

Dubberly Design Office

# Understanding Typography

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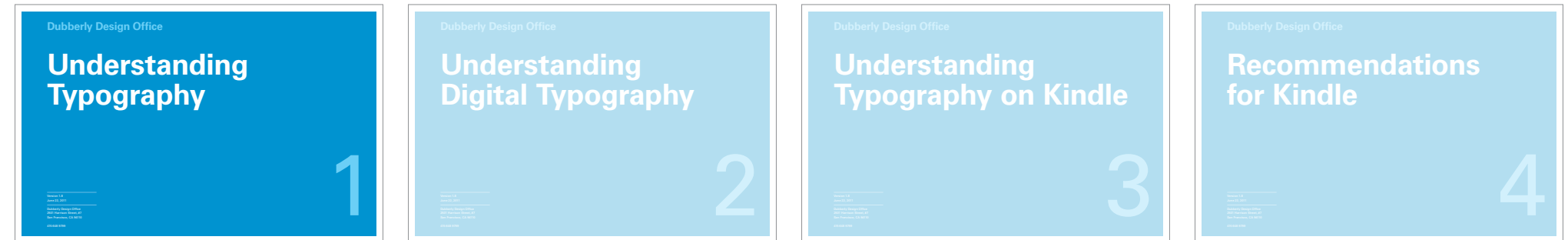
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# Overview

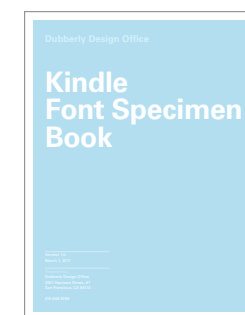
Dubberly Design Office analyzed typography on Kindle and suggested ways the experience of reading might be improved. We have produced a sequence of four reports leading to specific recommendations.

The first report provides an overview of typography; the second describes how computers have changed type and typesetting; and the third describes how Kindle implements type and typography today. We also produced a Kindle Font Specimen Book as a supplement to the third report. The fourth report suggests ways the experience of reading on Kindle might be improved.

All four reports are organized in a similar structure, beginning with an overview and preceding from glyphs to pages to books to collections for Latin and other character sets.



	<b>How Are Languages Represented?</b>	<b>What's Different?</b>	<b>What is Kindle?</b>	
Glyphs	<b>How Have Latin Characters Evolved?</b> <b>How Have Fonts Evolved?</b> <b>How Do You Make Letters Look Good?</b>	<b>How Is Type Input?</b> <b>How Is Type Encoded?</b> <b>How Are Characters Represented?</b> <b>How Do Computers Display Type?</b> <b>How Are Fonts Managed?</b>	<b>How Does Kindle Encode Fonts?</b> <b>How Does Kindle Render Fonts?</b>  <b>* Kindle Font Specimen Book</b>	<b>Fonts</b>
Pages	<b>How Do Characters Go Together?</b> <b>How Do Words Go Together?</b>	<b>How Is Text Formatted?</b> <b>How Are Pages Rendered?</b>	<b>What Can Users Change When Reading a Kindle Book?</b>	<b>Layout</b>
Books	<b>How Do Pages Go Together?</b>	<b>What Is a Digital Book?</b>	<b>How Does Kindle Encode Documents?</b> <b>How Does Kindle Render Documents?</b>	<b>Substrate</b>
Collections	<b>What Is a Book?</b>	<b>How Are Digital Books Managed?</b>	<b>How Do You Publish a Kindle Book?</b>	<b>Interactivity</b>
		<b>How Do Fonts Work on the Web?</b>	<b>*</b>	<b>The Future</b>



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# Introduction

This report provides an overview of typography. It sketches the issues typographers consider when designing books – how they think about optimizing the experience of reading.

The first major focus of this report is type: the range of systems used to represent language; the evolution of the shape of Latin characters into many forms; the evolution of font styles; and the subtle corrections type designers make to ensure that letters look good. Type design boils down to two things:

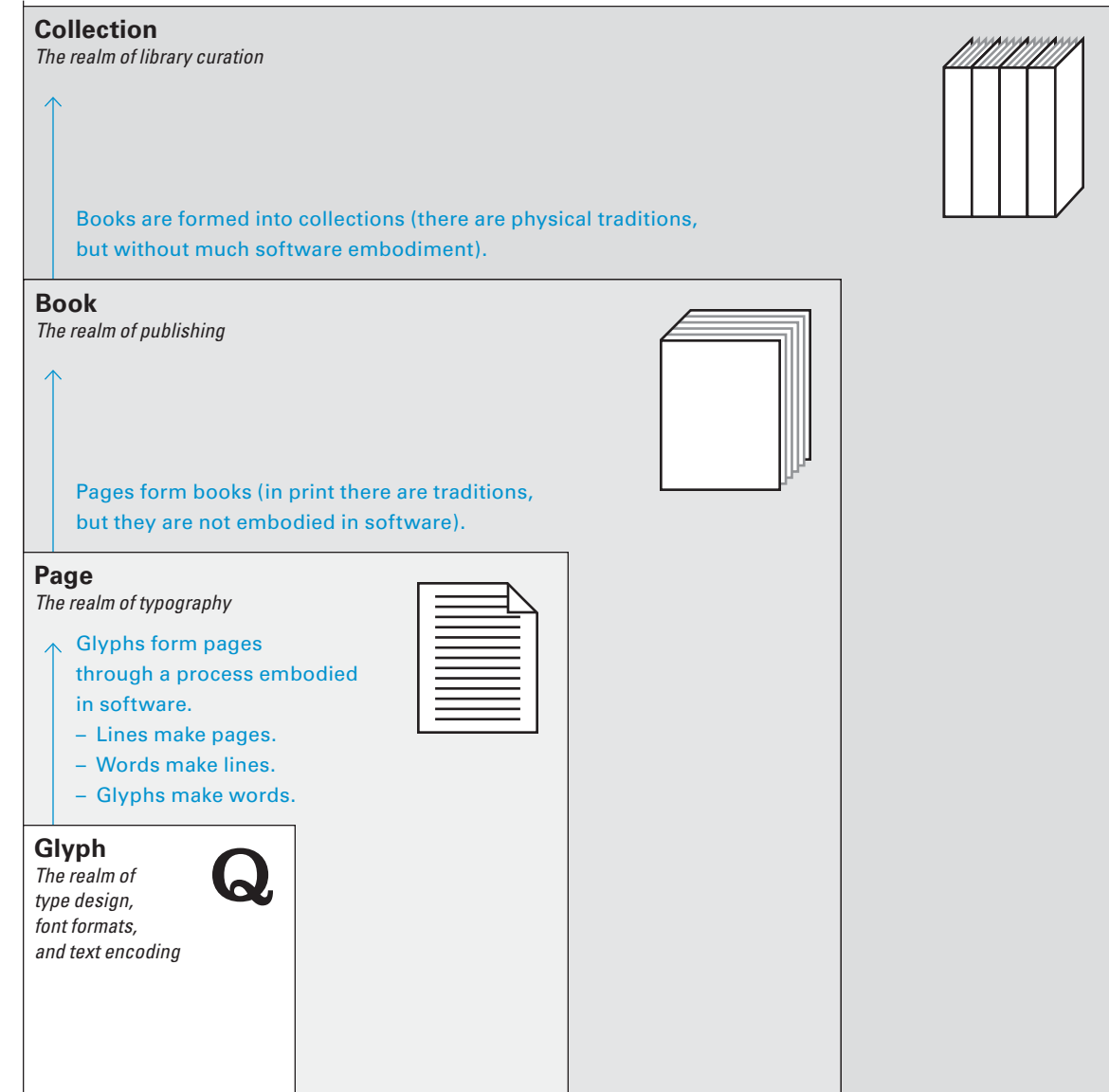
- 1 Creating a set of shapes that appear related and are easily recognizable – a font.
- 2 Creating fonts that appear related but are also easily distinguished – contrasting font families.

The second major focus of this report is typography per se: the process of arranging letters to form words, arranging words to form lines, arranging lines to form pages. Typographers use the contrasts offered by type (e.g., roman vs italic, large vs small, regular vs bold) to group some letters together and at the same time separate them from other groups of letters.

Concerns about reading (and book design) don't stop at the page. Reading takes place in a context. Printed books are three-dimensional objects. Their form and arrangement as objects are also designed and define the most immediate context for reading, the why and where you read any given book rounds out the context. While not a major focus, these issues are also discussed.

Readers often perceive the act of reading to take place between the levels of the book and the page, but reading encompasses realms both above and below these elements.

Beyond the curated collection (or library) exists all other books that are *not* part of the collection.



Averages → 1 page = 2000 glyphs / 325 words    1 book = 200 pages / 65,000 words    1 library = 18,000 books\*

\* The average city library  
Major university libraries have 10–15 million volumes grouped in tens of collections.  
The Library of Congress has 32 million books.



# How Are Languages Represented?

Languages come in many forms, and writing systems for representing those languages are almost as diverse. Some writing systems use one character to represent basic sound units, while others use one character to represent an entire word. In some cases writing systems indicate the pronunciation and pitch, while others indicate only consonants and leave vowel sounds to be determined by context. It is necessary to understand how any given writing system works before users and technical development requirements can be determined.

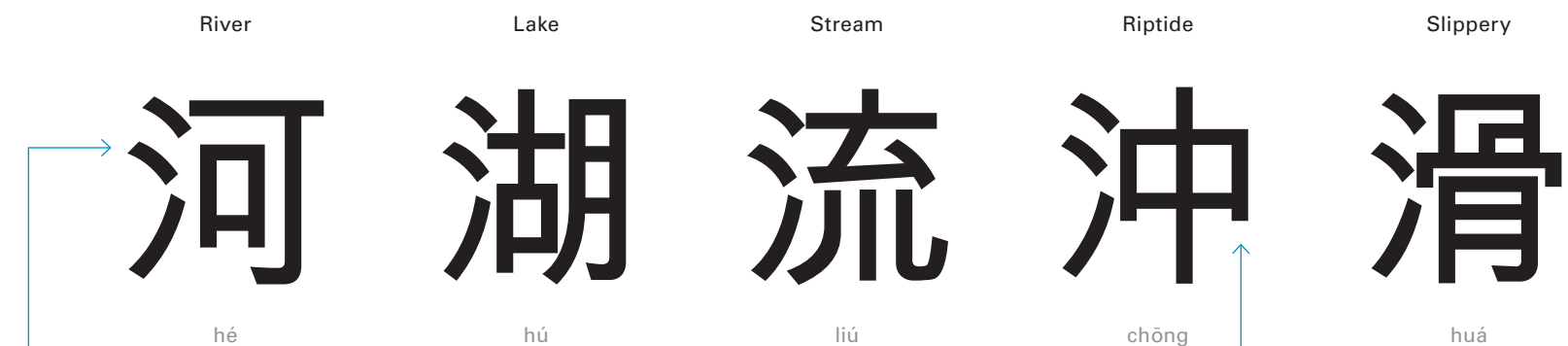
## How Are Languages Represented?

# Logographic

In logographic writing systems, each character – a logogram – represents a single word. These systems require huge numbers of characters to fully represent the language; Chinese has approximately 60,000 distinct characters, though only about 4,000–6,000 are commonly used. Compare this to English, which has about 250,000 words with a much smaller commonly-used set, all of which are composed from far fewer characters. Most writing systems use some logograms. An example of western logograms are the Hindu-Arabic numeric logograms – everyone who uses these characters understands what “1” means whether they call it *one*, *eins*, *uno*, *yi*, *ichi*, *ehad*, or *jedan*. Logograms are sometimes called ideograms, a word that refers to characters which graphically represent an abstract idea. Linguists avoid this use because it excludes characters which denote pronunciation as well as ideas, such as in written Chinese – each character contains elements that represent meaning and others that represent pronunciation.

Written Chinese is the most important and, to a degree, the only surviving logographic system. Chinese characters are or were used with varying degrees of modification in written Japanese, Korean, Vietnamese, and several other East Asian languages. Some of these systems also use Chinese characters in conjunction with other systems. Japanese, for example, makes use of about 4,000 Chinese characters along with its own alphabets. Ancient Egyptian hieroglyphs and the Mayan writing system are also systems with certain logographic features, although they may have marked phonetic features as well.

Chinese characters are made up of both a semantic element that describes a root associated idea and a phonetic element that indicates how the character is pronounced.



The radical of three short strokes on the left of each character is a simplified pictograph for a river, indicating the character has a semantic connection with water.

The right-hand side of each character is a phonetic indicator. For example, in the case of 冲 chōng, the phonetic indicator is 中 zhōng, which by itself means “middle”. In this case it can be seen that the pronunciation of the character is slightly different from that of its phonetic indicator; this process means that the composition of such characters can sometimes seem arbitrary today.

## How Are Languages Represented?

# Syllabic

A syllabary is a set of written characters that represent (or approximate) syllables, which in turn make up words. A character in a syllabary typically represents a consonant sound followed by a vowel sound, or just a vowel alone.

Syllabaries are best suited to languages with relatively simple syllable structure, such as Japanese. The English language on the other hand, allows many complex syllable structures, with a relatively large inventory of vowels and complex consonant clusters. The number of possible syllables in Japanese is no more than about fifty to sixty, whereas in English there are many thousands of possible syllables. To write English using a syllabary, every possible syllable would require a separate character.

In a “true syllabary”, there is no systematic visual similarity between phonetically-related characters though some syllabaries do have visual similarity for the vowels. For example, in written Japanese the characters for “ke”, “ka”, and “ko” have no similarity to indicate their common “k” sound (voiceless velar plosive). More recent creations such as the Cree syllabary embody a system of varying signs, which can best be seen when arranging the syllabogram set in an onset–coda or onset–rime table.

Other languages that use true syllabaries include Mycenaean Greek (Linear B) and Native American languages such as Cherokee. Several languages of the Ancient Near East used forms of cuneiform, which is a syllabary with some non-syllabic elements. Another type of writing system with systematic syllabic linear characters is abugida. (See page 11.)

Japanese has two distinct syllabaries that are structured in the same way but have different uses. Hiragana (seen to the right) is used to spell out native words phonetically in literature and personal writing while katakana is used to spell out foreign words phonetically. (Japanese also makes use of kanji, a limited set of borrowed Chinese Han characters used primarily for proper nouns and verb roots.) Hiragana and katakana developed from kanji.

The basic Japanese hiragana syllabary. Each character is either a vowel (top row) or a consonant plus a vowel. Going down the left-most column, the top row is pronounced “a”, the second is “ka”, the third is “sa”, and so on. Hiragana also has digraphs and diacritical marks that add the consonants G, Z, D, B, P, and V.

	a	i	u	e	o
	あ	い	う	え	お
k	か	き	く	け	こ
s	さ	し	す	せ	そ
t	た	ち	つ	て	と
n	な	に	ぬ	ね	の
h	は	ひ	ふ	へ	ほ
m	ま	み	む	め	も
y	や		ゆ		よ
r	ら	り	る	れ	ろ
w	わ	ゐ*		ゑ*	を
*	ん				

\* No longer in use

n  
(nasal)

The Japanese word *arigato* (“thank you”) spelled using hiragana. Each character represents one syllable. Anyone familiar with the sound of the word should be able to determine the spelling logically, and anyone familiar with the spelling should understand how to pronounce the word.

あ り が と

a ri ga to

The addition of a diacritic to the character for “ka” changes its pronunciation to “ga”. The same diacritic changes all of the syllables beginning with “k” into syllables beginning with “g”.

## How Are Languages Represented?

# Syllabic (cont.)

Katakana is primarily used for transcription of foreign language words into Japanese and also for writing loan words. It is also used for technical and scientific terms, the names of Japanese companies, plants, animals, and minerals

The basic Japanese katakana syllabary. Katakana represents the same syllables as hiragana, however it does so with an entirely different set of visual characters.

	a	i	u	e	o
	ア	イ	ウ	エ	オ
k	カ	キ	ク	ケ	コ
s	サ	シ	ス	セ	ソ
t	タ	チ	ツ	テ	ト
n	ナ	ニ	ヌ	ネ	ノ
h	ハ	ヒ	フ	ヘ	ホ
m	マ	ミ	ム	メ	モ
y	ヤ		ユ		ヨ
r	ラ	リ	ル	レ	ロ
w	ワ	ヰ*		ヱ*	ヲ
*	ン	n (nasal)	ツ	indicates a germinate consonant	

\* No longer in use.

A comparison of the word *konnichiwa*<sup>†</sup> (“hello”) written in both katakana (top) and hiragana (bottom). When Japanese words are uttered by a foreigner, they are represented using katakana instead of the normal hiragana characters.

Katakana

コニチワ  
ko n ni chi wa



Not all characters in the Japanese kana syllabaries follow a strictly logical pattern. The character for /chi/ is one such character: according to the table it should be /ti/. The character for the sound “ti” is actually represented by a digraph of the character for /te/ and /i/. This applies in both syllabaries.



Hiragana

こんにちは  
ko n ni chi ha<sup>†</sup>

<sup>†</sup> In hiragana, when “wa” is used as a particle, it is written with the “ha” character. Without the particle “wa”, “konnichi” is a polite way of saying “today”. The particle “wa” signals that there is more to be said. The literal translation is not “hello”, but rather “as for this day” – there is an implied continuation beyond the word.

## How Are Languages Represented?

# Alphabetic

### Segmental writing system

An alphabet is a small set of characters each of which roughly represents a phoneme of a spoken language. (A phoneme is the smallest segment of sound used to form meaningful contrast between utterances.)

In a perfectly phonetic alphabet, the phonemes and characters would correspond perfectly in two directions: a writer could predict the spelling of a word given its pronunciation, and a speaker could predict the pronunciation of a word given its spelling. Each language has general rules that govern the association between characters and phonemes, but, depending on the language, these rules may or may not be consistently followed.

Perfectly phonetic alphabets are very easy to use and learn. Languages that have them (for example Serbocroatian or Slovenian or Finnish) have much lower barriers to literacy than languages such as English, which has a very complex and irregular spelling system. Because languages often evolve independently of their writing systems, and writing systems are sometimes borrowed for languages for which they were not designed, the degree to which characters of an alphabet correspond to phonemes of a language varies greatly from one language to another and even within a single language. In modern times, when linguists invent a writing system for a language that didn't previously have one, the goal is usually to develop a phonetic alphabet.

The Greek alphabet. Each character represents a phoneme.  
Forming a syllable requires at least two characters (except in the case of vowels).

Alpha Αα /a/	Beta Ββ /b/	Gamma Γγ /g/	Delta Δδ /d/	Epsilon Εε /e/	Zeta Ζζ /zd/
Eta Ηη /ē/	Theta Θθ /th/	Iota Ιι /i/	Kappa Κκ /k/	Lambda Λλ /l/	Mu Μμ /m/
Nu Νν /n/	Xi Ξξ /ks/	Omicron Οο /o/	Pi Ππ /p/	Rho Ρρ /r/	Sigma Σσς /s/
Tau Ττ /t/	Upsilon Υυ /y/	Phi Φφ /ph/	Chi Χχ /kh/	Psi Ψψ /ps/	Omega Ωω /o/

Αλφάβητος

/a/ /l/ /ph/ /a/ /b/ /ē/ /t/ /o/ /s/

In the polytonic orthography of Greek pronunciation, an acute accent marks a high pitch.

## How Are Languages Represented?

# Abjad

### Consonantal writing system

Abjads differ from other alphabets in that they have only consonantal sound characters. Vowels are not usually marked in abjad. All known abjads (except maybe Tifinagh) belong to the Semitic family of scripts and derive from the original Northern Linear Abjad. The reason for this is that Semitic languages and the related Berber languages have a morphemic structure which makes the denotation of vowels redundant in most cases.

Some abjads (such as Arabic and Hebrew) have markings for vowels as well but use them only in special contexts, such as for teaching. Many scripts derived from abjads have been extended with vowel characters to become full alphabets, the most famous case being the derivation of the Greek alphabet from the Phoenician abjad. This has mostly happened when the script was adapted to a non-Semitic language.



/a/

/i:/

/b/

○

/r/

/ʕ/

/l/

\*

An example of the Arabic script, which is an impure abjad because it is not purely consonantal. As evidenced above, there are vowel sounds that are unwritten, implied, and written.

/a/

The /a/ sound here is unwritten.

The /ʕ/ sound is a voiced pharyngeal fricative, common to Arabic speech. Note that when the word is written out it begins with an 'A', but when spoken it is not a vowel sound but rather a kind of throat sound.

/a/

The initial Alif indicates that the word begins with a vowel, but does not specify what vowel it is. The reader would determine it is an /a/ sound by context.

# Abugida

## Inherent-vowel writing system

An abugida is an alphabetic writing system whose basic signs denote consonants with an inherent vowel and where consistent modifications of the basic sign indicate other following vowels than the inherent one. Thus, in an abugida with a sign for “k” with no vowel and one for “ka” (if “a” is the inherent vowel), then “ke” is written by modifying the “ka” sign in a way that is consistent with how one would modify “la” to get “le”. In many abugidas the modification is the addition of a vowel sign, but other possibilities are imaginable (and used), such as rotation of the basic sign, addition of diacritical marks, and so on.

The contrast with “true syllabaries” is that the latter have one distinct character per possible syllable, and the signs for each syllable have no systematic graphic similarity. The graphic similarity of most abugidas comes from the fact that they are derived from abjads, and the consonants make up the characters with the inherent vowel, and the new vowel characters are markings added on to the base character.

In the Ge’ez script, for which the linguistic term abugida was named, the vowel modifications do not always appear systematic, although they originally were more so. Canadian Aboriginal syllabics can be considered abugidas, although they are rarely thought of in those terms. The largest single group of abugidas is the Brahmic family of scripts, which includes nearly all the scripts used in India and Southeast Asia.

In Brahmic scripts, vowels are diacritical marks attached to consonants. If there is no vowel mark, the default vowel will be used and often there is a sign indicating the explicit lack of a vowel. Vowel diacritics may appear above, below, to the left, to the right, or around a consonant glyph.

Diacritical placement in the Devanagari abugida. The base form of a character has an implied vowel; writing all other vowel sounds with that character is accomplished through diacritics. The vowel diacritics are not used on their own.

None (base form)	Above	Below	Left	Right
क	के	कु	कि	को
/k(a)/	/ke/	/ku/	/ki/	/ko/
प	पे	पु	पि	पो
/p(a)/	/pe/	/pu/	/pi/	/po/

## How Are Languages Represented?

# Featural

A featural script represents finer detail than an alphabet – characters do not represent whole phonemes, but rather the elements (features) that make up the phonemes, such as voicing or its place of articulation.

Theoretically, each feature could be written with a separate character; and abjads or abugidas, or indeed syllabaries, could be featural, but the only prominent system of this sort is Hangul, the Korean script.

Hangul characters encode phonological features of the phonemes they represent. Each consonant sound is represented by a character depicting the position of the mouth and tongue while making the sound, with occasional extra marks showing features such as aspiration. Vowels are built from vertical or horizontal lines to distinguish them from consonants. There are 51 characters, or jamo, in Hangul. 20 are simple and equivalent to letters of the Latin alphabet while 31 are compounds of two or sometimes three of these characters. These building blocks can be combined to form some 15,000 common syllables. When writing out words, characters are grouped by syllables into squares. The layout of characters inside the square depends on the syllable structure as well as which vowels are used. Each square contains at least two characters, with at least one consonant and one vowel. These syllabic blocks can be written horizontally from left-to-right or vertically from top-to-bottom.

The Hangul alphabet. Underneath each character is a transliteration of the pronunciation in English. Two letters separated by a comma below a character indicates that the character is pronounced differently depending on whether it is in the initial or final location. In addition to the basic jamo forms, there are compound jamo (marked below in blue).

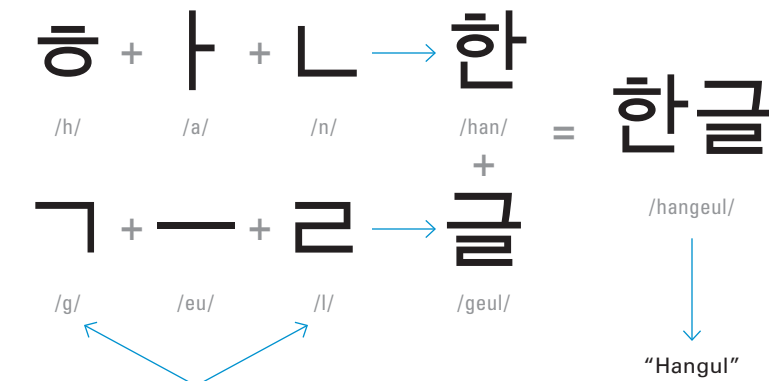
### Consonants

ㄱ	ㄲ	ㄴ	ㄷ	ㄸ	ㄹ	ㄺ	ㄻ
/g,k/	/kk/	/gs/	/n/	/nj/	/nh/	/d,t/	/tt/
ㄴ	ㄷ	ㄸ	ㄹ	ㄺ	ㄻ	ㄼ	ㄽ
/l,r/	/lg/	/lm/	/lb/	/ls/	/lt/	/lp/	/lh/
ㅁ	ㅂ	ㅃ	ㅄ	ㅅ	ㅆ	ㅇ	ㅈ
/m/	/b,p/	/pp/	/bs/	/s/	/ss/	/ng/	/j/
ㅉ	ㅊ	ㅋ	ㆁ	ㆁ	ㆁ		
/jj/	/ch/	/k/	/t/	/p/	/h/		

### Vowels

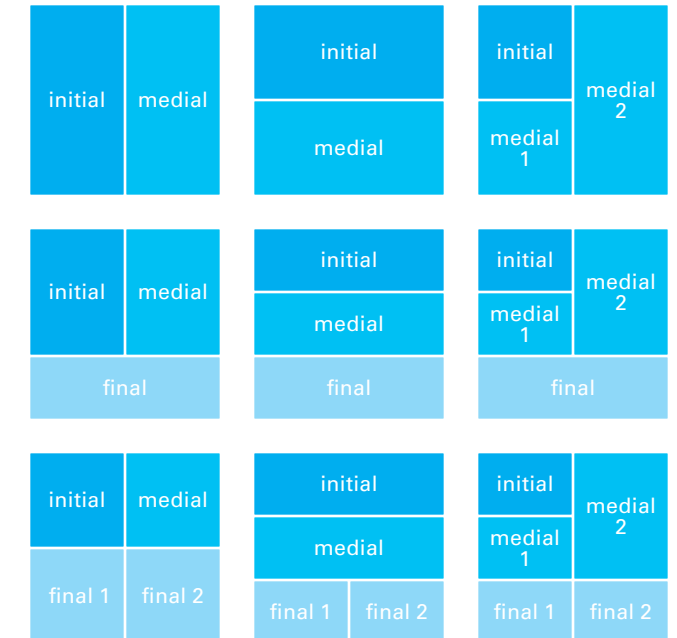
ㅏ	ㅑ	ㅓ	ㅕ	ㅗ	ㅛ	ㅜ	ㅠ
/a/	/ya/	/wa/	/eo/	/yeo/	/wo/	/o/	/yo/
ㅜ	ㅠ	ㅡ	ㅣ	ㅞ	ㅟ	ㅚ	ㅜ
/u/	/yu/	/eu/	/i/	/ae/	/yae/	/wae/	/e/
ㅟ	ㅞ	ㅜ	ㅝ	ㅞ			
/ye/	/we/	/oe/	/wi/	/ui/			

Forming the word “hangeul” using the Hangul script.



Notice how the “g” and “l” characters mimic the position of your tongue and mouth when you make these sounds. Really, try it out.

The diagram below illustrates how jamo are placed together to form blocks. Vowels always occupy the medial position.



Examples of the syllables constructed using the block method.





## How Are Languages Represented?

# Writing Systems & Languages

There are over 6,000 languages currently in use. Most of these languages can be categorized into one primary category of writing system. **Many languages are “ambiguous” and contain elements of more than one writing system.** Because of this it is very difficult to make a truly perfect taxonomy of writing systems, scripts, and languages. For example, English primarily uses the Latin alphabet but also has logograms such as &, #, \$. Other languages make use of more than one script, e.g. Japanese uses three scripts, two of which are syllabic (hiragana and katakana) and one logographic (kanji).

The table to the right categorizes languages by their primary affiliation. It should be noted that while the majority of the world’s languages use the Latin script, many of them have their own versions that use different diacritical marks. Additionally, the Brahmic scripts section could be further subdivided into sub-scripts, as roughly 75% of the listed languages use their own script (the Devanagari script claims the remaining 25%).

