A Medium Independent Model of Typography

A holistic approach to teaching typography.

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ABSTRACT

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The exponential growth of digital media has resulted in the convergence of different technologies and disciplines leading to more forms of media and the expansion or hybridization of media forms. Convergence continues to create new pathways and opportunities changing the way we define and practice typography. Today, typography is multidisciplinary; it is no longer just a practice of graphic design, but a field in itself. Typography is currently taught as a set of print based rules and remains closely associated with the history, development, and processes of print. Typographic methodologies—principles, practices, procedures, and rules—do not address the aspects, limitations, or possibilities of emergent media. In consequence, it is further distancing designers from transitioning to emergent mediums. Print and digital standards differ, but the methodologies are rooted in the same foundation; excluding or emphasizing one or the other is not helpful to the evolution of typographic practice. This research argues that a medium independent model for typographic instruction is critical to the evolution of typographic practice.

Keywords:

Typography, Education, Digital, New Media, Convergence

"The artist is the person who invents the means to bridge between biological inheritance and the environments created by technological innovation."

—McLuhan, Laws of Media, p. 99.

Introduction

The complex craft of typography is difficult to define. *Merriam-Webster* defines typography as either "the work of producing printed pages from written material [or] the style, arrangement, or appearance of printed letters on a page" ("Typography," def. 1a). Such definitions are far too narrow to describe the modern practice of typography. At the surface, typography is an element of design—"the visual component of the written word" (Butterick). Beginning with a blank medium, designers use type along with image, space, and color to shape a message. However, as with anything as widely used as typography, it fits into many categories and spans countless disciplines, practices and methodologies. Typography is concerned with legibility, readability, accessibility, leading, point size and the myriad of rules that govern *good typography* or the written word. Perhaps, typography is best defined as an act of expression; an act described by Ellen Lupton as a "continual tension between the hand and the machine, the organic and the geometric, the human body and the abstract system" (Lupton, Thinking, 13). Typography is the relationship between technology, the human eye, and the written word. It is not constrained or confined by technology, rather a mirror of it; a discipline with its own set of theories, principles and practices intertwined with the theories of the many disciplines it overlaps.

Typography evolved alongside advancements in publishing technology. The exponential growth of digital media has resulted in the convergence of both technologies and disciplines, leading to more forms of media and the expansion or merging of media forms. This growth places the practice of typography in a constant state of flux; adapting and expanding to meet the needs of society and/or exploit new technologies. This makes it difficult to holistically define and teach type and even more difficult to prepare students for the future.

Typefaces today exist in bits and bytes on a computer system, set through desktop publishing software, and outputted to a medium; the process and typefaces are digital. In this paper, *digital typography* refers to type set for on-screen reading or electronic display and *analog typography* refers to printed or physical type. Although today, typography is outputted to both analog and digital media as static or dynamic text, it remains closely associated with the history, development, and processes of print. Typographic methodologies do not adequately address the aspects, limitations, or possibilities of digital media. Evidence suggests this disconnect causes a deficiency when crossing or transitioning from one form of media to another (Yee, “Convergence” 1). Additionally, typography today is multidisciplinary; it is no longer just a practice of graphic design, but a field in itself; intertwined with many creative disciplines such as game design, interactive design, animation, and film. In return, more and more students from other majors are electing to take introductory courses in typography. However, working across media forms and their associated disciplines requires new skills and knowledge.

With typography so closely tied to print, digital variants of typography continue down a divergent path. Looking back on typography's rich history, it is clear that practice responds to emergent technologies. Setting type for digital media is therefore a mere extension of what we have been doing for over 560 years. The screen, however, remains a difficult transition for typographers and typeface designers. Synthesis of these divergent forms of typography is difficult when they are in tension. Today, advancements in display technology are blurring the lines between media forms. Rich text and media are now available and consumed on every screen everywhere and the need for on-screen typographic skills has increased dramatically. The screen, however, is not the first or last medium typography will need to adapt to. It is becoming seemingly critical to bridge this divergent path. Typography as a practice encompasses all

mediums and transitioning between the two has become a defining aspect of typographic practice. A medium-independent model for typographic instruction is critical to the evolution of typographic practice. Separating core and medium-specific knowledge while appropriating knowledge from different disciplines creates a holistic view that prepares typographers to cross all forms of media.

Chapter 1: The History of Typography Informs the Future of Typography

We learn the canon of typography through its historical context. Any significant shift in typography runs parallel to new reading environments, technologies or social change (Banham); printing and papermaking, for example, developed simultaneously. As humans and technology advance, new ways of communication emerge, and the message and means of production change. Each innovation inspires and demands typographers to meet new challenges that are often approached through remediation; the new way is the old way updated. Understanding the history of type is essential to understand typography contextually. To use typography correctly, you must first understand the origin, purpose, and why the canon of typography being taught was developed in the first place. This understanding allows designers to expand upon what they already know, avoid making the same mistakes previous designers made, and transition typography into new technologies. As Richard Hollis wrote: "Eyes and brains have worked the same way over generations…the environment changes but the principles of visual communication survive. History helps us understand these principles." (Heller 91). Understanding the context of typographic principles allows designers to see similar contexts today and rather than reinvent the wheel, extend and adapt the accumulation of collective knowledge called typography.

Looking Back

McLuhan wrote that, "We drive into the future using only our rear view mirror." In other words, we understand new media through the process of 'remediation'; as McLuhan predicted, in an effort to define itself, a new media imitates the old one (Bolter, Remediation) (McLuhan, Understanding). In ancient times typography was the art of lettering performed by artisans and scribes. This all changed with Johannes Gutenberg's revolutionary invention of movable type in

the 15th century. The process used a punch made of steel with a mirrored image of a letter struck into metal and placed into a matrix to form a page that was inked and pressed into paper (Phinney). Just like the web page road in on the metaphor of the printed page, the older medium of the scribes was reflected in the first Blackletter or Gothic type prints. For example, Gutenberg's Bible reproduced the Blackletter handwriting of the time by using letter variations and ligatures (Bringhurst) (see fig. 1).

