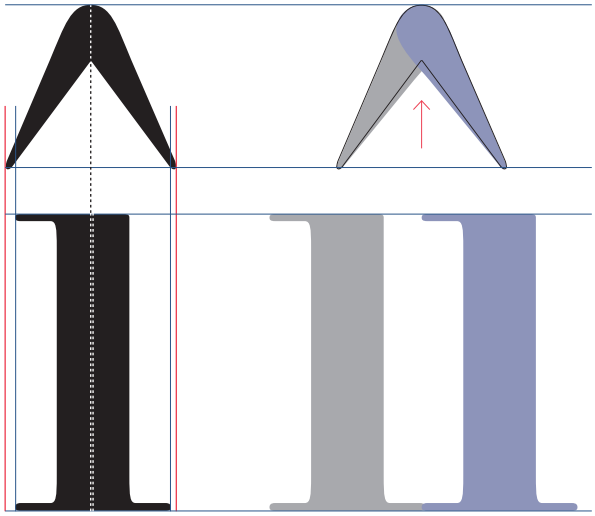
Above, Adobe Garamond Pro (Regular).
The circumflex is drawn flatter for the upper case vs. the lower case.

Wide vertex with flared endings



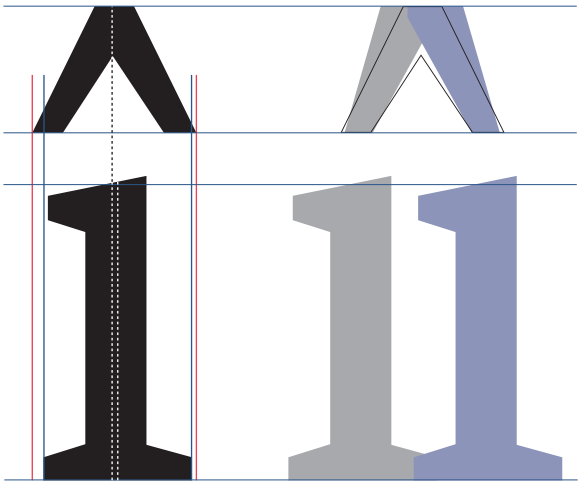
Fakt
(Medium)

Curved head relates to acute and grave shapes



Ambroise
(Regular)

Squared and tapered accents relate to serif shapes

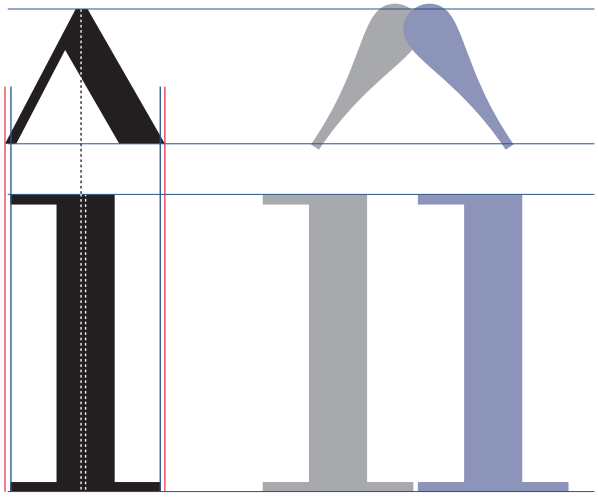


Lyon Text No. 2
(Regular)

Above, Eames Century Modern (Regular).
Unusual rounded forms; identical on the upper and lower case.

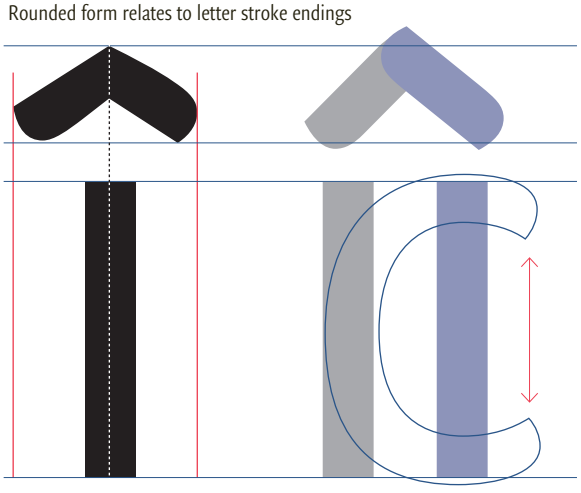
Above, Unica77 LL (Regular).
The same mark is used on both the upper and lower case.

Unusual contrasting form—distinct from rounded acute and grave



Questa Grande
(Regular)

Rounded form relates to letter stroke endings



Strada
(Regular)

Umlaut and Diaeresis

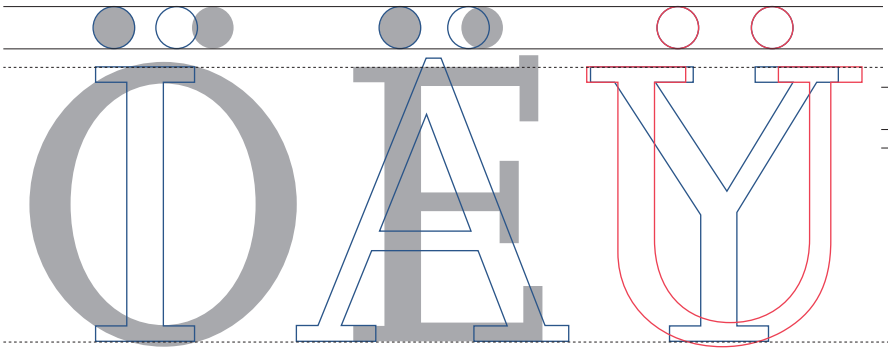
The umlaut and the diaeresis are identical in form—two small dots placed over a letter. However, the origin and function of these diacritics is different. An umlaut signifies the modification of a vowel sound. The term umlaut is a compound of the German word *um* (which means changed or transformed) and *Laut* (meaning sound). Originally, the umlaut was indicated by drawing a small e above the base vowel. After centuries, the overwritten character gradually became two short lines, and eventually, the simple pair of dots that we use today.

In contrast, a diaeresis indicates special emphasis (as in "coöperation"), or pronunciation of a vowel that would otherwise be silent (as in "naïve"). In either case, the diaeresis appears over one letter in a pair of vowels. The form of the diaeresis stems from an ancient Greek mark—a pair of vertical lines used to indicate meter boundaries in verse (the term *diaíresis* is Greek for division). Over time, these lines also evolved into a pair of dots.

The umlaut and the diaeresis appear most often over the upper- and lowercase a, o, and u, but they can also occur above the i, e, and y. The dots may be circular, oval, square, or rectangular. They are usually slightly smaller than the dot on the i to conserve space and prevent congestion above the x-height.

In many fonts, the dots have the same placement across cases. That is, the dots are closer to the capitals to conserve space, but farther away from the lowercase letters, given the extra room over the x-height. However, vertical alignment to the capline, i-dot, or acute/grave is also common. Of course, by using OpenType, we can customize spacing and placement for each letter. For example, in Scala, the dots have the same vertical alignment throughout, but are more tightly spaced on narrow glyphs (such as the i/I). In Adobe Garamond Pro, both the spacing of the dots and their vertical position vary on the capitals. The dots are tighter and lower on the A and I, and higher and looser on the O.

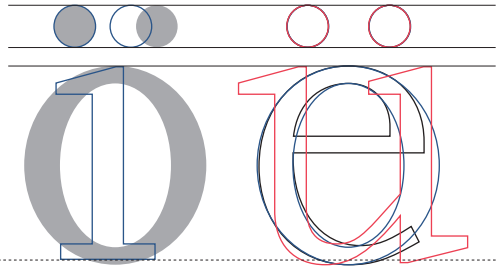
Above and below, Scala (Regular). The spacing of the dots vary according to the parent letter.



Tightest dot spacing on the Ï; loosest on the Ö

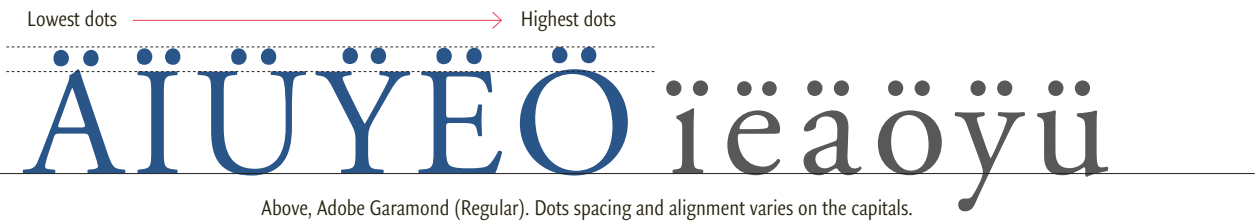
Dots of the Ä slightly looser than the ë

The Ü and Ÿ have the same dot spacing



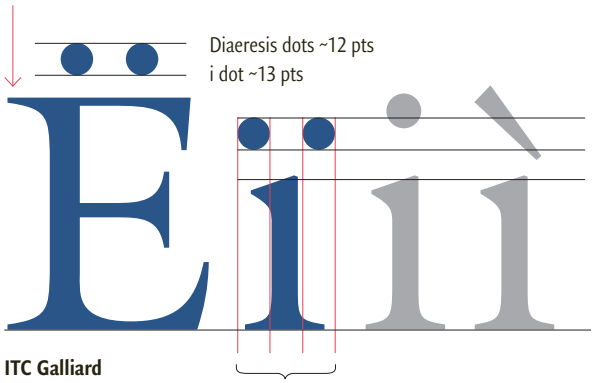
Tightest spacing is on the ï; loosest on the ö

The ü, ë, and ö have the same dot spacing



Above, Adobe Garamond (Regular). Dots spacing and alignment varies on the capitals.

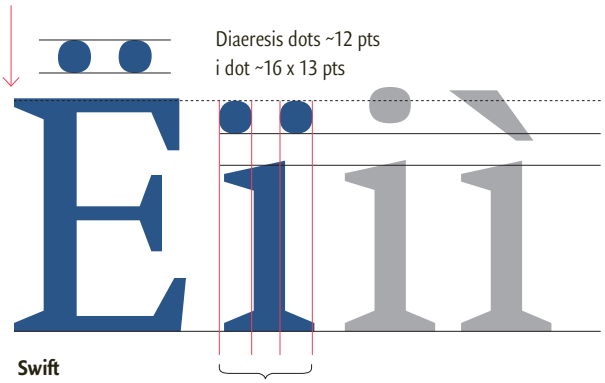
Less space below uppercase diaeresis



ITC Galliard
(Roman)

Dots evenly spaced;
positioned one dot width from x-height

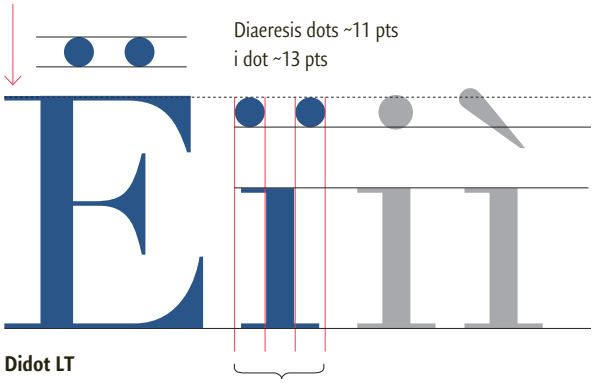
Less space below uppercase diaeresis



Swift
(Regular)