Writing System	Script	Language	# Spoken By
Logographic	Hanzi	Mandarin, Wu, Cantonese, Min, Xiang, Hakka, Gan	1,300,000,000
	Hanja	Korean (important supplemental system)	* 77,200,00
	Kanji	Japanese	122,000,000
Syllabic	Hiragana	Japanese	
	Katakana	Japanese	
Alphabetic	Latin	Afrikaans, Albanian, Aragonese, Asturian, Azeri, Basque, Boholano, Breton, Catalan, Cebuano, Cornish, Corsican, Croatian, Czech, Danish, Dutch, English, Esperanto, Estonian, Faroese, Filipino, Finnish, French, Frisian, Friulian, Fula (Pulaar), Gaelic (Scottish), Galician, German, Gikuyu, Guaraní, Hausa, Hawai’ian, Hungarian, Icelandic, Ido, Igbo, Ilocano, Indonesian, Interlingua, Innu-aimun, Irish, Italian, Javanese, Kikongo, Kinyarwanda, Kirundi, Kurdish, Latin, Latvian, Laz, Leonese, Lingala, Lithuanian, Lombard, Luganda, Luxembourgish, Maori, Malay, Maltese, Manx, Moldovan, Nahuatl, Navajo, Ndebele, Norwegian, Occitan, Oromo, Polish, Portuguese, Quechua, Romanian, Samoan, Scots, Shona, Slovak, Slovenian, Somali, Spanish, Swahili, Swedish, Tagalog, Tahitian, Tatar, Tongan, Tswana, Turkish, Turoyo, Vietnamese, Volapük, Võro, Walloon, Welsh, Wolof, Xhosa, Yoruba, Zhuang	1,700,000,000
	Cyrillic	Bashkir, Belarusian, Bosnian, Bulgarian, Erzya, Kazakh, Kildin, Komi, Kyrgyz, Macedonian, Mari, Moksha, Moldovan, Mongolian, Montenegrin, Ossetic, Romani Tajik, Russian, Rusyn, Sami, Serbian, Tuvan, Udmurt, Ukrainian	230,000,000
	Greek	Greek	12,000,000
	Georgian	Georgian, Kartvelian, Mingrelian, Svan	7,000,000
	Armenian	Armenian	6,700,000
Abugida	Brahmic	Angika, Assamese, Balinese, Bengali, Bhili, Bhojpuri, Buginese, Buhid, Burmese, Chakma, Cham, Dzongkha, Geba Karen, Gujarati, Hanuno’o, Hindi, Javanese, Kannada, Kayah, Khmer, Konkani, Kurukh, Ladakhi, Lao, Lepcha, Limbu, Magahi, Malayalam, Marathi, Mon, Nepal Bhasa, Nepali, Orriya, Palawan, Punjabi, Pwo Karen, Rejang, Rumi Paulang, Sanskrit, Saurashtra, Shan, Sinhala, S’gaw Karen, Tagalog, Tai Dam, Tai Lü, Tamil, Telugu, Thai, Tibetan	1,500,000,000
	Ge’ez	Ethiopian Semitic languages (e.g. Ge’ez, Amharic, Tigrinya, Tigre, Harari, etc.), Blin, Me’en	80,000,000
	Thaana	Divehi	350,000
	Canadian Syllabic	Inuit, Algonquian, Cree, Naskapi, Inuktitut, Ojibwe, Blackfoot, Slavey, Chipewyan, Dakelh, Tasttine, Tli Cho	215,000
Abjad	Arabic	Arabic, Garshuni, Kazakh, Kurdish, Kyrgyz, Persian, Azeri, Dari, Tajik, Uyghur, Judeo-Arabic, Azerbaijani, Sini, Salar, Xiao’erjing, Urdu, Sindhi, Punjabi, Kashmiri, Balochi, Arwi, Malayalam, Jawi, Malay, Bedawi, Comorian, Hausa, Mandinka, Fula, Wolof, Berber, Afrikaans, Aljamiado, Ottoman Turkish, Medieval Bosnian, Medieval Albanian	600,000,000
	Hebrew	Hebrew, Yiddish, Ladino, Judeo-Arabic	11,320,000
Featural	Hangul	Korean (primary system)	* 77,200,000

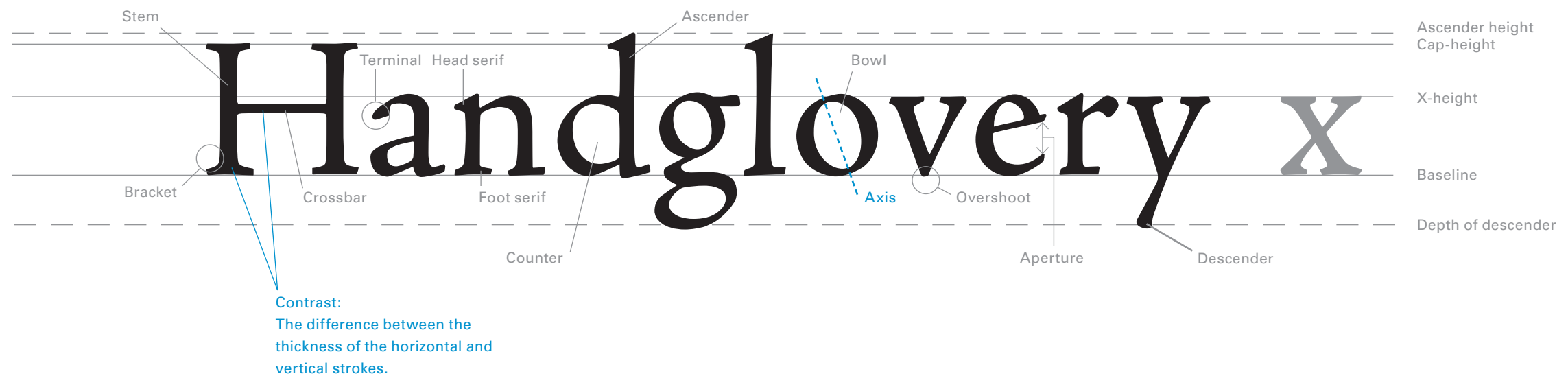
\* Hanja and Hangul are used together and represent a single population.

# How Have Latin Characters Evolved?

The visual form of a language is a shared convention that we (as speakers of that language) mutually agree upon. The characters used to represent languages are not fixed ideas. Over time they have changed and evolved, sometime drastically. It is useful to understand that the elements we understand today to be all parts of one system were not always so – some elements evolved out of older forms while other elements were imported from different systems.

# Anatomy

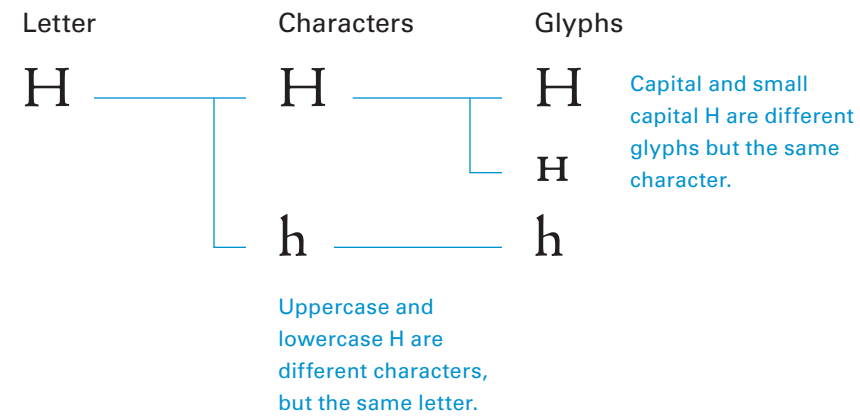
Letters are the building blocks of typography. The world of type is filled with arcane details and technical jargon: letters have parts that have names. When having a serious discussion about typography it is important to be familiar with this terminology. The design of the elements of a letter's anatomy impacts how that letter might look on screen.



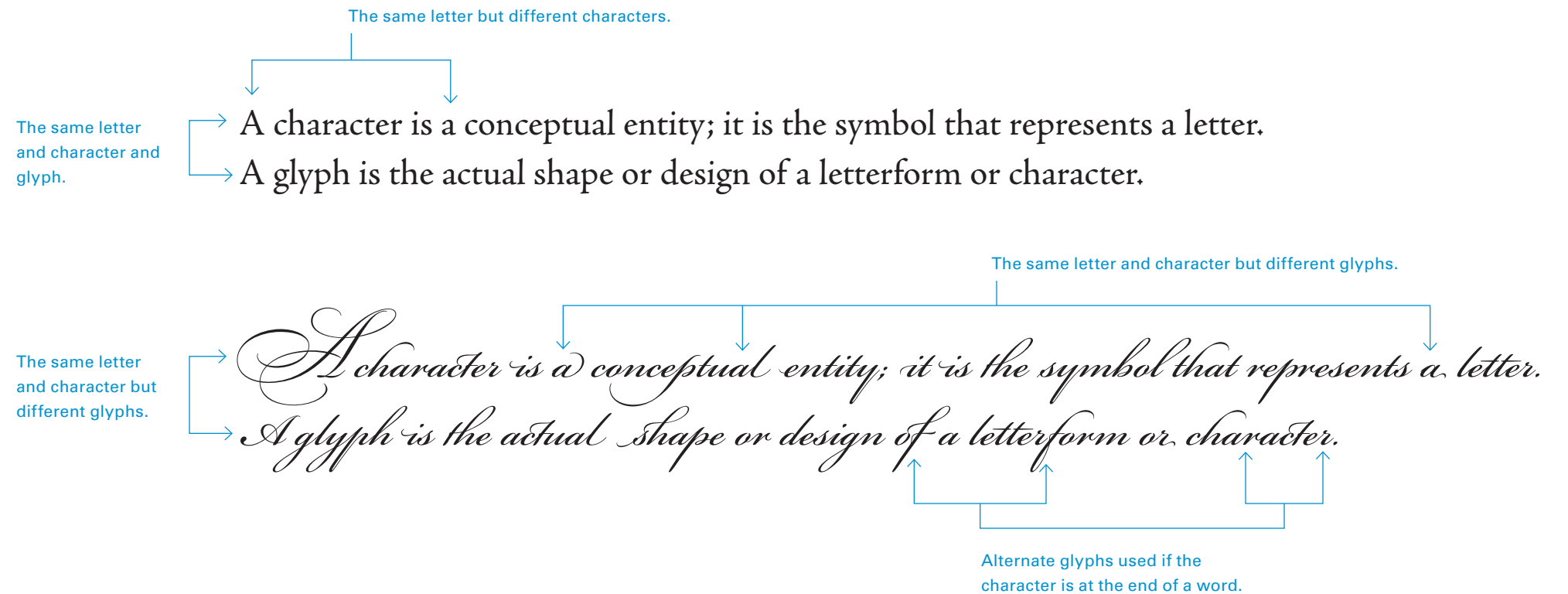
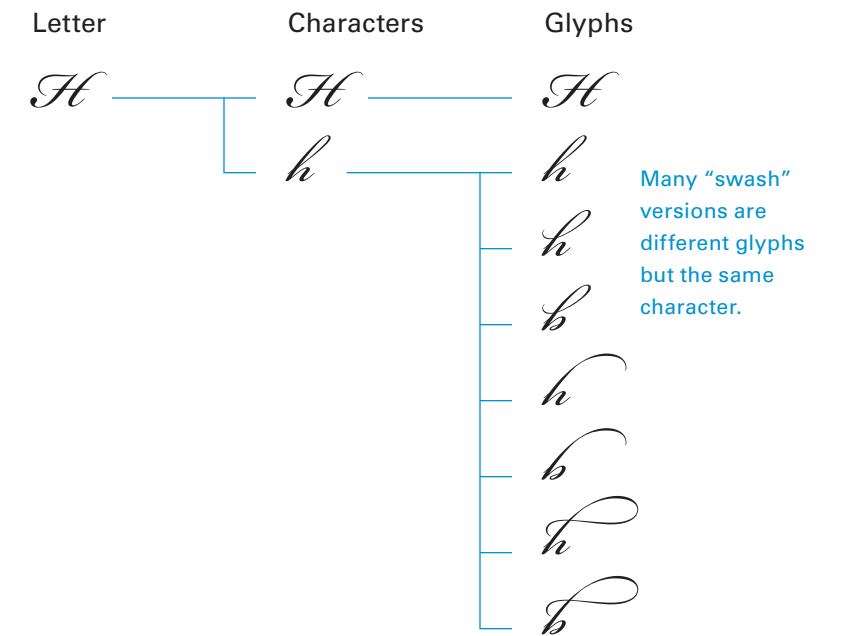
# Character vs Glyph

Characters and glyphs are different, and font files may have different numbers of each. A character is a conceptual entity; it is the symbol that represents a letter. On the other hand, a glyph is the actual shape or design of a letterform or character. Several glyphs may represent one character. For example, a lowercase “h” may be represented by glyphs of a swash h, a superscript h, a subscript h, etc. However, a capital h and an italic h are different characters (and yet they are the same letter). When different glyph versions of a character exist within the same font, they are not different font styles – they are variations in how to represent the same character within the same style.

Example 1



Example 2



# x-height

The x-height of a typeface is the height of all the lowercase glyphs minus any ascenders or descenders.

The relationship between x-height, cap-height, and ascender height is crucial to the perception of a typeface and its readability on screen. It is possible to make type feel larger without using more screen real estate by choosing typefaces with relatively tall x-heights. Because most Latin text is set in lowercase, the x-height has the greatest impact on our perception of type size. However, there must be enough of a difference between x-height and cap-height that uppercase characters still provide hierarchy and emphasis within strings of text.

The two fonts to the right have the same cap-height but very different x-heights, and the result is that the font on the right appears much larger.



Jenson

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Arnhem

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The font with the larger x-height appears larger. It also requires more horizontal space to set the same number of words on a line – the lowercase letters are literally larger!

## How Have Latin Characters Evolved?

# Majuscules vs Minuscles vs Small Caps

What we today know as upper- and lowercase letters were not always thought of as paired sets. Uppercase letters are more accurately called “majuscules” while lowercase letters are “minuscles”. Majuscules developed from the square capital inscriptions of the Latin alphabet. Minuscles evolved from majuscules for use in cursive writing. It wasn’t until the tenth century that majuscules and minuscles were used together in the way we now know.

In contemporary usage, majuscules (hereafter “uppercase”) are used to indicate the beginning of a sentence, a proper noun, and in some cases, acronyms. **When text is not a headline, acronyms should not be set in uppercase** because the letters will stand out too much and appear as a blotch on the page or screen. Instead of all uppercase letters, **small caps should be used instead**. Small caps are distinct glyphs that have the general shape of uppercase but are much shorter so they harmonize with lowercase letters.

It should be noted that not all languages using the same script have the identical characters. For instance German and English both use the Latin script, but German has more uppercase letters than English.

The terms “uppercase” and “lowercase” derive from when type was set in metal and the majuscules and minuscles of a given font would be kept in separate drawers, or “cases”. The convention was to keep the majuscules in the drawer above the minuscles, hence upper and lowercases.



This sample text shows how different forms of letters and affect overall appearance. There are two ways to set an acronym such as UNESCO. Using all uppercase letters to set UNESCO, the way most people do when typing, produces blotches in the type block because of the large size of uppercase letters in relation to lowercase letters. Small caps should be used to set UNESCO to create a more visually even text.

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If small caps are not available for a font, faux small caps (regular uppercase letters shrunken to small cap size) should not be used because they will be unnaturally light relative to the rest of the text.

Small CAPS  
Shrunken CAPS

## Lining vs Old Style

Figures also have two forms similar to upper- and lowercase letters, called lining figures and old style figures. Lining figures are used in headlines and when set on their own while old style figures are used in a block of text. Unlike upper- and lowercase letters, old style figures pre-date lining figures which were not developed until the eighteenth century.

Old style figures are rare in sans-serif fonts. Historically, sans-serif fonts developed out of titling styles set in all caps used for large headlines. The all caps setting required figures to match. When sans-serif fonts became popular, the Modernist designers who advocated for their use believed that lining figures were simpler and more utilitarian.

The body of this report is set in Univers 55. Univers is a modern sans-serif and has no old style figures. (See page 25.)

A row of lining figures (0-9) and an 'X' set in a serif font. The figures are tall and uniform in height, matching the height of the uppercase letters. The 'X' is a lowercase letter, smaller than the figures.

Lining figures

A row of old style figures (0-9) and an 'X' set in a serif font. The figures are shorter and more varied in height, matching the height of the lowercase letters. The 'X' is a lowercase letter, smaller than the figures.

Old style figures (a.k.a. text figures)

This sample text shows how different forms of figures affect overall appearance. There are two ways to set a figure such as 1968. Using lining figures to set 1968 the way most people do when typing produces blotches in the type block because of the large size of the lining figures in relation to lowercase letters. Old style figures should be used to set 1968 to create a more visually even text.

This sample text shows how different forms of figures affect overall appearance. There are two ways to set a figure such as 1968. Using lining figures to set 1968 the way most people do when typing produces blotches in the type block because of the large size of the lining figures in relation to lowercase letters. Old style figures should be used to set 1968 to create a more visually even text.



## How Have Latin Characters Evolved?

# Roman vs Italic

Italic letterforms are a direct descendent of cursive handwriting styles. As a result many italic glyphs are very different from their roman style equivalents (think of the difference between learning to print and learning to write in cursive).

The first italic typefaces were designed in Venice in the late 1500's. At first, books were set entirely in italic or roman type. It took about 50 years before the two forms began to be designed together with the italic typically intended as a complement to the roman.

Most sans-serif (see pages 31, 37–40) italic type today is actually not italic in the classic sense and could be more accurately described as “sloped roman” or “oblique”.

Italic type is used today primarily for emphasis or distinction. Note that with a “true italic” or cursive italic the letter shapes are distinct from roman letters in terms of shape *and* angle. Sloped roman, or oblique, differ from the roman form primarily in terms of angle. True obliques, like cursive italics, are hand drawn and not simply mathematically transformed roman shapes.

Italic used for emphasis.

Roman used for emphasis.

Note how roman letterforms used for emphasis in an italic text block are less effective than italic letterforms used within a roman text block because they are harder to pick out.

Upright or “roman” letterforms



Roman, serif

Roman, sans-serif



Cursive italic, serif

Sloped roman or oblique, sans-serif

When used to create contrast in a text block, *cursive-form italic is more effective than sloped roman italic* because the letterforms are more distinct when compared to roman letters.

When used to create contrast in a text block, *cursive-form italic is more effective than sloped roman italic* because the letterforms are more distinct when compared to roman letters.

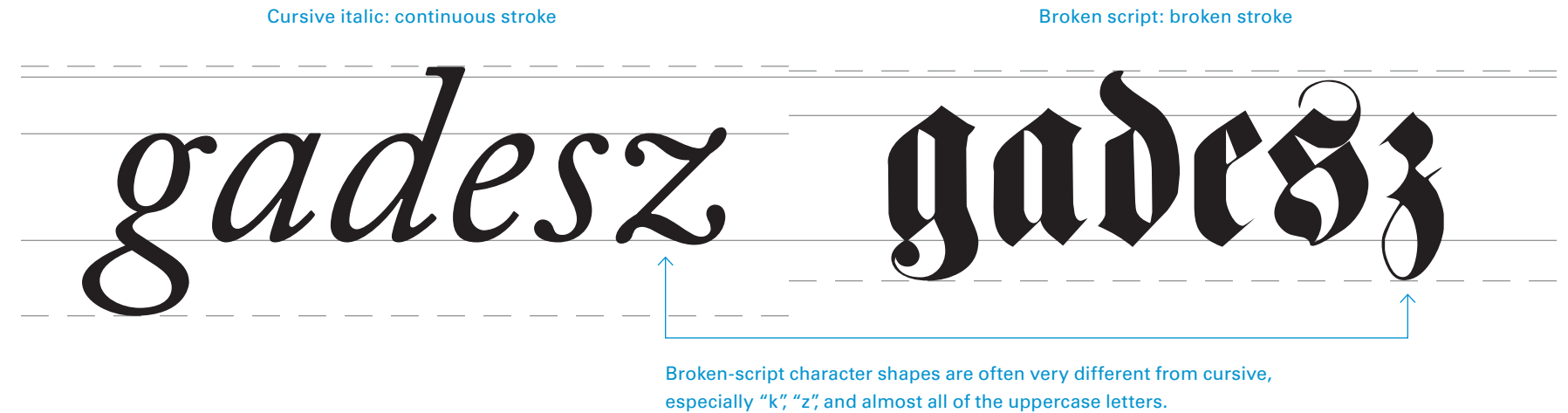
When used to create contrast in a text block, *cursive-form italic is more effective than sloped roman italic* because the letterforms are more distinct when compared to roman letters.

When used to create contrast in a text block, *cursive-form italic is more effective than sloped roman italic* because the letterforms are more distinct when compared to roman letters.



# Continuous vs Broken

Cursive italic can be characterized by a flowing, continuous motion – its letterforms are based on a kind of informal, everyday handwriting that used a single, uninterrupted movement of the pen for most letters. Broken script, or blackletter, is a style of handwriting characterized by a pen motion with many starts and stops, emphasizing the transitions between parts. Broken script letterforms have very few flowing curves – most letter shapes that would be curvilinear in an italic or roman letter will typically be made of several short strokes joined by angular movements. This kind of writing was much slower to create and was originally reserved for formal and important documents.



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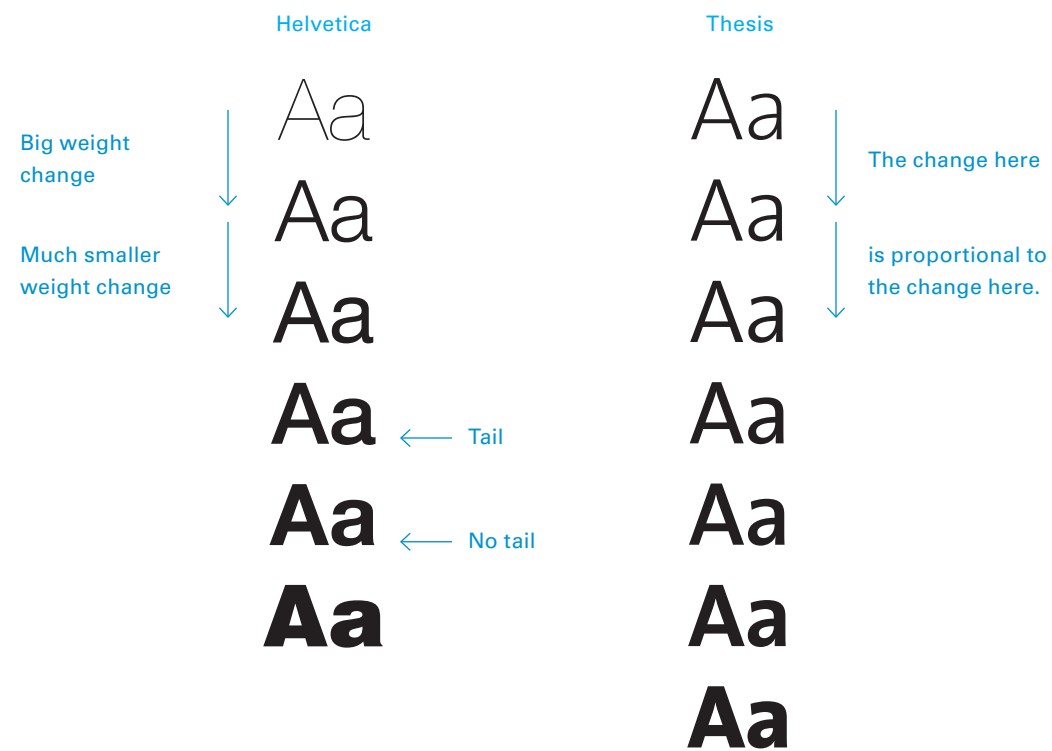
## How Have Latin Characters Evolved?

# Regular vs Bold

Today it is common for a typeface to have more than one weight, but this was not always the case. The first bold font designed in conjunction with a regular weight font was not introduced until the mid-nineteenth century. Up until that point, typefaces were designed in a single weight. Today it is common for typefaces to have two, three, or more weights ranging from light to bold (or even black). Some typefaces have as many as 10 weights!

**Bold fonts are typically used to create emphasis within a block of regular weight text;** however a skilled typographer might use a bold font as the main font for extended typesetting.

Not all typefaces with multiple weights have a well planned system of weight differences. Some typeface began with only two weights and later had more weights added by other designers. Other (typically newer typefaces) have more well planned weight systems that change weight in a more linear and logical way.



Weights added over a span of 50 years by different designers.

All weights designed at the same time by one designer.

Hamburge

Regular weight

Hamburge

Bold weight

Bold weight used for emphasis.

The first bold font designed in conjunction with a regular weight font **was not introduced until the mid-nineteenth century.** Up until that point, typefaces were designed in a single weight. Today it is common for typefaces to have two, three, **or more weights** ranging from light to bold (or even black). Some typefaces have as many as 10 weights!

Regular weight used for emphasis.

**The first bold font designed in conjunction with a regular weight font was not introduced until the mid-nineteenth century. Up until that point, typefaces were designed in a single weight. Today it is common for typefaces to have two, three, or more weights ranging from light to bold (or even black). Some typefaces have as many as 10 weights!**

Note how when a regular weight font is used for emphasis in a bold weight text block, the distinction is less immediately apparent.

# Condensed vs Expanded

Condensed and expanded versions of a typeface are a recent invention. The mid-nineteenth century saw the first condensed and expanded typefaces, but it wasn't until the early twentieth century that the first condensed and expanded typefaces were designed as compliments to a primary, normal width font.

Condensed type is often used as a way to create contrast with the body text, such as in captions or headlines. Condensed type can also be especially useful when attempting to fit text into cramped spaces. Extended type is rarely used for anything other than headlines because its extra-wide shapes are very space inefficient and slow reading down. (See page 56 for a note on the dangers of automatic condensing of fonts.)

HAMBURGE

Condensed

HAMBURGE

Normal

HAMBURGE

Expanded

Condensed and expanded type can be used for headlines or to contrast secondary text with a primary text block.

Condensed and expanded type can be used for headlines or to contrast secondary text with a primary text block.

Condensed and expanded type can be used for headlines or to contrast secondary text with a primary text block.

# Small vs Large

The idea of having multiple sizes of the same font was a deliberate invention. Aside from a few ornamental capital letters, scribes wrote letters in one size in manuscripts. Analogously, early metal types were cut and cast at one size. Cutting and casting multiple sizes was a large undertaking because it required the designer to draw the same glyphs at multiple sizes. Fine adjustments had to be made to the glyphs at each size to compensate for a wide variety of issues. At small sizes, the thinner parts of glyphs would be proportionally heavier than type cut at larger sizes. Why? Because the metal used for type could only be so thin before breaking. As glyphs got larger, capital letters became proportionally taller than lowercase letters to compensate for how the human optical system perceives character heights at different sizes.

The invention of the pantograph, a mechanical device for enlarging line drawings, aided in the process of creating multiple sizes of the same font, but optical and technical adjustments would still need to be made. (See page 50–54.)

## Common Metal Type Sizes

6 pt Hamburgetfont

7 pt Hamburgetfont

8 pt Hamburgetfont

9 pt Hamburgetfont

10 pt Hamburgetfont

12 pt Hamburgetfont

14 pt Hamburgetfont

18 pt Hamburgetfont

24 pt Hamburgetfont

36 pt Hamburgetfont

48 pt Hamburgetfont

72 pt Hamburgetfont

# Character Set

Also sometimes referred to as a “character repertoire”, a character set is the full assortment of letters, numbers, punctuation, ideograms, and other characters that together make up a font.

Univers 55 Roman is the primary text font used in this document.  
This is the character set:

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  
fi fl ß f Æ æ Œ œ Ø ø Þ þ Ł ł Đ đ  
À Á Â Ã Ä Å Ç È É Ê Ë Ì Í Î Ï Ñ Ò Ó Ô Õ Ö Ù Ú Û Ü Ý Š Ÿ Ž  
à á â ã ä å ç è é ê ë ì í î ï ñ ò ó ô õ ö ù ú û ü ý š Ÿ ž  
- ' " ° ^ ˇ ˘ ˙ ˚ ˛ ~ ¨ ←  
‹ { « [ - – — \_ ( ‘ „ “ . , : ; ” , ’ ) … ~ ’ ¡ ¿ ? ! ” ] » } ›  
@ # & ¤ ¢ \$ € ¥ £ % ^ ‰ \* † ‡ § • ¬ ¶ / | \ ¡ © ® ™  
¼ ½ ¾ < + − × ÷ ± = > μ ° ¹ º ³ . /

These characters are diacritical marks unattached to letters. The type designer draws them independently of the letters they work with and then creates a limited set of compound glyphs consisting of a letter and a diacritical mark. With sophisticated typesetting programs that allow a user to manually control the space between letters (e.g. InDesign), it is possible to create any accented character by hand by using negative kerning (see page 61) between any letter and any diacritic.

# Font Families

A font family is a collection of related fonts. What distinguishes a font family from just a random assortment of fonts is a shared set of visual characteristics such as size and shape of serifs, the general aspect of curves, the weight relationship between horizontal and vertical strokes, etc. Font families may contain a wide variety of styles including variation in weight (e.g. light, regular, bold), width (e.g. compressed, condensed, normal, extended), and angle (e.g. roman, italic). For instance, Jenson is a font family while Jenson Regular is a font.