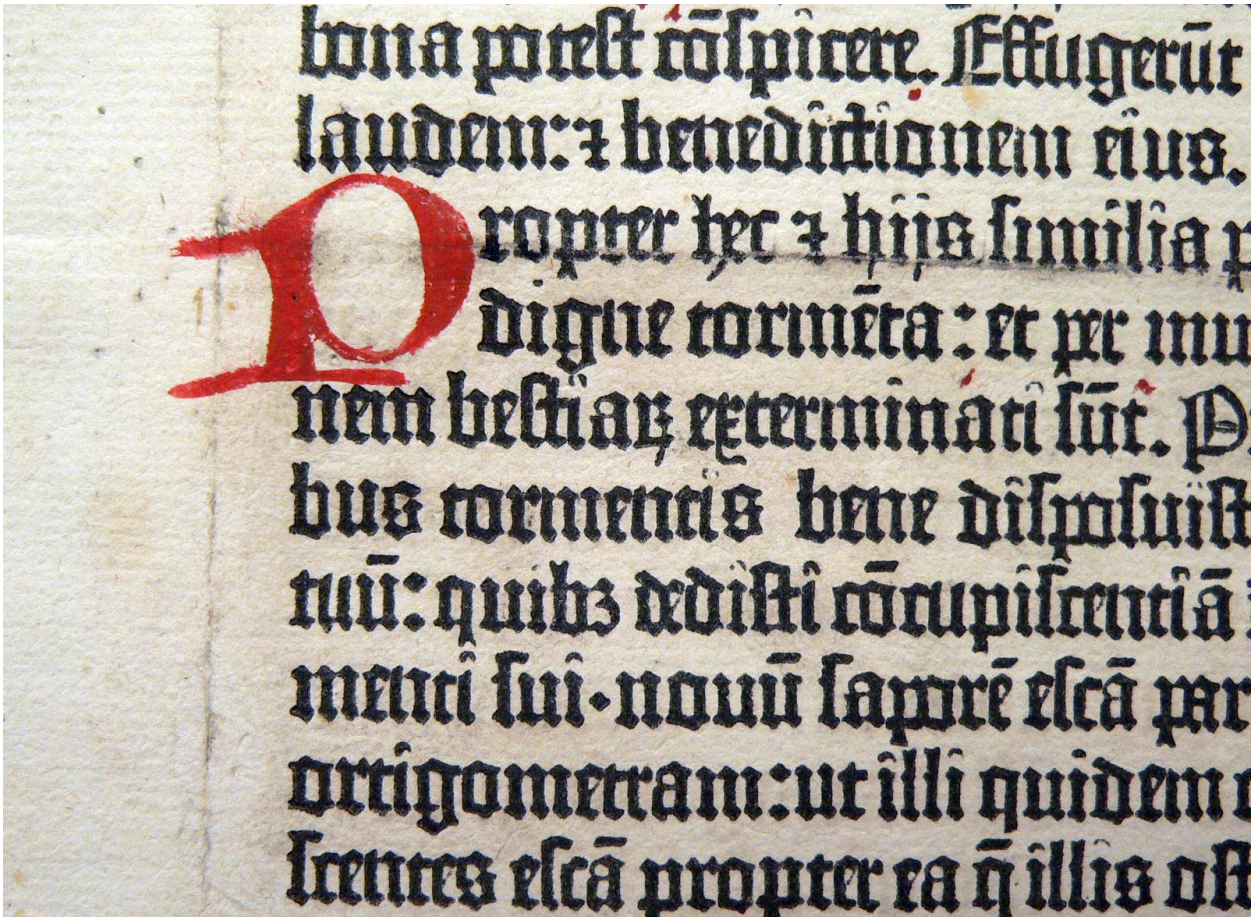


Fig. 1. Detail showing the Blackletter inspired type used in the Gutenberg Bible (also known as the 42-line Bible, the Mazarin Bible or the B42) ca. 1455 located at the University of California Riverside. Vlasta2. Gutenberg Bible, Rubrication. Digital image. Flickr. N.p., 24 Jan. 2007. Web. 11 Aug. 2015.

Hand inspired lettering was difficult to read and time consuming to set; it did not reflect the demands and productivity of the emerging technology of movable type. Without a suitable model to imitate, typesetters altered style with crisper letterforms and developed new standards for composition (Typography).

Movable type, the first mass media, spread across Europe, and in less than fifty years, there were thousands of printers (Meggs). The technology made type workable, leading to a more stylized approach. In response, typesetters began looking for inspiration in various writing forms. The Roman typeface was borrowed from Greek lapidary letters and additional Gothic, half-Gothic and Gothic-to-Roman transitional types emerged (Typography) (Meggs).

Every change in production guided the development of new approaches to visual communication. As more people began to read, words became shapes and the demand for legibility and aesthetic appeal became greater. Movable type opened up opportunities for reproducing texts creating a demand for typefaces (Sen). Small format or pocket books for example, called for more condensed type and thus the first italics was cast as a condensed text face (Berkeley). The industrial revolution brought with it further advancements in printing technology; steam and rotary presses replaced hand-operated screw presses and photoengraving replaced handmade printing plates (Dekker).

Looking Forward

It is clear that responding to the characteristics and restriction imposed by technology and emergent forms of media defined and shaped typography. Typefaces are responses to current conditions; they are history. Each typeface or solution contributes to the accumulation of knowledge that we call typography.

The story of contemporary typography in many ways begins with Modernism, a period spanning from 1860 until 1970. Modernism is a complex movement to define. Modernism can be seen as a response to a “newly industrialized society” (Armstrong, 146). In terms of typography, it can be seen as a search for universality. After a visit to the Bauhaus, Jan Tschichold captured the emerging style he witnessed in a 1925 pamphlet titled “Elementaire Typographie”. Tschichold asserted that a “new typography” was needed for the new industrial age. He felt people had more to read, less time to do it, and more competition for their attentions (Rabinowitz). His solution was to align with the German-based Bauhaus design school's philosophy, “form follows function”. He proposed that type design should be stripped of ornamentation, clear, and effective; sans serifs characterized the modernist movement (Rabinowitz). In 1928, Tschichold published a book, “The New Typography”, a manual for a functional Modernist design approach.

By the end of 19th century, typography had gone through many technological advancements. The typewritter invented by Christopeh Sholes and Carlos Glidden in 1873 made it possible for individuals to produce printed materials on a universal keyboard. The pantograph, originally invented by Christopher Scheiner in 1603, traced and scaled art up or down in size and was adapted by type designer Linn Boyd Benton in 1884; the Benton Pantograph was an engraving machine capable of scaling, condensing, extending and slanting font designs (Design History). The Benton Pantograph was one of the most important type technologies since the screw press; it was the first version of optical scaling and revolutionized punchcutting into a mechanical process. At the same time, the Linotype machine, invented in 1884 by Ottmar Mergenthaler, sped up the printing process revolutionizing the typesetting industry. Line casting, rather than setting individual letters, cast entire lines of type. The operator could now enter a line

of type on a keyboard, increasing the speed of typesetting as much as six times (Schlesinger). With each advancement, printing was getting more efficient and cost effective. The Monotype machine, invented by Tolbert Lanston in 1894 could cast individual letters by punching them into perforated tape using a keyboard. The new found speed and mechanization of typesetting revolutionized the industry making it possible to set long texts on a daily basis increasing the demand for print (Wilson).

Before the computer, designers relied on typesetters to set type. Starting in the 1950s, the the phototypesetter began to replace the physical process of typesetting with computer control and typefaces stored on magnetic film. Phototypesetting allowed for fully scalable fonts, and in response, greater contrast was given to letters and bracketed serifs turned into straight lines (Sen). In phototypesetting, the designer would *spec* type for typesetters; provide typesetting specifications such as font size, leading, column width, etc. as well as the copy. The typesetter would return the printed type, called a *galley,* that the designer would cut up with an Xacto knife and paste or *wax* (run through a waxer) to layout a page called a *paste up* or *mechanical*. A negative of the page was shot to make plates for offset printers. Unlike typesetting software used today, any changes to the copy meant another trip to the typesetter and repeating the mechanical process.

The phototypesetter dominated typesetting and printing until the personal computer emerged. The first computer was introduced in 1951. However, it was the personal computer, introduced in 1977, that marked the digital revolution (see Appendix A1). The personal computer brought with it change on scale never seen before. The personal computer merged the previously separated roles of typesetter, compositor, editor, type founder, designer, printer, and even reader. This resulted in a creative boom; with so many new avenues, typographers felt restricted by

modernist ideologies. Type became expressive and rebelled against the functionality of Modernism. Design shifted from universality to individuality. The personal computer, cable television, video games, and web pages, along with the added layer of interactivity and motion graphics, could not be expressed though functionality. The reader and designer began to question design theories, and this continues today. The digital revolution caused the demise of high cost printing presses and aesthetics moved to the forefront, turning typography back into an art form.

Up until the mid 1980s, typography remained confined to print and was developed in parallel with advancements in production and publishing (Kenna). In 1984, the Macintosh computer shifted the design and production process from analog to digital, changing the design profession and practice of typography forever (see Appendix A1). Designers were now the typesetters and had more flexibility and creative control. Text and the entire design was live; customers had more chances to make changes and designers could proof their designs. Digital typesetting offered new opportunities and called for new methods. In 1985 Adobe Systems introduced the PostScript page description language. PostScript let designers proof their designs in print on low resolution printers. This was as significant as the invention of Linotype; it allowed designers to be typesetters. Instead of relying on typesetters and designing by hand, type could be created with a click of a mouse and keyboard. The Postmodernist movement had a large influence on typography, technology, and typefaces. The creativity afforded by the Postmodern era showed the flexibility of type; its ability to move between the ornate and manufactured turned typography into an art form (Righthand). Rebellion against the Modernist ideology resulted in creative approaches to digital type (Righthand). Artists took the traditional rules of type design and turned them upside down, causing havoc with the Modernists. The typeface was bold, innovative, and for the first time, digital.

Like any new media, at first we imitated the old one. Early computer fonts imitated typewriter fonts; in fact, one of the first widespread screen fonts, Courier, was designed for the IBM Selectric typewriter and was made to resemble the previous strike-on typewriter (Courier). The first digital fonts were known as bitmap or raster fonts. Each glyph was drawn in pixels and offered in certain sizes (i.e 10pt, 12pt, 14pt, etc.). This led to poor quality when scaled outside their native pixels. The personal computer required type designers to integrate the graphical user interface (input) and printer (output). This need was called WYSIWYG (What You See Is What You Get). Integration was made possible by Adobe PostScript. As opposed to bitmap fonts, PostScript fonts used outlines or vectors. Drawn as a set of lines and curves instead of pixels, they could be scaled to any size without pixellation. By the mid-1980s, the Apple Macintosh and PostScript design software like Pagemaker (1985), Fontographer (1986), QuarkXPress (1986) and Adobe Illustrator (1986–87) became the tools of typography. The only noticeable change were the tools; instead of using analog tools to create a layout, digital tools were used to design the same layout. Before long, documents that would never be printed, electronic documents, were born and type had an entirely new technology to respond to. Divergent forms of typography emerged from the digital revolution and remediation wasn't enough to meet the needs and characteristics of, or bridge, the divergent digital medium.