Dots spaced tighter than dot width;
aligned just under capline

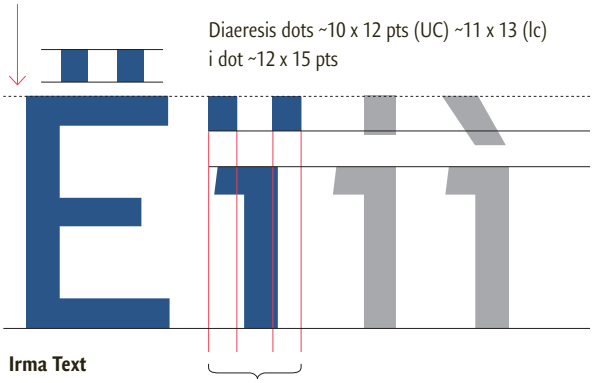
Less space below uppercase diaeresis



Didot LT
(Roman)

Dots evenly spaced;
aligned just under capline

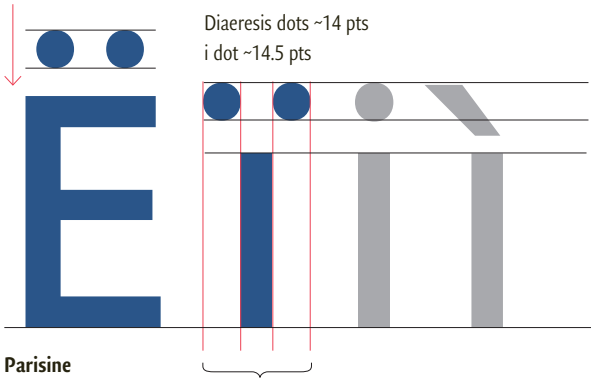
Less space below uppercase diaeresis



Irma Text
(Medium)

Dots widely spaced;
aligned to capline/top of grave

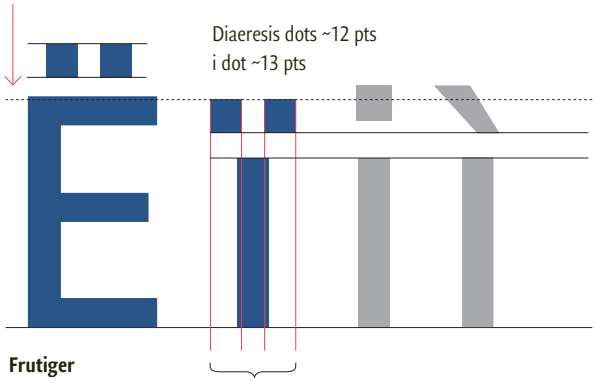
Less space below uppercase diaeresis



Parisine
(Regular)

Dots spaced tighter than dot width;
aligned near top of grave

Less space below uppercase diaeresis



Frutiger
(55 Roman)

Dots tightly spaced;
aligned near base of grave

Tilde

The tilde is an artifact of an ancient scribal tradition. In early Latin texts, the n or m could be written above a letter instead of after it. Over time, the form of the elevated letter gradually evolved into the modern tilde.

Today, the tilde is mostly used in Spanish, Portuguese, and Estonian to indicate specific sounds, such as nasalization. For example, the sound of the ñ can be roughly approximated with "ny" (as in the Spanish word *piñata*, which is pronounced "pinyata") or imitated with "gn" (as in the Italian word *lasagna*). In fact, a number of Spanish words that are English cognates directly replace the original English "gn" with ñ (for example, *campaña* for campaign).

The modern tilde has other uses as well. The tilde can indicate rising or falling tones in the romanization of Asian languages. In computer programming, the tilde may be used to denote directory structures (in this case, the tilde is often called a "squiggle" or "twiddle"). In mathematics, the tilde is also used as a stand-in for the swung dash (a lengthened version of the tilde).

As with all diacritical marks, the design of the tilde varies considerably. The spine of the tilde may be horizontal or diagonal; the outer strokes may be curved or straight; and the terminals may be pointed or blunted. If possible, it makes sense for the curves of the tilde to behave like the round shoulder on the n (and other lowercase curves such as those in the a, s, and g). Note that since the tilde is essentially a simplified N, it is almost always symmetrical: The end strokes are parallel and equal in height. As in the N, these end strokes are thinner than the central spine.

In general, the tilde is slightly narrower than the lowercase n. As discussed for the umlaut, in the vertical direction, the accent usually aligns to the top, bottom, or center of the acute and grave; in the lower case, the capline may be another possible guideline. In the horizontal direction, designers usually place the tilde in the optical center between the two vertical stems of the N/n. In the upper case, it may be necessary to shift left or right to avoid crowding upper serifs.

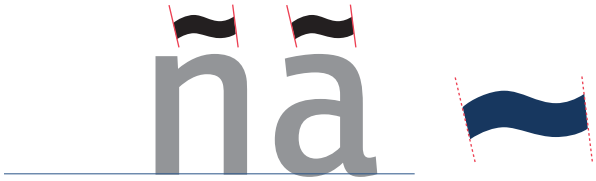
Adobe Garamond (Regular). The tilde has a straight, horizontal spine.

Miller Text (Roman). The tilde has a curved, diagonal spine.

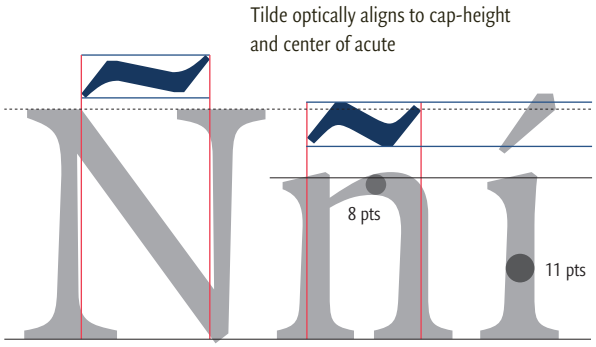
Abril Display (Regular). The ends of the tilde curl at an angle.

Questa Grande (Regular). The ends of the tilde curl upright.

Nexus Mix (Regular). The ends of the tilde are sliced diagonally.

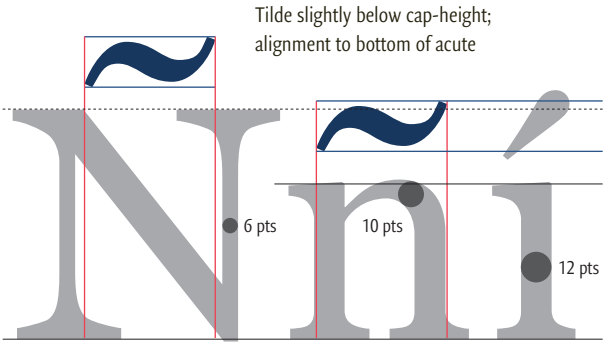


Ronnia (Regular). The ends of the tilde are sliced at different angles.



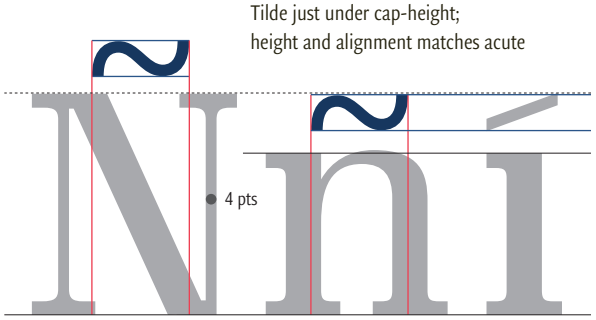
Quadraat
(Regular)

Lowercase tilde is taller and
narrower than upper case



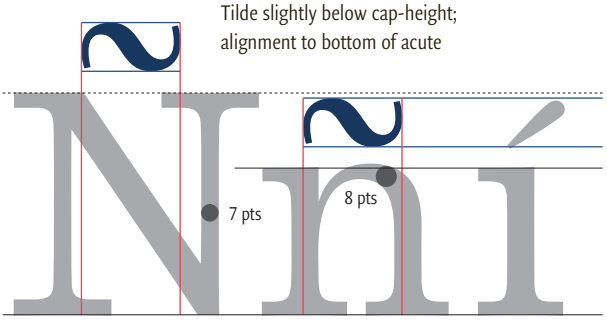
Miller Text
(Roman)

Tilde relates to branched glyphs



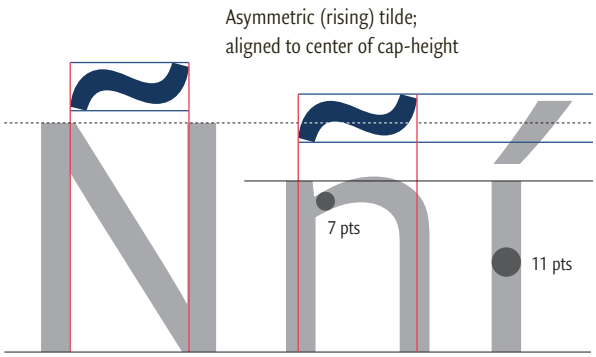
Algebra Display No. 2
(Regular)

Unusual monoline form



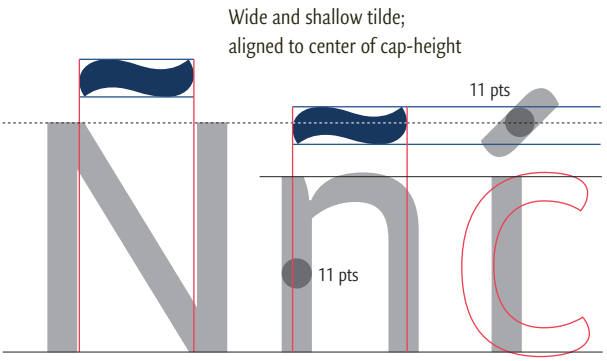
Eames Century Modern
(Regular)

Tilde relates to tail forms

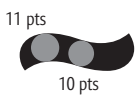


Ardoise
(Regular)

Tilde is thinner
in the center



Strada
(Regular)



Tilde endings relate to other
shaped stroke endings

Cedilla

The cedilla is a small hook placed under a consonant to change its pronunciation. The hook traditionally looks like an angular three or five that is missing the top bar. This shape is derived from the medieval (Visigoth) script version of a small z, which was used in Old Spanish. In fact, the word cedilla literally translates from Old Spanish as "little z," since it is a diminutive of the word *ceda* (the Spanish word for zed).

There are alternate cedillas that are quite different—simple hooks connected or disconnected below the letter. Some of these versions are attempts to make a hybrid shape between the classic cedilla and the comma below, which is a different diacritic used largely in Romanian and Turkish on the S and T (see: Ș/ș and Ț/ț). Historically, cedillas were often substituted for commas below, because there was a lack of support for these special characters in the early days of digital typesetting.

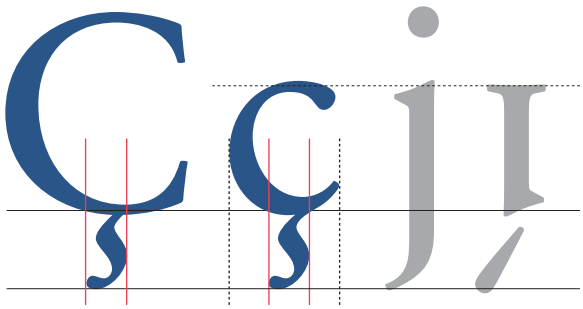
There are purists who discourage these hybrids, because they believe the traditional cedilla and comma below are part of unique cultures that should be preserved. On the other hand, there are also designers that advocate for simplification and standardization.

The celebrated type designer Adrian Frutiger stated his preference for a disconnected cedilla that would better match the acute and grave.[5] Matthew Carter's cedilla in Verdana is a highly simplified example—perhaps a necessity given the technical constraints of designing a typeface for low-resolution screens.