Another term for font family is “typeface” – the two terms are interchangeable. Most typographers will use the term typeface when referring to the visual characteristics common to a set of fonts, e.g. “Jenson is a nice typeface; it has very beautiful proportions.” They may use the term font family when referring specifically to the set of weight and style variations that are part of that typeface, e.g. “Jenson is not a very extensive font family; it only has 4 fonts.”

---

Jenson Regular

ABCDEFGHIJKLMNOPQRSTUVWXYZ  
abcdefghijklmnopqrstuvwxyz  
0123456789

---

Jenson Italic

*ABCDEFGHIJKLMNOPQRSTUVWXYZ*  
*abcdefghijklmnopqrstuvwxyz*  
*0123456789*

---

Jenson Bold

**ABCDEFGHIJKLMNOPQRSTUVWXYZ**  
**abcdefghijklmnopqrstuvwxyz**  
**0123456789**

---

Jenson Bold Italic

***ABCDEFGHIJKLMNOPQRSTUVWXYZ***  
***abcdefghijklmnopqrstuvwxyz***  
***0123456789***

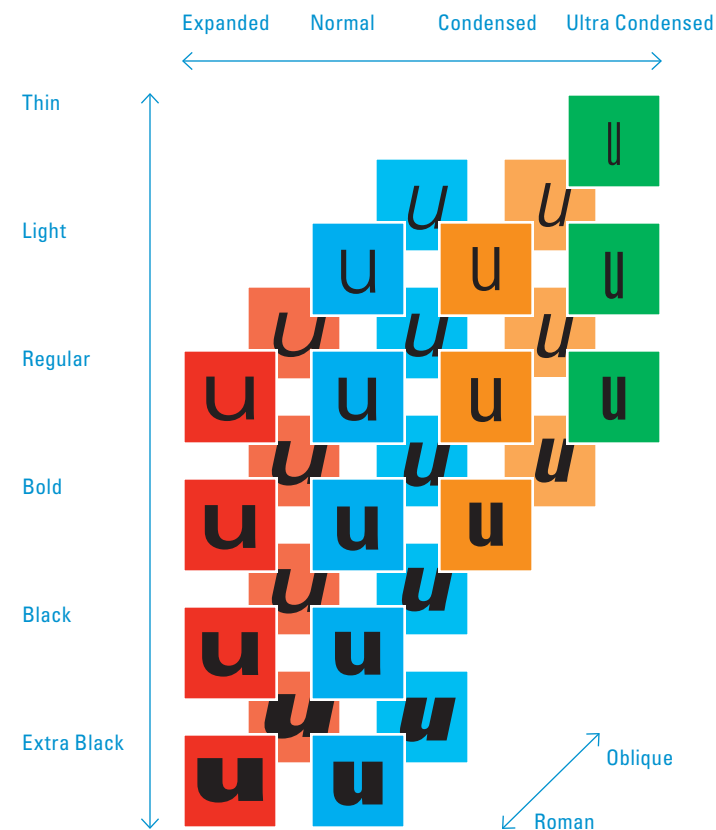


## How Have Latin Characters Evolved?

# Super Families

Font families have existed since roman and italic type were designed as paired sets (c.1540). Beginning in the nineteenth century when bold type was introduced and later designed specifically as a paired complement to regular weight type, font families began to grow. **The twentieth century has seen an explosion in the size of font families** from modest four or six font sets to upward of 20 or 30 fonts in a single family. This was accomplished by designing five or six weights for a typeface, each of which might have two or three widths, and then adding italic accompaniments for each. Since digital methods have taken over as the dominant means of designing type, the size of font families has grown even further to include serif, sans-serif, and slab-serif versions.

Univers was one of the first font families to be designed as a system of related weights, widths, and styles.



### Univers, 1964

- Thin Ultra Condensed
- Light Ultra Condensed
- Ultra Condensed**
- Light Condensed
- Light Condensed Oblique*
- Condensed
- Condensed Oblique*
- Condensed**
- Condensed Oblique**
- Light
- Light Oblique*
- Roman
- Oblique*
- Bold**
- Bold Oblique**
- Black**
- Black Oblique**
- Extra Black**
- Extra Black Oblique**
- Extended
- Extended Oblique*
- Bold Extended**
- Bold Extended Oblique**
- Black Extended**
- Black Extended Oblique**
- Extra Black Extended**
- Extra Black Extended Oblique**

### Freight, 2005

- Big Light
- BIG LIGHT SMALL CAPS
- Big Light Italic*
- BIG LIGHT ITALIC SMALL CAPS
- Big Book
- BIG BOOK SMALL CAPS
- Big Book Italic*
- BIG BOOK ITALIC SMALL CAPS
- Big Medium
- BIG MEDIUM SMALL CAPS
- Big Medium Italic*
- BIG MEDIUM ITALIC SMALL CAPS
- Big Bold
- BIG BOLD SMALL CAPS
- Big Bold Italic*
- BIG BOLD ITALIC SMALL CAPS
- Big Black
- BIG BLACK SMALL CAPS
- Big Black Italic*
- BIG BLACK ITALIC SMALL CAPS
- Display Light
- DISPLAY LIGHT SMALL CAPS
- Display Light Italic*
- DISPLAY LIGHT ITALIC SMALL CAPS
- Display Book
- DISPLAY BOOK SMALL CAPS
- Display Book Italic*
- DISPLAY BOOK ITALIC SMALL CAPS
- Display Medium
- DISPLAY MEDIUM SMALL CAPS
- Display Medium Italic*
- DISPLAY MEDIUM ITALIC SMALL CAPS
- Display Bold
- DISPLAY BOLD SMALL CAPS
- Display Bold Italic*
- DISPLAY BOLD ITALIC SMALL CAPS
- Display Black
- DISPLAY BLACK SMALL CAPS
- Display Black Italic*
- DISPLAY BLACK ITALIC SMALL CAPS
- Text Light
- TEXT LIGHT SMALL CAPS
- Text Light Italic*
- TEXT LIGHT ITALIC SMALL CAPS
- Text Book
- TEXT BOOK SMALL CAPS
- Text Book Italic*
- TEXT BOOK ITALIC SMALL CAPS
- Text Medium
- TEXT MEDIUM SMALL CAPS
- Text Medium Italic*
- TEXT MEDIUM ITALIC SMALL CAPS
- Text Bold
- TEXT BOLD SMALL CAPS
- Text Bold Italic*
- TEXT BOLD ITALIC SMALL CAPS
- Text Black
- TEXT BLACK SMALL CAPS
- Text Black Italic*
- TEXT BLACK ITALIC SMALL CAPS
- Micro Light
- MICRO LIGHT SMALL CAPS
- Micro Light Italic*
- MICRO LIGHT ITALIC SMALL CAPS
- Micro Book
- MICRO BOOK SMALL CAPS
- Micro Book Italic*
- MICRO BOOK ITALIC SMALL CAPS
- Micro Medium
- MICRO MEDIUM SMALL CAPS
- Micro Medium Italic*
- MICRO MEDIUM ITALIC SMALL CAPS
- Micro Bold
- MICRO BOLD SMALL CAPS
- Micro Bold Italic*
- MICRO BOLD ITALIC SMALL CAPS
- Micro Black
- MICRO BLACK SMALL CAPS
- Micro Black Italic*
- MICRO BLACK ITALIC SMALL CAPS
- Sans Light
- SANS LIGHT SMALL CAPS
- Sans Light Italic*
- SANS LIGHT ITALIC SMALL CAPS
- Sans Book
- SANS BOOK SMALL CAPS
- Sans Book Italic*
- SANS BOOK ITALIC SMALL CAPS
- Sans Medium
- SANS MEDIUM SMALL CAPS
- Sans Medium Italic*
- SANS MEDIUM ITALIC SMALL CAPS
- Sans Bold
- SANS BOLD SMALL CAPS
- Sans Bold Italic*
- SANS BOLD ITALIC SMALL CAPS
- Sans Black
- SANS BLACK SMALL CAPS
- Sans Black Italic*
- SANS BLACK ITALIC SMALL CAPS

# Latin vs Non-Latin Scripts

Most typeface design is done for the Latin script. Reasons for this are largely practical – designing a typeface that can represent western Latin-based languages requires the designer to draw approximately 250–300 characters while designing a typeface that can represent Chinese requires the designer to draw more than 2500 characters.

The most common method of designing font families to represent more than one language script is for the designer to begin with a single script (e.g. Latin) and then later extend the visual design to a second related script (e.g. Greek), and so on. **Few typefaces support more than one writing system** – a typeface might provide support for Latin, Greek, and Cyrillic scripts, all of which are alphabetic, but will not likely cover logographic or abjad writing systems. Typefaces that do cover more than one writing system sometimes maximize coverage at the expense of visual consistency and quality.

Arial Unicode covers almost every language script in the world, and many of the covered scripts are stylistically related. Latin, Greek, Hebrew, and Arabic all have similar visual traits, creating the impression of one family of fonts extended to cover a variety of languages and scripts.

Arial Unicode also covers the Armenian script, however it bears almost no visual resemblance to the other covered scripts.

## Arial Unicode (sample covered scripts)

Latin script

ABCDEFGHIJKLMNOPQRSTUVWXYZ  
abcdefghijklmnopqrstuvwxyz

Greek script

ΑΒΓΔΕΖΗΘΙΚΛΜΝΞΟΠΡΣΤΥΦΧΨΩ  
αβγδεζηθικλμνξοπρστυφχψω

Hebrew script

אבגדהוזחטיכילמנסעפצקרשת

Arabic script

ي و ه ن م ل ك ق ف غ ع ظ ط ض ص ش س ز ر ذ خ ح ج ث ت ب ا

Armenian script

ԱԲԳԴԵԶԷԸԹԺԻԼԽԾԿՀՁՂՃՄՅԸՇՈՉՊՂՌՍՎՏՐՑԻՓԹՕԾ  
աբգդեզէըթժիլխծկհձղնմյնցոչպջոսվտրցւփօֆ



## How Have Latin Characters Evolved?

# Universal Fonts

Very few typefaces have been created that cover all, or nearly all, writing systems. One primary reason for this is the amount of time needed to draw all of the necessary characters. Another is that many writing systems have different conventions for how a letter is drawn (e.g. where stress is placed, if and how characters are connected). Developing the body of knowledge required to draw one typeface of high quality is an extremely difficult undertaking. Adding script systems, each with their own linguistic and cultural idiosyncrasies, increases the difficulty substantially. **To date, there are no known universal fonts of high typographic quality.**

Arial Unicode is often used as the default font for multi-lingual web browsing. It is an acceptable quality font but lacks distinction or refinement.

Code 2000 is an open source universal font that covers approximately the same character set as Arial Unicode. Unfortunately the typeface is very poorly drawn and lacks coherence between language scripts.

### Sample Universal Fonts

Arial Unicode

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

ا ب ت ث ج ح خ د ذ ر ز س ش ص ض ط ظ ع ف ق ك م ن و ه ي

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# How Have Typefaces Evolved?

Typefaces are the primary building block of typography – they are the repeatable units that allow typography to be distinct from writing or lettering.

Every time you see a word printed in a book, every time you press a key on your keyboard and a letter appears, you are seeing a typeface. Typefaces have a history dating to the invention of movable type in China c.1040, though we will mainly be concerned with their emergence in Germany c.1450 when Gutenberg made the first western movable type. Since that time they have progressed away from their original handwritten sources, becoming more rational and often more geometric.

People have been thinking for hundreds of years about what constitutes the “right” typeface for any given set of information and for any given reproduction or display technology. The history of letterforms and the accumulated body of typographic knowledge and tradition should inform decisions about what kind of fonts should be used on Kindle.

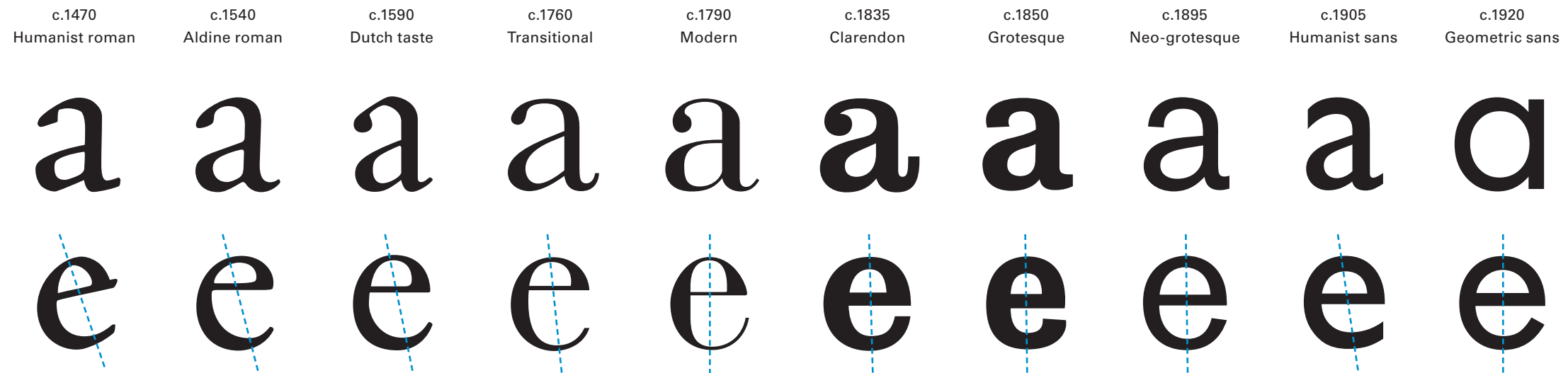
All typeface samples featured in this document, while often based on historical samples, are digital and were created within the last 20 years or so.

## How Have Typefaces Evolved?

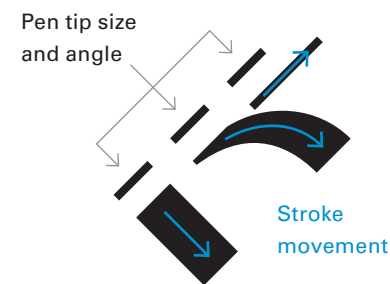
# Overview

Since the introduction of the printing press, the form of letters have been constantly evolving. For the first 300 years of type development, the trend was toward ever sharper and more rationalized designs, culminating in the modern typefaces of the late eighteenth century. After this point, type development began to move in several directions. Sans-serif type, first seen in the mid-nineteenth century, very quickly developed several directions at once due in part to differing ideological positions about the purpose of type in communication. Today, almost anything goes, with genres or categories of traditional forms commonly mixed and remixed in the search for new form.

The axis of stress in a typeface is measured by drawing a line through the thinnest parts of the letter (typically the lowercase "e" or "o"). The more the axis slopes to the left, the stronger the sense of forward movement because the thicker parts of the letterforms will appear to be angled to the right.



Changing axis of stress is one of the primary ways that the evolution of letterforms can be understood. Typefaces from the Renaissance had a diagonal stress axis, based on a model of broad nib pen use. These pens were wide and flat, and held at a consistent angle when writing, which produced a modulated stroke thickness. Renaissance typefaces appear more handwritten and have a greater sense of forward movement.



Over time, letterforms developed a more vertical stress axis. These glyphs are typically far more regular and geometric in their shape, feeling more drawn than written. These typefaces can be easier to render on screen because they match up with a pixel grid in a simple way. In fact, early development toward a vertical stress axis was some of the first work to draw a typeface on a grid.

In the early twentieth century the general trend was towards more vertical stress axes. Nonetheless, some designers began to explore what it would mean to have a sans-serif form based on Humanist ideals. (See page 32.)

# Humanist

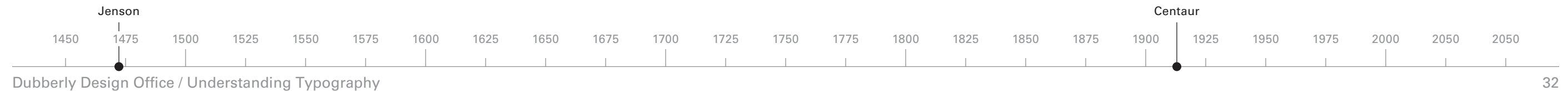
Typefaces influenced by the humanist bookhand (a calligraphic script) are considered the first “roman” typefaces. Developed in Padua, Italy, in the fifteenth century, these typefaces combined the square capital characters found on ancient Roman inscriptions with lowercase characters based on the miniscules of written manuscripts. The lowercase also adopts attributes of the inscriptional capitals – notably the tapered serifs – to achieve harmony.

References to their origins in written works can be found in the sloped crossbar of the lowercase “e”, for example. Nicolas Jenson created the prototypical humanist typeface in 1470, and it remained popular for nearly 50 years before inspiring and then being supplanted by the roman of Aldus Manutius. The humanist style was then largely ignored until the late nineteenth century when it was revived by William Morris.

baegnxARQEN

High angle of stress axis.  
Contrast is relatively low.

baegnxARQEN



## How Have Typefaces Evolved?

# Old Style

The aldine roman, cut by Francesco Griffo for Aldus Manutius in Venice, first appeared in 1495. Inspired by the earlier humanist roman typefaces, it is characterized by an improved balance between upper and lowercase glyph heights and a characteristic, straight-barred "e". It would become the dominant style for letterforms for the next 200 years. The design was further refined in France in 1540 by Claude Garamond, Jean Jannon, and Robert Granjon.

Toward the end of the sixteenth century typefaces with more robust glyphs, a taller x-height, darker "color" and higher contrast began to replace aldine romans. Known as Dutch taste, these typefaces were developed by Henrik van den Keere and refined by Christoffel van Dijk and Mikos Kis, who is responsible for what we call Janson. The metal type was in turn bought by English printers and strongly influenced the future work of William Caslon.

Aldine roman

Bembo

baegnxARQEN

Garamond

baegnxARQEN

Angle of stress is less than Humanist, but still present.  
Relatively low contrast.

Janson

baegnxARQEN

Dutch taste

Caslon

baegnxARQEN



## How Have Typefaces Evolved?

# Transitional

At the start of the Enlightenment, King Louis XIV of France commissioned the Romain du Roi (King's Roman) for the Imprimerie Royale (Royal Printer). The Romain du Roi was a significant departure from old style types and was much less influenced by handwritten forms, favoring instead the rationality of the grid. The letters had a vertical axis of contrast and appeared more drawn than written with a pen. The other major innovation was the use of unbracketed serifs that transition from vertical stem to horizontal serif at a 90 degree angle.

The trajectory set out by the Romain du Roi was carried forward by designers such as Simon Fournier in France and John Baskerville in England. Fournier, whose namesake typeface bears a very strong resemblance to the engravings of the Romain du Roi, also developed a standardized system of measuring type (the Fournier Scale) that forms the basis of our modern point system.

Baskerville's designs featured bracketed serifs, but they were sharp and precise, much like the rest of the letters. His letterforms achieved extremes of thinness for the time to such a degree that they required a smooth, more even paper than was available at the time, forcing Baskerville to make his own paper. In addition, because of exaggerated contrast between thick and thin, one critic accused him of trying to "blind all the readers of the nation." Baskerville's letters had little influence at home in England during his lifetime. In 1758 he met Benjamin Franklin who returned to America with his type, popularizing them through their eventual adoption as one of the standard typefaces employed by the nascent federal government.

Fournier

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Unbracketed serif.

Baskerville

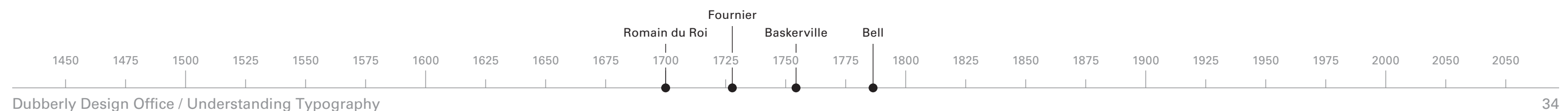
baegnxARQEN

Bracketed serif.

Angle of stress moving towards vertical.  
Contrast increasing.

Bell

baegnxARQEN



## How Have Typefaces Evolved?

# Modern

Modern, or “didone” type, carried forward the transitional forms of Fournier and Baskerville to an extreme degree. The alternative “didone” name is derived from Didot, a typeface designed by Firmin Didot and first used in 1784. Didot featured completely flat and ultra thin, unbracketed serifs and extreme contrast between thick and thin with abrupt transitions. In addition to designing typefaces, Didot also developed a standard system for measuring type called the Didot point. (See page 59.) The Italian designer Giambattista Bodoni, inspired by Didot, created the eponymous Bodoni typeface, perhaps the archetypal Didone font. Bodoni drew heavily on the Romain du Roi and Baskerville.

The evolution of letterforms toward the didone form coincided with transitions in paper making away from rough handmade sheets and toward smoother, brighter white paper made by machine. Thanks to changes in both fashion and technology, typefaces had now lost almost all of their resemblance to handwriting.

Didot

baegn $\times$ ARQEN

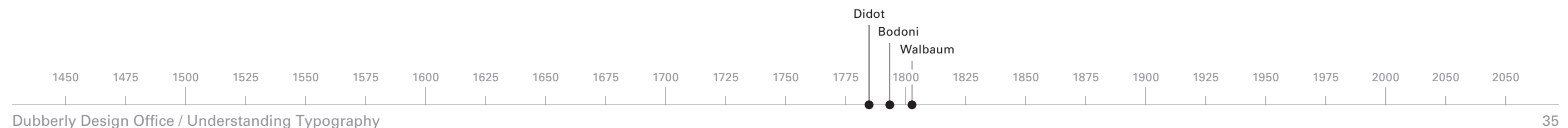
Bodoni

baegn $\times$ ARQEN

Stress now completely vertical.  
High contrast.

Walbaum

baegn $\times$ ARQEN



## How Have Typefaces Evolved?

# Fat Face, Egyptian, Clarendon

During the nineteenth century, industrialization had a profound effect on society and created new and diverse uses for type. Commercial printing evolved to allow for the creation of inexpensive handbills and large, display advertisements. New letterforms appeared, specifically designed in large sizes for use in display ads.

The first of these typefaces are called fat face and Egyptian. Fat face types are essentially **didone type on steroids**: take Bodoni and make the vertical stems thicker without changing the weight of the horizontal strokes and you have fat face. Egyptian type is another name for slab-serif type which, as the name implies, have **thick, slab-like serifs much like Bodoni or Didot with the horizontal weight increased to compliment the vertical weight**. The name Egyptian has nothing to do with any visual similarity to hieroglyphics but stems from Napoleon's return from Egypt and artifacts of the area being *en vogue* at the time.

In the mid-1800s a sub-set of the slab-serif began to emerge – the Clarendons. These types were an attempt to reign in some of the extravagances of fat face display type, making them fit for use as text faces. **Contrast was reduced, the serifs were thinned and the bracketing was rounded**.

Bodoni Poster

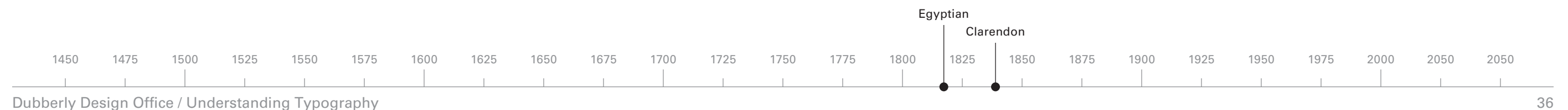
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Ziggurat

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Clarendon

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# Grotesque

Though Greek letters c.600 BCE had no serifs, the first sans-serif typeface was designed by William Caslon IV, the Egyptian of 1816 – a clumsy, unbalanced set of capitals probably intended for headings and emphasis only). It wasn't until 1835 that a sans-serif typeface was designed with a full set of upper- and lowercase characters. Early sans-serifs were named "grotesque" or "grot" for short and were typically quite heavy in weight with contrast between the thicks and thins to accommodate the heaviness. Interest in the form began to build at the beginning of the twentieth century, and designers in America further developed the form, typically referred to as "gothic" in the United States.

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## How Have Typefaces Evolved?

# Neo-grotesque

In 1898, Berthold's Akzidenz (meaning "jobbing") Grotesk refined the sans-serif form and created what became the most prevalent twentieth century form. Compared to the older grotesques, these "neo-grotesque" types had much less contrast in their stroke widths, becoming almost monoline in appearance, and simplified some of the letter shapes, notably the double-storey "g"; are replaced with simpler forms. This corresponded with an increasing interest in the visual language of machines. While designers were attempting to create letterforms that best represented the spirit of the time, it is notable that the best typefaces never forgot about subtleties of optical adjustment and visual balance.

Akzidenz Grotesque

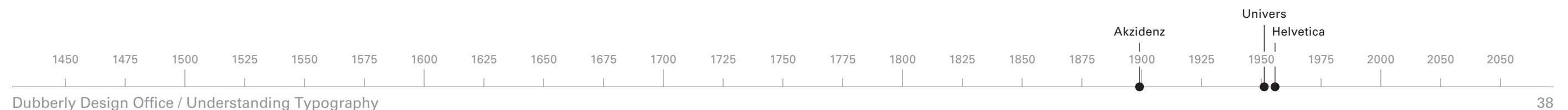
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Helvetica

baegnxARQEN

Univers

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# Geometric Sans

Designers and artists have long been fascinated by geometry. In the fifteenth century Albrecht Durer tried to rationalize letterforms in accordance with geometric principles. It was not until the twentieth century, however, that geometry began to influence type in a direct way. At the Bauhaus, designers such as Herbert Bayer experimented with constructing geometric alphabets. These experiments formed the basis for Paul Renner's Futura of 1927. A close inspection of the letterforms reveals that they are not mechanically constructed but have many careful adjustments that allow them to appear monoline and geometric while still being highly usable for the setting of text. Other notable typefaces were developed in the wake of Futura, and the geometric model became one of the most fertile areas for experimentation with rationalizing and standardizing the Latin alphabet.

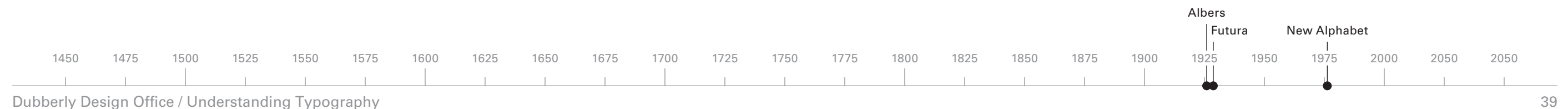
b a e g n x A R Q E N

Futura

b a e g n x A R Q E N

New Alphabet

b u e d n i j r q e n



# Humanist Sans

While the neo-grotesque form was an extension of the early sans-serif grotesque model, humanist sans-serif type was an offshoot that took the idea of a serif-less letter in a different direction. These typefaces looked back to earlier models based on the humanist hand but applied a sans-serif finish. The resulting letters typically appear softer than neo-grotesque forms and when used to set large amounts of text provide a better rhythm.

Edward Johnston, teaching formal writing in London, was commissioned to design the signage for the London Underground and created letterforms that fused the sans-serif model with that of humanist and old style typefaces. Several years later, in 1928, Eric Gill designed the first real humanist sans typeface. Gill Sans remained the major commercial example of this idea for many years until the appearance of Herman Zapf's Optima and Hans Eduard Meier's Syntax. In recent years the model has become a source for much inspired work. These typefaces typically appear more elegant than the sans-serifs that came before them, and while this lends itself well to high resolution printing, it often does not hold up to the low resolutions of computer screens.

Gill Sans

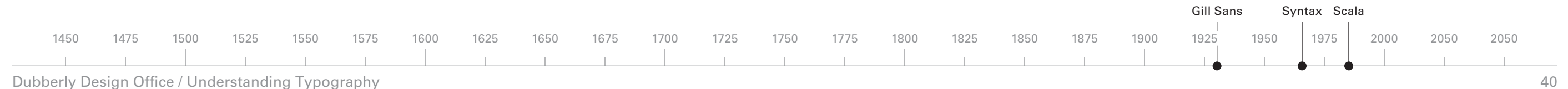
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Syntax

baegnxARQEN

Scala Sans

baegnxARQEN



# Hybrids

Mixing styles of letterforms has always been possible, but digital technology has made it widespread and very common. In the last 20 years there has been an explosion of type design, facilitated by the introduction of the Macintosh personal computer. New type designers exploring the craft often venture far from proven and “acceptable” historical standards, mixing and matching as they see fit. Today it can be very hard to classify new typefaces because they often take as reference multiple historical eras and blend them together to create hybrid styles.