The Problem With Looking Back to Look Forward

When approaching new media, imitating what came before and relying on ‘history’ can be as restraining as it is influential. Such reliance frames innovation. There are two ways to view remediation. One view is that new media imitates and defines itself in relation to the previous medium(s). In this simple view, remediation is a continuing process. A more accurate view is that remediation is the process of repurposing; a transitional step that allows for the development of

new ideas and techniques. In this light, remediation allows a practice like typography to enter a new medium, the current media stands as a point of reference until the new medium can stand on its own. Remediation is not always unidirectional; it can also be bidirectional.

Older media can remediate new media in an attempt to reassert itself. A good example of this is seen in the page footer. The footer has always been used as a locator; word processing software still carries this view of the footer. It contains information about the name, section, and page number within the document. The footer of a web page was borrowed from the previous print-based footer. The web footer, over time, became larger and was repurposed as a means of navigation. Many printed newspapers have borrowed from the web footer including photos, descriptions, and references to other sections (see fig. 1).

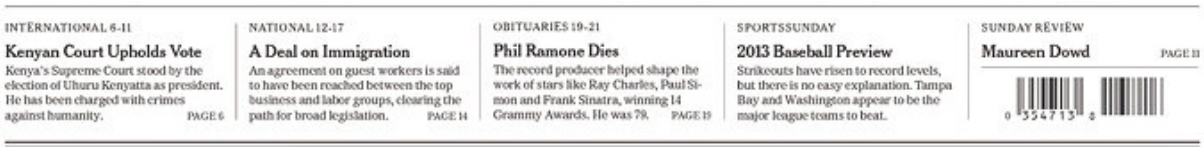


Fig. 2. Footer from The New York Times, March 31, 2013.

Remediation may not solve every problem, however, in the case of web design we can see how over time, media keeps the conventions of what came before, discards the ones that don't fit, and augments them—creating new standards that may be adopted back by the older medium. Digital typography has a lot to learn from print, and at the same time, print has much to learn from its digital counterpart.

Unlike imagery which is applied across media such as painting, photography, and film, typography is and always was represented in a printed form. It is this narrow view of typography that makes it difficult to understand and apply type in new media and reinforces divergent paths. When the 'wrench' of digital publishing was first thrown into the 'design machine' the community felt that 'digital' was not here to stay, that their 'analog' way was the best way. When

it didn't go away, digital typography was placed below its printed counterpart. John D. Barrow, in *The Artful Universe: The Cosmic Source of Human Creativity* wrote that "Arguments against new ideas generally pass through three distinct states, from 'It's not true,' to 'Well, it may be true, but it's not important,' to 'It's true and it's important, but it's not new—we knew it all along" (Barrow, 1). This captures the road typography has taken in the digital age. Just recently, it has been recognized as vital to digital communication, but perhaps as Barrow stated, we knew that all along.

Imitating print and the analog world wasn't enough to meet the needs and characteristics of the digital medium. The exponential growth of technology since the advent of the computer resulted in convergence, requiring new ways of thinking and the development of and demand for new skills. Convergence is the merging of distinct technologies, disciplines, or devices that creates a host of new pathways and opportunities (Sharp). Convergence leads to more forms of media and the expansion or hybridization of media forms (Yee, Convergence). This convergence has been happening since the dawn of typography; for example, the discipline of advertising called for large attention-getting display faces and type designers responded with the 'Fat Face'. Branded by that particular font, the 'Fat Face' was later adapted to text by increasing the x-height, reducing the contrast, and thinning the serifs...the Slab Serif, like Courier, was born (Fat Faces). The exponential growth of digital media has increased the convergence of different technologies and disciplines, and continues to change the definition and practice of typography.

Chapter 2: Convergence

Remediation is the blending of old and new media while media convergence is the merging of distinct technologies, disciplines, or devices. In 1983, Ithiel de Sola Pool coined the term *convergence of modes* as the process of "blurring the lines between media" (Pool, 24). Pool's view referred to the divisions between media industries, such as the press and broadcasting, that were "collapsing" under the influence of digital media (Freitas). Based on Negroponte's model of convergence, this is convergence 1.0, where publishing, broadcasting, and computing merge (Dubberly). Convergence 1.0 argues that all media will become digital; the transition will transform media creating opportunities, and once media is digital, the boundaries between them will blur and opportunities for interaction will grow, creating new pathways (Dubberly). The term *technological convergence* was defined by Pavlik as the "coming together of all forms of mediated communications in an electronic, digital form, driven by computers" (Diehl, 301). With so many forms of media and new ones on the horizon, typography is constantly needing to converge with new media.

The Convergence of Print and Digital Text

To see this convergence, we must look back at the role of graphic design in digital environments, how design reacted to new media. Graphic design not only has to respond to new and emerging technologies, it has to address the relationships (in practice) formed by these new technologies (Cope).

The obvious example of this type of convergence can be seen by looking at changes in the book designer's tools. E-books, like digital publishing, at first took a divergent path from the traditional printed book. Bill Cope and Diana Kalantzis in *Print and Electronic Text Convergence* show that book design has since converged; typesetting and page layout today all

occur on a common platform, the desktop. For example, the same document, e.g. a PDF, can be both printed from and read on screen. Tools like Photoshop, Illustrator, and InDesign render to both print and digital environments. For the most part, the tools for print and digital text are the same. However, to work with these tools, designers need broader skills and the ability to work across what was previously several different disciplines; this is a result of convergence.

Divergent Paths

You cannot have convergence without divergence. Tim Brown describes design thinking as "a series of divergent and convergent steps"(Brown) in his 2008 article "What does design thinking feel like?". Brown explains that we create choices through divergence and make choices through convergence, therefore, design relies on analysis and synthesis—"breaking problems apart and putting ideas together" (Brown). Synthesis is difficult when things are in tension (Brown). If we look at design using this model we see that during divergence, choices are created; during convergence, choices are made. Additionally, during analysis, problems are broken apart and during synthesis, ideas are put together (see fig. 2).

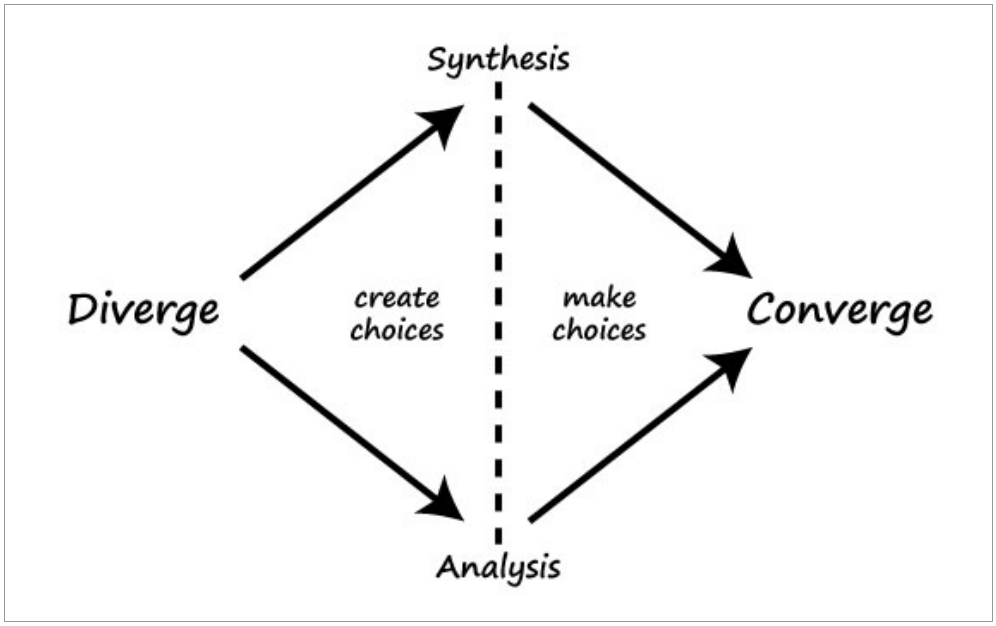


Fig. 3. Model of divergence and convergence recreated from Tim Brown's *Design Thinking*.