In any event, the most common character modified by the cedilla is the upper- and lowercase C/c. The c-cedilla occurs in both Portuguese and French; it is no longer part of the modern Spanish language. The traditional cedilla is small; on these pages, its width ranges between 37 and 63% of the lowercase c, with lengths of 39 and 63% of the x-height. For efficiency in text settings, the cedilla rarely extends much beyond the length of letter descenders. In many types, the hook rests on or just above an imaginary line defined by an upside-down acute.

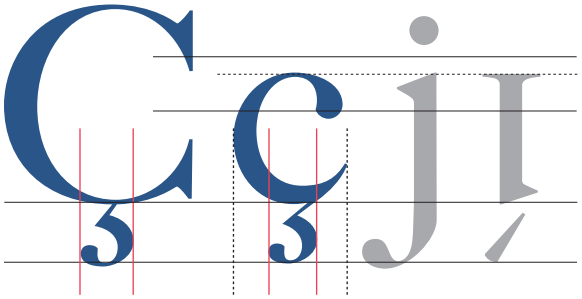
Because the cedilla is a complex form, its stroke thicknesses are narrow—often thinner than those of the acute and grave. To improve clarity, the bowl can be drawn quite openly, with a large aperture. Ending with a sharp or blunted point (rather than a shaped terminal) also helps to increase the limited interior space.

5 Frutiger, Adrian, et al. *Adrian Frutiger Typefaces. The Complete Works*. English ed., Basel: Birkhäuser, 2009, p. 254.



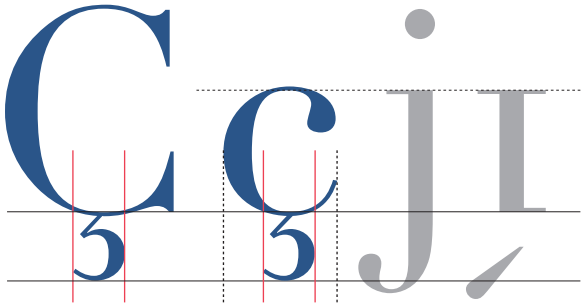
Sabon Next
(Regular)

Cedilla = 63% of x-height + 37% of c-width
Simplified s form; aligns to letter descender



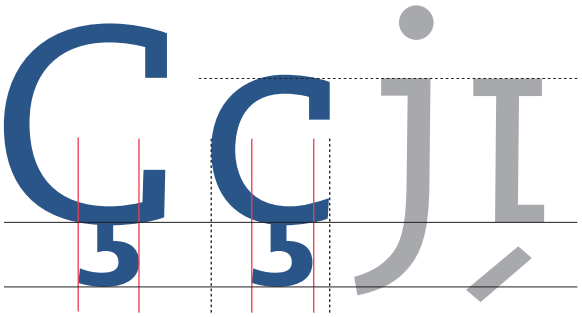
Big Caslon
(Regular)

Cedilla = 47% of x-height + 43% of c-width
Aligns to upside-down acute



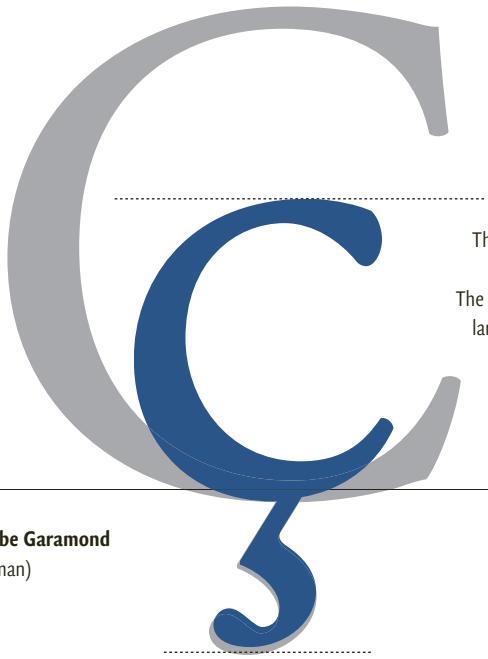
Didot LT
(Roman)

Cedilla = 58% of x-height + 45% of c-width

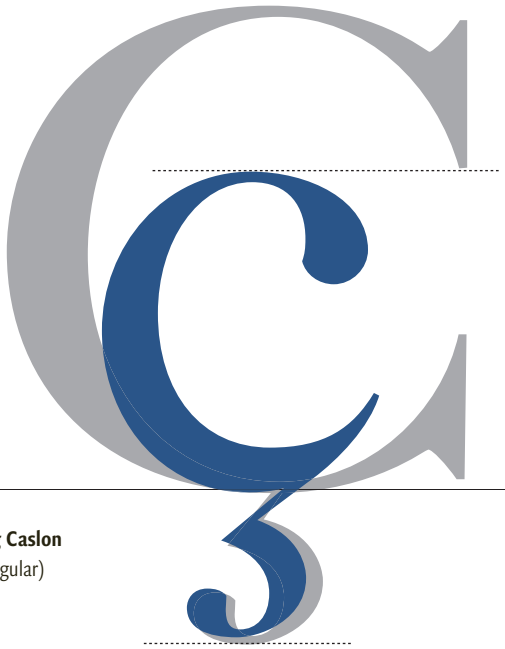


PMN Caecilia
(Roman)

Cedilla = 46% of x-height + 63% of c-width
Note vertical letter descender

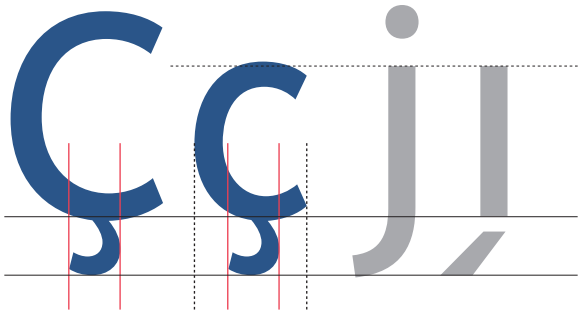


The cedilla is lighter and has less contrast than its base letter. The uppercase cedilla may be slightly larger than the lowercase accent.



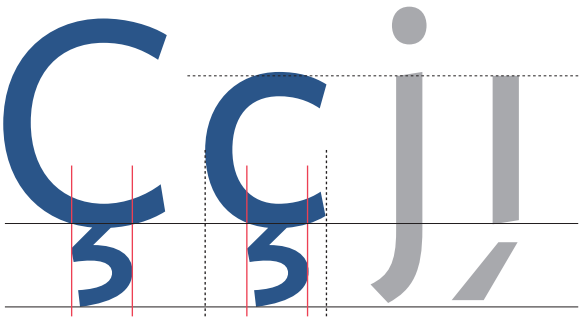
Adobe Garamond
(Roman)

Big Caslon
(Regular)



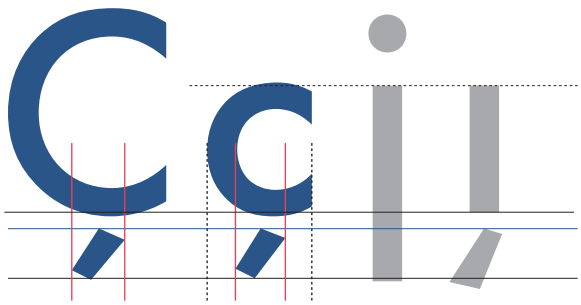
Parisine
(Regular)

Cedilla = 39% of x-height + 47% of c-width
Comma form; aligns to upside-down acute



Freight Sans
(Medium)

Cedilla = 57% of x-height + 51% of c-width



Futura PT
(Medium)

Cedilla = 40% of x-height + 49% of c-width
Detached comma form

Verdana
(Regular)

Cedilla = 38% of x-height + 59% of c-width
Comma form; aligns to letter descender

Eszett (Sharp S)

The eszett (also spelled esszett or referred to as a "sharp s") is not a diacritic, but a ligature that occurs only in the German language. In general, the eszett signifies an "ss" letter combination. Correct use of the eszett is particularly important in German, since improper ss substitution can alter the meaning of a word. For example, Maße means "measure" (in the sense of dimensions), but Masse means "mass" (a body of matter).

Prior to 2008, the eszett only existed in lowercase form. There are two main lowercase versions, both drawn with the normal lowercase stroke widths.[6] In both variations, the left side of the ligature is derived from the long s, an ancient letter that looks like the modern lowercase f, but with a truncated or deleted crossbar. This nub is a vestige of the upward stroke in the original calligraphy.

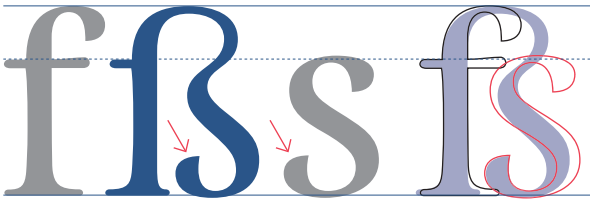
In the first option (called the "fs option" by German designer Ralf Herrmann) the long s is joined to a lowercase roman or italic s. This small s is often condensed and redrawn (especially at the top and right) to create a more graceful join with the vertical stem. In general, the join occurs at or near the x-height.

In the second option (which is called the "Sulzbach design" by Herrmann) the long s is joined to a cursive, lowercase z. Usually, this cursive z is expanded into a taller, non-descending form that resembles the number 3. When joined to the long s, the "sz" eszett resembles the lowercase Greek beta. However, unlike the beta, the interior of the eszett is not fully enclosed, and the stem does not descend (although there are exceptions).

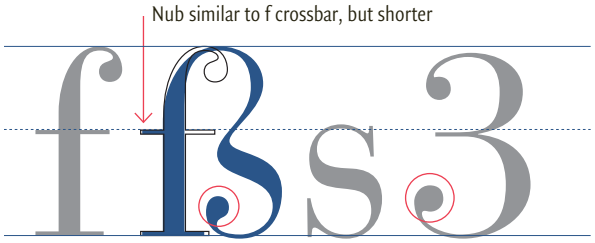
As of 2008, the uppercase sharp s has been accepted as part of the Unicode Standard, a character coding system maintained by the International Organization for Standardization (ISO). This was a major change for the German language, because the capital eszett had been proposed and rejected multiple times in the past; in fact, some groups still advocate for both cases of the eszett to be eliminated altogether. Nonetheless, the change is now official, and new uppercase versions of the eszett are being implemented.

In anticipation of this need, in 2006, type designers Andreas Stötzner and Adam Twardoch proposed several designs. The situation is still developing, but key design issues include: 1) making the new capital eszett distinct from the lower case, and 2) avoiding a form that can be mistaken for a capital B. Thus far, similar to the lower case, the two most popular options have been a "f+S" and a "f+Z." In either design, the upper left join can be round or square. Some designers believe that a hard corner makes the glyph more distinct and therefore more legible. We can also draw the new capital eszett wider than the B—and open at the base—to avoid confusion between the two glyphs.

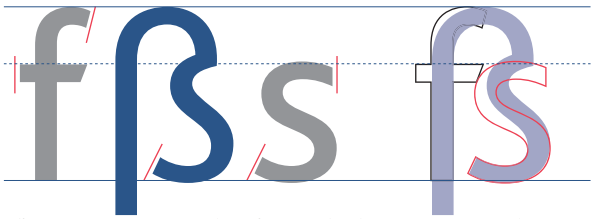
6 There is a third design of the lowercase eszett based on historic blackletter script, but it is rare, and considered appropriate only for historical revivals.