Argo

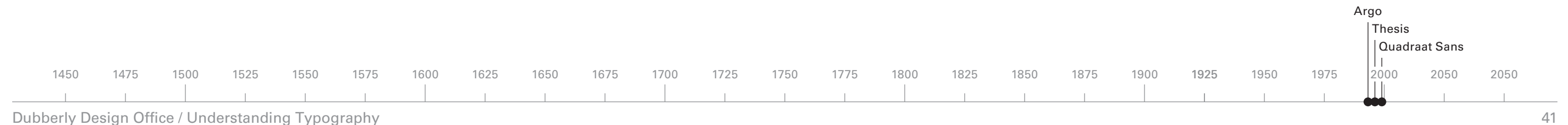
baegnxARQEN

Thesis Mix

baegnxARQEN

Quadraat Sans

baegnxARQEN



# Display Type

Display typefaces are designed for use with titles and headings exclusively. Most display type has characteristics that make it unsuitable for extended reading, such as exaggerated shapes or weights. Display type as a category originates from fat face and related types developed beginning in the early nineteenth century for advertising. Today, display type can take on almost any form and represents a wide range of visual possibilities.

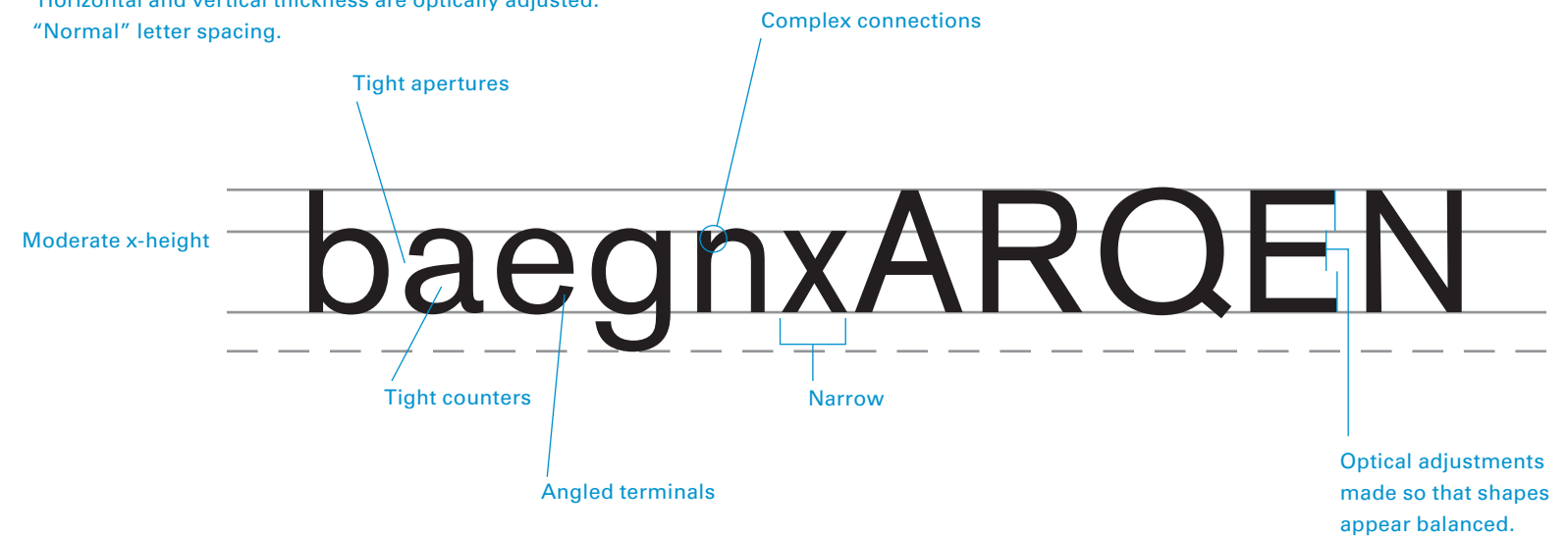


## How Have Typefaces Evolved?

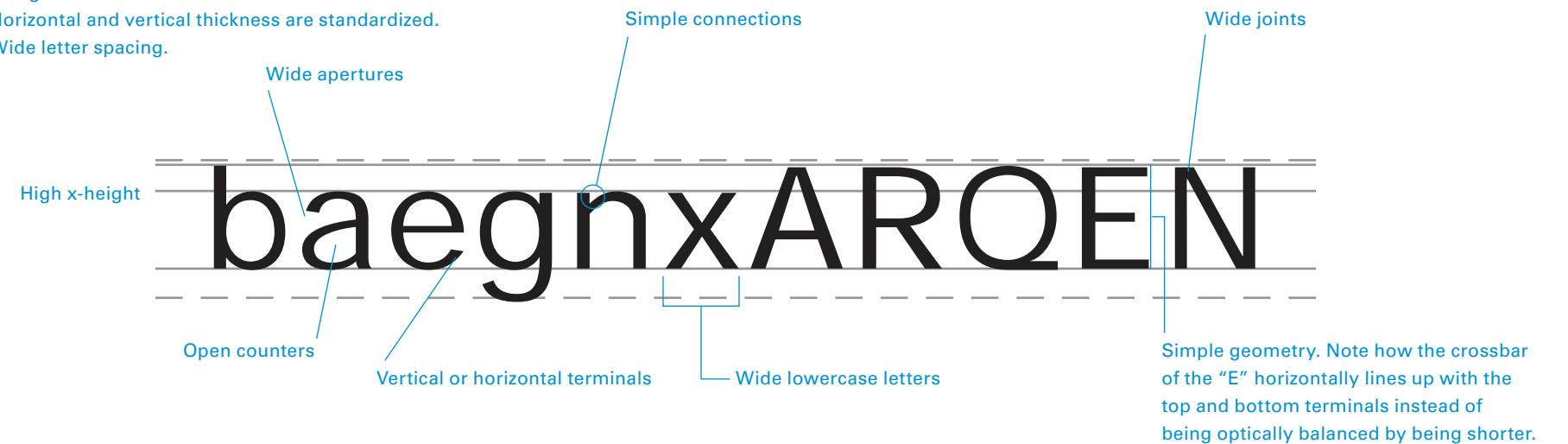
# Type for the Screen

What works well in print may not work on screen: tight counters might fill in or hairline strokes might disappear because there are not enough pixels to adequately form an image of a character (this mainly applies at small sizes). Because of the display limitations of drawing with pixels, type design for the screen ("screen fonts") has a set of considerations wholly its own.

Akzidenz Grotesk  
Designed for metal printing.  
Horizontal and vertical thickness are optically adjusted.  
"Normal" letter spacing.



Verdana  
Designed for screens.  
Horizontal and vertical thickness are standardized.  
Wide letter spacing.



baegnxARQEN

The simple shapes of Verdana translate well to pixels and allow the glyphs to remain clear and distinct.



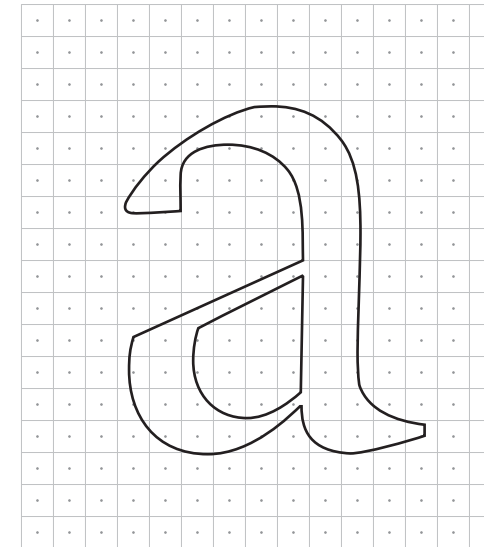
## How Have Typefaces Evolved?

# Bitmap to Outline

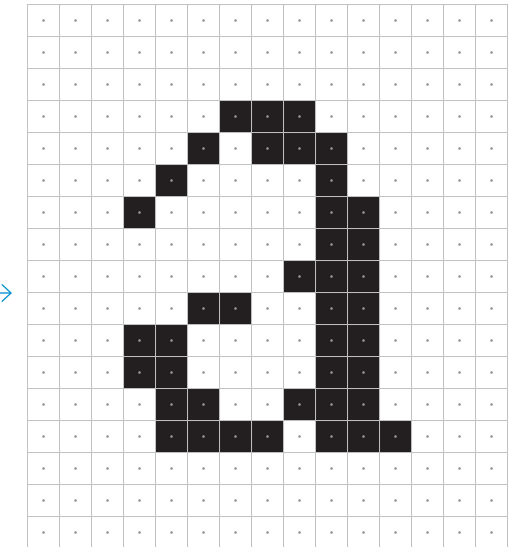
Some experiments with screen font design took a different approach than classic type design. Instead of starting with hand drawn letters and refining them for the technology that would reproduce them, a few designers first created glyphs out of pixels and then translated them into resolution-independent outlines. Typefaces created in this way include Lucida (by Charles Bigelow and Kris Holmes), Stone (by Sumner Stone), and Verdana (by Matthew Carter).

### Outline to Pixel

Typefaces designed for print begin as outline drawings. They have many elegant features that work beautifully in print but are impossible to replicate at low resolutions. Mapping the outline to the pixel grid typically results in a strange, distorted glyph.



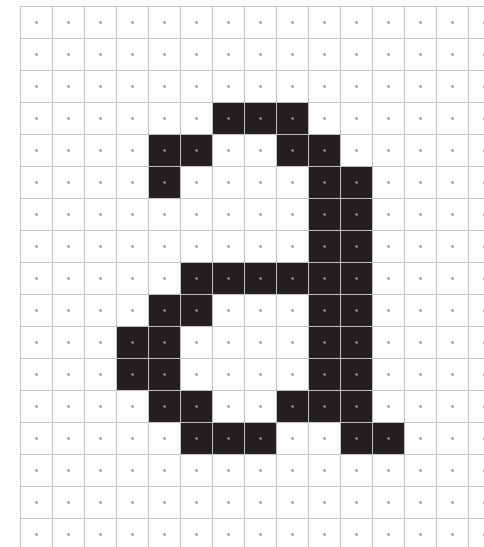
Galliard, outline



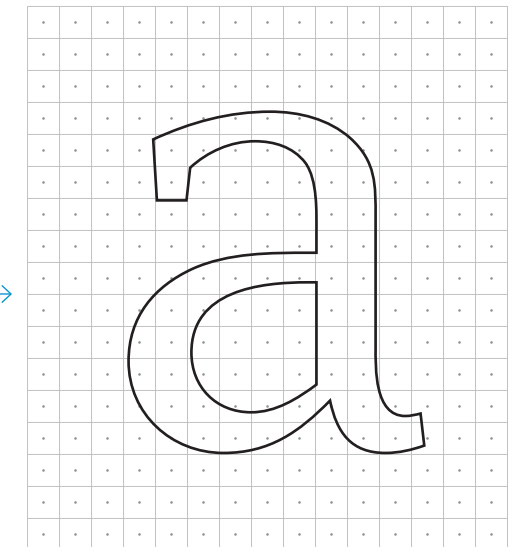
Galliard, pixel

### Pixel to Outline

Some typefaces are designed as pixel forms first. This allows the designer to create reasonably complex glyph shapes such as a lowercase "a" that displays well at low resolution. The pixel shape can be translated back into outlines to produce a scalable font design that will work at all sizes. The designer has considered the primary display medium from the outset, which eliminates the need for workarounds when trying to create a screen-optimized version of an outline font.



Lucida Serif, pixel



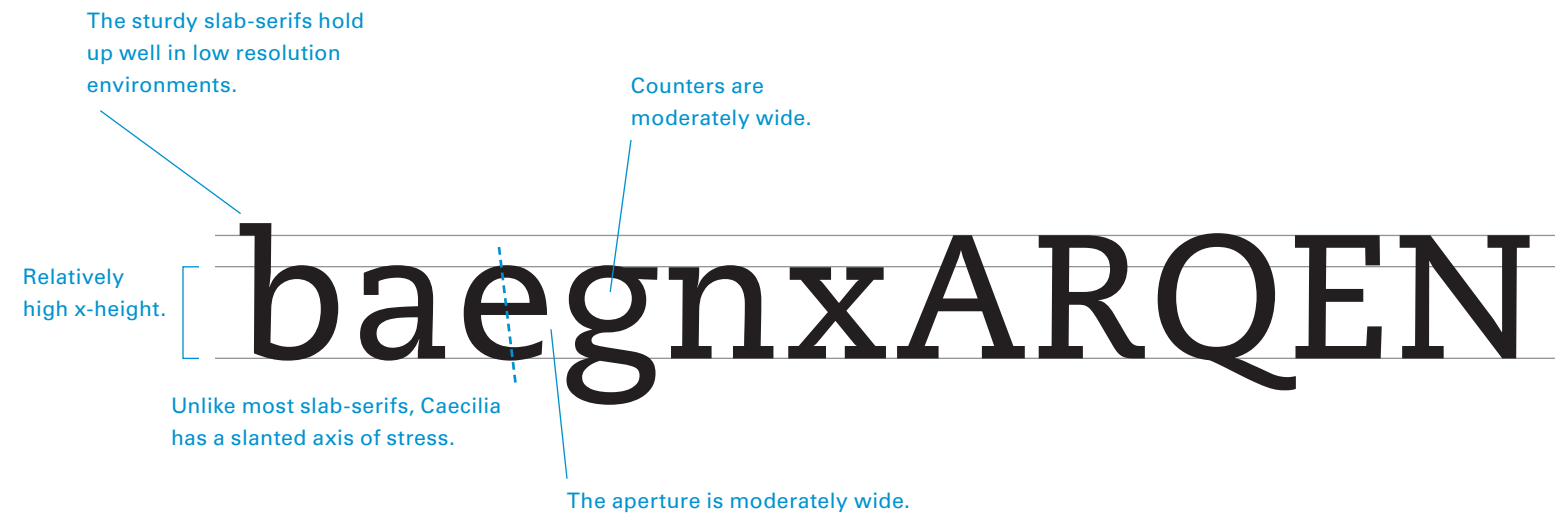
Lucida Serif, outline

## How Have Typefaces Evolved?

# Caecilia

Designed by Peter Mathias Noordziq and published in 1991 (though exhibited in 1984), **Caecilia was the first typeface to successfully reconcile formal qualities of low-contrast slab-serifs with humanist letterform shapes.** This combination of design ideas is especially visible in the italic, which is fully cursive.

### Caecilia roman



### Caecilia italic

The overall form of the letters is more cursive than oblique, coinciding with the humanist spirit of the typeface.



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How Have Typefaces Evolved?

## Classic Chinese

Chinese characters can be loosely divided between serif and sans-serif forms. Serif forms can be divided between those derived from brushwork, called regular script fonts, and those derived from print, called Ming fonts. Both regular script and Ming fonts feature triangular stroke terminals and moderate to extreme contrast between horizontal and vertical strokes. Regular script fonts are typically looser in shape and feature flowing, calligraphic strokes while Ming fonts are more rectilinear and feature straight, sharp strokes. Sans-serif fonts, called Hei in Chinese, typically have little to no contrast between horizontal and vertical strokes and unadorned terminals.

Kai [An example of a regular script font](#)

三事亥俱乘丈乾仍

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Song [An example of a Song font](#)

三事亥俱乘丈乾仍

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Hei [An example of a sans-serif font](#)

三事亥俱乘丈乾仍

## Classic Japanese

Japanese characters can be loosely divided between serif and sans-serif forms. Serif forms, called Ming fonts, feature triangular stroke terminals and moderate to extreme contrast between horizontal and vertical strokes. Sans-serif fonts, called Goshikku (based on the English word “gothic”) typically have little to no contrast between horizontal and vertical strokes and unadorned terminals. A variation on Goshikku fonts, called Maru Goshikku, features rounded terminals.

Kazuka Mincho [An example of a Ming font](#)

まあえちみオゲポロ

Osaka [An example of a Goshikku font](#)

まあえちみネゲポロ

Hiragino Maru Gothic [An example of a Maru Goshikku font](#)

まあえちみオゲポロ

## How Have Typefaces Evolved?

# Classic Korean

Korean characters can be loosely divided between serif and sans-serif forms. Serif forms, called Batang fonts, feature triangular stroke terminals and moderate to extreme contrast between horizontal and vertical strokes. Sans-serif fonts, called Dodum, typically have little to no contrast between horizontal and vertical strokes and unadorned terminals.

Bareun Batang An example of a Batang font

Serifs on the top of glyphs rise above the cap-height to create a more energetic rhythm.

아름다운 한글 글꼴의 표현

Baseline is optically even, creating a regular rhythm.

Sandol Myungjo An example of a Batang font

Linear and circular forms are balanced so that no single aspect dominates.

아름다운 한글 글꼴의 표현

Stroke widths are modulated, using lighter strokes at joints and where there are many small strokes, and heavier strokes where there is a large single stroke on its own – this produces an even overall color.

Bareun Dotum An example of a Dodum font

High quality “gothic”, or sans-serif, Korean fonts have subtle stroke modulation to create more balanced shapes.

아름다운 한글 글꼴의 표현

Sandol Gothic An example of a Dodum font

Some forms that appear often, such as the O resize, and subtly change their shape, to fit the context. The resizing is *not* handled mechanically to avoid glyph weight problems.

아름다운 한글 글꼴의 표현

# How Do You Make Letters Look Good?

Letterforms are complex shapes. Designing a letter so that it looks balanced and stable is difficult because there are many small optical adjustments that need to be taken into account. Even the simplest of geometric letterforms typically requires a number of small tweaks to not end up looking clunky and misshaped.

The process involves many simultaneous considerations:

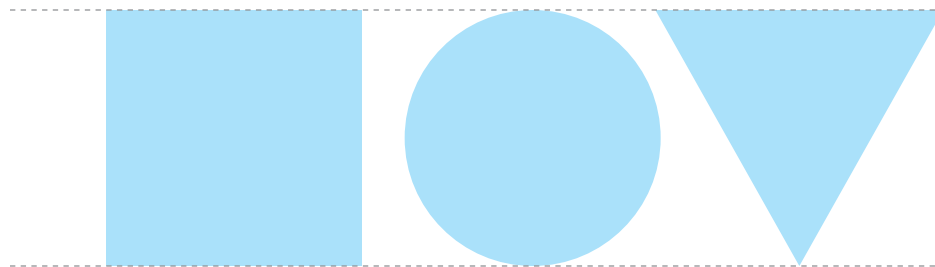
- Relationship to a historical form and considerations of readability.
- How the letter looks on its own – balance and stability.
- Relationship to other parts of the letter, overall weight.
- Relationship to other letters.
- Relationship to other weights.

# Overshoot

A square, circle, and triangle of the same height will not appear the same height. The principle of overshoot is to optically adjust letterforms so they appear to be the same height or width as other letterforms.



## Mathematically Even



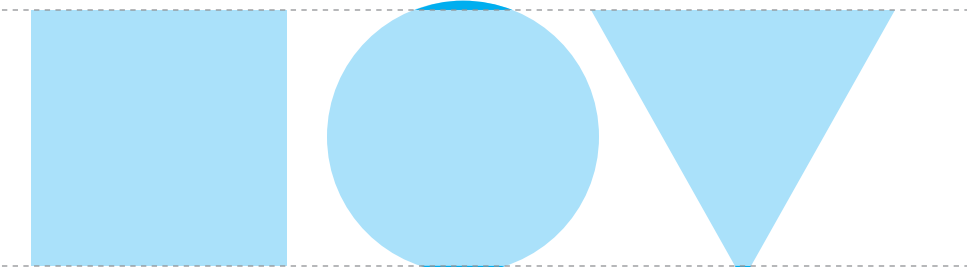
Every letter in the Latin alphabet can be made from four kinds of strokes; vertical, horizontal, curved, and diagonal. (Combining these strokes yields the square, circle, and triangle above.)

If these shapes are drawn to the same height, they actually appear to be different heights. This is most apparent when comparing the circle to the square: the circle appears to be much shorter than the square.

Optical adjustments are required to make the different shapes appear to be the same height.



## Optically Adjusted

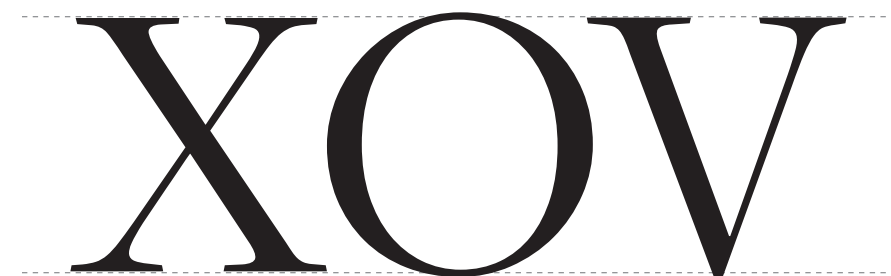


The size of the circle is increased so that it extends above and below the top and bottom edges of the square.

Now the circle *appears* the same height as the square.

Similarly, the point of the triangle is extended below the bottom edge of the square.

The strong visual alignment with the top of the square doesn't need adjustment.





## How Do You Make Letters Look Good?

# Horizontal vs Vertical

Due to the physiology of human sight, horizontal strokes appear thicker than vertical strokes of the same width. Type designers take this into account by slightly slimming horizontal strokes in comparison to vertical strokes.

The relative size of spaces within letters also needs to be optically adjusted. For instance the crossbar in an "E" should be higher than the mathematical vertical center to prevent the letter from feeling bottom heavy. This applies to the center point of all letters (e.g. B, E, H, K, X, S, etc.)



### ✘ Mathematically Even

The thickness of both horizontal and vertical strokes is identical here. Notice how the form feels heavy and clunky.

### ✔ Optically Adjusted

This shape has been adjusted so that the horizontal strokes are thinner. Notice how the letter feels more balanced and graceful overall.

### Comparison

A comparison of stroke thicknesses. Pink indicates the unadjusted form.

# Big vs Small

Numerous tweaks and inconsistencies are required to make a typeface appear consistent and even. For example, uppercase letter strokes must be 2–5% heavier than lowercase letters. Otherwise, uppercase letters appear lighter than lowercase letters of the same weight – the extra stroke weight counterbalances the greater white space in larger characters.

✘ Mathematically Even

Hello, World!

Hh

hH

The stroke thickness of the upper- and lowercase letters is identical, causing the uppercase letter to appear lighter.

✔ Optically Adjusted

Hello, World!

Hh

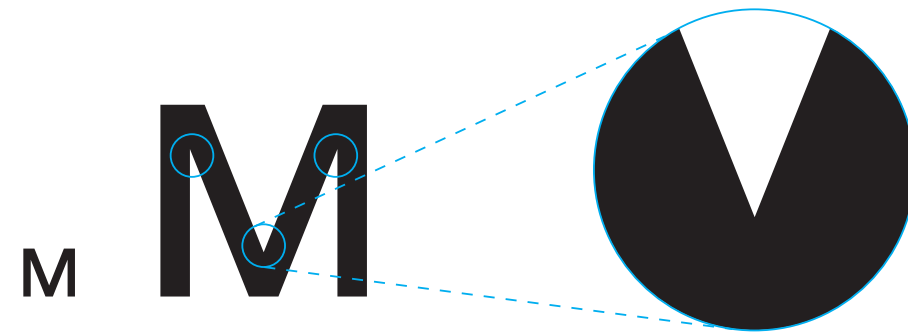
hH

The stroke thickness of the uppercase letter is approximately 5% heavier than the lowercase. This creates the appearance of equal weight.

# Light Wells

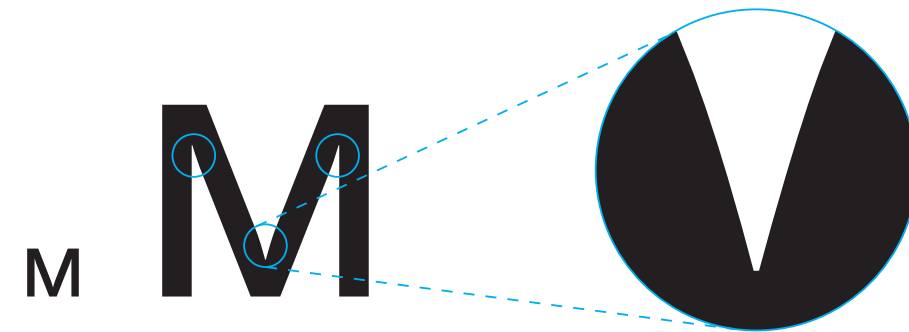
Light wells are adjustments applied to letterforms where multiple strokes join together. **If drawn mechanically, the joints of a letter might appear heavier than the individual strokes, so slight cuts are taken out of the joints to achieve a visual balance.**

Light wells are also used to compensate for the spread of ink into paper in the printing process – when designed for this purpose light wells are referred to as “ink traps”.



**✘ Mathematically Even Character  
(without light wells)**

Points where multiple strokes join can appear thicker and visually heavier than the individual strokes.



**✔ Optically Adjusted Character  
(with light wells)**

This “M” has been optically adjusted where the strokes meet to achieve an even balance between strokes and the joints.

# Components

Though letterforms are often complicated in shape, type designers often attempt to regularize as many components as possible. This is done to save time but also to create harmony within the alphabet as a whole. On the other hand, if this concept is carried too far, it can become a problem and create strange letterforms. Often related letterforms are 98% the same but have small adjustments made to make them feel visually harmonious.

Sets of letters that typically have regularized components include:

b d p q

n m h u r

o c e

ijl

v y w

H E F L I

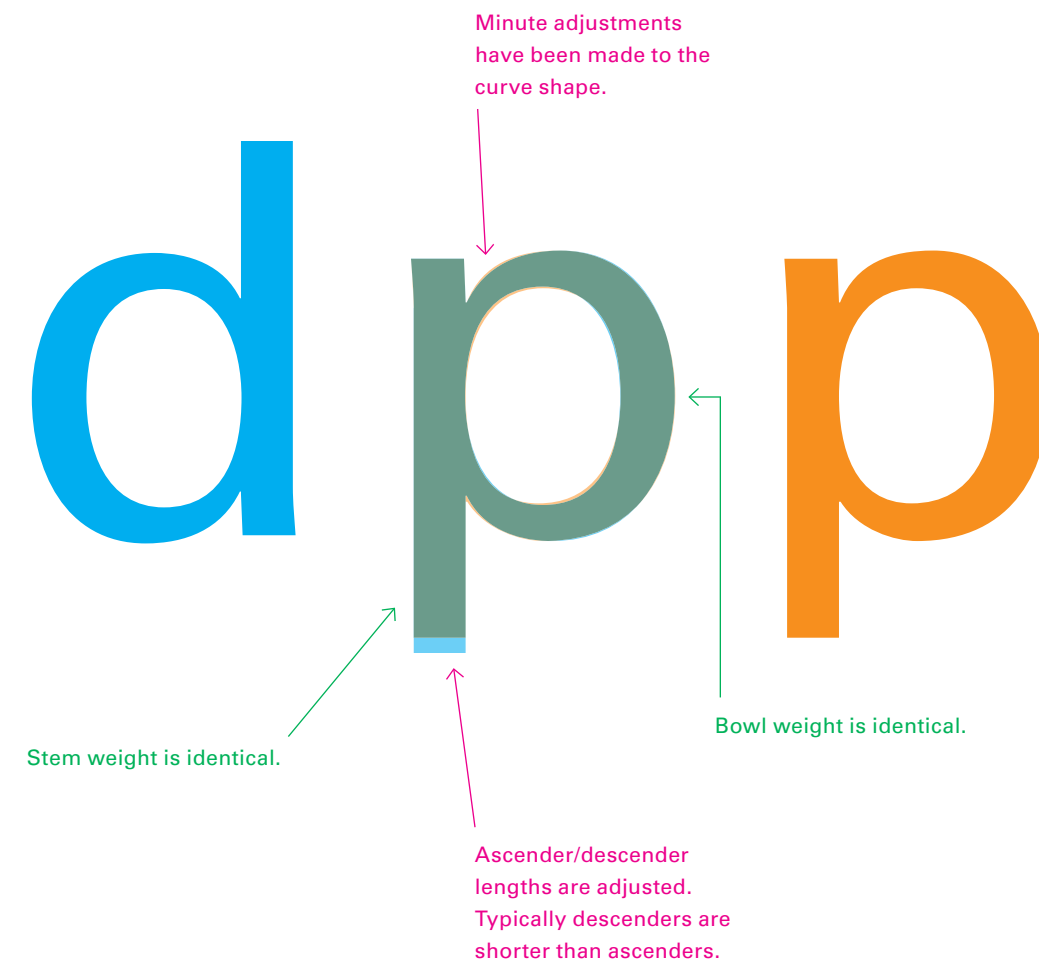
B P R

O Q C G

## Commonly Regularized Shapes

Letters such "b", "d", "p", and "q" all share the same basic structure. The vertical stems and bowls should have standardized thicknesses; however small adjustments may be made at the joins to balance each letter individually.

In the illustration below the "d" is rotated 180° to sit on top of the "p".



# Text Cut vs Titling Cut

Metal type came in fixed point sizes. Large point sizes (titling cuts) were not simply linearly-scaled versions of smaller point sizes (text cuts). All the characters in smaller sizes tended to be wider and bolder than the same characters in larger point sizes.