Designing type for the screen and setting text in digital media is a mere extension of what we have been doing for over 560 years. The screen was, however, a difficult transition for typographers and typeface designers. For the majority of typographic history, technological transitions occurred at a slow rate, where formal style and practice was used as a method of transition. These transitions occurred mostly through remediation; however, formal analog methods did not fit the digital medium. In addition, as according to Moore's Law, the computer has increased its speed and performance twofold every eighteen months (Intel). Digital technology has advanced at such a fast rate that typography has had a difficult time keeping up and staying relevant. John Heskett, in *Toothpicks and logos: Design in everyday life*, argues that the history of design is best viewed as the process of layering: "…in which new developments are added over time to what already exists. This layer, moreover, is not just a process of accumulation or aggregation, but a dynamic interaction in which each new innovative stage changes the role, significance, and function of what survives." (Hesket, 6–7). A transition occurs when something no longer fits our current model and concludes when something new emerges (Bridges). A transition may result in the expansion of core skill sets or the "application of a core skill in a non-traditional manner" (Yee, Brave, 68). Typography has been through many design transitions and has been in a state of transition since the advent of the computer.

In addition, our understanding of how type works in print did not translate directly to digital space. The fine details of letterforms evolved from a printed past and were, therefore, naturally aligned to the environmental properties and high resolution of paper (Kenna). The lower resolution of the screen did not allow for a smooth transition and digital typography was held back by technical constraints. However, this resolution deficiency is something typographers have always dealt with. Type evolved alongside advancements in paper

manufacturing just as it did with display and laser printing technology. The quality of paper and printing speed affects the way type reproduces in print. Newsprint for example didn't always have a calendered finish. Similar to the problems bitmaps caused on screen, type rendered poorly on low quality paper where ink has a tendency to spread out as it is absorbed into paper, an effect known as *dot gain*. At small type sizes, this spread affects the shape of letterforms. In response, type designers used thinner strokes that allowed the ink to spread out and ink traps, notches removed from the corners of letterforms that allow ink to flow into. Likewise, fonts designed for low-resolution displays may avoid fine lines and details that a screen cannot clearly render. However, in the early days of digital type, this resolution gap made it difficult for typographers to apply their skills to the new medium of the screen. In consequence, designers were slow or hesitant to move into the medium; their passions were in print and the technical barriers and restrictions were too high for the intricacies of typography, contributing to a different approach between mediums.

The Future of Typography

After 500 years, type changed to bits of code. This transformation gave almost anyone access to the *art* of typography. Almost overnight designers had more typefaces to choose from and much more sophisticated tools to work with. While computers were used to set type, the message was mostly outputted in the same physical form (laser printers or offset printing). By the early 1990s type began the most significant change since Gutenberg. The internet, increasing number of fonts, and greater experimentation created a host of new pathways for typography. Today, words are portable and temporary (Matteson). The art of typography is now open to everyone who interacts with a device. Letters are created for countless specific tasks such as branding, e-book covers, or systems that have little to no prior printed history or context.

Digital technology has brought with it more choices. With so many fonts, it has become necessary to select a font for specific media, not just style or emotion. Selecting a font for a specific media such as the screen is becoming an important and difficult skill to master (see Appendix A7) . To do so requires knowledge of multiple mediums (see Appendix B5). For example, a typeface designed for print may not work well on a mobile devices. Out of tens of thousands of fonts, only a handful may be suitable for reading on screen. The increased complexity of working across mediums is only increased by the added layer of interactivity. This complexity combined with an overwhelming amount of fonts calls for designers to practice informed restraint.

The biggest concern for the future of typography is quality. In the pre-digital era, typefaces were selected based on how they would perform on a particular quality of paper or ink. That practice remains today, but has been amplified by the characteristics of displays, specific software, rendering engines, browsers, and various applications. Typographic tools today allow for the seamless integration of type and multiple media forms. Designers can only keep the quality standards that define typography as a craft by mastering this multimedia integration. The key to typographic success today is being prepared to adapt to these environments.

Convergence 1.0 may no longer describe the networked world. The internet provides networked services and socialization. The boundaries between the digital and analog world are themselves blurring. Service, social, and physical are converging. Today, designers and society embrace the screen medium. Advancements in display technology are allowing more and more typographic detail on screen. Web typography has, in response, advanced. Advancements like font embedding and OpenType features in current markup languages (CSS3) have given

typographers much more typographic control and thus expression. Many of the restrictions and barriers that prevented the detailed nature of fine typography have been lifted.

Since the advent of the computer, typography has been a digital process. Designers work in digital form first before anything is printed. Digital typesetting replaced *spec'ing* type. In a digital workflow, designers are setting type themselves. Before PostScript, only low-resolution bitmap proofs were possible and designers still relied on service bureaus for sophisticated output. Today, both printing and screen technology has increased the quality of both our digital designs and printed proofs. The key advantage of digital printing is the accuracy of the proof. Digital printers output extremely detailed proofs that are both quick and cost effective. This enabled designers to hold a proof in their hands that accurately resembled the final print run. However, a new problem emerged; designers were designing a printed piece on screen and sometimes even relied on the screen itself for proofing. This is a problem as there are significant differences that directly affect type on screen (see Appendix A4).

Designing a printed piece on a digital screen has its challenges and differs from setting type on screen for screen output. Unlike paper, we cannot put a dimension to or control the countless properties that affect our design on screen; there is no telltale proof. The screen is an adaptive medium; it is not a letter sized piece of paper but every paper size there is. On screen we must design for the range of what can happen; the design we see in front of us is only a version, one that needs to adapt to countless resolutions, sizes, and devices. This is a big challenge for typography let alone a print educated typographer, and in consequence, a lack of knowledge is further distancing designers from transitioning their skills to digital mediums.

It is vital to the future to realize that the screen is not the first or last technological transition typography will adapt to. The screen is only a current substrate; future holographic

augmented reality technology will allow digital typography to have an even closer relationship with the physical (printed) world. This raises several questions: What do future screens, digital projectors, dynamic shape displays or holographic AR technology have in store for typography? Will our current typographic methodologies and curricula be able to respond? No one knows the future of typography, like Erik Spiekermann said, "You might as well ask 'What is the future of mankind?' " (qtd. in Gosling). However, one thing is clear; technology is going to affect communication and design tomorrow, just as it did yesterday. Right now, we are even seeing digital style and typefaces transitioning back to print. With new technologies like font embedding and OpenType font features, it is an exciting time for digital typography. The question is, "Will our definitions and frameworks adapt to these emerging environments?"

Chapter 3: Medium Dependence

Even under the influence of technology, typography has and remains closely associated with the history, development, and processes of print. In this sense, typography remains stuck in a medium specific or even historical context, making it difficult to cross multiple present day mediums. Digital typography is becoming as widely if not more widely used as its print counterpart. Current theory and vocabulary used to describe practice and scholarship are based on a historically print-derived framework. This is a problem; digital typography is on a divergent path from its traditional print medium (Yee). For example, we use terms like leading and line-height to describe the same function in different mediums. It is becoming seemingly critical to bridge this divergent path and free typography from the shackles of a single medium.

Review of Definitions

Definitions of typography reflect a medium or print specific context. *Merriam-Webster* defines typography as "the work of producing printed pages from written material…the style, arrangement, or appearance of printed letters on a page…[or] letterpress printing" ("Typography," def. 1a) . *Oxford Dictionaries* defines typography as "the style and appearance of printed matter…[or] the art or procedure of arranging type or processing data and printing from it" ("Typography," def. 1b). *Collins English Dictionary* shares the same view stating that typography is "the art, craft, or process of composing type and printing from it…[or] the selection and planning of type for printed publications" ("Typography," def. 1c). Even *Dictionary.com* defined typography as "the art or process of printing with type…the work of setting and arranging types and of printing from them…[or] the general character or appearance of printed matter" ("Typography," def. 1d). One thing every definition has in common is that typography is for the printed page.

Typography must be redefined to reflect modern multimedia usage. Peter Bilak wrote in his essay "What is Typography?" that such definitions "are not as flexible as the activities which they define", that typography should not be linked to any specific medium, technology, or method of production; that it is a creative discipline with room for experimentation. Bilak concluded that typography "is no longer defined by technology, but evolves with it" (Bilak). Typography today crosses many disciplines and media forms; a new definition, perhaps even a new term, is needed to define modern practice. Current words used to describe digital type, (electronic text, web typography, screen type, digital typography, etc.) further promote the divergent path and define digital type as an extension of printed type. It may very well be easier to come up with a new term that promotes convergence, as the term *typography* is so deeply rooted in print.