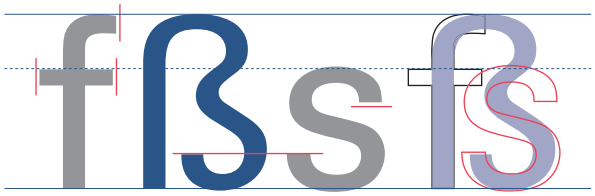
Feijoa Display (Regular) — Flared terminals on the eszett and s



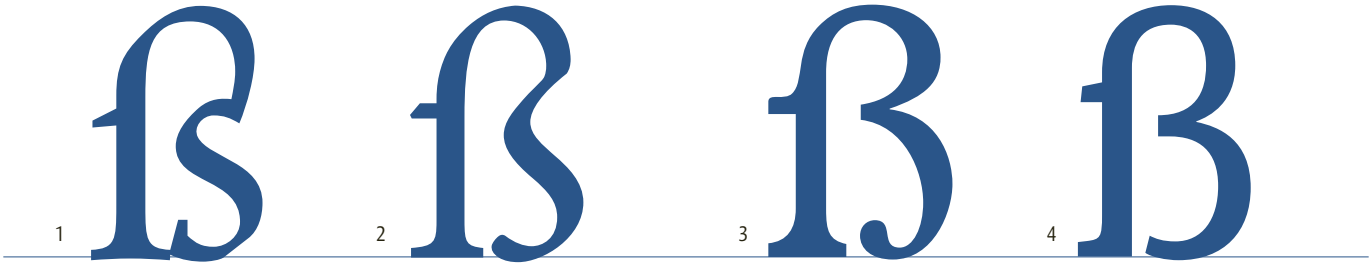
Bauer Bodoni (Roman) — Ball terminals on the eszett and 3



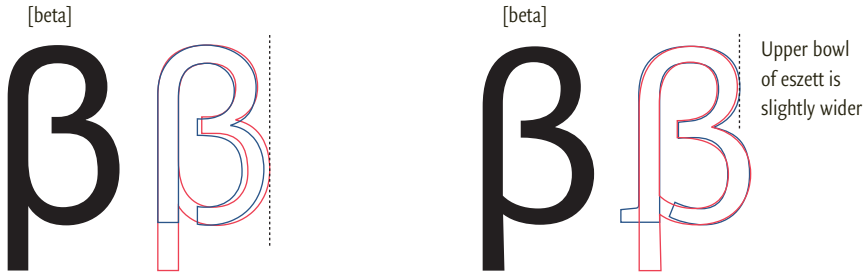
Bliss (Regular) — Descender references the "long s"—an ancient letter that was the original basis for the eszett



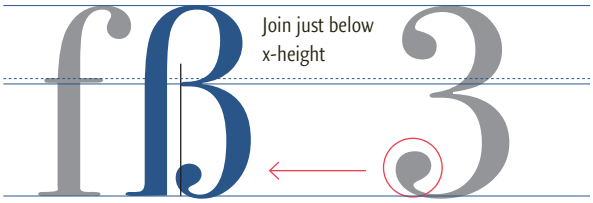
Univers (55 Roman) — Horizontal endings on the eszett and s



Above left, Palatino (1) and Minion (2) are both “s+s” eszett forms. This is the “fs” design (the f is actually a long s form).
Above right, Plantin (3) and Portada (4) are “s+z” eszett forms—the “Sulzbach” design. The long s is joined to a cursive, lowercase z.

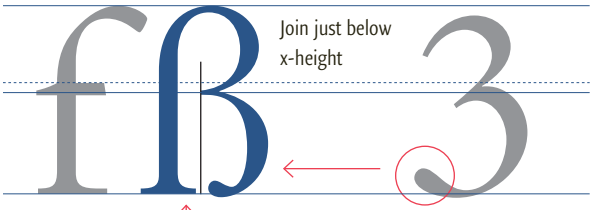


Left, Helvetica Neue. Right, Adelle PE (Pan-European) include Greek characters.
Unlike the eszett, the beta (red line) descends, and has a fully enclosed interior counter.



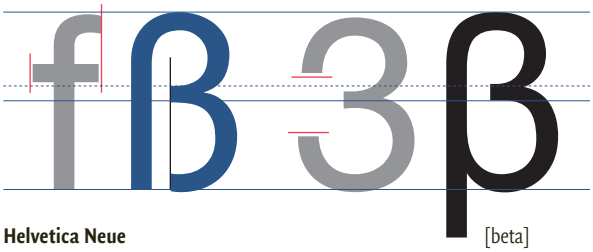
ITC Bodoni
(Book)

No interior serif

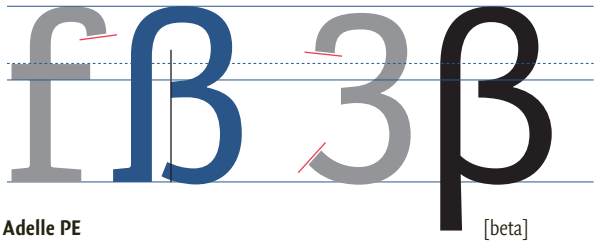


Bembo MT Pro
(Regular)

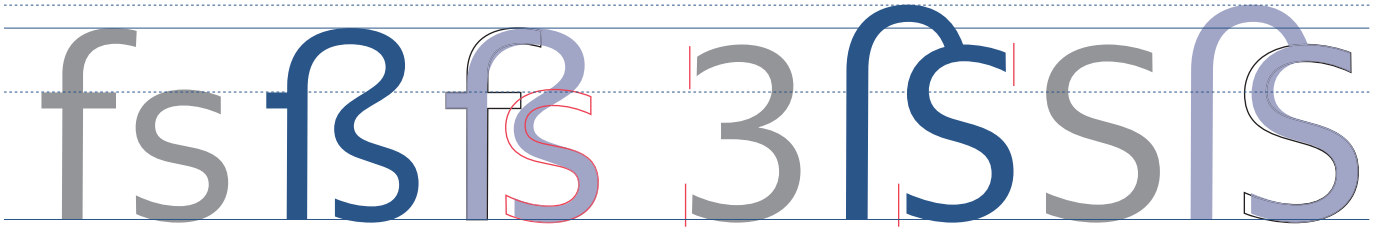
Interior serif



Helvetica Neue
(Regular)

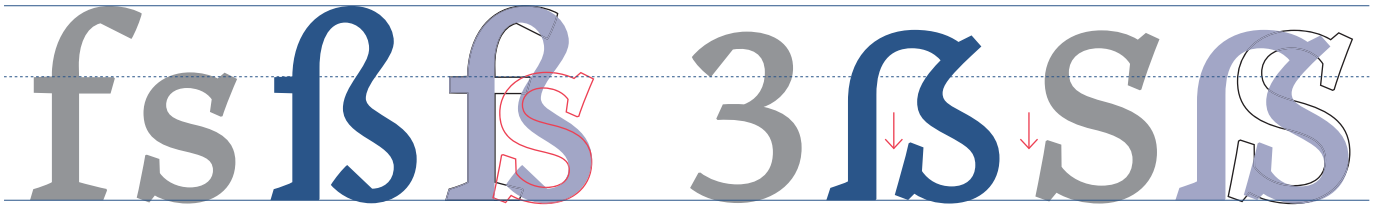


Adelle PE
(Regular)



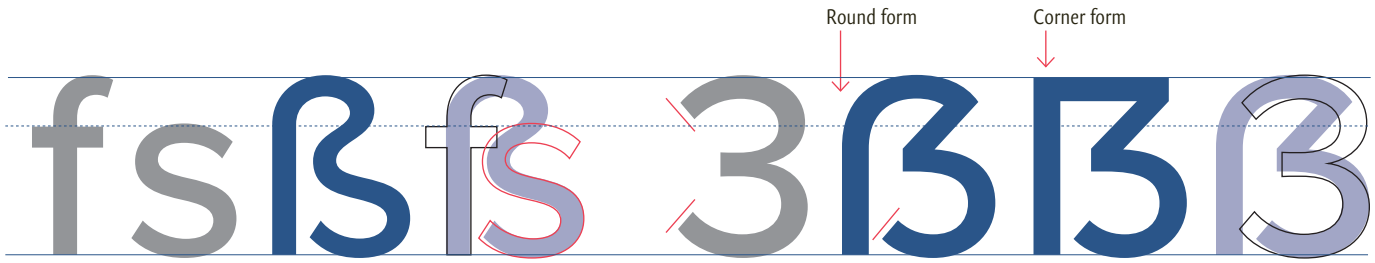
PMN Caecilia Sans Head
(Regular)

Tall construction allows for full capital S[7]



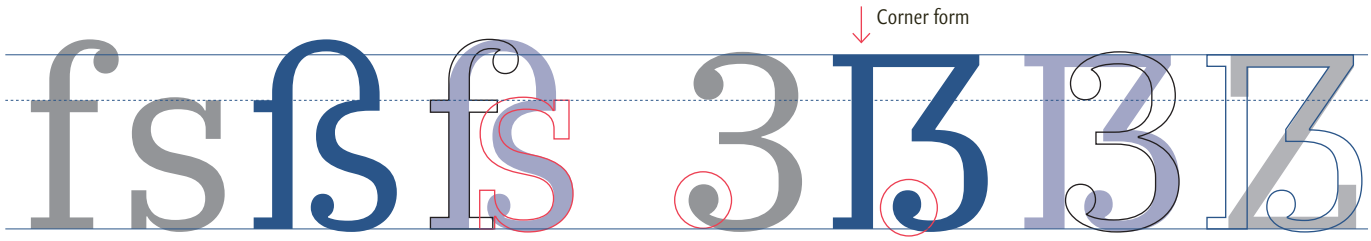
Noort
(Book)

Unusual construction with cropped S form;[7]
serifs repeat on eszett and capital S



Proxima Nova
(Medium)

Font includes two variations of the capital eszett



IBM Plex Serif
(Regular)

Ball-shaped terminals on eszett and 3

Diagonal of capital eszett matches Z

7 Type designer Luc(as) de Groot describes Caecilia Sans's capital eszett as "Brave and beautiful!" He also commends the eszett in Noort (lucasfonts.com/learn/1E9E).

a

APPENDICES

APPENDIX 1: TYPEFACE CLASSIFICATION

Many type designers and design historians have attempted to capture both the formal and contextual differences of typefaces in classification systems. Most taxonomies of type are based at least in part on the mid-century work of French typographic historian Maximilien Vox.[1] This book focuses on six of the nine groups proposed by Vox and ATypI (Association Typographique Internationale). These categories are defined by both their visual characteristics (stroke contrast, serif shape, stress) and their time of historical development.