A digital text cut font should not be enlarged and used for headlines. Conversely, a digital title cut font should not be reduced and used with long blocks of text.

## Text Cut

Title Size  
(72 pt)

✗ TORONTO

Text Size  
(14 pt)

✓ TORONTO

A text cut font looks good at reading sizes but appears too bold when used at headline size.

## Title Cut

✓ TORONTO

✗ TORONTO

A title cut font looks good set large but appears too light when used at reading sizes.

TORONTO  
TORONTO

Both examples are the same size (24 pt).

### Set Width Comparison

Smaller text sizes require more space between letters for legibility. Title cuts have narrower spaces between letters.

# Condensed: Auto vs Manual

Most, but not all, condensed fonts are intended to visually complement “regular” width fonts. **Condensed fonts should never be made automatically by mathematically compressing a regular width font – this creates uneven vertical and horizontal stroke weights that can cause the letters to appear awkward and unbalanced.** Condensed fonts, like their regular width inspirations, should be designed by hand to have proper balance and internal consistency.

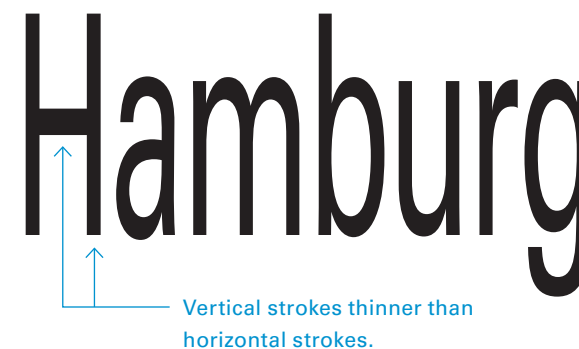
Condensed fonts are useful for visually differentiating secondary or supporting information from the main body of text or simply to fit more characters into a given space.

Regular Width

Hamburg

✘ Auto Condensed (Mathematically Calculated)

Hamburg



Vertical strokes thinner than horizontal strokes.

Auto-condensed fonts are created by negatively scaling the outlines of a normal font only in the x-dimension. In this process, the y dimension remains unchanged. Auto-condensed fonts appear awkward and unbalanced because the vertical strokes are condensed along with the set-width. In extreme situations the vertical strokes can become thinner than the horizontal strokes.

✔ Manually Condensed (Optically Corrected)

Hamburg

A correctly designed condensed font maintains the proper ratio of horizontal to vertical stroke thickness. Condensed fonts should be designed so their glyph shapes relate to but don't try to mimic the regular width font. The narrower widths require shapes better suited to tight spacing.

# How Do Characters Go Together?

Composing characters into words is the first step toward composing a page. Sizing, spacing, and contextual alterations all require careful attention to detail on the part of the typographer to make each word feel considered and balanced.



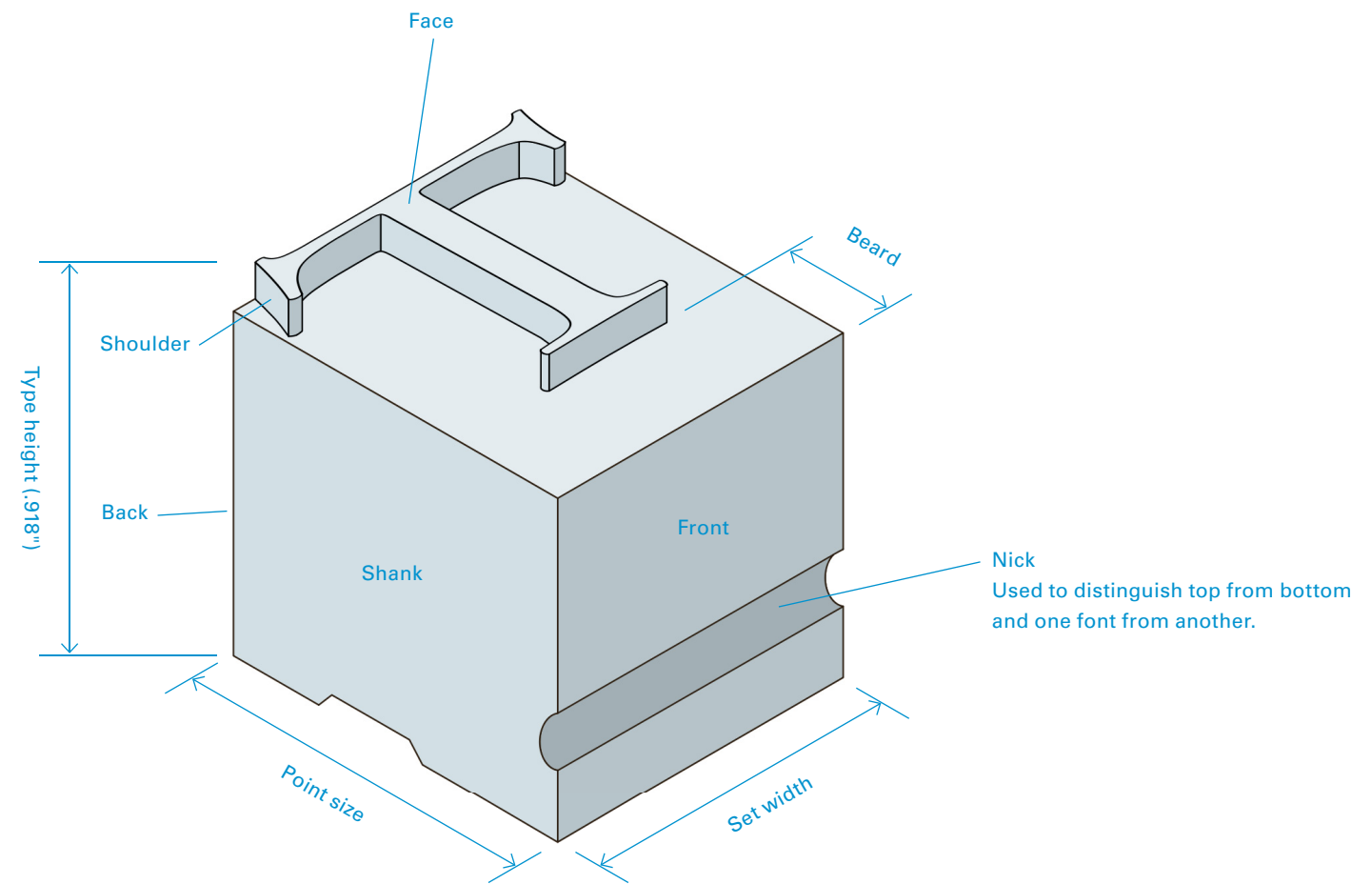
## How Do Characters Go Together?

# Bodies

Until the middle of the twentieth century, type was made out of metal. Each glyph was its own individual piece of metal with the shape of the glyph raised on the surface. These pieces of metal were composed into orderly rows using a composing stick, and sets of rows would be combined to form a page. All of the pieces in a single set (at a single size) had to be the same height so that when pressed into a sheet of paper they would all make an equal impression.

The individual block of metal that each letter was on was larger than the letter itself. In the x-dimension, extra space was added to keep characters from touching. In the y-dimension extra space was added to accommodate the tallest ascenders and deepest descenders. The y-direction is referred to as the “point size.” All of the glyphs in a single font had to be the same point size so that they fit into an even row when composed into a line.

Letterpress printing with metal type worked in much the way it sounds. The letters were composed into lines and pages, locked in place, and then the tops (or “faces”) of the letter were inked and pressed into a sheet of paper. Because the page image was made by physically impressing the inked metal into paper, the letters were all cast in reverse, and all lines had to be composed in reverse.



Metal type being set in a composing stick.



Typefaces that are the same point size may have very different x-heights, baselines, weight, and even apparent size.

## How Do Characters Go Together?

# Type Size & the Em Square

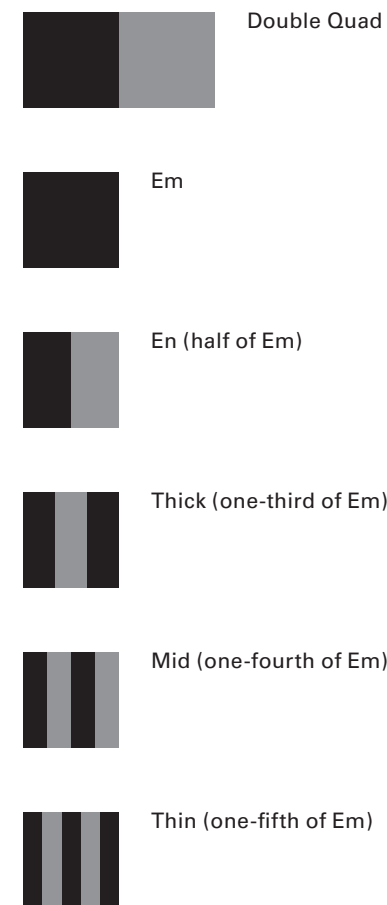
Type is measured in “points”. A point is a subdivision of the “pica”. There are 12 points in a pica, and essentially six picas in an inch. (The typographic point is typically abbreviated “pt” while a pica is abbreviated as simply “p.”) The original printer’s point varied from .18 to .4 mm depending on geographical location but was standardized to be .376 mm in the nineteenth century with the advent of the Didot measurement system. Under this standard, now referred to as the “American point”, 72 points equalled 1.065 inches. In the 1980s the traditional point was revised again with the advent of desktop publishing so that there would be exactly 72 points in an inch. This measurement system is referred to as either the “DTP point” or the “PostScript point” because of the heavy promotion done by Adobe toward adoption of the revised system.

Because of the changing nature of how type is manufactured and used, what a typeface’s point size measures has become murky. For metal type, the point size is simply the height of the piece of metal. For digital type, the point size refers to a kind of invisible bounding box that surrounds the glyphs. There have been efforts to revise this system so that the point size would refer to something actually measurable (such as the cap-height) but none of these efforts have gained much traction.

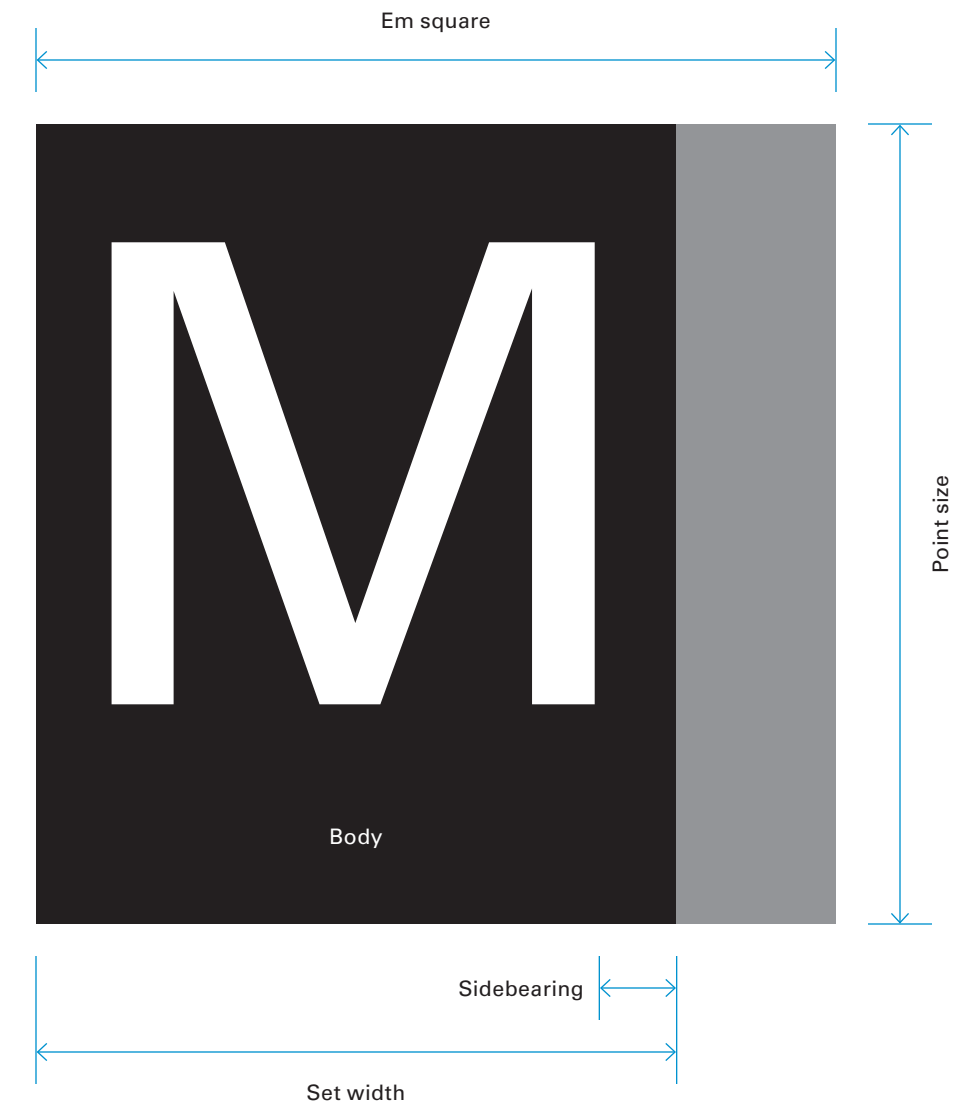
In metal type, a square the same size as the point size is referred to as an “em square” and serves as a reference for standardized proportional spacing units, such as the “en” (half as wide as an em), “thick” (one-third of an em), “mid” (one-fourth of an em), and “thin” (one-fifth of an em). Other larger spaces, known as “quads” were used to space lines out.

In digital type, the em continues to be used as the basis for sizing. In PostScript the em square measures 1000 x 1000 units, while in TrueType it measures 2048 x 2048 units. When the typeface is made and used, the 1000 unit height becomes the point size while the width is defined by the designer. The total rectangular area occupied by the glyph is often called the “body”. Space between the glyph and the edge of the body is called the “sidebearing”, and the sidebearings plus the glyph width is called the “set width”.

Note that with digital type, it is possible to allow ascenders, descenders, accents, etc. to exceed the point size.



In addition to the em divisions shown above, typesetting in metal made use of thinner spaces, made of brass, copper, and even tracing paper. In the desktop publishing world, it is now possible to use spacing units of any size.



## How Do Characters Go Together?

# Fixed-width

Most letterforms have their own width based on the shape of the letter, however some categories of letterforms are designed to be the same width. **Figures are typically designed to all fit on the same size set width** – typically the size of an en-quad – so that they can easily be arranged in mathematical, or “tabular” settings. Until the invention of the typewriter, figures were the only fixed-width glyphs. Early typewriters had “hammers” (the small metal arms with a letter shape on their faces) that were all the same width to make the mechanism simpler. This led to the design of **fonts with all characters fitting on the same set-width**. These fonts are known as fixed-width or mono-spaced. In this kind of typeface, **letterforms are sometimes distorted to fit into the same size space**.

### Tabular Figures

Tabular figures are useful for mathematical settings, but some characters, such as the 1, can look awkward.

$$\begin{array}{r} 1\ 2\ 3\ 4 \\ +\ 4\ 5\ 6\ 7 \\ \hline 5\ 8\ 0\ 1 \end{array}$$

### Proportional vs Fixed-width Setting

Most typefaces are “proportionally” spaced so that each letter has its own width. Fixed-width typefaces force all characters to adhere to the same spacing settings. This can cause some characters to look stretched or squashed while others change their shape to try to take up enough space (see the lowercase “i”).

Proportional

Quickest  
Handglovery

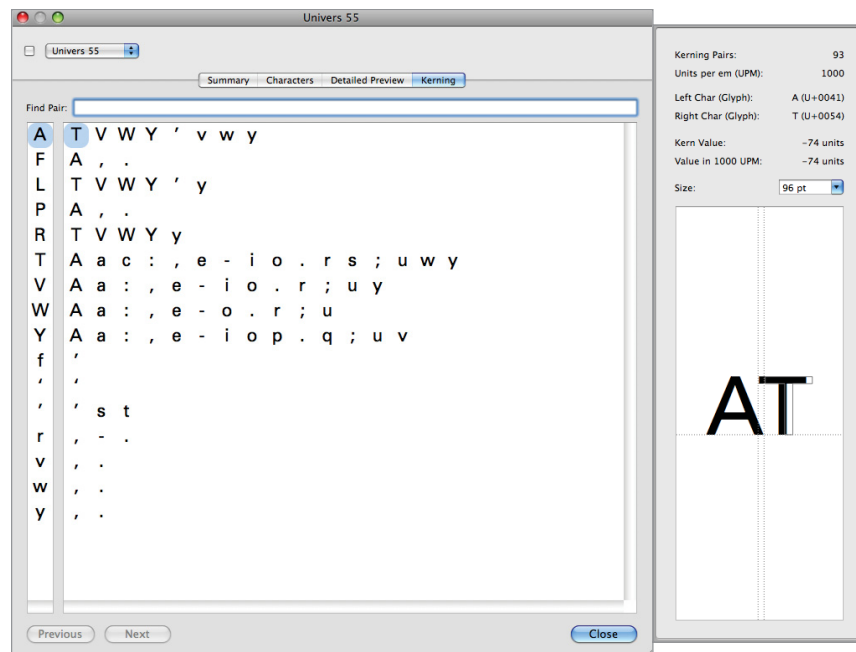
Fixed-width

Quickest  
Handglovery

## How Do Characters Go Together?

# Kerning

In addition to determining the shape of a letter, the type designer must determine how much space to put around it – this is known as the bounding box. This amount is a compromise designed to look as good as possible in the most likely letter combinations. However, there are common letter combinations that require custom spacing. **Kerned pairs are pairs of letters pre-programmed by the type designer to have special spacing instructions that modify the sidebearings between them.** Typically kerned pairs are used to remove space between two characters although space is occasionally added between characters. Type designers should not use kerned pairs to correct for bad overall spacing, but rather kerned pairs should be exception cases to correct awkward glyph combinations.



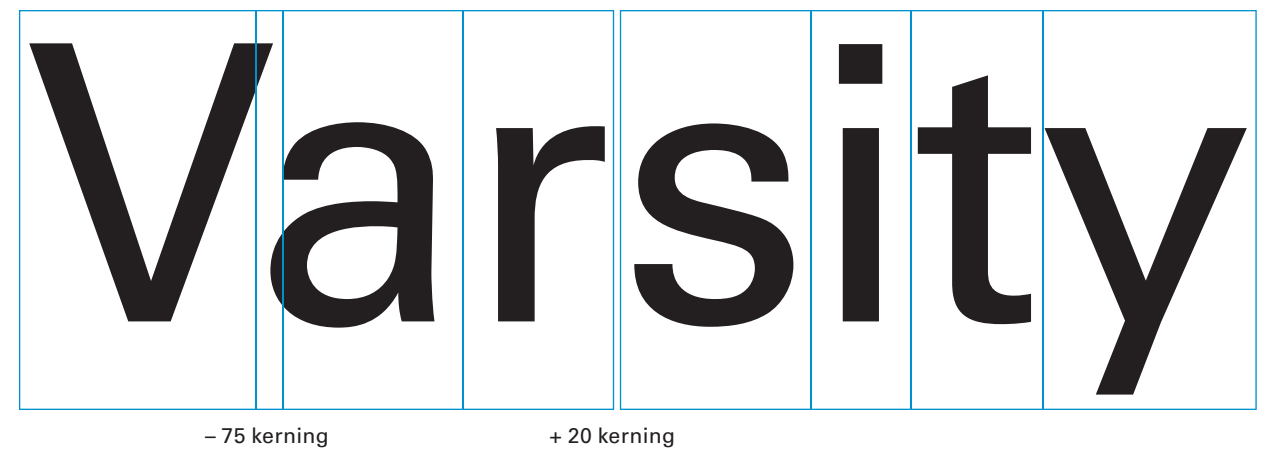
Kerned pairs for the Univers font as seen in Linotype FontExplorer.

In digital font files, overall kerning settings as well as kerned pairs are stored as a table that lists the space modification values per letter combination. Desktop publishing and typesetting programs allow graphic designers to alter the spacing between any two letters, independent of kerned pair settings.

### Without Kerning



### With Kerning



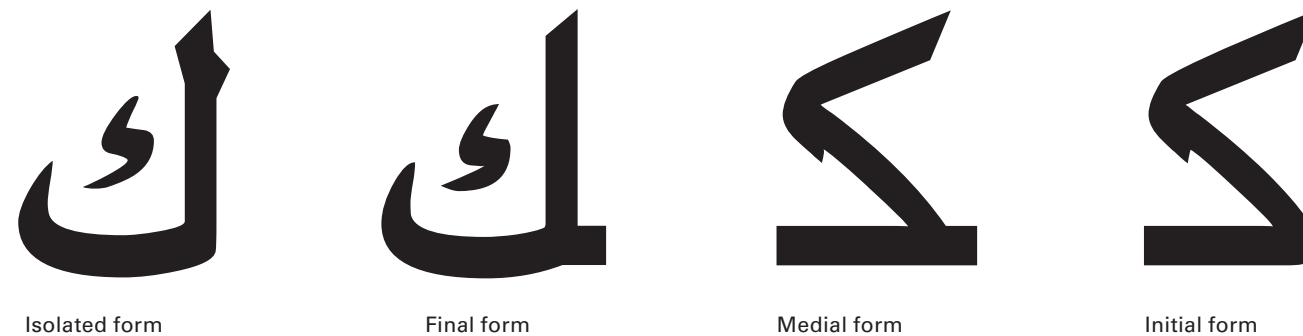
## How Do Characters Go Together?

# Contextual Shaping

In many scripts, letters can take different forms depending on their context. In western Latin-based scripts, this usually isn't an issue because there is only one version of any character. A font may have alternative glyphs for individual characters (see page 16) but the use of alternatives is an aesthetic choice, not a grammatical requirement. However, in some scripts, such as Arabic and Indic scripts, **the glyph displayed depends on the surrounding characters**. A single Arabic character may take different shapes depending on if it's alone, the first, middle, or last character in a word. Indic scripts have different glyph shapes for vowels depending on which character the vowel is attached to. **Contextual shaping is the formation of correct sequences of glyphs given these contexts**.

### Arabic (an abjad system) letters change form depending on where they fall in a word

Forms of the Arabic letter "kaaf". (Note: Arabic reads from right-to-left.)



### Strings of Devangari (an abugida system) consonants can form complex ligatures



#### Sources:

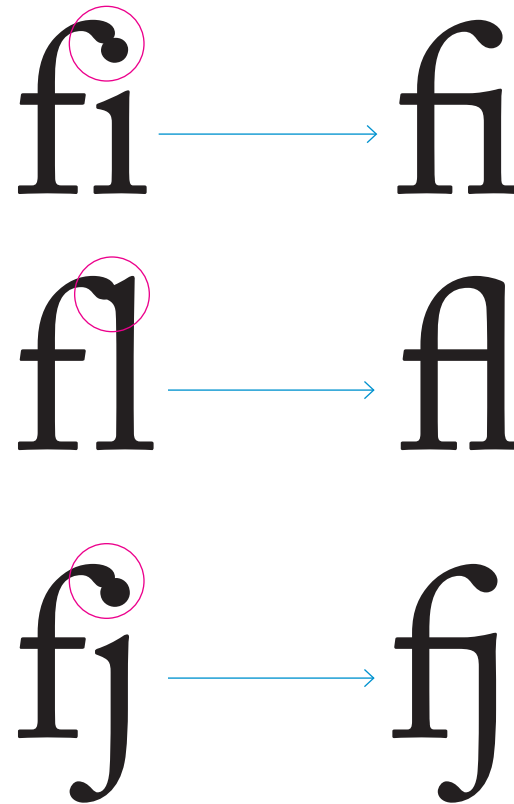
[msdn.microsoft.com/en-us/goglobal/bb688172](https://msdn.microsoft.com/en-us/goglobal/bb688172)  
[people.w3.org/rishida/scripts/featurelist/index.php?col=6](https://people.w3.org/rishida/scripts/featurelist/index.php?col=6)

## How Do Characters Go Together?

# Ligatures

There are some pairs of letters with an awkward space relationship between them that can't be fixed through kerning. Reducing the space between the two characters may cause elements of the glyphs to overlap. Increasing the space between the two characters may create an awkward white space in the flow of the text. To correct this situation, a special character, called a ligature, is created that modifies the two original glyphs so they fit together nicely. This is the most common use of contextual shaping in western Latin-based alphabets, and it is an aesthetic choice, not a grammatical requirement.

Examples of problematic letter pairs with the conflicting elements circled. Note that in the corresponding ligature glyph more than the colliding shapes have been adjusted.



Examples of ornamental ligatures. These are typically discretionary in nature, used primarily for headlines and rarely seen in the body of a text.



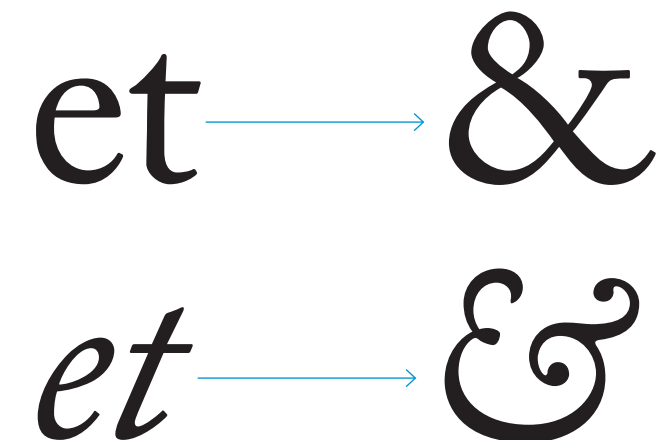
The glyphs shown below are ligatures for common diphthongs. They have been promoted to full letters in some languages, including Danish, Icelandic, and Norwegian.



In German, a common ligature is the Eszett, which is used in place of a double "s".



A very common ligature that is often not recognized as such is the ampersand, which is combination of the "e" and "t" characters. In Latin, "et" means "and". It is easier to see the combination in the italic version of the character.



# How Do Words Go Together?

Combining words into lines and paragraphs expands on the ideas dealt with in forming words from characters. Spacing is of paramount importance, but there are other factors to consider.



## How Do Words Go Together?

# Letter Spacing

On any page, the printed areas interact with the unprinted areas. This applies to lines of text, words, and letters themselves. The amount of space needed between letters is a function of their interior space, or counters. A typeface with small counters will require less space between individual letters than a typeface with large counters. The goal is to achieve an even tone on the page or screen. The gray tone produced by a block of text is referred to as its “color”. Too much space between letters and the words will appear to fall apart. Too little space between letters will create blotchy, uneven words. There is no universal correct amount of letter spacing for all type. It must be determined on a case-by-case basis, by taking into account the typeface used, the size of the type, whether the letters are upper or lowercase (or both), and the display medium. Because of the variety of shapes that letters take, there is no way to achieve perfect mathematical evenness. Rather, the designer should strive for an optical balance.

Language also affects color. Two texts in the same script (e.g. English and German) and using the exact same spacing settings will typically produce a different color on the page because the languages differ in their letter frequency, use of diacritical marks, capitalization conventions, and more.

Examples of type with different size counters and how this affects achieving optimal letter spacing.

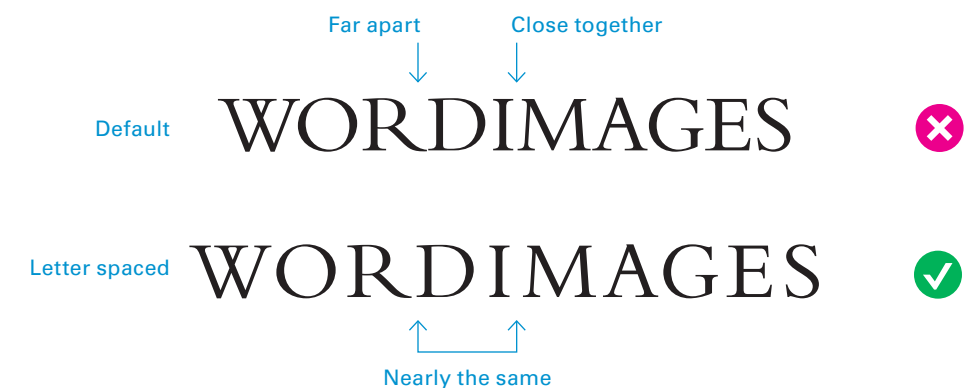


Letter spacing can go too far in either direction.

**set too loose    just right    and too tight**

A string of all uppercase letters is a special problem in letter spacing. To achieve an optical balance across a word, it is often necessary to expand the letter spacing because default spacing values are designed for mixed-case setting (i.e. uppercase initial letters followed by lowercase letters). In the example to the right, the default letter spacing (top) creates strange gaps in an attempt to keep letters from colliding. Notice the large gap between the “R” and the “D” and the gaps around the “A” relative to the space around the “I”.