Review of Traditional Resources

Typography is forever intertwined with design. Emil Ruder, in the introduction to his book *Typographie—A Manual of Design,* captured this idea well saying that "typography and design are virtually synonymous" (Ruder). Today it may be more accurate to say that typography and communication are virtually synonymous. Up until the late 1980s design remained confined to print. Typography was born out of print and was developed in parallel with advancements in print production and publishing. For over 560 years typography evolved in a printed world. Today we learn the craft and practice of typography through an endless collection of resources that were meticulously explored and documented from this printed past. Reviewing popular books (Bringhurst), (Cheng), (Kenna), (Lupton) on typography, it is clear that the typography is well established in print.

Most typographers have read *The Elements of Typographic Style* by Robert Bringhurst. Nested inside this three hundred and sixty four page book is chapter nine, 'The State of the Art', eighteen pages on *digital* mediums. Bringhurst, however, does not explain how typography must adapt for digital display. What it does offer the modern typographer is a solid footing in the principles of typography. In its five revisions over the past twenty years, Bringhurst mentions the *World Wide Web* and *hypertext* only once and *e-books* twice (Meilleur). Looking at the index, you will not find *screen*, *World Wide Web*, *Web*, *webfonts*, *online publishing*, *internet, HTML*, *or CSS*. In contrast, The Linotype machine, appears twelve times and the Monotype machine, four (Meilleur). *The Elements of Typographic Style* is grounded in print. The latest version, 4.0, added a new section on metal type, yet most, if not all, rising typographers will never set metal type.

Many resources since the advent of the computer have overlooked digital type. Book critic Maurice Meilleur pointed out that there is no mention of the Web in Walter Tracy's *Letters of Credit* (1987), Geoffrey Dowding's *Finer Points in the Spacing and Arrangement of Type* (1998), Willi Kunz's *Typography: Macro and Microaesthetics* (2000), Emil Ruder's *Typographie: A Manual of Design* (2001), Hans Bosshard's *The Typographic Grid* (2002), Jan Tschichold's *The New Typography* (2006), Jost Hochuli's *Detail In Typography* (2008), or Alexander Lawson's *Anatomy of a Typeface* (2010), either (Meilleur). Further investigation is needed to examine if such resources mention digital typography. Meilleur examined these resources for instances of the Web. To be fair, before Netscape introduced the font tag in 1995, there was no such thing as *web typography*. Nevertheless, the absence of digital typography doesn't necessarily make Bringhurst's book or any other resource mentioned obsolete. The principles of typography transcend technologies, mediums, and substrates; what is lacking is a bridge between them and new media.

Review of Digital Typography Resources

Resources concerning web typography and digital mediums on the other hand are wide open to obsolescence. Any attempt to address digital typography or emergent mediums would quickly date these books, unlike print-oriented scholarship would. Digital technology changes overnight. In addition, the basics of typography for print provides a much needed foundation for working in any medium. Print typography is over 560 years old. When digital typography matures, perhaps it too will deserve the same depth and attention, but will likely suffer the same problem, a dependence on a single medium. Digital resources are screen-oriented and rarely mention print. In addition, they are concerned with techniques and technologies rather than the underlying design principles (Yee).

Ellen Lupton's books *Thinking with Type* and *Type on Screen* are arguably two of the most referenced resources today. With a title like *Type on Screen* and not *Type on Web*, one would expect a book about the medium...not the tools. However, there is little to bridge *Thinking with Type* and *Type on Screen*. In other words, like other resources for digital typography, the absence of how type on screen differs from type on the printed page reinforces the divergent paths these forms of typography have taken. Lupton provides an overview of the issues typographers face working with digital mediums and how we have and are working to solve them. Lupton's book, like many others, is filled with code with little explanation of how to do it; it is a guide, not a manual, and open to obsolescence.

Till this day, we define and learn typography through the lens of specific mediums. With our definitions and resources for learning typography closely tied to print, digital typography continues down its divergent path. This same problem, medium dependence, exists in typographic frameworks.

Frameworks are Medium Specific

There are many differences between print and screen typography. Joyce Yee examines these difference in her PhD thesis “A Practice-led Study of Design Principles for Screen Typography”. Yee explains that the screen has “nontraditional” (time-based) aspects such as motion, sound, and interactivity and “traditional” aspects such as style, weight, measure, color, and composition. (Yee, Practice, 25). These differences challenge our traditional methods and a new framework is needed to address them. Our print derived framework cannot respond to the countless changes afforded by digital media.

Education Models

In most classes, typography is style; content is about grids and hierarchy and the rules of typography. However, it is understanding the design system and the context of our typefaces that allows one to draw from different parts of the system to solve problems in media forms that exist outside the predetermined foundation. A common technique for teaching typography is scaffolding knowledge, building knowledge by using repetition while adding to the predetermined foundation of the subject. An educator has the responsibility to encourage and ensure that students understand these rules while simultaneously encouraging students to discover opportunities to exploit them. This is no easy task.

First-level typography begins with typographic form and typesetting that is enriched by the history of typography. Jerry Kelly, in *The Education of a Typographer*, expressed that typography is taught in a historical and factual basis, much like a science. Therefore, you must learn type as a tool before aesthetics can be applied. This is why starting with history as well as technology is important. Historical terms, like leading, can only be understood through historical contexts, however much of the context behind such terminology is long gone. Additionally, the

ever increasing number of digital fonts and advancing desktop publishing technology makes it difficult to keep a history curricula up-to-date and provide relevant context. The history of typography should not stop in 1957, when Max Miedinger created Helvetica, or in 1984, when the Macintosh computer was invented. Today, when students enter their first typography course, they are often already setting type for digital mediums through word processing, social media, blogging, etc. Whereas most educators emerged from a printed practice, most students are emerging from digital practice. Providing context through digital mediums may even increase synthesis. However, history does not have all the answers and necessary context to frame the problems we face in digital media. A foundation course in typography should introduce anatomy, terminology, and classifications, and provide relevant context to the typefaces and technologies that exist today.

Institutions struggle to manage the rapid technological advancement in design education. Educators argue that design education is “stuck in the past” (qtd. in Fleischmann 2), “out of date” (Dubberly p. 81), and “incapable of meeting the demands of the changing profession” (qtd. in Fleischmann 2). Digital mediums are constantly advancing and therefore our theories exist in a state of flux. Design education is continuously challenged by this. The emergence and exponential growth of digital media has caused the convergence of countless disciplines and technologies. Imagery, sound, three-dimensional visuals, video, and other time-based elements are combined with type. Typographers often need to operate across several disciplines. Game designers, graphic designers, illustrators, animators, architects, file makers, and many more creative disciplines share at least two things in common, a digital platform and the use of typography.

Working across media and disciplines defines many modern practices including graphic design and its subdiscipline typography. Anecdotal evidence suggests that students educated in a print medium struggle transitioning their knowledge to emergent digital mediums (Yee, “Convergence” 1). This was evident when examining the typographic skills of graphic designers and interactive designers. The likely cause of this struggle is that there is limited terminology, methods, and tools in existing typographic frameworks that depict new media environments (Yee, “Convergence” 1). However, there is a larger problem at work here. Convergence, networking, and globalization continue to break down the boundaries between disciplines. Designers competing in a global market are working more and more at the cusp or completely across disciplines. To address social and technological problems associated with cross-disciplinary design requires many skills outside of traditional boundaries and the merging of theories and practices. Typography is already a multidisciplinary practice. Multidisciplinarity draws on knowledge from different disciplines but stays within their boundaries (Choi). This is the process of using several disciplines at once and acknowledges the differences between disciplines. However, multidisciplinarity lacks a way to bridge the differences. It is non-integrative, each discipline retains its methodologies without adapting or developing from the disciplines it crosses. To bridge the differences, typography should be looked at as an interdisciplinary and ultimately transdisciplinary practice. Typography is interdisciplinary in that it crosses academic disciplines. To achieve interdisciplinarity, the canon of typography should analyzes, synthesizes and harmonizes links between disciplines into a coherent whole. Interdisciplinarity can not be fostered when the canon of typography remains dependent on specific mediums and designs methodologies. In order to be transdisciplinary, and transcend the boundaries of conventional approaches, typography must expand to include new principles from

the disciplines it coexists with. For example, the theories of interactive design have become part of the practice of typography. Interactive design brings with it accessibility, laws to govern universal access that plays a vital role in setting type. These laws can further advance both the printed and digital page.