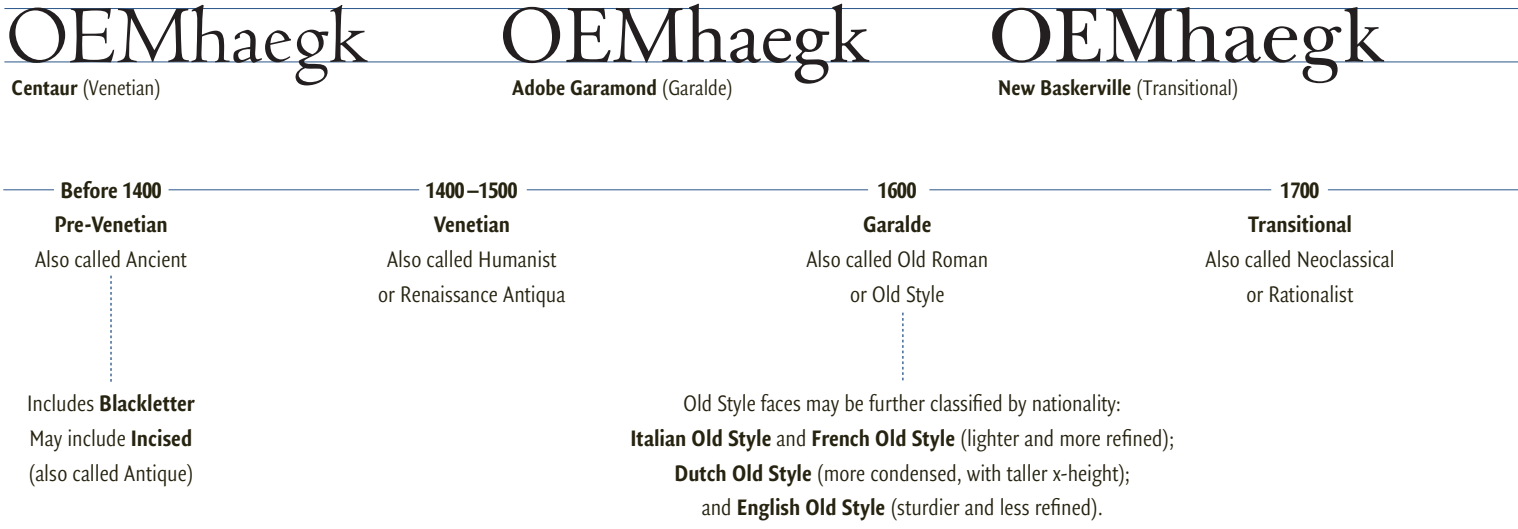
For example, the Venetian, Garalde, and transitional classifications refer to typefaces designed in the fifteenth, sixteenth, and seventeenth centuries respectively. The differences between these categories are, at first glance, relatively subtle—some designers use the term "Old Roman" to refer to them collectively. However, the separate classifications are in fact important, because each group defines a specific step within a larger typographic movement: the evolution of letters from written, calligraphic forms to drawn and designed constructions.

Within this subset, perhaps the finest distinction is made between Venetian and Garalde designs. Venetian types have the clearest relationship to pen-formed writing: The oblique axis is severe, contrast is low, and letter components (serifs, bowls, tails, and so on) display the abrupt modeling of a broad-edge pen. In Garalde typefaces, these hallmarks of calligraphy are softened in favor of new esthetic influences—the Mannerist and Baroque movements. Garalde typefaces have flowing forms, medium to high contrast, and variable widths (the capital letters have wide and narrow old-style proportions).

The transitional period is so named for its chronological position of development, which falls between the Garalde and Didone categories. Transitional typefaces were influenced by rationalist philosophy and Neoclassicism; these movements visually manifest themselves in types that have a vertical (or near vertical) axis, systematic construction, and high stroke contrast.

The Didone classification partially overlaps the transitional category. (The term "Didone" is a portmanteau word that combines "Bodoni" and "Didot"—the major types in this category.) Although Didones were inspired by pre-existing transitional models—especially Baskerville—both styles were popular in the 1700s and 1800s. However, unlike the analytical transitional age, Didones reflect the expressive ideals of Romanticism. The Didone style exaggerates key features of the earlier transitionals: Letters are drawn with vertical stress, uniform widths (modern proportions), and extreme contrast.

Chronologically, the slab serif category follows the Didone classification. However, unlike the previously discussed typestyles, slab serifs were developed for commercial reasons. Prior to the



nineteenth century, typeface design was almost exclusively orientated toward the production of books. The Industrial Revolution dramatically enlarged the typographic scene; printers (and their entrepreneurial clients) demanded bigger, bolder, and more flamboyant typefaces for advertising and display. For example, the type designer and sculptor Eric Gill was asked to make five bold versions of Gill Sans: "each one thicker and fatter than the last because every advertisement has to try and shout down its neighbours."[2]

In the beginning, designers such as Gill did simply make existing typefaces bolder, but this of course resulted in vulgar forms of limited legibility. Eventually, designers turned to alternative vernacular models of type and developed two different kinds of slab serifs: the earlier, unbracketed versions known as Egyptians and the later, bracketed versions known as Clarendons.

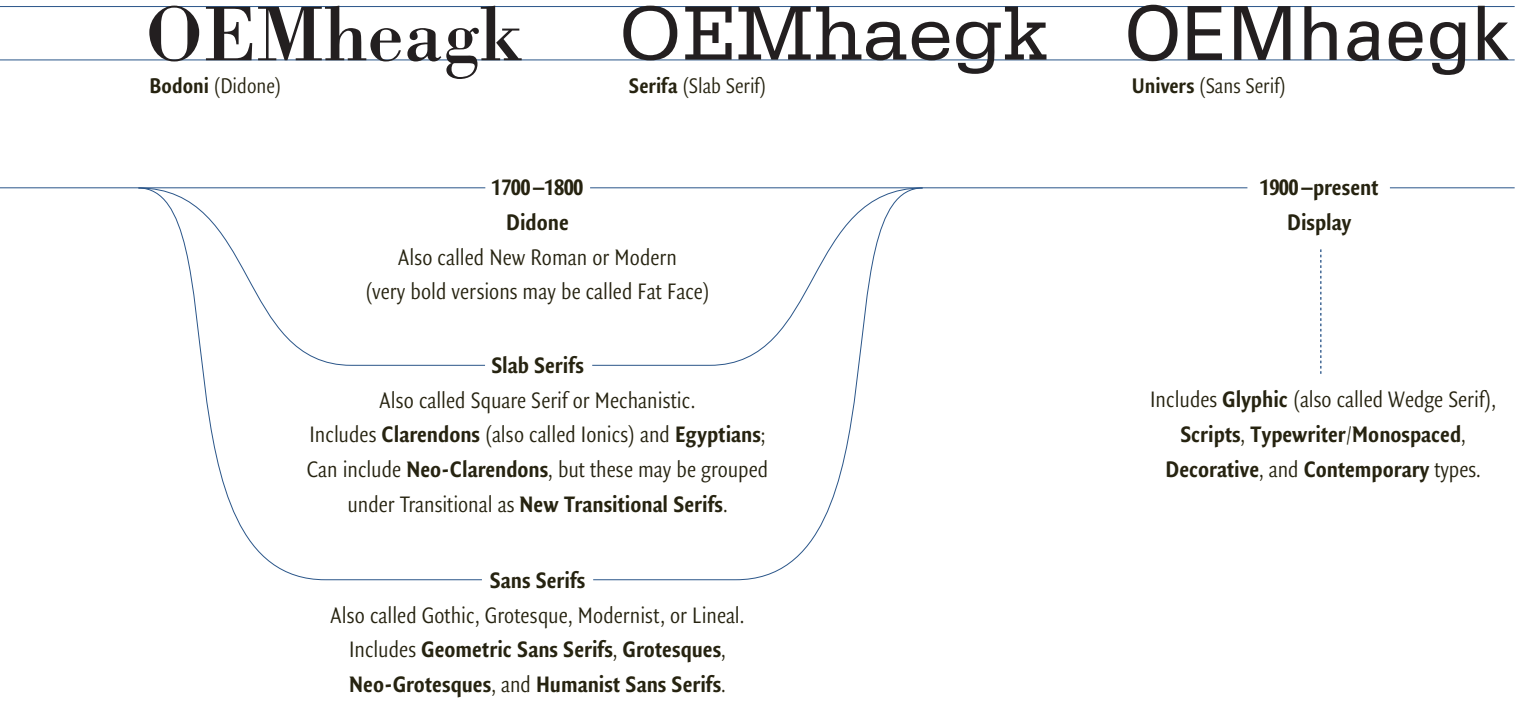
The final historical classification is sans serif, a category that includes the widest range of subgroups (grotesques, neo-grotesques, geometric sans serifs, and humanist sans serifs). When the first sans serif designs appeared in the early 1800s, they were literally called "grotesque" for their shocking, unadorned appearance. In England, grotesques were largely ignored, owing to the popularity of fat faces (very bold Didones) and slab serifs. However, other countries (such as Germany and Switzerland) embraced the sans serif esthetic, especially during the rise of modernism in the 1920s.

Modernists favored sans serif typefaces for their streamlined simplicity and perceived alliance with the "machine age." The emphasis on unity and rationality naturally led to the development of a geometrically constructed typestyle—geometric sans serifs. Later, in the pursuit of ever greater purity and refinement, designers also adapted the original grotesques (which were essentially slab serif faces with the serifs cut off) into neo-grotesques of ever more systematic construction.

Throughout the twentieth century, a wide range of humanist sans serifs (sans serifs influenced by calligraphy and classical ideals) co-existed with both grotesques and neo-grotesques. The earliest humanist sans serifs (such as Johnston and Gill) had capitals with classical proportions, and lowercase letters with calligraphic structures (particularly the a, g, and t). Contemporary humanist sans serifs share these traits, but the capitals often have modern proportions for efficiency in text. In general, a sans serif is considered humanist when the letters have classic shapes, wide apertures, angled stroke endings, and/or angular stress.

1 Childers, Taylor, et al. "25 Systems for Classifying Typography: A Study in Naming Frequency." *Parsons Journal for Information Mapping*, Vol. V, No. 1, 2013, pp. 1–15.

2 Gill, Eric, and Christopher Skelton. *An Essay on Typography*. Boston: David R. Godine, 2007.



The complete history of type is far more lengthy and complex than what I have summarized here. For example, we have not discussed the Scotch Roman genre (named for foundries in Glasgow and Edinburgh that specialized in these types). Scotch Romans originated largely as an attempt to revise transitional and Didone styles into typefaces that would be suitable for text-size use (the high contrast of Didones makes them look spindly at small size). Similarly, there were efforts to modify bold slab serifs into "humanist slab serifs" that were lighter, more readable, and more efficient for setting long texts. It is well worth exploring the veins of typographic history to better understand the conditions and theories that have made type successful (and unsuccessful) in the different contexts throughout history.

PROBLEMS OF CLASSIFICATION

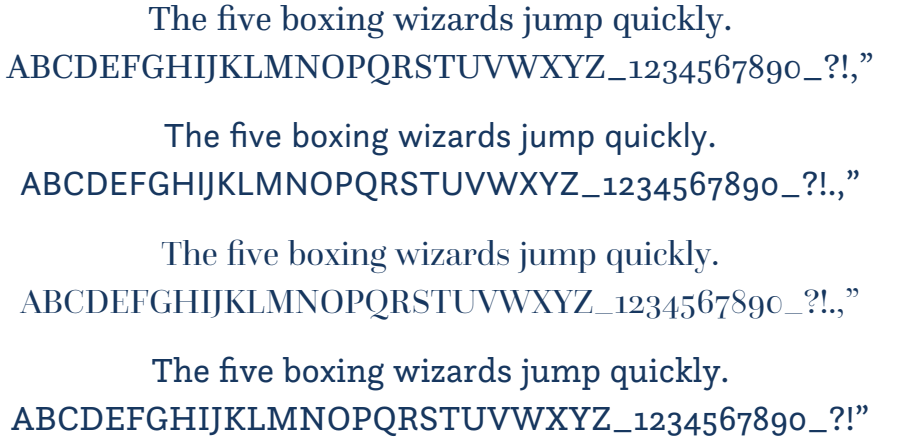
The Vox classification is useful in that it describes a clear, linear progression of typographic development. However, since Vox's time, type design has continued to change and evolve. Advances in technology (especially the widespread adoption of digital type founding) have resulted in thousands of new types. Some of these types defy description, let alone classification. While attempts have been made to expand the original Vox system by creating new or hybrid categories (for example, reverse-contrast, demi-Didone, neo-Clarendon), these classifications are not universally understood or accepted.