The bottom example has an overall increased letter spacing (also known as “tracking”). Individual letter pairs have been hand-kerned to better match the minimum spacing dictated by the “RD” pair.



Sources:

Hochuli, Just. *Detail in Typography*, London: Hyphen Press, 2008.

## How Do Words Go Together?

# Word Spacing

What applies to letter spacing also applies to word spacing: **word spacing, like letter spacing, is a function of the counters of the individual letters.** When the letters have small counters, the word spacing should be small (and vice versa). The general rule for word spacing is: as much as necessary, as little as possible. A clear but not excessive space will usually be about one fourth the body size, e.g. 2.5 pt word spacing for 10 pt type. But again, a critical eye must be used in all situations because there are no universal rules. **Smaller type sizes usually need proportionally more word spacing and large type sizes proportionally less.** In desktop publishing programs (e.g. Adobe InDesign), the graphic designer can alter the word spacing for a piece of text via the Hyphenation and Justification settings (H&Js).

Both examples below are the same point size, but have different letter widths.

Broad type  needs larger wordspaces  
Narrow type  needs smaller wordspaces

In DTP programs, word spacing is measured in percentages. By default, the word spacing is set to 100% in the H&J settings. This is the default value the type designer set for the width of the word space character. A graphic designer setting type in a DTP program can modify this number to be more or less than 100%. While there is no magic number for all situations, most fonts set at small sizes (i.e. between 8 pt and 12 pt) will look better with about 90% – 95% word spacing. At larger sizes, the word spacing can be reduced further.

This line is too loosely wordspaced. (130%)

This line is too tightly wordspaced. (70%)

This line is correctly wordspaced. (86%)

The first two lines are set at different point sizes but with the same wordspacing. While the smaller type appears correct, at the larger size it is too loose. If the wordspacing is tightened slightly at the larger size, it feels more attractive.

These lines are set in the same typeface. (96%) **correct**

These lines are set in the same typeface. (96%) **too loose**

These lines are set in the same typeface. (86%) **correct**

Sources:

Hochuli, Just. *Detail in Typography*, London: Hyphen Press, 2008.

## How Do Words Go Together?

# Line Length

The length of a line of text (also called the “measure” or “set width”) can also affect readability. Lines that are too short or too long can be tiring to read, though this problem is more pronounced with lines that are too long. The kind of text and the general context in which it appears also affect what will be appropriate. An academic paper with many mathematical formulas, tables, or diagrams will naturally have longer line lengths than a novel, a reference work, an entertainment magazine, or newspaper. Captions, which tend not to require extended reading times, can have much shorter line lengths than would be considered reasonable for a novel. Generally typographers recommended line lengths between 45 and 75 characters per line, with 65 characters per line being something of a gold standard. If a line is too short, natural phrases are broken, more hyphenation is needed, and readers spend more energy putting the pieces back together. If lines are too long, readers spend extra energy trying to find the beginning of the next line. What line length works best for a particular text depends on three factors: letter spacing, word spacing, and line spacing. (See page 68.)

Jenson, 10 pt  
30 characters per line (average)

The length of a line of text (also called the “measure” or “set width”) can also affect readability. Lines that are too short or too long can be tiring to read, though this is more pronounced with lines that are too long. The kind of text and the general context in which it appears also affect what will be appropriate. An academic paper with many mathematical formulas, tables, or diagrams will naturally have longer line lengths than a novel, a reference work, an entertainment magazine, or newspaper. Captions, which tend not to require extended reading times, can have much shorter line lengths than would be considered reasonable for a novel. Generally typographers recommended line lengths between 45 and 75 characters per line, with 65 characters per line being something of a golden standard.

OK for captions,  
too short for extended reading.

Jenson, 10 pt  
65 characters per line (average)

The length of a line of text (also called the “measure” or “set width”) can also affect readability. Lines that are too short or too long can be tiring to read, though this is more pronounced with lines that are too long. The kind of text and the general context in which it appears also affect what will be appropriate. An academic paper with many mathematical formulas, tables, or diagrams will naturally have longer line lengths than a novel, a reference work, an entertainment magazine, or newspaper. Captions, which tend not to require extended reading times, can have much shorter line lengths than would be considered reasonable for a novel. Generally typographers recommended line lengths between 45 and 75 characters per line, with 65 characters per line being something of a golden standard.

Optimum.

Jenson, 10 pt  
45 characters per line (average)

The length of a line of text (also called the “measure” or “set width”) can also affect readability. Lines that are too short or too long can be tiring to read, though this is more pronounced with lines that are too long. The kind of text and the general context in which it appears also affect what will be appropriate. An academic paper with many mathematical formulas, tables, or diagrams will naturally have longer line lengths than a novel, a reference work, an entertainment magazine, or newspaper. Captions, which tend not to require extended reading times, can have much shorter line lengths than would be considered reasonable for a novel. Generally typographers recommended line lengths between 45 and 75 characters per line, with 65 characters per line being something of a golden standard.

On the short side for extended reading  
but still reasonably comfortable.

Jenson, 10 pt  
88 characters per line (average)

The length of a line of text (also called the “measure” or “set width”) can also affect readability. Lines that are too short or too long can be tiring to read, though this is more pronounced with lines that are too long. The kind of text and the general context in which it appears also affect what will be appropriate. An academic paper with many mathematical formulas, tables, or diagrams will naturally have longer line lengths than a novel, a reference work, an entertainment magazine, or newspaper. Captions, which tend not to require extended reading times, can have much shorter line lengths than would be considered reasonable for a novel. Generally typographers recommended line lengths between 45 and 75 characters per line, with 65 characters per line being something of a golden standard.

Too long for extended reading;  
would result in frequent confusion about which line is next.

### Sources:

Baines, Phil, *Type and Typography*, New York: Watson Guptill, 2005.  
Hochuli, Just. *Detail in Typography*, London: Hyphen Press, 2008.

## How Do Words Go Together?

# Line Spacing

For a typographer, line spacing is an important tool for controlling the “color”, the perceived gray tone, of a block of text. Generally, for a given typeface and size, the longer the line the more line spacing (also called “leading”) that will be needed. Lighter typefaces (those with larger counters) need more line spacing than darker ones. The internal forms of the letters thus influence not only the letter and word spacing but also the line spacing. None of these factors can be considered in isolation. Neither line length nor line spacing can be changed without changing the other if maximum readability is to be preserved.

In the days of metal type, “leading” referred to actual strips of lead which could be inserted between each line of type. This paragraph would thus have been described as 10 pt type with 4 pt leading. Lines of metal type set without any additional strips of lead would be described as “set solid”. In the digital desktop publishing era, the terminology changed somewhat. Now, leading refers to the space measured from baseline to baseline. This paragraph is now typically described as 10 pt with 14 pt leading. A common shorthand used by typographers for these measurements is to say that this paragraph is “set 10 on 14 pt”, usually written as “10/14 pt”.

Sources:

Hochuli, Just. *Detail in Typography*, London: Hyphen Press, 2008.

### 10/9 pt (negative line spacing)

For a typographer, line spacing is an important tool in controlling the “color”, the perceived gray tone, of a block of text. Generally, for a given typeface and size, the longer the line the more line spacing (also called “leading”) that will be needed. Lighter typefaces (those with larger counters) need more line spacing than darker ones. The internal forms of the letters thus influence not only the letter and word spacing but also the line spacing. None of these factors can be considered in isolation. Neither line length or line spacing can be changed without changing the other if maximum readability is to be preserved.

Unbearable

### 10/10 pt (solid)

For a typographer, line spacing is an important tool in controlling the “color”, the perceived gray tone, of a block of text. Generally, for a given typeface and size, the longer the line the more line spacing (also called “leading”) that will be needed. Lighter typefaces (those with larger counters) need more line spacing than darker ones. The internal forms of the letters thus influence not only the letter and word spacing but also the line spacing. None of these factors can be considered in isolation. Neither line length or line spacing can be changed without changing the other if maximum readability is to be preserved.

Feels tight

### 10/11 pt

For a typographer, line spacing is an important tool in controlling the “color”, the perceived gray tone, of a block of text. Generally, for a given typeface and size, the longer the line the more line spacing (also called “leading”) that will be needed. Lighter typefaces (those with larger counters) need more line spacing than darker ones. The internal forms of the letters thus influence not only the letter and word spacing but also the line spacing. None of these factors can be considered in isolation. Neither line length or line spacing can be changed without changing the other if maximum readability is to be preserved.

OK

### 10/12 pt

For a typographer, line spacing is an important tool in controlling the “color”, the perceived gray tone, of a block of text. Generally, for a given typeface and size, the longer the line the more line spacing (also called “leading”) that will be needed. Lighter typefaces (those with larger counters) need more line spacing than darker ones. The internal forms of the letters thus influence not only the letter and word spacing but also the line spacing. None of these factors can be considered in isolation. Neither line length or line spacing can be changed without changing the other if maximum readability is to be preserved.

Good

### 10/14 pt

For a typographer, line spacing is an important tool in controlling the “color”, the perceived gray tone, of a block of text. Generally, for a given typeface and size, the longer the line the more line spacing (also called “leading”) that will be needed. Lighter typefaces (those with larger counters) need more line spacing than darker ones. The internal forms of the letters thus influence not only the letter and word spacing but also the line spacing. None of these factors can be considered in isolation. Neither line length or line spacing can be changed without changing the other if maximum readability is to be preserved.

A little loose

### 10/16 pt

For a typographer, line spacing is an important tool in controlling the “color”, the perceived gray tone, of a block of text. Generally, for a given typeface and size, the longer the line the more line spacing (also called “leading”) that will be needed. Lighter typefaces (those with larger counters) need more line spacing than darker ones. The internal forms of the letters thus influence not only the letter and word spacing but also the line spacing. None of these factors can be considered in isolation. Neither line length or line spacing can be changed without changing the other if maximum readability is to be preserved.

Too much



## How Do Words Go Together?

# Set Length

The same text, translated into different languages, will rarely end up the same length as the original. This is due to inherent differences in vocabulary, spelling, common character usage, and grammar.

English typically runs shorter than most other languages that use the Latin script. For example, German runs on average about 10–20% longer than English. This rule applies at the word level as well as at the paragraph level.

This expansion factor has to be taken into account when designing user experience elements for software that will be localized into languages other than English.

### English

33 lines

Alice was beginning to get very tired of sitting by her sister on the bank, and of having nothing to do. Once or twice she had peeped into the book her sister was reading, but it had no pictures or conversations in it, “and what is the use of a book,” thought Alice, “without pictures or conversations?”

So she was considering in her own mind (as well as she could, for the day made her feel very sleepy and stupid), whether the pleasure of making a daisy-chain would be worth the trouble of getting up and picking the daisies, when suddenly a White Rabbit with pink eyes ran close by her.

There was nothing so very remarkable in that, nor did Alice think it so very much out of the way to hear the Rabbit say to itself, “Oh dear! Oh dear! I shall be too late!” But when the Rabbit actually took a watch out of its waistcoat-pocket and looked at it and then hurried on, Alice started to her feet, for it flashed across her mind that she had never before seen a rabbit with either a waistcoat-pocket, or a watch to take out of it, and, burning with curiosity, she ran across the field after it and was just in time to see it pop down a large rabbit-hole, under the hedge.

### German

39 lines

Alice fing an sich zu langweilen; sie saß schon lange bei ihrer Schwester am Ufer und hatte nichts zu thun. Das Buch, das ihre Schwester las, gefiel ihr nicht; denn es waren weder Bilder noch Gespräche darin. »Und was nützen Bücher,« dachte Alice, »ohne Bilder und Gespräche?«

Sie überlegte sich eben, (so gut es ging, denn sie war schläfrig und dumm von der Hitze,) ob es der Mühe werth sei aufzustehen und Gänseblümchen zu pflücken, um eine Kette damit zu machen, als plötzlich ein weißes Kaninchen mit rothen Augen dicht an ihr vorbeirannte.

Dies war grade nicht sehr merkwürdig; Alice fand es auch nicht sehr außerordentlich, daß sie das Kaninchen sagen hörte: »O weh, o weh! Ich werde zu spät kommen!« (Als sie es später wieder überlegte, fiel ihr ein, daß sie sich darüber hätte wundern sollen, doch zur Zeit kam es ihr Alles ganz natürlich vor.) Aber als das Kaninchen seine Uhr aus der Westentasche zog, nach der Zeit sah und eilig fortlief, sprang Alice auf; denn es war ihr doch noch nie vorgekommen, ein Kaninchen mit einer Westentasche und eine Uhr darin zu sehen. Vor Neugierde brennend, rannte sie ihm nach, über den Grasplatz, und kam noch zur rechten Zeit, um es in ein großes Loch unter der Hecke schlüpfen zu sehen.

### Japanese

37 lines

アリスは、非常に銀行に姉のそばに座って飽き始めていたとは何の関係もないこと。一度か二度、彼女は姉が読んでいた本にのぞいていたが、それは、それには写真や会話を持っていた”とどんな本を使用することである”、”写真や会話なし?”とアリスは思いました

デイジーチェーンを作るのは楽しいが取得し、ヒナギクを選んでのトラブルの価値があるかどうか、(日、彼女は非常に眠く、愚かな感じさせたのも彼女ができるように、)それで彼女は自分の心に検討していたときに突然、白うさぎがピンクの目と彼女の近くに走ってきました。

何も、とてもという点で注目があってもアリスはそれが道のように非常に兎がまあ、”それ自体に言うのを聞くと思うよ! まあ! 私は遅すぎるしなかなければならない!”しかし、ウサギは、実際には、チョッキのポケットの時計を取り出して見るとそれをしに急いで、アリスは、彼女の足を始めた彼女は前にウサギを見たことがなかった彼女の心にフラッシュのための好奇心に燃えていずれかのチョッキのポケット、またはそれの中から取る時計、および、彼女はそれ以降のフィールドに出会った、それはヘッジファンドの下で、大規模なウサギの穴をダウン開くを参照してくださいにちょうど間に合うようにした。

### Swedish

33 lines

Alice började bli väldigt trött på att sitta av sin syster på banken, och för att ha något att göra. Ett par gånger hade hon tittade in i boken hennes syster läste, men det hade inga bilder eller samtal i det, “och vad är användningen av en bok, tänkte Alice,” utan bilder eller samtal?”

Så hon övervägde i sitt eget sinne (liksom hon kunde, för dagen fick henne att känna sig mycket sömning och dumma), även nöjet att göra en daisy-kedja skulle vara värt besväret att stiga upp och plocka prästkragar, när plötsligt en vit kanin med rosa ögon sprang närheten henne.

Det fanns ingenting så mycket anmärkningsvärda i det, inte heller Alice tycker det så mycket ur vägen att höra Kanin säga till sig själv, “Oj! Kära nån! Jag ska vara för sent! “Men när Rabbit faktiskt ägde en klocka ur sin väst-ficka och tittade på den och sedan skyndade på, började Alice till hennes fötter, för det blixtrade över henne att hon aldrig förr hade sett en kanin med antingen en väst-ficka, eller en klocka att ta ur den, och brinnande av nyfikenhet, sprang hon över fältet efter den och var precis i tid för att se det pop ner en stor kanin-hål, under häcken.

# Alignment

There are four primary ways in which text is aligned: flush left (aka ragged right), flush right (aka ragged left), centered, and justified. Each derives from slightly different practices and has its particular advantages.

This is flush left or ragged right alignment. Although this is the way people write in English, it was rare to find a printed book set flush left until the twentieth century. Eric Gill was an early advocate of this style, arguing its efficacy by word and example in *An Essay on Typography* (1931). There are differing opinions about whether flush left text should be hyphenated or not. If it is not, the right-hand margin can look extremely messy.

Good! For left-to-right reading languages, this is a very natural way to set type.

This is flush right or ragged left text alignment. Because each line starts in a different place (when using a Latin based script, which reads from left to right), and is therefore potentially difficult for the eye to find, this alignment hinders the reading process. It is generally reserved for captions or short passages of text where its deficiencies are less noticeable. In Arabic however, this is a common method of aligning type since Arabic reads from right to left.

Bad! This should never be done with languages that read left to right.

This is centered alignment. It is mainly used for display purposes. – LIKE ON A TITLE PAGE – It was shunned by Modernists but can be deployed to great effect as a way of creating contrast among text blocks.

Useful for titles and headlines, but bad for body text.

This is justified text. It has been the conventional way of setting copy for books since c.1450. The even right-hand edge is achieved by altering the width of the word space from one line to the next and by allowing words to be hyphenated. If the line length is too short the word spaces on adjacent lines can create unsightly vertical holes known as “rivers”. The size of word space, how much it can vary in size, and the frequency of hyphenation are controlled by Hyphenation and Justification (H&J) settings. The designer should edit these rather than trust a program’s defaults.

Good when care is taken with spacing.

Sources:

Baines, Phil, *Type and Typography*, New York: Watson Guptill, 2005.

# Approaches to Flush Left Alignment

Among those who believe that flush left alignment is preferable to other options, there are several schools of thought about precisely how to achieve optimum results.

## Sense Breaks

This approach believes that text should be broken for sense – the rhythm of the text should determine breaking. This approach is often coupled with a removal of all non-essential punctuation (e.g. commas are often redundant when text is broken for sense).

Alice was beginning to get very tired of sitting by her sister on the bank, and of having nothing to do. Once or twice she had peeped into the book her sister was reading, but it had no pictures or conversations in it, “and what is the use of a book,” thought Alice, “without pictures or conversations?”

So she was considering in her own mind (as well as she could, for the day made her feel very sleepy and stupid), whether the pleasure of making a daisy-chain would be worth the trouble of getting up and picking the daisies, when suddenly a White Rabbit with pink eyes ran close by her.

There was nothing so very remarkable in that nor did Alice think it so very much out of the way to hear the Rabbit say to itself “Oh dear! Oh dear! I shall be too late!” But when the Rabbit actually took a watch out of its waistcoat-pocket and looked at it and then hurried on Alice started to her feet for it flashed across her mind that she had never before seen a rabbit with either a waistcoat-pocket, or a watch to take out of it and, burning with curiosity, she ran across the field after it and was just in time to see it pop down a large rabbit-hole under the hedge.

Breaking for sense can be very difficult with a short measure – thoughts and phrases often run longer than a typical line length.

Redundant punctuation has been removed from this section.

## Massaged Breaks

This approach believes that a rag should be actively shaped by the designer with the goal of having nothing stand out. Advocates for this approach believe that flush left text setting is easier to read because of the consistent word spacing, but that a rag needs to be tended so it does not become oddly shaped.

Rougher Alice was beginning to get very tired of sitting by her sister on the bank, and of having nothing to do. Once or twice she had peeped into the book her sister was reading, but it had no pictures or conversations in it, “and what is the use of a book,” thought Alice, “without pictures or conversations?”

So she was considering in her own mind (as well as she could, for the day made her feel very sleepy and stupid), whether the pleasure of making a daisy-chain would be worth the trouble of getting up and picking the daisies, when suddenly a White Rabbit with pink eyes ran close by her.

Smoother There was nothing so very remarkable in that, nor did Alice think it so very much out of the way to hear the Rabbit say to itself, “Oh dear! Oh dear! I shall be too late!” But when the Rabbit actually took a watch out of its waistcoat-pocket and looked at it and then hurried on, Alice started to her feet, for it flashed across her mind that she had never before seen a rabbit with either a waistcoat-pocket, or a watch to take out of it, and, burning with curiosity, she ran across the field after it and was just in time to see it pop down a large rabbit-hole, under the hedge.

There are different schools of thought about how a rag should appear: some designers prefer a rag with more variation in line length so that the text is emphatically *ragged* while others prefer their rags to be smoother so that the rag is not distracting.

## “Natural” Breaks

This approach believes in not manipulating the rag into a tidy shape. Advocates for natural breaks believe it is the most honest approach. Untidy or ill-shaped rags are a consequence of column width and should be corrected.

Without hyphens Alice was beginning to get very tired of sitting by her sister on the bank, and of having nothing to do. Once or twice she had peeped into the book her sister was reading, but it had no pictures or conversations in it, “and what is the use of a book,” thought Alice, “without pictures or conversations?”

So she was considering in her own mind (as well as she could, for the day made her feel very sleepy and stupid), whether the pleasure of making a daisy-chain would be worth the trouble of getting up and picking the daisies, when suddenly a White Rabbit with pink eyes ran close by her.

With hyphens There was nothing so very remarkable in that, nor did Alice think it so very much out of the way to hear the Rabbit say to itself, “Oh dear! Oh dear! I shall be too late!” But when the Rabbit actually took a watch out of its waistcoat-pocket and looked at it and then hurried on, Alice started to her feet, for it flashed across her mind that she had never before seen a rabbit with either a waistcoat-pocket, or a watch to take out of it, and, burning with curiosity, she ran across the field after it and was just in time to see it pop down a large rabbit-hole, under the hedge.

Hyphenation can be useful for creating a less oddly shaped rag, though it does not promise completely tidy results.

An unfortunate and discourageable trait in flush left setting is the appearance of odd shapes in the rag.

This can be mild,

or extreme.

# Hyphenation & Justification

Hyphenation and justification (H&J) settings are used to control the hyphenation frequency and allowed word spacing range for a block of text. System defaults for hyphenation settings may result in words being hyphenated too frequently or very short words being hyphenated. Likewise, default settings may result in awkward wordspacing that is frequently too large, creating “rivers” – unsightly blotches of white in a text block caused by overly large word spacing when justifying text. The designer can fine tune H&J settings, not to micro-manage every line but to establish general spacing and hyphenation principles to apply to the text as a whole.

Adjusting H&J settings is especially important for justified type and narrow column measures but is also useful on left-aligned type and more generous line lengths because often the default word spacing of a typeface is too large – it is common practice to reduce the default word space from 100% to approximately 92–96% for left-aligned text.

Wide word spacing

Unsightly “rivers”

Em dash at beginning of line

## Default H&J Settings

Hyphenation and justification (H&J) settings are used to control the hyphenation frequency and allowed word spacing range for a block of text. System defaults for hyphenation settings may result in words being hyphenated too frequently or very short words being hyphenated. Likewise, default settings may result in awkward wordspacing that is frequently too large, creating “rivers” – unsightly blotches of white in a text block caused by overly large word spacing when justifying text. The designer can fine tune H&J settings, not to micro-manage every line but to establish general spacing and hyphenation principles to apply to the text as a whole.

Adjusting H&J settings is especially important for justified type and narrow column measures, but is also useful on left-aligned type and more generous line lengths because often the default word spacing of a typeface is too large – it is common practice to reduce the default word space from 100% to approximately 92–96% for left-aligned text.

### Hyphenation Limits

Words with at least: 5 letters  
After first: 2 letters  
Before last: 2 letters  
Hyphen limit: 3 in a row

### Hyphenation Options

Capitalized words: Yes  
Across columns: Yes  
Last word: Yes

### Justification, Word Spacing Ranges

Minimum: 80%  
Desired: 100%  
Maximum: 133%

Excessive hyphenation (“hyphenation ladder”)

## Tuned H&J Settings

Hyphenation and justification (H&J) settings are used to control the hyphenation frequency and allowed word spacing range for a block of text. System defaults for hyphenation settings may result in words being hyphenated too frequently or very short words being hyphenated. Likewise, default settings may result in awkward wordspacing that is frequently too large, creating “rivers” – unsightly blotches of white in a text block caused by overly large word spacing when justifying text. The designer can fine tune H&J settings, not to micro-manage every line but to establish general spacing and hyphenation principles to apply to the text as a whole.

Adjusting H&J settings is especially important for justified type and narrow column measures, but is also useful on left-aligned type and more generous line lengths because often the default word spacing of a typeface is too large – it is common practice to reduce the default word space from 100% to approximately 92–96% for left-aligned text.

### Hyphenation Limits

Words with at least: 6 letters  
After first: 3 letters  
Before last: 3 letters  
Hyphen limit: 2 in a row

### Hyphenation Options

Capitalized words: No  
Across columns: No  
Last word: No

### Justification, Word Spacing Ranges

Minimum: 75%  
Desired: 90%  
Maximum: 112%



# Hanging Punctuation

Some typographic elements (such as a quote mark or hyphen) will disrupt the shape of the text block when located at the beginning or end of a line because they are much smaller than most characters and thus create an unsightly notch. Fine typography counteracts this effect by moving the punctuation mark outside of the text block so that it “hangs” – this is thought to be less disruptive to the text block shape because a small mark outside the text block is less noticeable than a large hole inside the text block. The most common example of hanging punctuation is left-margin hanging quotation marks, but it is of crucial importance to justified text where the text block shape should remain as even and clean as possible.

Without hanging punctuation, the quotation mark at the beginning of the line creates a visual notch in the left side of the text block.

Creating an optically even edge rather than a mechanically even edge also applies to the edges of the text block overall – the left edge of a text block when it set flush left, and both the left and right edges of a text block when it is set justified. Because letters are a variety of shapes, it is impossible to have a mechanically “perfect” edge. The sidebearings built into the font by the designer do the work of creating an even optical edge, however it is possible to alter sidebearings in desktop publishing programs.

## Without Hanging Punctuation

Some typographic elements (such as a quote mark or hyphen) will disrupt the shape of the text block when located at the beginning or end of a line because they are much smaller than most characters and thus create an unsightly notch. Fine typography counteracts this effect by moving the punctuation mark outside of the text block so that it “hangs” – this is thought to be less disruptive to the text block shape because a small mark outside the text block is less noticeable than a large hole inside the text block. The most common example of hanging punctuation is left-margin hanging quotation marks, but it is of crucial importance to justified text where the text block shape should remain as even and clean as possible.

Hyphens at the end of the line also create notches or holes in the text block due to their small relative size.

## With Hanging Punctuation

Some typographic elements (such as a quote mark or hyphen) will disrupt the shape of the text block when located at the beginning or end of a line because they are much smaller than most characters and thus create an unsightly notch. Fine typography counteracts this effect by moving the punctuation mark outside of the text block so that it “hangs” – this is thought to be less disruptive to the text block shape because a small mark outside the text block is less noticeable than a large hole inside the text block. The most common example of hanging punctuation is left-margin hanging quotation marks, but it is of crucial importance to justified text where the text block shape should remain as even and clean as possible.

Properly hung punctuation does not mean that letters should form an even edge and punctuation sits completely outside the text block. Instead, the designer should strive to create a visually even text block edge – this requires punctuation to be partially inside and partially outside the text block.

# Widows & Orphans

A “widow” occurs when the last line of a paragraph has only one or two words; widows are problems because they leave too much white space between paragraphs, creating the visual impression of a blank line. Widows also disrupt the rhythm of the reading process by being drastically out of proportion with the length of a typical line.

An “orphan” occurs when one or two lines of a paragraph appear alone at the top or bottom of a column or page. The problem with orphans is that, like widows, they disrupt the rhythm of reading.

To avoid both widows and orphans, some designers will manipulate the letter and word spacing of a paragraph or page, or add hyphenation. While widows and orphans are disagreeable, bad spacing and excessive hyphenation are worse options and manipulating the text in these ways should be avoided.

*A common mnemonic is*

*“An orphan has no past; a widow has no future”*

usually one or two words; it is a problem because it leaves too much white space between paragraphs, creating the visual impression of a blank line. Widows also disrupt the rhythm of the reading process by being drastically out of proportion with the length of a typical line.

An “orphan” is a up to two lines cut-off from the rest of their paragraph by being at either the bottom or top of a column or page. The problem with orphans is that, like widows, they disrupt the rhythm of reading.