Practitioners from all sides of creative disciplines are not only seeking but becoming reliant on typographic skills. In return, typography is naturally converging into a interdisciplinary practice. To meet the needs of this diverse group and educate the modern typographers involves providing a holistic foundation. We must reevaluate what knowledge, skills, preconceptions, and misperceptions students might have. We must also consider what we want students to leave a foundation course with; a foundation tied to a medium, or one that can cross and enter them. Separating core and medium-specific knowledge while appropriating knowledge from different disciplines prepares typographers to cross all forms of media and work across disciplines. A medium-independent model for typographic instruction is critical to enforce interdisciplinary practice and evolve into a transdisciplinary one. This may requires us to redefine typography itself and accept that it may now need to stand on its own, that it is no longer just a practice of graphic design but a transdisciplinary field.

Chapter 4: A Holistic View

There is a clear disconnect between traditional typographic knowledge and contemporary digital typography. As outlined in this paper, convergent media resulted in divergent paths for analog and digital type. Traditional typographic methodologies do not address the aspects, limitations, or possibilities of digital mediums, nor the diversity of typographers, forms of media, or the complexity of modern practice. Print standards and digital standards differ, but the methodologies are rooted in the same foundation. The core goals of typography do not change across mediums, however the methods and application often do. The core is just as relevant on screen as it is in print. Whatever foreseeable new media emerges, this will remain true. Legibility and readability remain fundamental to learning typography and apply to every medium. Additionally, types role, communication, remains true regardless of media.

Typographers over time perfected craft and developed standards while artists experimented with the subject. Typography was influenced by many artistic movements (Futurism, Constructivism, Dadaism, Modernism). Such external influences have contributed to the whole of typography. Like the relationship between the typographer and artist that drove typography, new media require a cross-disciplinary approach. Typography needs to consider the theoretical frameworks and requirements of the external disciplines that define it. Typography is dependent on interactivity, motion, hypertext, cyberspace, and the virtual, just as much as it must rely on terms like leading and kerning. At its foundation, typography consists of non-medium dependent knowledge (the core) and medium-specific knowledge (print, screen, Web, etc.); the core is global in its applications.

Digital media brings with it both an overlapping and extended taxonomy and its own rules, but relies on the same core principles. A typographic foundation should cover the wide

array of physical and virtual contexts that defines modern typography by including the medium-specific knowledge and theoretical frameworks that govern type in these environments. Such a framework stands ready to adapt to advancements in current mediums and new mediums entirely. This could be accomplished by converging traditional analog typography with digital sub-specialisms of type and presenting core principles along with the medium-specific knowledge needed to apply that principle across all forms of media and applications. A framework independent of a medium allows the canon of typography to work within the canon of old and new media. This could lead to the expansion of skillsets or the application of core skills in non-traditional manners expanding the core itself. Appropriating knowledge from different disciplines forms a more holistic view of typography that reflects modern practice.

Action Based Research

Joyce Yee's paper, “Design Education in the Age of Media Convergence”, presented at the International Conference on Engineering and Product Design Education in 2007, provides significant support for medium independence. Yee conducted three action research projects with “two groups of second-year multimedia design students and one group of graphic design students from Northumbria University” (Yee, “Convergence” 1). Project 1 required multimedia design students to design four typographic book covers. Project 2 required multimedia design students to design an online promotion for their book. Project 3 required graphic design students to produce a trailer, interactive website and DVD package for a fictional movie. Both groups were asked to design outside their primary mediums and the graphic design students, educated in print, had more difficulty translating their conceptual and procedural knowledge to the screen medium. Their conceptual knowledge, narrative and time-based skills, were “based on print’s spatial and temporal model” (Yee, “Convergence” 2). In contrast, the multimedia design group was able to

translate their knowledge to a printed medium without much difficulty, however, their solutions lacked sophistication “due to their inexperience of the medium” (Yee, “Convergence” 3). Yee felt this was because “print is an established medium with familiar technological and representational characteristics” (Yee, “Convergence” 3) without the added complexity of time-based characteristics. The screen appropriated concepts from print, but the concept of movement, timing, and sound were derived from an entirely different discipline, film; and with the added complexity of medium-specific and technological requirements, graphic design students found it difficult to work within the defining characteristics of the screen. Again, the technical side of onscreen design, that is the medium-specific characteristics, created a barrier of complexity and students lacked the knowledge required to execute their concepts. The multimedia design students, in contrast, had little difficulty using print-based software (Adobe Photoshop, Illustrator, and InDesign) as they were already familiar with them as the tools are used to render both digital and analog concepts.

Yee’s second observation was that there were “gaps” in concept generation. This was most evident in multimedia design students. They were asked to develop three solutions that were conceptually linked and similar in style. However, concepts for print and screen were presented separately. This showed that students did not have an understanding of the medium-specific knowledge needed to generate appropriate concepts, revealing a deficiency when changing from one form of media to another. The multimedia design students were also found to be more reliant on digital tools as opposed to traditional methods like sketching. This limited creativity to the possibilities of the tools themselves, forcing the design without a fully developed concept.

Yee's research showed that working across media requires new skills and knowledge. Her research concluded that "a knowledge-model, rather than domain-model, with emphasis on delivering global concepts first before focusing on the specifics of different media requirements" (Yee, "Convergence" 5) helped students successfully work across disciplines and media. Her solution called for new reference frames through remediation. The three action research projects called for typographic knowledge, and knowledge derived from external disciplines (game design, film, interactive). This project alone helped students in several ways. Multimedia design students were introduced to the core principles and rules of typography and improved their digital use of type. Graphic design students were introduced to the characteristics of the screen medium and how they affect type. Yee advised educators to "review the suitability of current design curricula in response to changes brought about by convergent media" (Yee, "Convergence" 5).

An Example of a Medium Independent Approach

Teaching the core rules of type for multiple mediums simultaneously illustrates how typography responds to different mediums and allows for the addition of theories and methodologies outside the boundaries of conventional approaches. Presenting a core rule alongside medium-specific knowledge creates a holistic view that can be applied to the many typographic applications that define modern practice. This view can also help typographers apply the core to new forms of media. To test the validity of such an approach, the website *TotallyType* was created (see Appendix B). Based on a medium independent model, *TotallyType* presents a holistic view of typography that focuses on delivering global concepts first, followed by medium and discipline specific knowledge. *TotallyType* was written to assist educators in adapting their curricula to meet the needs of a changing landscape. *TotallyType* currently contains seventeen lessons that

both stand as a resource for educators to expand their curricula and as as a crash course for practitioners entering new mediums or students learning typography for the first time. *TotallyType* is a permanent work-in-progress, an organic project that will continue to expand alongside advancements in publishing.

TotallyType showed that appropriating knowledge from both print and digital disciplines and mediums formed a holistic view of typography. Based on the idea that rules are only useful when you understand the contexts and reasons behind them and how they change or do not change across applications, *TotallyType* aims at placing the rules and elements of typography into a modern context. For example, in the lesson on line-spacing (see Appendix B5), the rule of thumb is 120% of the point size in print and 150% of the font size on screen. Like so many typographic *rules*, this is just a generalization—a starting point. *TotallyType* scaffolds knowledge to form a holistic view that incorporates the dependencies of each lesson. It became evident that in order to form a holistic view, each rule, step, and element needed to be positioned within the larger system it is part of. At a core level, line-spacing is relative to text size, measure, and a typefaces x-height and stroke weight. A face with a taller x-height or thicker strokes requires more line-spacing; understanding this requires knowledge concerning the anatomy and the internal metrics of a typeface (see Appendix B5). Line-spacing also increases with measure and text size which is relative to proximity, how close the reader is from the medium (See Appendix B5) and resolution, how clear the forms will render. In addition, each medium has certain environmental properties and requirements: stroke weight should be slightly heavier on screen to prevent light bleeding into the thin strokes and that decision is dependent on pixel density. With this knowledge, one can understand how a taller x-height helps text appear bigger, opens counters, and gives a typeface more pixels to work with on screen. Whereas in print we typically

want a more moderate stroke weight to prevent ink pooling and a medium x-height to brighten the page. Understanding the uniqueness of each medium helps typographers experiment and handle line spacing across all current and even future mediums.

Chapter 5: The Challenge of Medium Independence & Multidisciplinary Approaches

Bridging 'typography' is no easy task. Synthesis is difficult especially when digital media is still developing and print and digital type is in tension. However, the line between physical and analog mediums is blurring; traditional typography and divergent forms of type are already beginning to converge. There are many challenges that come with the convergence of analog and digital typography; none more evident than change.