The limitations of the original Vox system are a result of its reliance on only two attributes of type: visual characteristics and chronological development. Today, type is more complex; fonts could be classified on the basis of several additional factors, including, notably, both function and intent. Ideally, fonts designed for specific media (for example, signage, print or online newspapers, computer programming, e-books, small digital screens/watches, or textbooks) might be grouped together; placing them within the historical Vox categories prevents designers from understanding their intended use. Similarly, typefaces influenced by specific artistic or social movements (such as modernism or postmodernism) might also be grouped in some fashion. Revivals (reinterpretations of classic typefaces) could also be related to their source material. Finally, typefaces designed as superfamilies or "mega-families" (a related set of serif, semi-serif, semi-sans, and/or sans serif fonts, such as Questa and Thesis, for example) would likely also benefit from a unique classification.

The original Vox system also fails to account for geographic and cultural differences that influence the design of type. Although globalization has eroded some of these differences, there are still important distinctions that can and likely should be made between American and European types. Furthermore, there are clearly national characteristics that define French, Italian, German, Dutch, British, US, Spanish, Czechoslovakian, and Polish types, among others. Indeed, the differences in letter and diacritic frequency (for example, the density of capitals in German) might even dictate specific typographic attributes.

Clearly, both type designers and typographers would benefit from a new classification system that addresses these and other issues of modern type design. Ideally, the new system would be capable of ordering types on several scales—including the visual, historical, technological, functional, cultural, and geographic. Unfortunately, it seems unlikely that such an ideal system can be designed without resulting in inaccessible complexity.

Still, attempts at type classification should not be abandoned altogether. For both the type designer and typographer, the activity of classification is an important aid to the study of type. Classification reveals important influences—historical, social, cultural, and functional—that have shaped the design of the alphabet since the invention of the written word. As such, classification remains a useful, albeit imperfect, field.



Above, the four members of the Questa superfamily by Martin Majoor and Jos Buivenga: Questa, Questa Sans, Questa Grande, and Questa Slab.

abcdefghijklmnopqrstuvwxyz 1234567890 .,?!”
ABCDEFGHIJKLMNOPQRSTUVWXYZ
All questions asked by five watched experts amaze the judge.

Brunel Text Short (Roman): An example of the Scotch Roman genre designed by Paul Barnes of Commercial Type.

abcdefghijklmnopqrstuvwxyz 1234567890 .,?!”
ABCDEFGHIJKLMNOPQRSTUVWXYZ
All questions asked by five watched experts amaze the judge.

Brix Slab (Roman): An example of a humanist slab serif by Hannes von Döhren and Livius Dietzel of HvD fonts.

abcdefghijklmnopqrstuvwxyz 1234567890 .,?!”
ABCDEFGHIJKLMNOPQRSTUVWXYZ
All questions asked by five watched experts amaze the judge.

Capitolium News 2 (Regular): An example of a typeface designed for a newspaper by Gerald Unger with the TypeTogether foundry.

abcdefghijklmnopqrstuvwxyz 1234567890 .,?!”
ABCDEFGHIJKLMNOPQRSTUVWXYZ
All questions asked by five watched experts amaze the judge.

Bell Centennial: A typeface designed for names and addresses in telephone directories by Matthew Carter (commissioned by AT&T to replace Bell Gothic).

abcdefghijklmnopqrstuvwxyz 1234567890 .,?!”
ABCDEFGHIJKLMNOPQRSTUVWXYZ
All questions asked by five watched experts amaze the judge.

Input Mono (Regular): An example of a monospaced typeface designed for computer programming by David Jonathan Ross.

abcdefghijklmnopqrstuvwxyz 1234567890 .,?!”
ABCDEFGHIJKLMNOPQRSTUVWXYZ
All questions asked by five watched experts amaze the judge.

Hobeaux (Regular): James Edmondson’s 2015 revival (issued by Oh no Type Company) of Morris Fuller Benton’s Hobo from 1910 (which was influenced by Art Nouveau).

Throughout this book, I have referenced the font editors Glyphs and FontLab, because, at this time, they are the best known and most popular commercial type design software. Other options include FontForge, which is a free and open-source UNIX application; RoboFont, which is built in the Python programming language and developed by faculty and alumni of the Type and Media program at KABK (Royal Academy of Art, The Hague); and DTL (Dutch Type Library) OTMaster, an editor with unique technical capacities (for example, it allows users to examine and modify the internal structures of a font). All of these programs have robust documentation and active user forums, which are typically the best source of up-to-date information.

DIGITIZING SKETCHES

All font editors allow users to import a scan (e.g. a drawing of a letter) and trace it with specialized drawing tools. These tools are similar to those in other vector drawing programs (e.g. Adobe Illustrator) but are optimized for drawing glyphs. The overall environment is also specialized for creating fonts. For example, most programs have an overview of the entire type matrix with individual boxes for each glyph. Within each font file, the designer can set global guidelines for the x-height, capital-height, ascenders, descenders, overshoot, and undershoot. Then, each glyph needs to be drawn, and its sidebearings (left and right) set for spacing.

When drawing letters in vector software, points should be placed at the horizontal and vertical extremes. The point handles need to be tangent to the curve in order for type to look best on screen. As a rule of thumb, the control points of a curved segment should fall inside an imaginary triangle. The bezier handles of a point should be symmetrical, and they should not cross. To avoid increasing the file size of a font, designers strive to use the smallest number of points to create the shape of a character. You do not have to skimp on points—use a point if it is necessary—but fewer points tend to make smoother curves. Most font editors have functions to help optimize point placement.

HINTING

A key function of any font editor is providing hinting, or instructions for rendering fonts. To display fonts on a digital screen, the vector outlines of type must be mapped to a pixel grid. On low-resolution devices, mathematical rounding can make small type look unattractive, because the pixels selected are not necessarily the best representation of a certain glyph. For complex glyphs in non-Latin languages (e.g. Chinese, Japanese, and Korean, or CJK) poor screen rendering can even make text illegible.

Hinting addresses this problem by adjusting letter contours so that the pixels being used more accurately represent the glyph. For example, in PostScript, hinting can force all vertical and horizontal stems to render at a specific number of pixels; it can also ensure consistent vertical alignment within certain zones (such as at the baseline, cap-height, and x-height). In conjunction with a user's particular screen and anti-aliasing algorithm, hinting can sometimes also improve the rendering of diagonal strokes and elements that would otherwise look "jaggy" and "stair-stepped."

In Europe and North America, hinting has become somewhat less important, thanks to increased adoption of high-resolution displays and technological advances in screen rendering. However, low-resolution screens are still common elsewhere, and can be a factor for slow-moving institutions—government offices, schools, hospitals, libraries—any organization that has large quantities of legacy machines. Hinting also remains critical in non-Latin languages with complex characters (e.g., CJK fonts).

Because hinting is a highly technical procedure that varies according to the font format being generated (TrueType or OpenType), many designers outsource hinting to specialists, or rely on the automatic hinting provided in font design software. One could also manually refine only the most problematic characters. The specific process for hinting is too complex to describe here, but there are many tutorials and resources in the user forums of font editors.

INTERPOLATION AND FONT GENERATION

In the past, designers had to painstakingly craft each variant of a font family—every style, weight, and width. However, today many font editors can now interpolate, or generate, intermediate fonts from two or more masters. For example, type designers may begin by drawing both a light and a bold master; the font software then generates as many in-between weights as requested. This could be a single regular weight between the two masters, or three different weights: regular, medium, and semi-bold. Alternatively, the regular weight could be designed first as the master, with bold and light weights generated programmatically.

Other typographic properties can also be interpolated besides the weight example described above. Axes can be defined for width, contrast, serif size, degree of obliqueness, and so on. Most software programs require at least each end of an axis to be defined with a master; additional masters can be used to further control the interpolation. For example, the designer might include a normal-weight master (between light and bold) to help shape medium and semi-bold weights being interpolated.

One could also create an alternate master that activates when a threshold on the axis is reached. This is useful for text and display alternates. For example, a typeface might have a display version of the Q with a tail stroke that extends into the interior counter. Once a certain boldness is reached, a text version of the Q (without the interior tail) can be automatically substituted.

Furthermore, two or more axes can be combined. This is useful for auto-generating styles such as small capitals (the shorter capital letters designed to blend with lowercase text). Small caps are typically used for acronyms, Roman numerals, and proper names (including "camel words" such as ATypI), because full-height capitals would visually stand out in a block of text. Small caps can also be used instead of other styles (such as bold or italic) to create a different level of typographic hierarchy.

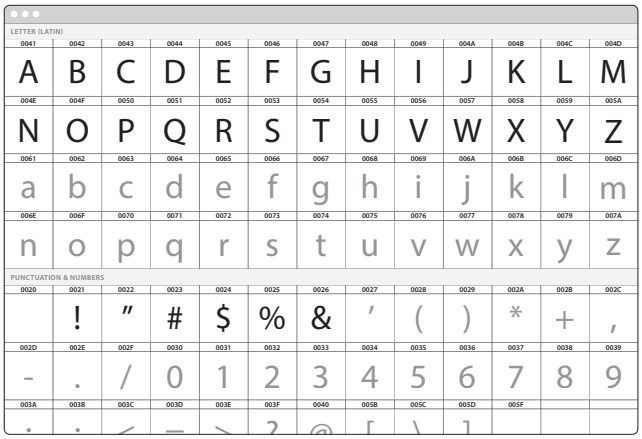
Because small caps are usually designed to be slightly taller than the x-height, interpolation can be used to reduce the overall height of the full capitals. At the same time, interpolation can be used to generate stem and stroke weights between that of the full capitals and the lower case. The resulting small caps are not likely to be perfect, but are a good starting point for further refinement.

VARIABLE FONTS

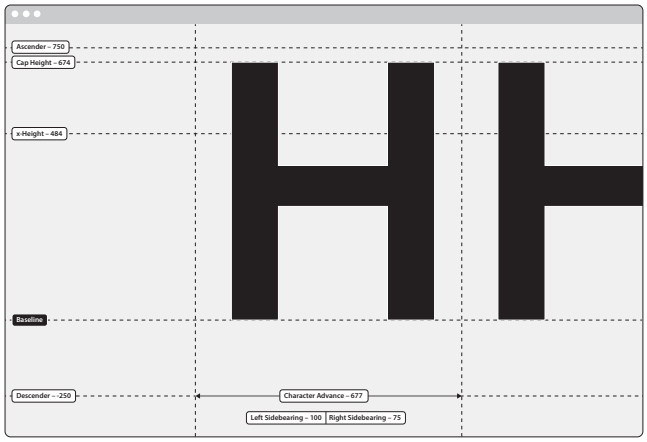
The concept of interpolation underlies the OpenType Variable Font format introduced by Adobe, Apple, Google, and Microsoft in 2016. Rather than exporting each interpolation instance as a separate, static font file, designers can now build a single master font that directs a web browser (or any text-rendering software) to generate the desired interpolated fonts "on the fly." A key benefit to this scheme is efficiency, since only one master font needs to be loaded by the browser, rather than several typestyles. Additionally, the variable type being generated can be optimized to the specific environment of the viewer (for example, a small mobile phone vs. a large tablet or a high-resolution desktop monitor).

While font files are relatively small, especially in comparison to images, readers are known to be impatient. According to Google Analytics, more than half of all users (53%) will leave a webpage if it takes more than three seconds to load.[3] In 2017, the average size of a US webpage was around 2MB. Replacing five webfonts with a single variable font saves could save around 0.5MB—or 25% of the total page. Saving half a megabyte saves about an eighth of a second in the US (in 2019, the average US Internet speed was approximately 4MB per second). However, even a small reduction in data has potentially large effects, since the international companies supporting variable fonts are serving literally billions of font files.