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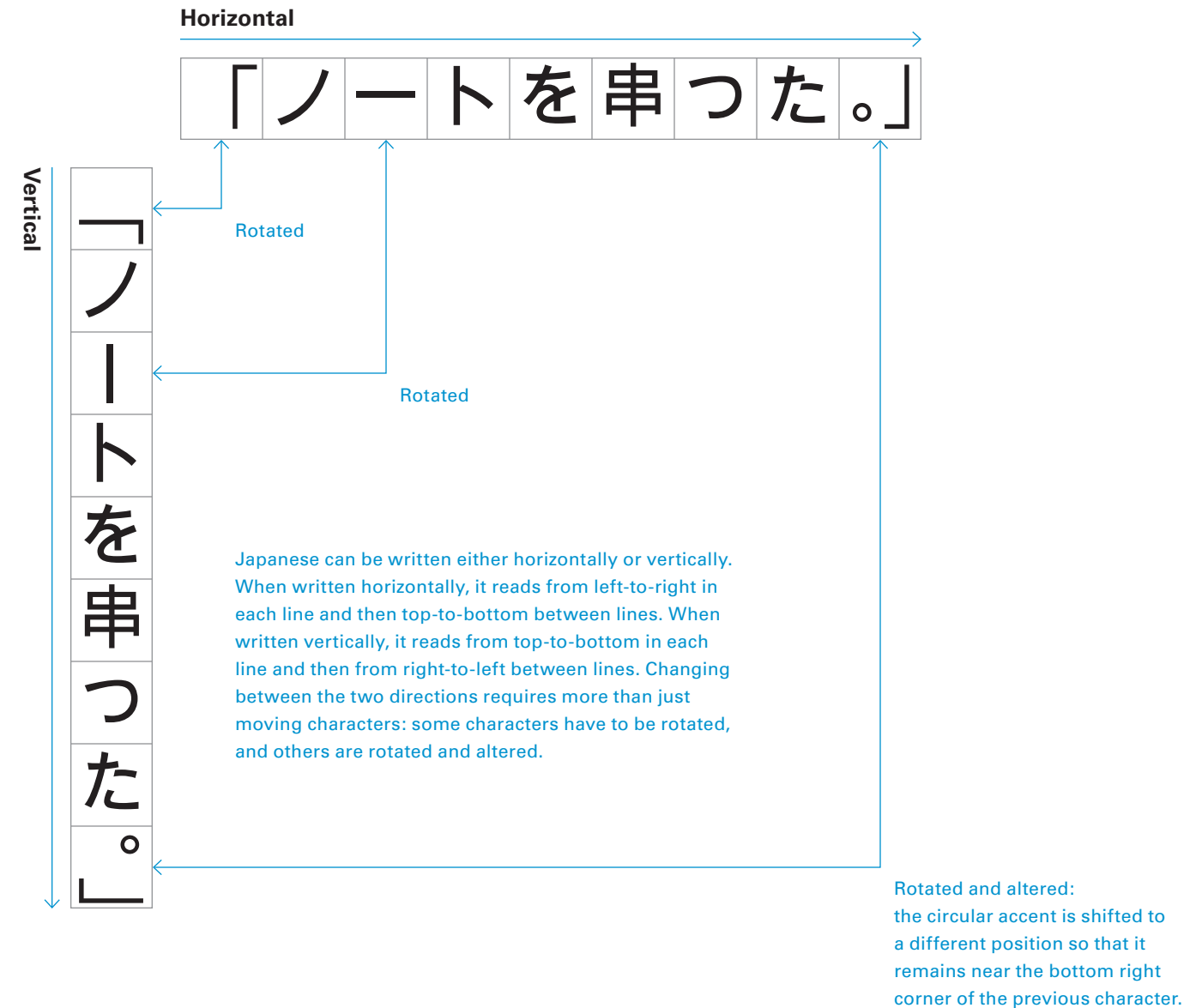
Widows

Orphans

## How Do Words Go Together?

# Line Direction

As many typographic line setting solutions are required as there are reading directions in written languages. Latin writing systems read left-to-right. Arabic, Hebrew, and many other Middle Eastern script systems read right-to-left. Some script systems, most notably Chinese and Japanese, can be written in multiple directions. These writing systems mainly consist of either disconnected syllable or word units each occupying a square block of space, which can be oriented either horizontally or vertically.



## How Do Words Go Together?

# Ruby

Ruby characters are small, annotative characters placed above or to the right of infrequently used Chinese characters to show pronunciation or because the character has more than one pronunciation. Ruby characters are also used in written Japanese in conjunction with borrowed Chinese characters of the kanji writing system. Ruby characters in Japan are known as “furigana”. They can be written using either hiragana, katakana, or romaji transliteration. They are most commonly used as a teaching aid for children but also appear in texts for adults when a little known or hard to pronounce Chinese character is used.

**Chinese: Zhuyin**  
Used in Taiwan

ㄅㄟ ㄐㄩㄥ  
北 京

**Chinese: Pinyin**  
Used in mainland China

běi jīng  
北 京

**Japanese: Hiragana**

とうきょう  
東 京

**Japanese: Katakana**

トウキョウ  
東 京

**Japanese: Romaji**

tō kyō  
東 京

All of the examples above serve the same purpose:  
to indicate pronunciation for a rare or ambiguous logographic character.

# Legibility vs Readability

Legibility and readability are related, yet describe separate ideas.

**Legibility refers to the letterform and how easily it can be recognized.**

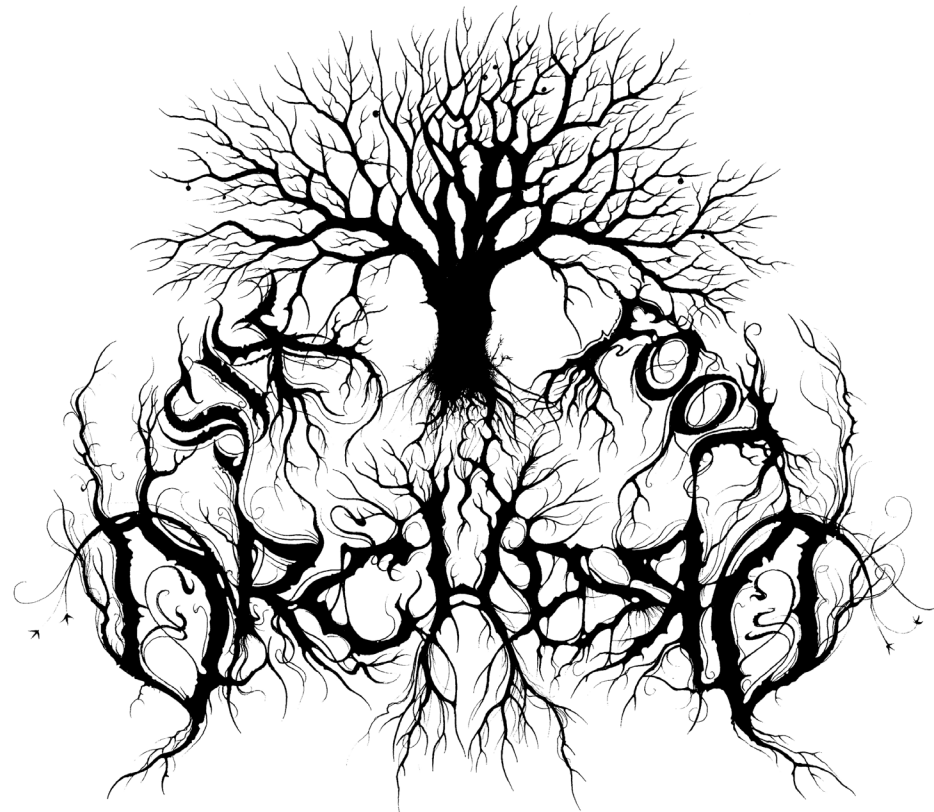
**Readability refers to both the typeface and its arrangement and how easily the results can be read.** It is possible to set a highly legible

typeface in an entirely unreadable way.

**Ideas about what is legible change over time.** For instance, broken script (see page 21) was very legible to fifteenth century German readers. Broken script can seem almost illegible to readers today.

**A wide range of factors affect readability.** Some are choices made by the typographer: size, use of space, color, arrangement, etc. Others are related to the medium of presentation: ambient light levels, paper color, printer resolution, screen resolution, and bit depth, etc. A typographic solution that is highly readable under certain circumstances can be completely unreadable under others. An e-ink screen is useless in the dark; a luminous tablet screen can be useless in bright daylight.

## Legibility



Heavy metal band logos are often designed to be on the edge of legibility. The logo shown above says "six foot orchard".

## Readability

l d e a s  
a b o u t w h a t  
i s l e g i -  
b l e c h a n g e  
o v e r t i m e ,  
f o r i n -  
s t a n c e  
w h a t w a s  
v e r y l e g -  
i b l e t o a -  
f i f t e e n t h -  
c e n t u -  
r y s c h o l a r  
i n G e r m a n y  
w o u l d s e e m  
v e r y d i f -  
f i c u l t t o  
d i s c e r n f o r  
m o s t r e a d -  
e r s t o d a y .

Simple typographic adjustments can make individual letters that are highly legible on their own nearly unreadable.

Sources:

Baines, Phil, *Type and Typography*, New York: Watson Guptill, 2005.



## How Do Words Go Together?

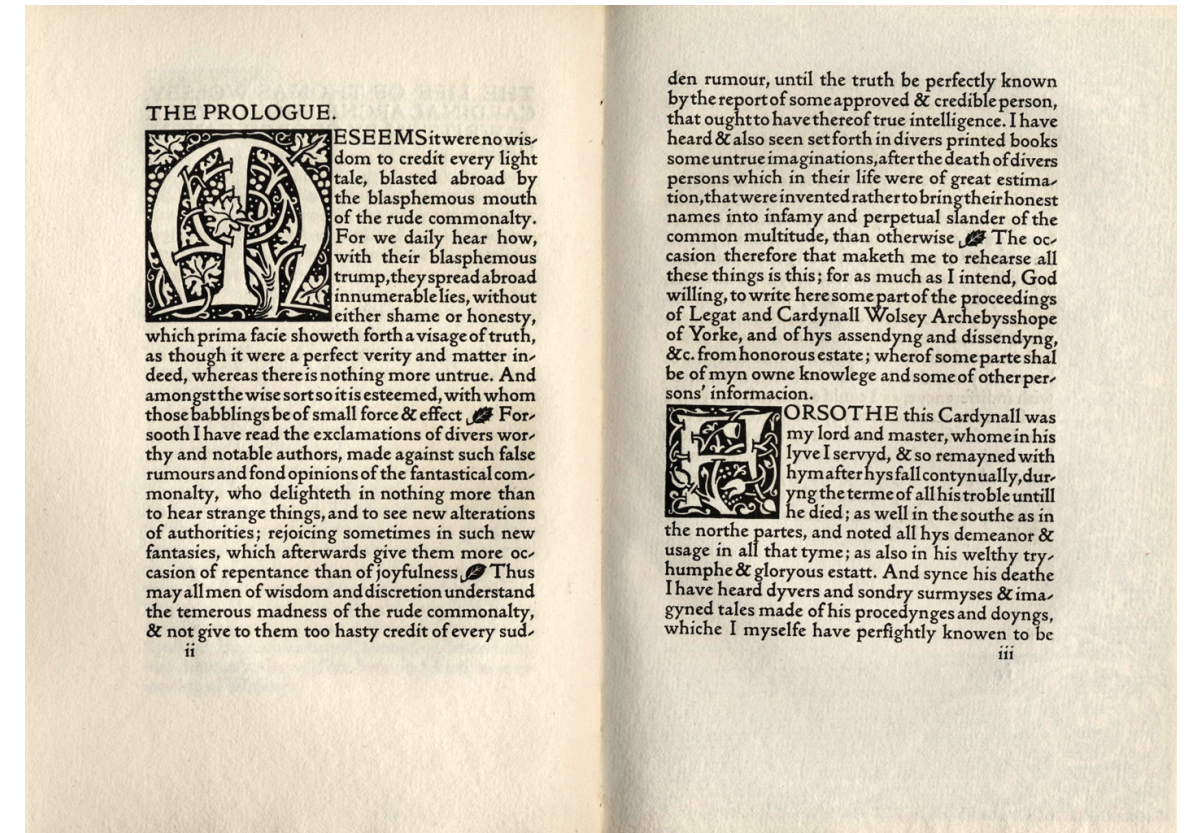
# Pop-out

The elements of typography previously described are tools a typographer can use to compose textual matter. There are many ideas and philosophies about how text should be treated, but at their core all of these ideas share one precept: **nothing should stand-out unintentionally.**

This principle can be used to describe Renaissance typographers who strove for a perfectly even and smooth page, as well as contemporary advertising designers who seek the maximum amount of impact and attention grabbing visual fireworks. Each seeks to control the hierarchy of the textual material to a very fine degree so that the reader encounters the material in the intended order – it's the intent itself that differentiates each type of page design. In other words, typography is about controlling what the reader sees and in what order.

**Bad typography, therefore, isn't bad because the reader dislikes the font but because it doesn't allow the reader to move through content in the intended way.** Fully justified, non-hyphenated text (as currently found on the Kindle) is bad typography therefore because it results in poor wordspacing and rivers that distract the eye and hinder the intended smooth reading experience.

A book spread printed by William Morris' Kelmscott Press c.1890. The visual ideal sought is that of "the black page", with a dark and even texture to the text. Large woodblock initials mark the beginning of sections. The largest initial calls out the first paragraph with the section heading ("The Prologue") situated above it, clearly calling to the reader to begin here.



A Nike advertisement designed by Neville Brody. Despite the typographic wildness, the reading sequence is clearly defined and the copy is easy to read.



# How Do Pages Go Together?

Overall page composition is the part of typography that is most often noticed and examined, because it is where initial impressions about the material are made. Some designers start with the macro-level composition while other begin with micro-level detail; both are necessary to create beautiful and functional typography.

# Paragraph Articulation

A paragraph typically consists of a single thought, and as such one paragraph needs to be distinguished from another. There are many strategies for indicating where a paragraph starts and stops, each varying in strength and appropriateness to the context. It is important to keep in mind the nature of the text in selecting the most appropriate paragraph articulation strategy.

The simplest method for articulating a paragraph is with a full line space. This convention derives from typing. Some designers argue in favor of its simplicity, but it can cause the text to feel like a series of fragments rather than a continuous whole.

Full line space

It is also possible to use a half line space. This method (seen between this paragraph and the next) is simple in appearance and adds some subtlety in spacing, resulting in a more refined feel. However sometimes it can be difficult to distinguish paragraphs from one another.

Half line space

The simplest method for articulating a paragraph is with a full line space. This convention derives from typing. Some designers argue in favor of its simplicity, but it can cause the text to feel like a series of fragments rather than a continuous whole.

Paragraphs starting “full out” (that is, without an indent and with no extra line space between them) may be indistinguishable from the previous paragraph if the latter ends with a full, or almost full, line (just like this one here).

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These paragraph breaks are almost undetectable

One em indent

Using an indent plus a full line space is redundant articulation, like a belt and suspenders.

Full-out lead paragraph

When setting paragraphs with indents, it is common practice to set the first paragraph in a section (e.g. the beginning of a chapter, after a sub-title) without an indent because the space before it renders the indent redundant. The neatest way to indicate the beginning of a paragraph is with an indent. Indents derive from the omission of the character ¶ that was originally used inline. Older typography books always suggested an indent of one em (i.e. equal to the type size) but a value equal to the leading (line spacing) is often clearer.

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Hanging line indents are effective but not very space efficient. The overall shorter line length means that paragraphs set this way are longer for any given column width than any other paragraph articulation option.

In addition to indents and full line spaces, a hanging line indent may also be used to indicate the beginning of a paragraph. A hanging line indent is also sometimes called an outdent or exdent. These work in much the same way as an indent, but allow for fewer words to be typeset in the same physical space and are thus less economical.

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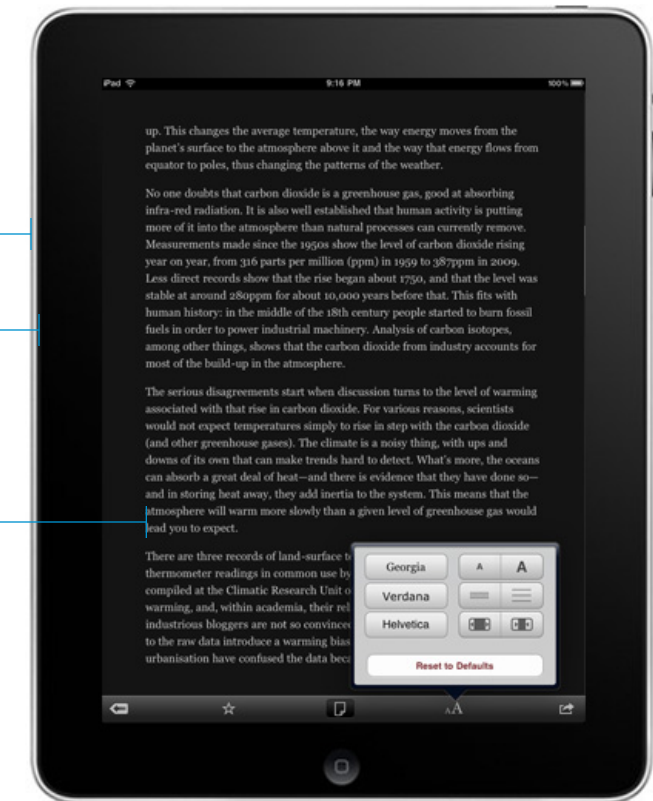
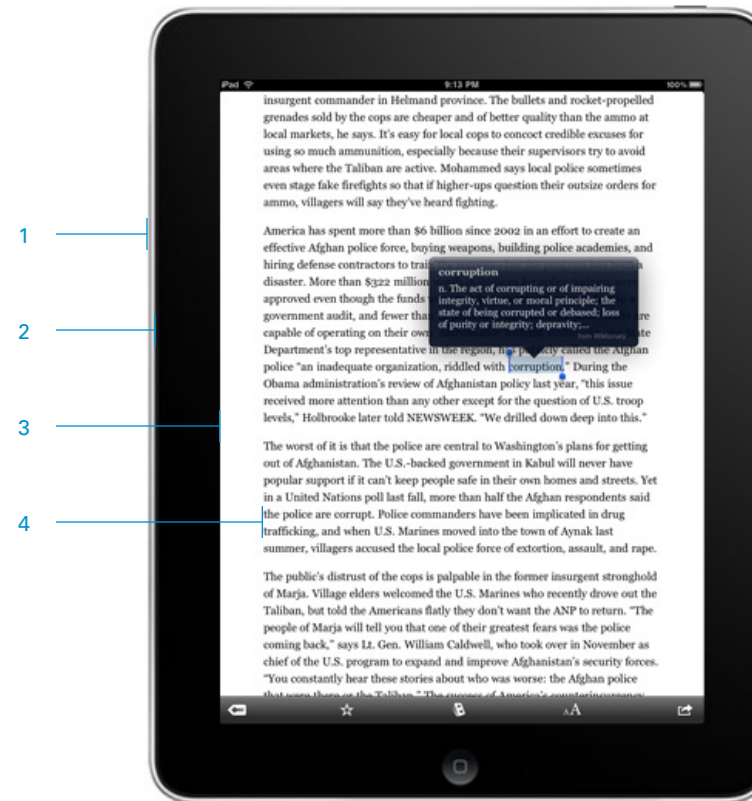


## How Do Pages Go Together?

# Border-Border-Border

In most books, the margin serves to separate the text from the edge of the page. In this sense, there are two devices between written content and everything else in the reader's field of view: the margin and the edge of the page. In contemporary displays, there are often three, four, five, or more devices between the text and the outside world. **Two devices is a useful level of redundancy. However more than two devices can add a level of visual noise to the reading experience that is not favorable.**

### A Simple Reading Layout on the iPad



Some manufacturers have attempted to deal with this problem by building devices with recessed screens that disguise the edges.

The text on this screen is distinguished from the outside world by the metal bezel, the black edge of the physical border of the display, the edge of the screen, and lastly the margin for a total of four devices.

Switching white text on a black background creates a smoother visual experience because it almost eliminates one of the edges.

Unfortunately, white text on a black background is generally considered more difficult to read and tiring for the eyes.



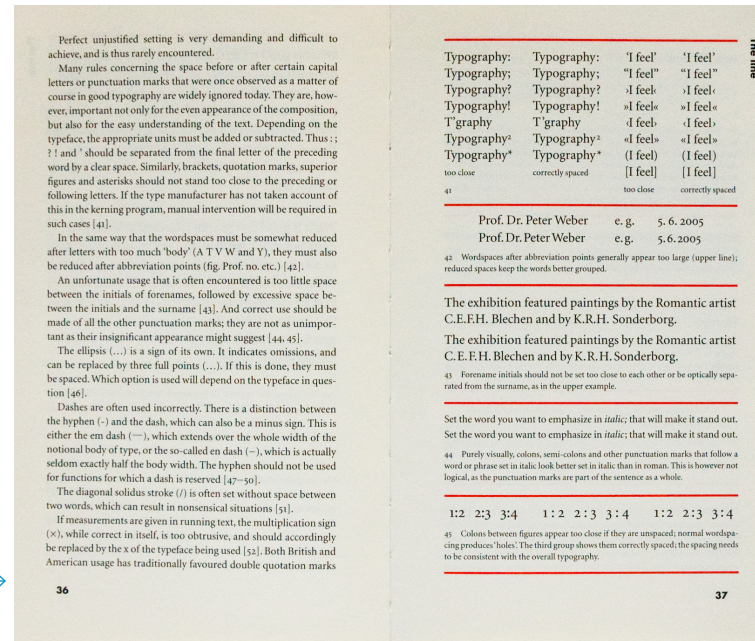
## How Do Pages Go Together?

# Headers & Footers

Headers and footers are sign-posts – **they mark the way for the reader and aid in navigation**. To be useful, the reader should not have to hunt for them. On the other hand, they should not be so prominent as to be constantly in the reader's field of vision. A designer laying out a page must first determine what is needed to make navigation easy and then decide how to arrange those elements.

Generally if a text is longer than two pages, page numbers (a.k.a. "folios") are a good idea. Page numbers provide a way for a reader to easily navigate back to a particular place in a text. Running heads that display the title of the chapter or section are very common and useful in periodicals or other formats that have many sections and sub-sections. They can become a nuisance in formats like a novel because the information is typically simple enough to recall easily – it would be rare for a reader to forget what book they were reading.

Headers and footers are also very useful for reference purposes. When citing an book or article, it is typically important to cite the page(s) that the reference refers to. Headers that state the name of the article, book, or periodical became very important after the invention of the photocopier, when a text could easily be divorced from its original context. A photocopy of a page without a header has no intrinsic documentation of its origin.



The running head and page numbers of this book are prominent, but designed so as to not be too obtrusive.

Page numbers

Running heads



Sometimes designers can go too far with their desire to create inventive arrangements. This book features page numbers one-third of the way up the page and in the books gutter, making them both hard to find and easily confused with citation numbers for the illustrations.

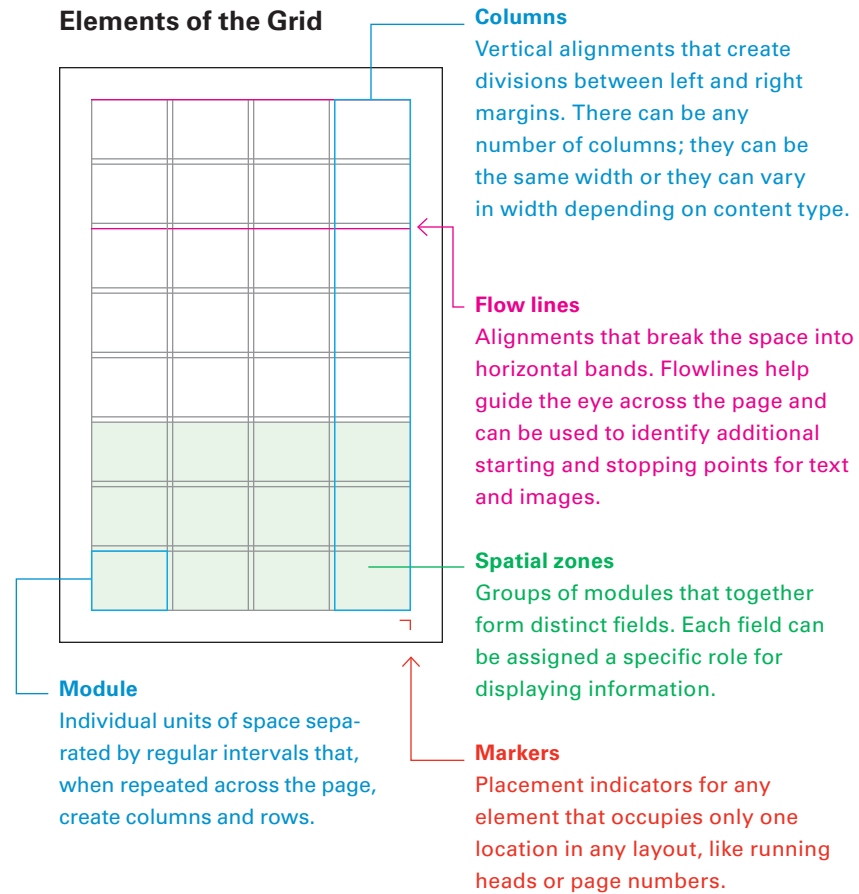
Page numbers

## How Do Pages Go Together?

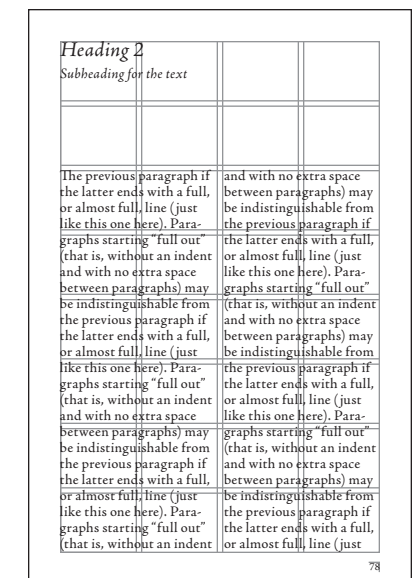
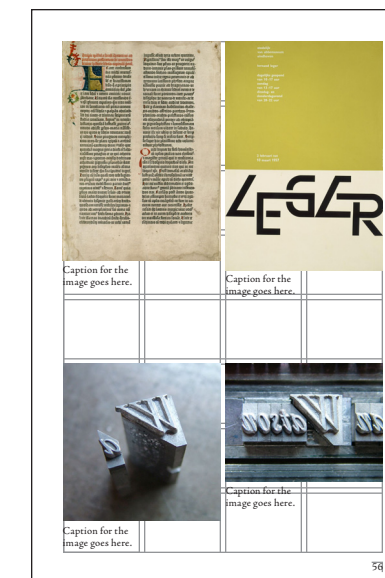
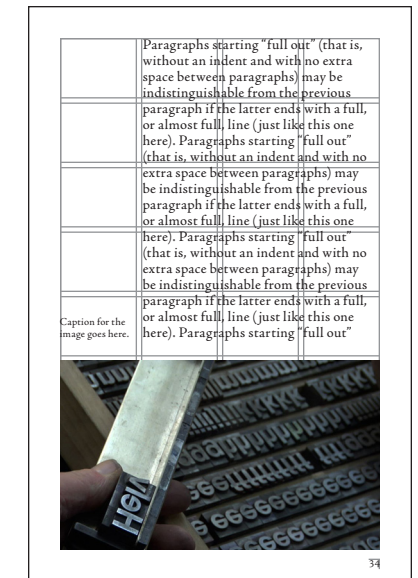
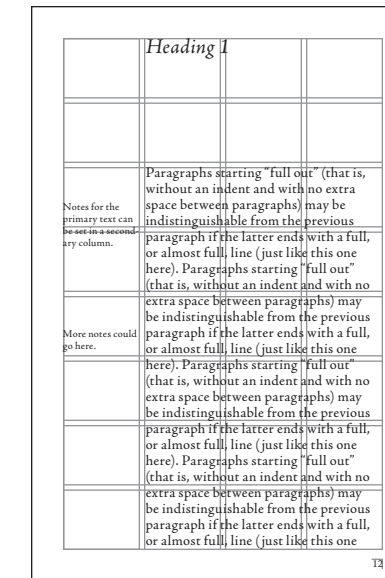
# Grids

A grid is a tool for organizing the internal divisions of a page. Grids provide a framework relating the text block(s), headers, footers, margins, images, etc. to one another. When all the pages in a document use the same grid, they relate to one another visually even if, at first glance, they are very different from each other. Underlying the use of grids is the belief that visual coherence helps the reader to focus on content rather than form.

While the term “grid” implies rigidity, grids can be used in a flexible way that does not prescribe that all pages be identical. A grid is most useful when it allows the designer to create a set of visual relationships, not by dictating that nothing ever changes page to page.



## Page Variations Using the Same Grid



How Do Pages Go Together?

# Relating Elements

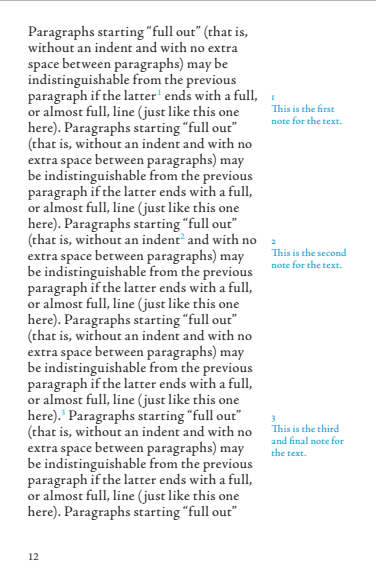
Typography is about text and the ways in which a designer both differentiates and relates text elements, such as copy, captions, notes, and sidebars as well as graphics and images, to and from one another. Repetition of visual relationships is an important part of helping the reader understand how parts relate to one another – an image / text arrangement seen once can be arbitrary, but seen five times it is a system that tells the reader what the parts are and how they relate without requiring extra work to decode them.