Typography Exists in a Constant State of Flux

The practice of typography, like design, exists in a state of flux. It is constantly changing, adapting and expanding to meet the needs of society and/or exploit new technologies. According to Barnes-Powell "two momentum trends of this century are the growing complexity and increasing rates of change" (Fleischmann, 378). The response typography takes to this change and increasing complexity is a transition; a moment when practice evolves to meet new demands or emerging technologies. This constant state of flux makes it "impossible to prepare students for a future that is yet to take shape" (Fleischmann, 2). The rapid advancement, state of flux, and convergence of disciplines and technologies raises many questions for typographic education:

1. What skills do students need to be successful in a cross-discipline field?
2. How might educators teach design skills that cross media and disciplines?
3. How might educators address the differences between mediums?
4. How might a curricula combat obsolescence?

Taxonomies

The digital medium borrowed and appropriated concepts, terminologies, and definitions from previous printed media. However, digital media matured to have both an overlapping and extended taxonomy. Again, I will use line spacing as an example. The amount of vertical space between lines of type is referred to as line spacing. Left over from the age of typewriters which had limited choices, most people are familiar with double or single-spaced type, the options presented by word processors. Word processors and other forms of software have a bewildering number of ways to set, measure, and reference line spacing. Line spacing describes the function of terms such as leading (print/analog) and line-height (web/digital). Leading dates back to the days of metal type; as opposed to being set solid, strips of lead of varying thickness were inserted between lines of type to create space. Leading refers to the size of the font and that strip in points. These terms describe a single function; a result of the early divergence digital took from analog typography. In the early days of word processing, companies copyrighted taxonomies and software creators used varying terminology, units, and ratios to measure and accomplish the same thing. Leading is a measure of the space between lines whereas line-spacing in CSS is the measure of the font size and the space above and below the line in pixels, percentages, or ems, this is why you can technically use line-height in CSS to vertically center something.

Historical Context

There are countless typefaces available today and since the rise of font-embedding, every font is now available on screen. Picking a font is perhaps one of the most exciting steps of setting type. However, with so many fonts and media forms, organizing them and selecting an appropriate font has become a chore for designers. Robert Bringhurst, follows a historical approach, like most organizational systems we teach, he arranges typefaces by period; the time period the

typeface was designed in or seeks to evoke. Typefaces changed throughout history, not only in response to the prejudices of time periods, but also the different technologies used to produce them. Bringhurst suggests to “choose a face whose historical echoes and associations are in harmony with the text” (Bringhurst, p. 97). However, font-embedding has led to a boom in new fonts, some of which have little historical context.

Obsolescence

The screen is a relatively new technology that quickly became a primary reading surface. In the past three decades, as according to Moore's Law, the computer has increased its speed and performance twofold every eighteen months. This means that screen technologies are ever changing. Due to this rapid advancement, obsolescence is a big concern for this research, typography, and education itself. This concern, however, justifies the need for a model of instruction that is not aligned to technology or specific mediums. It is critical that the framework for teaching typography accounts for not only our current substrates but also tomorrow's. A system with a separate core that is not tied down to specific production methods or technologies stands ready to accept new forms of media. There exists opportunities, and future opportunities will surface, for a medium-independent system to respond to change. This system is not, however, immune to obsolescence. Perhaps in 10–20 years this system will become obsolete, unless educators continuously adapt it to emergent technology.

Limitations

Like industrial designers, typographers and typeface designers work within constraints. Typesetting often requires compromise, therefore, the limitations of digital mediums should fit right into practice. Like print, there are several constraints when setting type in digital mediums, and many of them are specific to the technologies. On the Web for example, kerning is, for a lack

of a better word, impossible. There are also environmental limitations to consider. Paper is viewable by the reflection of light and can have up to 2400 DPI (dots per inch) on a laser printer, whereas screens project images through the emission of light and its PPI (pixels per inch) pales in comparison. Such limitations contributed to a different strategy and approach between mediums. The DPI–PPI gap has led the web's typographic standards form day one. However, as technology advances limitations are lifted, the limitations themselves become obsolete, and what is left are antiquated standards.

Standards Based on Limitations

The medium specific limitations raise the question what typographic skills and rules were left in the dust. One such example is indenting paragraphs. In the early days of HTML, there wasn't a good way to indent paragraphs and so we didn't. Online reading grew in popularity and that limitation quickly became a standard that influenced modern style. When CSS came along and we could indent paragraphs, it was no longer customary to do so. In this context, we must ask what current digital standards stemmed from limits that have been lifted and what limitations are likely to be lifted in the future. One must also consider that our distance and disconnect from technology, combined with this rapid evolution, causes outdated knowledge and misinformed assumptions to linger. Many of the rules of type are dismissed on screen today, because at one point they were not possible or designers were unaware of tools at hand. An understanding of the medium, how its characteristics affect typography, affords knowledge of limitations and therefore, as limitations are lifted, typographers stand ready to respond.

Conclusion

In this thesis paper, we have discussed how the exponential growth of digital media created new pathways and opportunities—changing the way we define and practice typography. Today, typography is multidisciplinary yet remains closely associated with the history, development, and processes of print. In return, typographic methodologies that are rooted in the same foundation do not address the aspects, limitations, or possibilities of emergent media—further distancing designers from transitioning to emergent mediums. Prior to digital publishing, typography had a clear path and methodical practices. Not only did typography have a rich history to draw from but a well-established agreed upon model for teaching it. Today, typography is taught as form and a functional element of graphic design. In a sense, educators blend a functional and clear Modernist approach with the experimental type of Postmodernism—giving students the tools to use type both functionally and expressively. To use type functionally requires control, simplicity, and established standards. Perhaps this practice can best be summarized as the enforcement of *good typography.*

When considering emerging issues in the teaching of typography, the first question that comes to mind is, “What is Typography?”. To answer that question, it is analog and digital, temporary, portable, static and dynamic type. It is printed type, web type, digital type, screen type, art, and science. It is also part graphic design, interactive design, web design, publication design, and cinematography. It relies on design and interactive methodologies along with the sciences of accessibility, human-computer-interaction, reading, and cognition. Typography is the rendered character.

At an undergraduate level, typography is a sub-specialism within graphic design rather than a complex system that crosses disciplines. Among other things, its tie to design education

often results in limited time to explore the whole of typography or provide a holistic view. Most efforts to converge typography have been tackled through the addition of courses. These courses help outline the differences between print and digital text. The problem is not whether we teach digital typography, but how we teach it. In curricula we define courses by media (motion graphics), practice (Web design), or process (Photoshop). This view does not capture the convergence of media, practices, and processes that exist in real world application. The goal of introductory courses in typography should be to make students aware of the global concepts that transcend media. The biggest problem is that the theoretical foundations typography overlaps are absent; typography is disconnected from the knowledge it requires. For example, interaction design includes the theoretical foundations of user experience, human-computer interaction, social and behavioral sciences, and computer science. When typography crosses into interactive design, these theoretical foundations are vital to successful application. Education should combine craft and theory to tackle new media. This will allow future generations to develop the theory typography and design will require as new media continues to emerge and converge. For the craft of typography to survive in the future, design education must view typography as an all-encompassing field.

This is no easy task. The digital medium did not allow for the standards and control that defined *good typography*, and in return digital type split away from traditional typography. The digital era overwhelmed typography with choices, options, media forms, and conflicting standards. Digital media caused the mixing of mediums (print and interactive). The outcome of this convergence changed information; modern typography is more about how information is delivered than the information itself. Typography needs to be reexamined in this context. Digital typography requires new skills that have less to do with form than understanding users and how

technology affects form. The expansion and blending of skills afforded by technology requires more expertise and outside knowledge than is currently reflected in content and pedagogy. The root of the problem is that design curricula and the associated pedagogies do not sufficiently acknowledge the underlying convergence and emergence of practices this paper has outlined.

Course structure and sequencing proceeds from simple to complex: letter, to word, sentence, paragraph, and page. This progression itself reflects a print process and is not as relevant in digital communication. For the most part, typography still looks at complexity as a problem to solve through simplification. However, complexity is not a problem but a defining characteristic of new media. We should strive to make the complex manageable and meaningful, not just simple. This may also stem from the ideology that the computer is an extension of our traditional tools and media. This became extremely evident in the literature review, almost every book split print from digital typography. This is not an accurate model of real world practice where our designs need to communicate a message in both analog and digital media. This paper has built a case that every avenue of the design process is transformed by technology. Technology should not be looked at as an element that constrains and confines typography but as a force that drives its evolution. Labeling technology as ‘a tool’ sends digital design spiraling down a divergent path rather then converging it with the large system of communication it is part of. Digital media is tacked on to a print based practice. Therefore, digital design comes into play after a traditional print introduction, resulting in the transfer of print-based design and theory to the screen.