3 "Find Out How You Stack Up to New Industry Benchmarks for Mobile Page Speed," ThinkWithGoogle.com, Feb 2017, think.storage.googleapis.com/docs/mobile-page-speed-new-industry-benchmarks.pdf.



Most font editors open with an overview of the entire type matrix, which has individual boxes for each glyph. Each box needs a vector drawing.



One usually begins by setting global guidelines for the x-height, cap-height, ascenders, descenders, overshoot, and undershoot. Then each character is drawn, and the left and right sidebearings are set for spacing.

Illustrations by Peiran Tan.

APPENDIX 3: FURTHER READING

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Font Review Journal: fontreviewjournal.com
Written and published by designer Bethany Heck.

Fonts in Use: Fontsinuse.com
Published by Stephen Coles, Editorial Director and Associate Curator at The Letterform Archive.

Typographica: Typographica.org
Published by Stephen Coles, Editorial Director and Associate Curator at The Letterform Archive.

ONLINE TYPE DISCUSSION FORUMS

Type Drawers: TypeDrawers.com
Originally a project of Stephen Coles (see above); now administered by designer/writer Tiffany Wardle de Sousa and type designer James Hultquist-Todd.

Typography Guru: typography.guru
A project of type designer Ralf Herrmann.

OTHER TYPOGRAPHIC RESOURCES

365typo.com–Blog of type news (also a book series).

lettermodel.org–Dr. Frank E. Blokland's blog with research on letterspacing and LS Cadencer.

paulshawletterdesign.com–Research from Paul Shaw, type design and graphic design historian.

typeculture.com—Academic resources from type designer and design scholar Mark Jamra.

typographher.com–Blog of Nicole Arnett Phillips, designer and publisher of *TYPOgraph* journal.

typotheque.com/articles—Writings curated by Peter Biľak, type designer/founder of Typotheque type foundry.

TYPOGRAPHIC ORGANIZATIONS

Alphabettes: alphabettes.org

American Institute of Graphic Design: aiga.org

Association Typographique Internationale: atypi.org

Herb Lubalin Study Center: lubalincenter.cooper.edu

International Society of Typographic Designers (ISTD): istd.org.uk

Letterform Archive: Letterformarchive.org

St. Bride Foundation: sbf.org.uk

Society of Typographic Aficionados: typesociety.org

Tokyo Type Directors Club: tdctokyo.org

Type Directors Club: tdc.org

Type Thursday: typethursday.org

The Typographic Circle: typocircle.co.uk

Typeright: typeright.org

APPENDIX 4: TYPEFACES AND FOUNDRIES

Abril • TypeTogether
José Scaglione and Veronika Burian

Acropolis • Hoefler & Co.
Jonathan Hoefler. Part of the Proteus Project, a set of four nineteenth-century styles: Acropolis, Leviathan, Saracen, and Ziggurat.

Adelle • TypeTogether
José Scaglione and Veronika Burian

Aglet Slab • XYZ Type
Jesse Ragan

Akzidenz Grotesk • Berthold
Originating designer unknown; adaptation for Berthold by Günter Gerhard Lange.

Albertina • Dutch Type Library
Chris Brand and Frank E. Blokland

Algebra • Commercial Type
Kai Bernau and Susana Carvalho

Ambroise • Typofonderie
Jean François Porchez

Amplitude • Font Bureau
Christian Schwartz

Apolline • Typofonderie
Jean François Porchez

Apollo • Monotype
Adrian Frutiger

Archer • Hoefler & Co
Tobias Frere-Jones and Jonathan Hoefler.
See also: Rockwell.

Ardoise • Typofonderie
Jean François Porchez

Avenir Next • Monotype
Adrian Frutiger with Akira Kobayashi

Baskerville, New ITC • Monotype
Originating designer John Baskerville; adaptation by John Quaranda.

Baskerville Original • Storm Type Foundry
Originating designer John Baskerville; adaptation by František Štorm.

Baskerville, PT • Paratype
Originating designer John Baskerville; adaptation by Arina Alaferdova and Dmitry Kirsanov.

Bau, FF • Monotype
Originating designer unknown; based on a grotesk designed in-house at the Schelter & Giesecke type foundry. Adaptation by Christian Schwartz with art direction by Erik Spiekerman.

Bell Centennial • Monotype
Matthew Carter and Alex Kaczun

Bell Gothic • Monotype
Chauncey Griffith with Isabella Chaeva (Cyrillic)

Bembo • Monotype
Frank Hinman Pierpont, Fritz Stelzer, and Stanley Morison; Robin Nicholas (digital redesign, Bembo Book).

Benton Sans • Font Bureau
Cyrus Highsmith and Tobias Frere-Jones.
See also: Trade Gothic.

Bernina Sans/Bernino Sans • Just Another Foundry
Shoko Mugikura and Tim Ahrens

Bliss • Jeremy Tankard
Jeremy Tankard

Bodoni • Monotype
Originating designer Giambattista Bodoni; adapted for Monotype by Sol Hess.

Bodoni, Bauer • Monotype
Originating designer Giambattista Bodoni; adapted by Heinrich Jost with punchcutter Louis Hoell.

Bodoni, ITC • Monotype
Originating designer Giambattista Bodoni; adaptation by Holly Goldsmith, Janice Fishman, Jim Parkinson, and Sumner Stone.

Bodoni, LTC 175 • P22
Originating designer Giambattista Bodoni; adaptation by designers Paul Hunt (digital font remastering) and Dave Farey (bold weight).

Bookman, ITC • Monotype
Ed Benguiat

Brandon Grotesque • HvD Fonts
Hannes von Döhren

Bree Serif • TypeTogether
José Scaglione and Veronika Burian. Part of the Bree family, which includes Bree Sans.

Brix Slab • HvD Fonts
Hannes von Döhren and Livius Dietzel

Brunel • Commercial Type
Paul Barnes

Caecilia Family, PMN • Monotype
Peter Matthias Noordzij

Campaign • PS Type
Mark Caneso

Capitolium/Capitolium News • TypeTogether
Gerard Unger

Caslon, Adobe • Adobe
Carol Twombly

Caslon, Big • Carter & Cone
Matthew Carter

Centaur • Monotype
Bruce Rogers with punchcutter Robert Wiebking

Century • Monotype
Linn Boyd and Morris Fuller Benton

Century Gothic • Monotype
Monotype Type Drawing Office (TDO).
See also: Futura, Avenir.

Century Schoolbook • Monotype
Morris Fuller Benton. See also: Harriet.

Champion Gothic • Hoefler & Co.
Jonathan Hoefler. Originally designed for *Sports Illustrated* magazine and available in six weights, later expanded into the Knockout Family of 32 fonts.

Cheltenham, ITC • Monotype
Bertram Goodhue with Hannibal Ingalis Kimball and Morris Fuller Benton

Chiswick Sans • Commercial Type
Paul Barnes. Part of the Chiswick Collection, a set of three styles: a serif, a high contrast sans, and a grotesque.

Clarendon • Monotype
Originating designers Robert Besley, William Thorowgood, and Benjamin Fox; adapted for Haas Type Foundry by Hermann Eidenbenz. See also: Eames Century Modern, Superclarendon.

Cloister • Monotype
Originating designer Nicolas Jenson; adapted by Morris Fuller Benton for ATF (American Type Founders) and Phil Martin for Linotype.

Covik Sans • OH no Type Co.
James Edmondson

Dax, FF • Monotype
Hans Reichel

Didot, HTF • Hoefler & Co.
Originating designer: Firmin Didot; adaptation by Jonathan Hoefler for *Harper's Bazaar* magazine.

Didot, Linotype • Monotype
Originating designer: Firmin Didot; adaptation by Adrian Frutiger.

DIN 1451 • Monotype
Ludwig Goller and Adolf Gropp

DIN, FF • Monotype
Originating designers Ludwig Goller and Adolf Gropp; adaption by Albert-Jan Pool at the suggestion of type designer Erik Spiekermann.

Domaine • Klim
Kris Sowersby

Eames Century Modern • House Industries
Erik van Blokland with Ken Barber, Andy Cruz, and Tal Leming. See also: Clarendon.

Emigre / Emperor • Emigre
Zuzana Licko. Now part of the Lo-Res type family; also includes Oakland and Universal.

Esso • (unreleased)
Molly Boyd, Rachel Hobart, Jamie Martin and Lacey Verhalen with Koko Morrill

Eureka Sans • Monotype
Peter Biľak. Part of the Eureka Family, which includes Eureka Serif, Eureka Sans, and Eureka Mono.

Faber Sans • Ingo Fonts
Ingo Zimmerman

Fakt • Type By
Thomas Thiemich

Fedra Family • Typotheque
Peter Biľak (Latin and Greek) and Gayaneh Bagdasaryan (Cyrillic). Includes Fedra Serif, Sans, Sans Condensed, Mono, Display, and Screen.

Feijoa • Klim
Kris Sowersby

Foco • Dalton Maag
Fabio Luiz Haag

Forma • DJR
David Jonathan Ross. See also: Helvetica.

Fournier, PS • Typofonderie
Stéphane Elbaz

Franklin Gothic • Monotype
Morris Fuller Benton with John L. Renshaw and Whedon David. See also: Benton Sans, Trade Gothic.

Freight Sans • Garage Fonts
Joshua Darden

Frutiger • Monotype
Adrian Frutiger. See also: Univers.

Futura LT • Monotype
Paul Renner. See also: Avenir, Gotham.

Futura PT • Paratype
Originating designer Paul Renner; adaptation by Vladimir Yefimov and Isabella Chaeva (Cyrillic).

Galliard, ITC • Monotype
Originating designer Robert Granjon; adaptation by Matthew Carter.

Garamond, Adobe • Adobe
Originating designers Claude Garamond (Roman) and Robert Granjon (Italic); adaptation by Robert Slimbach.

Garamond, ITC • Monotype
Originating designer Jean Jannon; adaptation by Tony Stan.

Garamond, Stempel • Monotype
Originating designer Claude Garamond; adaptation by Rudolf Wolf. See also: Sabon, Sabon Next.

Gedau Gothic • FontFarm
Natascha Dell and Karl-Friedrich Oetzbach

Geneo • Typofonderie
Stéphane Elbaz

Georgia • Carter & Cone
Matthew Carter. See also: Miller, Brunel.

Gerstner Programm • Forgotten Shapes
Karl Gerstner with Christian Mengelt and Stephan Müller (adaptation in 2018)

Gill Sans • Monotype
Eric Gill

Gotham Family • Hoefler & Co.
Tobias Frere-Jones with Jesse Ragan, Malou Verlomme, and Sara Soskolne. Includes four widths in the sans as well as a rounded style (Gotham Rounded).

Granjon • Monotype
George W. Jones and Chauncey Griffith (modelled after Garamond; Granjon is a misnomer.)

Graphik • Commercial Type
Christian Schwartz

Grifo • R–Typography
Rui Abreu

Gustan • Lux Typo
Greg Lindy

Harriet • Okay Type
Jackson Cavanaugh

Helvetica • Monotype
Eduard Hoffman and Max Miedinger. See also: Neue Haas Grotesk, Helvetica Neue.

Helvetica Neue • Monotype
Originating designers Eduard Hoffman and Max Miedinger; Helvetica Neue digitized at Linotype with external consultant Erik Spiekermann. See also: Neue Haas Grotesk, Unica77.

Hobeaux • Oh no Type Co.
Originating designer Morris Fuller Benton (Hobo); adaptation by James Edmondson.