**Example: Notes**

There are conventions for many kinds of typographic relationships. Primary text and notes is one example. Each strategy presents a different relationship between the elements – choosing the most appropriate strategy is important because it helps the reader understand how to mentally relate the two parts. The way parts are related may also help or hinder the reading process by making parts easier or harder to find or quickly grasp what kind of material they are.

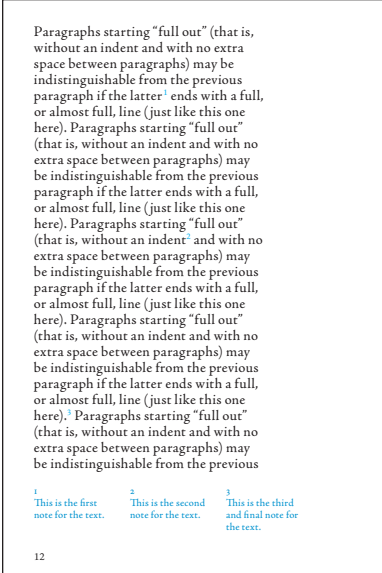
**Sidenotes**

Notes next to the primary text; they are extremely easy to find but might be distracting.



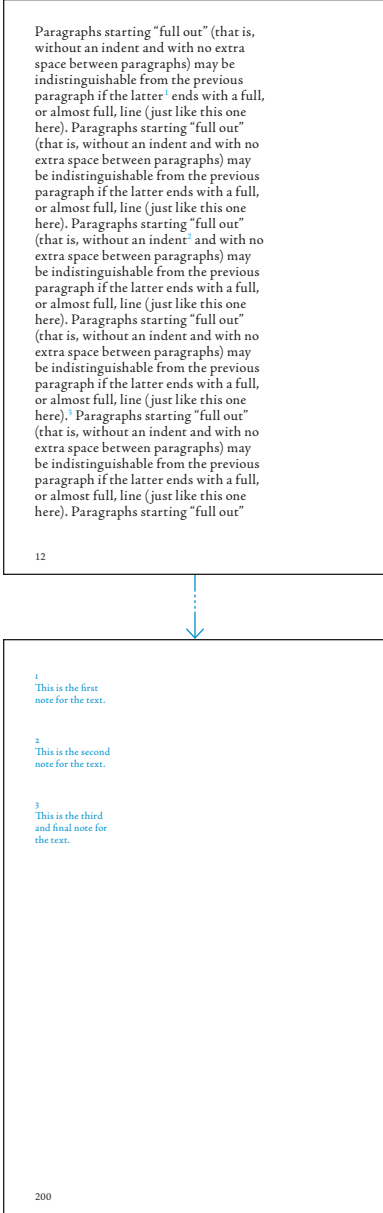
**Footnotes**

Notes are grouped by page, below the primary text; they are out view but still close enough for easy reference.



**Endnotes**

Notes at the end of the text. Notes are all in one place, but completely separate from primary text.





## How Do Pages Go Together?

# (Re)Flowing

Text printed on a page is fixed and unmoving. You can turn the page or tear out a page, but you can't rearrange the layout of a page. Text on screen can be fixed or flexible. If flexible, you can resize the display window or the text size – or both – and the digital page layout has to respond.

The flexible nature of digital text causes problems when there are elements positioned near and directly related to specific places in the text. **When text size is increased or browser window size is decreased, how does the text react?**

Coordinating the integration of text and images is one of the most common tasks for typographer. A carefully composed digital page can logically reformat in response to changing user preferences.



Fig. 1

Text printed on a page is fixed and unmoving. You can turn the page or tear out a page, but you can't rearrange the layout of a page. Text on screen can be fixed or flexible. If flexible, you can resize the display window or the text size – or both – and the digital page layout has to respond. The flexible nature of digital text causes problems when there are elements positioned near and directly related to specific places in the text. When text size is increased or browser window size is decreased, how does the text react? Coordinating the integration of text and images is one of the most common tasks for typographer. A carefully composed digital page can logically reformat in response to changing user



Fig. 1

Text printed on a page is fixed and unmoving. You can turn the page or tear out a page, but you can't rearrange the layout of a page. Text on screen can be fixed or flexible. If flexible, you can resize the display

If type size is increased, the type column becomes proportionally narrower – in the example above, extremely so. With so few words per line, the text can be uncomfortable to read.



Fig. 1

Text printed on a page is fixed and unmoving. You can turn the page or tear out a page, but you can't rearrange

A better solution when type size increases would be to move the text below (or above) the image, allowing for a wider text column better proportioned to the larger type size.

# Substrates

Typography is about more than the arrangement of letters on a flat plain: it also must address the plain itself. Today, type can be carried by paper, metal, plastic, screens, and more. The nature of the substrate on which (or in which) the type resides can drastically affect the appearance of the type.

## Uncoated Paper, Uncalendered

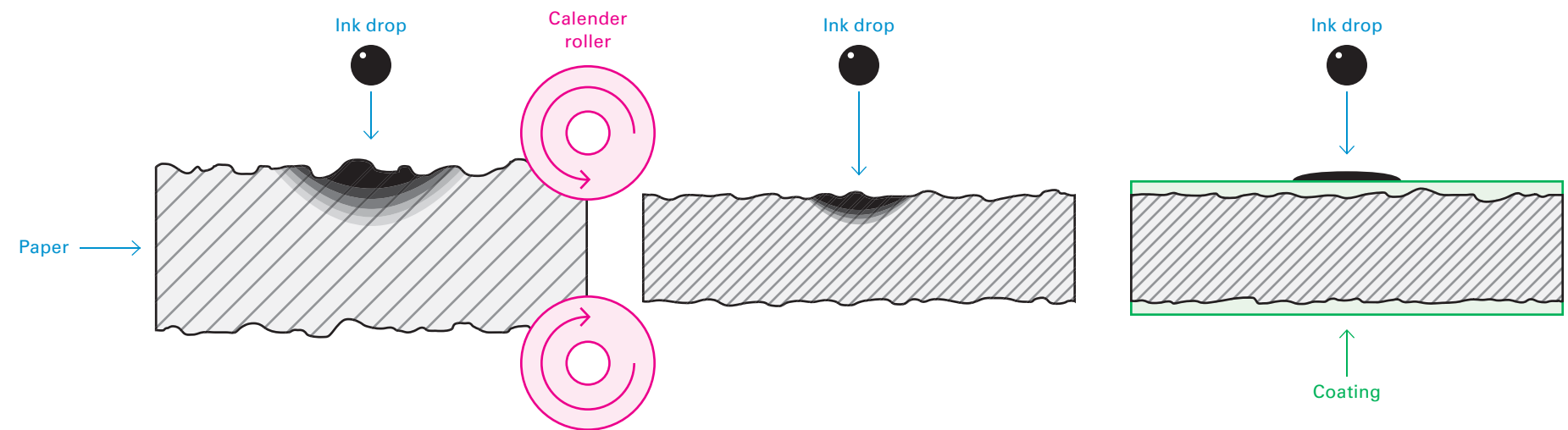
Paper made by hand is frequently thick and “loose” in its weave and has a soft and almost fluffy feeling. While it is nice to touch, because of its loose internal structure, ink printed onto it will spread a large amount resulting in blobby letterforms.

## Uncoated Paper, Calendered

Calendering is a process of running raw paper between metal rollers to smooth out the surface (it also has the effect of making the paper thinner). Calendered paper has a harder feel than uncalendered and its printing surface shows less ink spread because it is denser internally.

## Coated Paper, Calendered

Coated paper is internally identical to calendered paper, although it is often calendered to a greater degree. After calendering, one or more coatings of clay are applied to the surface to create a smoother and more solid surface. Coated paper comes in a number of finishes from matte to glossy.



Examples of how letterforms change depending on the printing substrate.

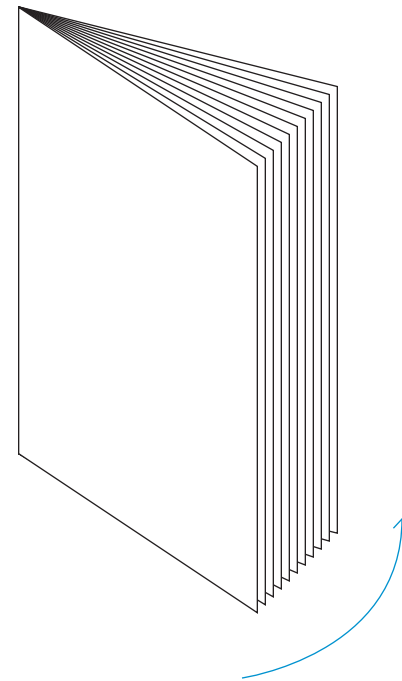


How Do Pages Go Together?

# Pagination Direction

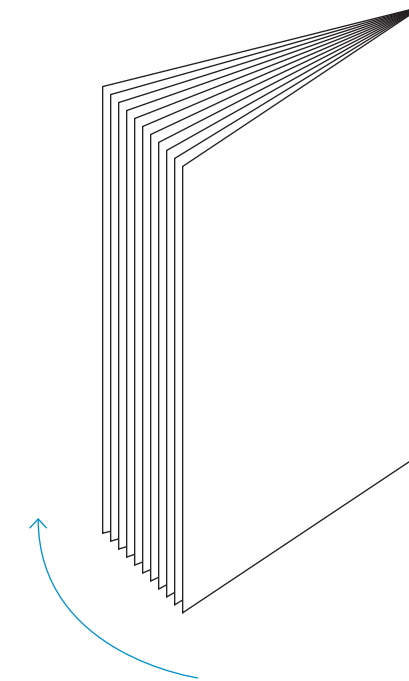
Pages composed into a book can move either left-to-right or right-to-left. Typically the pagination direction is determined by the direction of the script. Some scripts, such as Japanese when written horizontally, paginate in the opposite direction as the text flow (left-to-right text flow and right-to-left pagination).

Left-to-Right



Typical English

Right-to-Left



Typical Japanese



# What Is a Book?

Like all cultural artifacts, books have evolved – first from scrolls to codex, then from large manuscript to printed pocket book. Electronic books mark a new phase in that evolution.

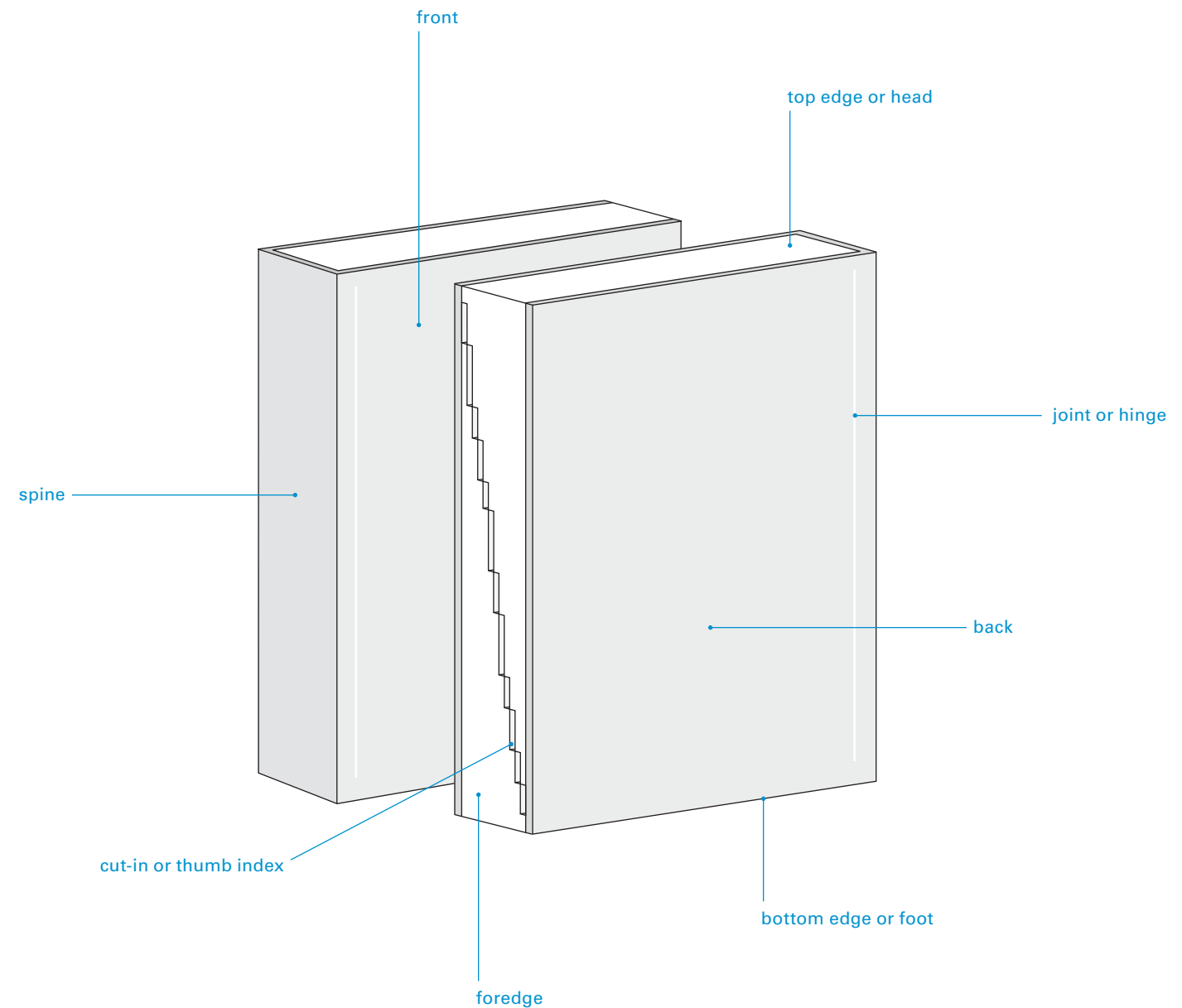
## What Is a Book?

# Book Anatomy

The physical structure of books has, like letterforms, evolved over time.

The modern “codex” form – a stack of pages bound on one edge – emerged in the first-century from Roman-style wax tablets and had almost completely replaced scrolls as the primary means of recording and transporting texts by the sixth-century. The codex has the practical advantages of being compact, highly portable, and easier to manipulate than a scroll. Early codex-form books were large and heavy, designed for longevity. The “pocket book”, which emerged in the sixteenth century, had the advantages of being both cheaper and easier to carry and read – early codex-form books required a lectern for comfortable reading.

The codex book form has several affordances for interaction that are useful to the reader: the structure can only be opened in one direction, the location of a reader in the text is marked by the number of pages before and after the spread they are opened to, and the thickness of the book suggests the scope of the text inside.



## What Is a Book?

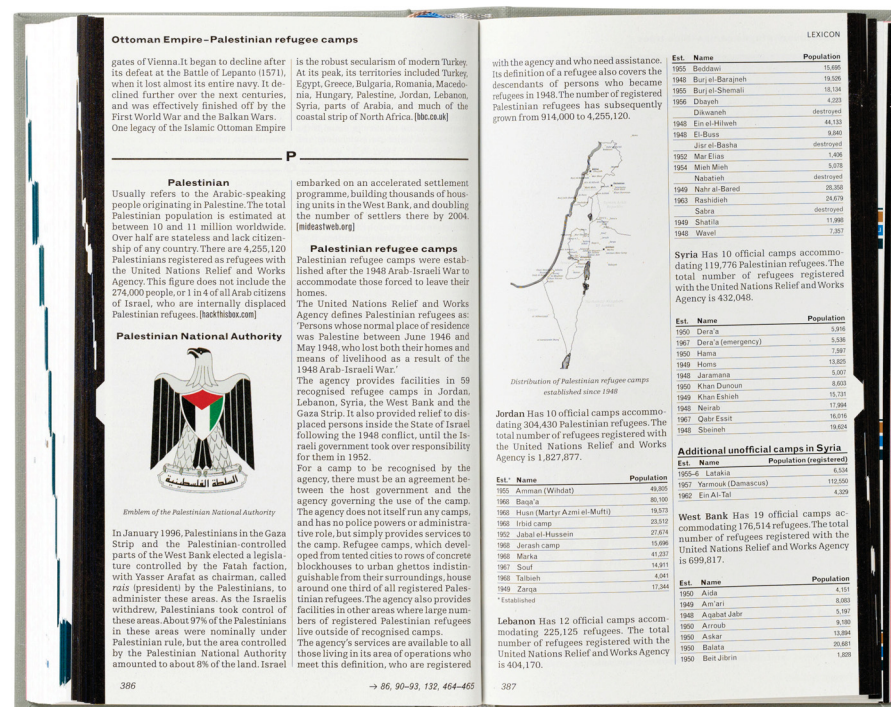
# Types of Books: Database

Databases are poorly suited to printing and better suited to electronic media. For example, printing freezes the content, but the content might change and require updating. Database books typically make use of a template for organizing and standardizing their form and content – this makes database books easy to adapt to electronic publishing by reformatting the template for screen usage.

Common types of database books:

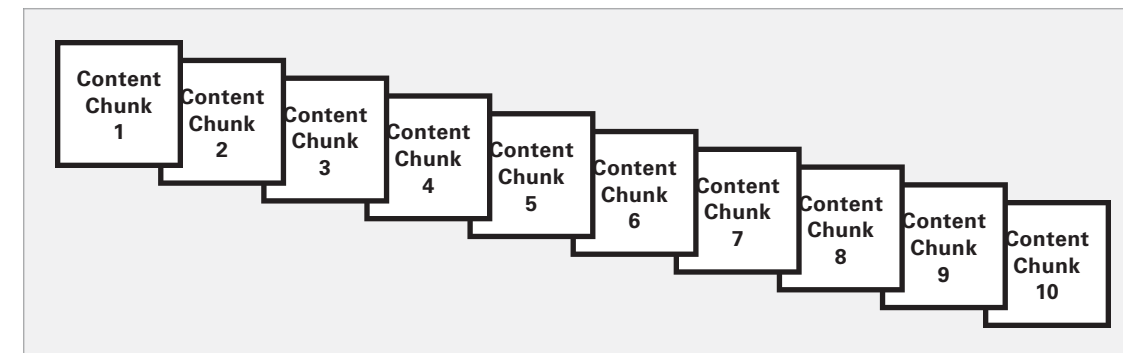
- Atlas
- Bird watching guide
- Cook book
- Dictionary
- Encyclopedia
- Phone book

A database type book example.



## Typical Database Book Structure

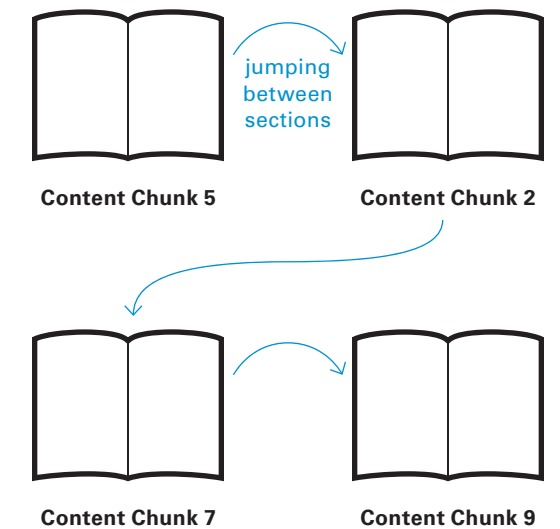
Printed Form



Content in a database type book is sequential because the codex form of a printed book dictates it to be so. However content is intended to be accessed "randomly", i.e. the reader can jump in and out of the book, accessing content as needed.

Database books are also problematic because the size of the content chunk often does not match up with the size of the page, e.g. a recipe may be longer or shorter than a page. This presents problems for content organization and navigation.

As Read



Material is referenced as needed, with the book designed so the reader can jump around easily.

## What Is a Book?

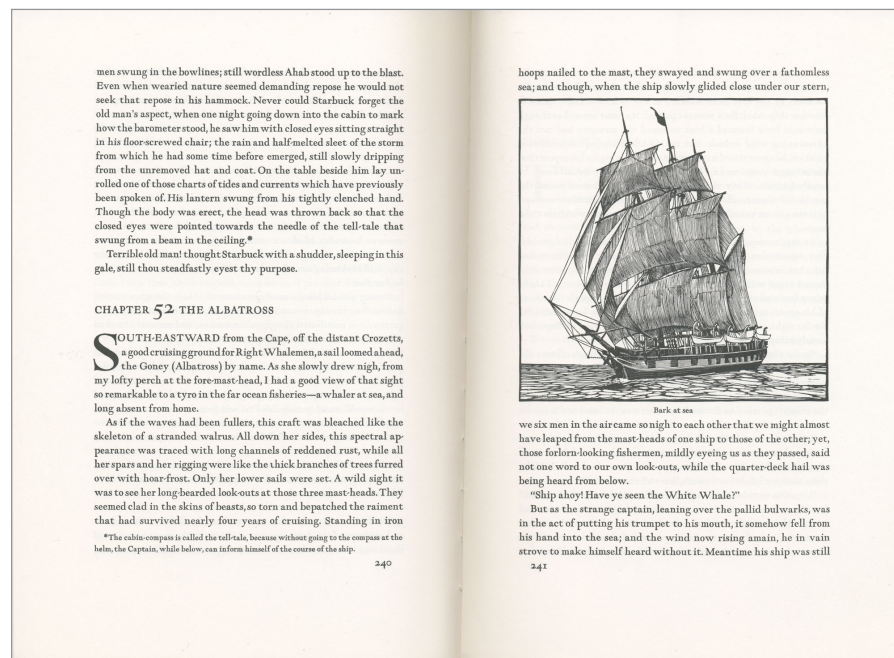
# Types of Books: Linear

Linear books make good use of the codex form – their content primarily unfolds in a linear sequence. However, linear texts often have ancillary matter which readers access while reading the main text. The user flips back and forth between the main text and maps, notes, glossary, etc. These ancillary components strain the traditional codex form.

Common types of linear books:

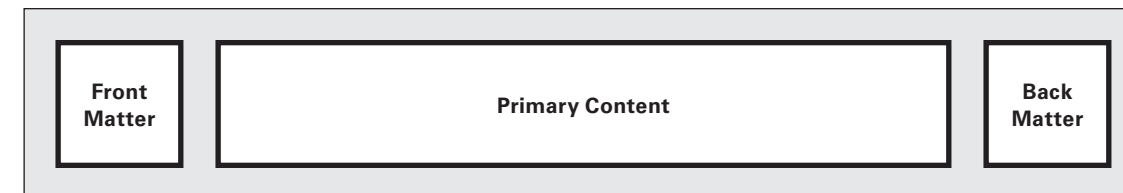
- Comics
- Essays
- Novels
- Reportage

A linear type book example.



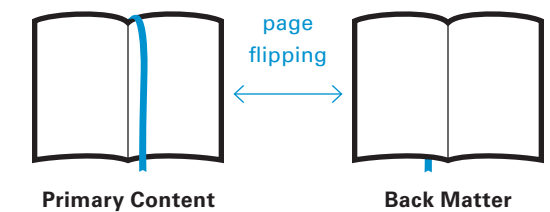
## Typical Linear Book Structure

Printed Form



Front and back matter are conceived as being distinct units relative to the primary content, and are physically separated. This structure can be troublesome when front or back matter needs to be referenced while reading the primary content – there is not a good way to look at two book spreads at the same time.

As Read



Referencing material that isn't part of the primary content – e.g. end notes, glossary, appendices – requires the reader to page back and forth, only seeing one spread at a time.

## Common Ancillary Book Components

Some items are meant to read before or after the main text.

Others (in blue) are meant to supplement the main text during reading.

### Front Matter

- Cover
- Summary
- Testimonials
- Copyright + publication info
- Half title
- Title
- Dedication
- Acknowledgements
- Introduction
- Preface
- Foreword
- Prologue
- **Dramatis personae**

### Back Matter (or End Matter)

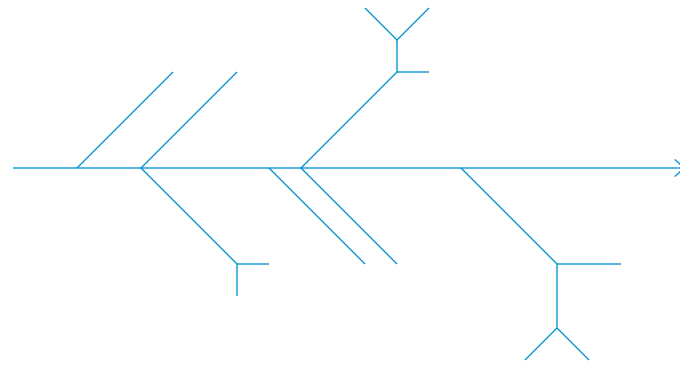
- **Notes (side, foot, end)**
- **Maps**
- **Timelines**
- Epilogue
- Afterword
- Postface
- **Glossary**
- **Appendices**
- **Agenda**
- **Bibliography**
- **Index**
- Colophon
- (production notes + credits)



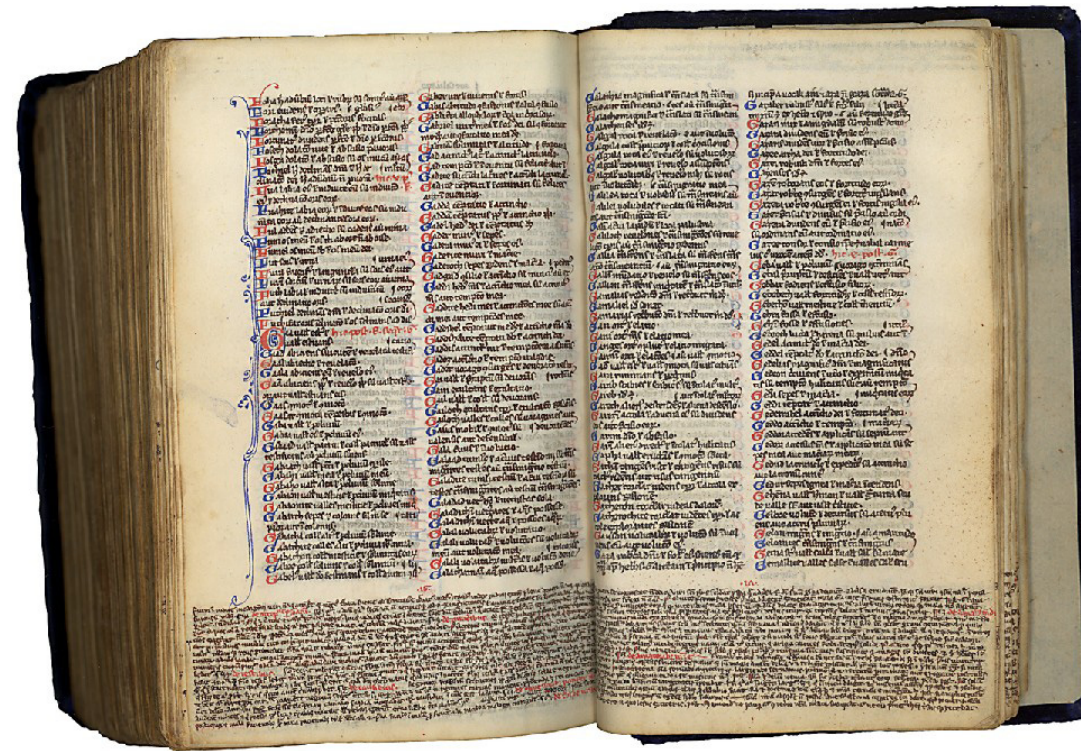
## What Is a Book?

# Glosses

Originally made in the margin or between lines of a text in a Classical language to **explain a word or passage**, glosses may vary in length and complexity from **page cross-references** to simple marginal notes explaining the meaning of a word to **interlinear translations of a text**. A collection of glosses is a glossary.



Glosses can be understood as a branching-off from a primary text, providing further information, clarification, expansion, and re-direction of a topic.



A medieval bible with extensive glosses containing Hebrew names, the St. Hieronymus Prologues, and a calendar of Dominican use.



A Spanish language textbook for German speakers with interlinear pronunciation and translation glosses.



## What Is a Book?

# Collections

Collections of books must be stored, and storage conventions have evolved over time. The bookshelf on which books stand with their “top edge” facing up and with an outward facing spine is an invention that dates from the Renaissance. Prior to this invention, books were often stored with the cover facing up and stacked one on top of another. Other methods of storing and displaying books include the revolving bookstand and the bookwheel, which was designed to allow one person to read and compare a variety of books in one location with ease.

The problem of how to store a lot of books didn’t occur until there were a lot of books, which didn’t occur until the invention of printing.

Prior to the seventeenth-century, libraries were private, typically the personal libraries of people of means or institutional libraries (such as the Vatican library), which were primarily archival. In the seventeenth-century “lending libraries” – libraries that allow members to borrow books – began to appear; however they did not become common until the nineteenth-century.



The contemporary bookshelf was invented in the early Renaissance.



The bookwheel was designed to allow a user to read and compare multiple books, without having to repeatedly open and close the books.