IBM Plex • IBM and Google Fonts
Mike Abbink and Bold Monday, led by Paul Van der Laan. Supporting designers Pieter van Rosmalen, Barbara Bigosinska, Diana Ovezea, Aleksandra Samuļenkova, Jasper Terra, Edgar Walthert, Marko Hrastovec, and Pablo Gamez. Includes Sans, Sans Condensed, Mono, and Serif.

Input Mono • DJR
David Jonathan Ross

Interstate • Font Bureau
Tobias Frere-Jones

Irma Text • Typotheque
Peter Biľak and Alexander Tarbeev

Joanna • Monotype
Eric Gill. See also: Whitman.

Klavika • Process Type
Eric Olson

Klint • Monotype
Hannes von Döhren

Le Monde Family • Typofonderie
Jean François Porchez. Includes Le Monde Courrier, Journal, Livre (Book), and Sans.

Legacy Sans, ITC • Monotype
Ronald Arnholm

Lucida Sans • Bigelow & Holmes
Charles Bigelow and Kris Holmes

Lydian • Monotype
Warren Chappell

Lyon • Commercial Type
Kai Bernau

Maiola • TypeTogether
Veronika Burian

Malaga • Emigre
Xavier Dupré

Mallory • Frere-Jones Type
Tobias Frere-Jones and Nina Stössinger

Melior • Monotype
Hermann Zapf

Mercury • Hoefler & Co.
Jonathan Hoefler and Tobias Frere-Jones for *Esquire* magazine.

Méridien • Monotype
Adrian Frutiger

Merriweather • Google Fonts and Sorkin Type
Eben Sorkin

Meta, FF • Monotype
Erik Spiekermann and Oded Ezer. See also: ITC Officina Sans.

Miller • Carter & Cone
Matthew Carter. See also: Georgia, Brunel.

Minion • Adobe
Robert Slimbach

Mrs Eaves / Mrs Eaves XL • Emigre
Zuzana Licko. Part of the Eaves family, which also includes Mr Eaves, a sans companion.

MS Sans • Microsoft
Microsoft

Neubau Grotesk • Neubau Studio
Stefan Gandl

Neue Haas Grotesk • Font Bureau
Originating designers Eduard Hoffman and Max Miedinger; adaptation by Christian Schwartz and Berton Hasebe. See also: Helvetica, Helvetica Neue, Unica77.

News Gothic • Adobe
Originating designer Morris Fuller Benton; adaptation by Adobe.

Nexus Mix, FF • Monotype
Martin Majoor. Part of the Nexus family, which includes Nexus Serif, Nexus Sans, and Nexus Typewriter. See also: FF Scala.

Noe • Schick Toikka
Florian Schick and Lauri Toikka

Noort • TypeTogether
Juan Bruce

Oakland • Emigre
Zuzana Licko. Now part of the Lo-Res type family; also includes Emigre, Emperor and Universal.

Officina Sans, ITC • Monotype
Erik Spiekermann, Just van Rossum, and Ole Schäfer. Part of the Officina family which includes Officina Serif and Officina Display. See also: FF Meta.

Ogg • Sharp Type
Lucas Sharp and Greg Gazdowicz with Connor Davenport and Wei Huang

Olsen, FF • Monotype
Morten Olsen

Omnes • Darden Studio
Joshua Darden

Orientation • Commercial Type
Sandrine Nugue

Palatino • Monotype
Hermann Zapf

Parisine • Typofonderie
Jean François Porchez

Patisserie • (Unreleased)
Cameron Coupe, Dana Golan, Eva Grate, Sahm Lee, and Jennifer Strong

Pilat • General Type Studio
Stéphane Elbaz

Piquette • wayjaywang.com
Fellix Wang

Plantin • Monotype
Frank Hinman Pierpont, Fritz Stelzer, and Stanley Morison

Portada • TypeTogether
José Scaglione and Veronika Burian

Praxis Next • Monotype
Gerard Unger

Proxima Nova • Mark Simonson Studio
Mark Simonson

Qashiko • Khaito (Kaito) Gengo
Kaito (Khaito) Gengo

Quadraat Family • Type By
Fred Smeijers. Includes Quadraat Serif, Mono, Sans, Sans Condensed, Display, and Headliner.

Questa Family • Fontspring
Martin Majoor and Jos Buivenga. Includes Questa, Questa Grande, Questa Sans, and Questa Slab.

Real, FF • Monotype
Erik Spiekermann and Ralph du Carrois

Renommée • Lazydogs
Originating designer Jan van Krimpen (Romanée typeface) with punchcutter Paul Helmuth Rädisch; adaptation by Holger Königsdörfer.

Replica • Lineto
Dimitri Bruni and Manuel Krebs

Requiem • Hoefler & Co.
Jonathan Hoefler

Retiro • Typofonderie
Jean François Porchez

Riga • Ludwig Type
Ludwig Übele

Rockwell • Monotype
Morris Fuller Benton, Frank Hinman Pierpont, Fritz Stelzer, and Monotype Type Drawing Office (TDO)

Romain • Swiss Typefaces (retired)
Based on the models developed by the French Royal Committee: Jean-Paul Bignon, Jacques Jaugeon, Gilles Filleau des Billettes, and Jean Truchet with engraver Louis Simonneau; also related to Philippe Grandjean's Romain du Roi. Adapted by Ian Party.

Romanée PT • (Unreleased)
Originating designer Jan van Krimpen with punchcutter Paul Helmuth Rädisch; adaptation by Peiran Tan. See also: Renommée.

Ronnia • TypeTogether
José Scaglione and Veronika Burian

Rosart • Camelot
Originating designer Jacques-François Rosart; adaptation by Katharina Köhler.

Sabon • Monotype
Jan Tschichold. See also: Stempel Garamond.

Sabon Next • Monotype
Originating designer Jan Tschichold; adaptation by Jean François Porchez. See also: Sabon, Stempel Garamond.

Sansa • Type By
Fred Smeijers

Scala Family, FF • Monotype
Martin Majoor. Includes Scala Serif and Scala Sans.

Sectra • Grilli Type
Dominik Huber, Marc Kappeler, and Noël Leu

Serifa • Monotype
Adrian Frutiger with André Gürtler

Souvenir, ITC • Monotype
Originating designer Morris Fuller Benton; adaptation by Ed Benguiat.

Stag • Commercial Type
Christian Schwartz

Strada, FF • Monotype
Albert Pinggera

Suisse Family • Swiss Typefaces
Ian Party with Pascal Zoghbi (Arabic). Includes Suisse Int'l, Suisse Neue, Suisse Sign, and Suisse Works.

Superclarendon • Typodermic
Ray Larabie. See also: Century Schoolbook, Clarendon, Eames Century Modern.

Supria Sans • HvD Fonts
Hannes von Döhren

Swift • Monotype
Gerard Unger

Syntax • Monotype
Hans Eduard Meier

Thesis Family • Lucas Fonts
Luc(as) de Groot. Includes TheSans, TheSerif, and TheMix.

Trade Gothic • Monotype
Jackson Burke. See also: News Gothic, Benton Sans.

Trajan • Adobe
Carol Twombly

Trianon • Production Type
Loïc Sander. See also: Didot, HTF Didot.

Trilby • DJR
David Jonathan Ross

Trump Mediaeval • Monotype
Georg Trump

Unica77 • Lineto
Originating designers Team77: André Gürtler, Christian Mengelt, and Erich Gschwind for Haas Type Foundry. Adapted by Christian Mengelt with Maurice Göldner for Lineto. See also: Helvetica, Helvetica Neue, Neue Haas Grotesk, Univers.

Unit Slab • Monotype
Erik Spiekermann, Christian Schwartz, and Kris Sowersby with Panos Haratzopoulos (Greek) and Alexandra Korolkova/Olga Umpeleva (Cyrillic). Part of the Unit Family which includes sans and rounded styles. See also: FF Meta, ITC Officina.

United Serif • House Industries
Tal Leming

Univers • Monotype
Adrian Frutiger. See also: Unica77.

Usual • R-Typography
Rui Abreu

Velo • House Industries
Christian Schwartz, Mitja Miklavčič, and Ben Kiel. Part of the Velo family which includes Velo Serif. See also: Melior.

Verdana • Carter & Cone
Matthew Carter

Walbaum • Monotype
Carl Crossgrove, Steve Matteson, and Juan Villanueva

Whitman • Font Bureau
Kent Lew. See also: Joanna.

Whitney • Hoefler & Co.
Tobias Frere-Jones. Originally designed for the New York Whitney Museum.

William • Typotheque
Maria Doreuli. See also: Adobe Caslon, Big Caslon.

Workroom Sans • (unreleased)
Philbert Widjaja, Ruby Peven, Annabelle Lee, and Joe Jang

Ziggurat • Hoefler & Co.
Jonathan Hoefler. Part of the Proteus Project, a set of four nineteenth-century styles: Acropolis, Leviathan, Saracen, and Ziggurat.

This appendix researched and compiled by Peiran Tan.

TYPE FOUNDRIES

A2-TYPE www.a2-type.co.uk

Adobe fonts.adobe.com

ATF (American Type Founders) Collection atftype.com

Berthold bertholdtypes.com

Bigelow & Holmes bigelowandholmes.typepad.com

Bold Monday boldmonday.com

Briefcase Type Foundry briefcasetype.com

Camelot camelot-typefaces.com

Canada Type canadatype.com

Carter & Cone cartercone.typenetwork.com

Commercial Type commercialtype.com

Dalton Maag daltonmaag.com

Darden Studio dardenstudio.com

DJR (David Jonathan Ross) djr.com

Dutch Type Library dutchtypelibrary

ECAL Typefaces ecal-typefaces.ch

Emigre emigre.com

Font Bureau fontbureau.typenetwork.com

Font Farm fontfarm.de

FontFont fontshop.com

Fontsmith fontsmith.com

Fontspring fontspring.com

Forgotten Shapes forgotten-shapes.com

French Type frenchtype.com

Frere-Jones Type frerejones.com

Future Fonts futurefonts.xyz

Garage Fonts garagefonts.com

General Type Studio generaltypestudio.com

Grilli Type grillitype.com

Hoefler & Co. typography.com

House Industries houseind.com

HvD Fonts hvdfonts.com

Ingo Fonts ingofonts.de

Jeremy Tankard typography.net

Just Another Foundry justanotherfoundry.com

Klim klim.co.nz

Lazydogs lazydogs.de

Lineto lineto.com

Linotype linotype.com

Lucas Fonts lucasfonts.com

Ludwig Type ludwigtype.de

Lux Typo luxtypo.com

Mark Simonson Studio marksimonson.com

Milieu Grotesque milieugrotesque.com

Monokrom monokrom.no

Monotype monotype.com

Neubau Studio neubauladen.com

OH no Type Co. ohnotype.co

Okay Type okaytype.com

Pampatype pampatype.com

P22 p22.com

Paratype paratype.com

Process Type processtypefoundry.com

Production Type productiontype.com

PS Type pstypelab.com

R–Typography r-typography.com

Retype re-type.com

Schick Toikka schick-toikka.com

Sharp Type sharptype.co

Sorkin Type sorkintype.com

Storm Type Foundry stormtype.com

Sudtipos sudtipos.com

Suitcase Type Foundry suitcasetype.com

Swiss Typefaces swisstypefaces.com

TEFF (The Enschedé Font Foundry) teff.nl

Tiny Type tinytype.co

Type By typeby.com

TypeTogether type-together.com

Typodermic typodermicfonts.com

Typofonderie typofonderie.com

Typotheque typotheque.com

Underware underware.nl

Village vllg.com

XYZ Type xyztype.com

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Bold page numbers refer to text; all other page numbers refer to illustrations.

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