Substrates and technologies are ever changing, making it difficult to prepare students for the future. Current graduates will be practicing design for the next fifty years and beyond. A first-level typography course must account for the increasing complexity that has come to define

practice. Students should be considering the new reader and their role as participants in the process. To do so requires preparing student for emergent technologies, and most importantly, considering the demand for new knowledge to support both media and practice. Today a typography student must be able to express an idea in print, online, and in motion. Their typographic decisions must reflect technical issues and be informed by the theoretical knowledge from multiple disciplines. In order for this to be possible, typographic education must include the skills, theoretical frameworks, medium-specific knowledge, and characteristics that define modern application.

Previous typographers—their interaction and responses to emergent technologies and media—have helped define and develop typography. Typography today must be measured through new and multiple forms of communication. Emergent forms of communication lead to greater and greater specialization. These specializations are constantly changing. Mediums and technology are much more subject to change than the methods; for this reason, typography should no longer align itself to a specific medium or technology. Instead, it should introduce a methodology that is open to technological and cultural innovation. Information must be dispersed on many mediums and each solution must be designed for the characteristics of that medium.

Typography is a digital practice that spans countless disciplines and outputs to both digital and analog media. This complexity calls for the convergence of print and digital practices so that typography can cross the boundaries of various disciplines. Design education requires a new framework to merge existing knowledge with specialist knowledge in order to better prepare the modern typographer. This paper proposes a holistic view that focuses on delivering global concepts (the core) alongside medium specific knowledge. At its foundation, typography consists

of non-medium dependent knowledge (the core) and medium-specific knowledge (print, screen, Web, etc.); the core is global in its applications. Such a view could provide students with a foundation that adapts to both changes in technology and communication reflecting modern practice.

APPENDIX A
NOTES

A.1: The Digital Revolution (1984–1997)

Like every advancement in publishing, digital technology had a huge impact on typography. Digital technology offered new opportunists for designing typefaces and enabled typographers to manipulate text in new ways. The computer added new outputs like pixels on screen and dots on paper. Loretta Staples, in her paper "Typography & the Screen: A Technical Chronology of Digital Typography, 1984–1997" provides an overview of the digital revolution.

The age of digital type can be said to have started in 1984, the year the Apple Macintosh computer an I were born. The technologies had existed prior but the Macintosh put them all in one place, the designer's studio. The Macintosh had a 72 pixel-per-inch display which corresponded to the number of dots used to print on a dot-matrix printer. There was a close match between what you saw on screen and printed on paper. This changed the way documents were created and what was considered a document. The built in styling (typefaces, font families, bold, italic, underlined, outlined, shadowed, and a range of sizes) the Macintosh offered pushed appearance to the forefront. In that first year, it became clear that dot-matrix printing degraded typography and in 1985 Apple introduced the LaserWriter printer. The laser printers 300 dots-per-inch rivaled offset printing and enhanced the appearance of type (Staples). The increased dpi allowed for more typographic detail and thus smaller type sizes and clear serifs. The laser printer led to the rise of desktop publishing. The laser printer was made possible by PostScript, a "page description language", and detailed pages with images and text that could be scaled at the designer's will. This allowed for much more sophisticated layouts through design software like Fontographer (1986), QuarkXPress (1986) and Adobe Illustrator (1986–87). The new tools of typography (software and the LaserWriter) made it possible to output high quality typography

right from your desk. The success led Apple to develop even more software (tools) like Aldus' PageMaker, MacPublisher, and ReadySetGo. Software allowed for the integration of type and image in a wide array of layouts. In only a few years desktop publishing replaced typesetting and even offset printing (Staples). By the late 1970s, letters began to be digitized. This process brought together computer scientists and type designers (Staples). Typefaces fit for both print and screen like Luchida (1986) set out to meet the multiple demands of text.

Screen technology played a large role in the development of type. The cathode ray tube (CRT), which used a grid of pixels to display letters, became the defining matrix. The 1984 Macintosh used a black and white screen and the bitmapped typefaces Chicago and Geneva until 1997. It also offered bitmapped typefaces for printing and setting text and the ability to install more fonts. Typefaces like Helvetica, Times, and Palatino were made available from font vendors like Adobe.

Although PostScript revolutionized publishing, it also sent digital typography down a divergent path. Laser printers used outlines not bitmaps to print letterforms, therefore, each font required two separate descriptions—one for screen and one for printing. In 1989, the NeXt computer addressed this by using PostScript to both output text on screen and in print. It also used grayscale rendering surpassing the black and white Macintosh and allowing for greater dimensionality (Staples).

Designers saw the potential of the computer and digital typography. Designers translated pixellated letterforms into fonts for printing. In 1985, Zuzanna Licko designed three typefaces—Emperor, Oakland, and Emigre—that exploited the pixel medium. April Greiman began experimenting with digital using pixellated letterforms and pictures in print. By bringing the actual look of the screen to paper, Greiman challenged the printed page.

The pixellated look of type did not last long, antialiasing technology soon smoothed or blurred the jagged edges of letterforms. Although this blurred the lines between print and digital typography, antialiasing also decreased legibility by decreasing edge contrast, especially in small text. By 1987, the Macintosh II supported grayscale rendering and by 1990 color. As displays advanced antialiasing became necessary and more advanced software like Adobe Photoshop (1990) emerged. Photoshop offered a set of tools for combining type and images allowing designers to edit pixels for bitmapped graphics. This was important for type as it was translated to pixels; type was image. Photoshops phototypesetting capabilities inspired typographic expression on screen. Adobe Illustrator automatically generated PostScript code, capable of outputting an EPS (encapsulated PostScript), allowing for a preview of what was to be printed. Photoshop allowed designers to fuse text and image "stimulating the rise of visual-effects driven typography" (Staples).

By the late 1980s interactive media like the CD-ROM introduced digital media, communication made for screen display. Tools like Macromedia Director allowed for the creation of interactive art. Text combined with motion graphics, video, and sound was now displayed on a single medium, the screen that users could navigate. Even with advanced software and multimedia options, typefaces were scarce and limited. Most fonts used bitmaps that were not tuned for the screen. These bitmaps were rough counterparts of the outlined PostScript files used in printing. This did not go unnoticed, Apple released the Espy family for the screen in 1993 and Matthew Carter co-founded Bitstream to develop digital typefaces. Adobe soon became the leader in digital fonts, however these were just well drawn scalable bitmaps. Apple developed an alternative to PostScript, TrueType, which used auto-scaling.

By the mid 1990s, the World Wide Web threw everything upside down. It presented designers with complex problems by placing typographic contol in the hands of the audience. Web browsers came with pre–defined typographic specifications and gave users control of options like typeface, font size, and color. The work around was to set type as image using software like Photoshop. Designers sought out solutions to bring the limitations of page design to the web. One such effort as the OpenType format (1996) supported more typographic control across screens and allowed font embedding into HTML documents.

Digital typography challenged the very defining characteristics of typography and its rich history, as Staples put it, “Digital tools at first necessitated (due to technical constraints), and later explicitly encouraged (due to technical advances) specific kinds of representation that would challenge their historical antecedents.” (Staples). This typographic development fueled by digital technologies continues today. Digital technologies made it possible for designers to see typography in a new way and through a new platform. The relationship between pictorial space and the written word blurred, changing typography forever.

A.2: A brief history of web typography

When HTML was released in 1990, fonts were controlled by the browser. There was no way to control web type until Netscape introduced the <font> tag in 1995 that was standardized into HTML2. With it, designers could specify a font, but there was a catch, it had to be on a user’s system, if the user didn’t have the defined font installed, the design would fallback to the browser’s default and often monospace font. This limitation carried over to Cascading Style Sheets (CSS), in 1996. In 1998, CSS2 further simplified types process by separating content from style but still relied on installed system fonts. A list of “web-safe” fonts, fonts likely to be present on most systems, was defined and CSS2 gave designers the ability to define a font stack,

a string of defined fallback fonts. This allowed designers to at least control font style (serif, sans-serif, monospace, or cursive) and stack the closest matches to their intended choice.

With the web and screen-based technology exponentially growing and designers choosing their own fonts, Microsoft started the Core Fonts for the Web initiative. They released a series of freely distributable screen friendly fonts. In that list was Matthew Carter's “Georgia” and “Verdana”, which both became staple screen fonts and a model for every web font to follow. At the same time Microsoft added support for downloading remote fonts in Internet Explorer (IE) 4.0 that was integrated into CSS2 as the font-face rule. However, type foundries sided against it; the delivery method made their fonts available to be downloaded and used by everyone. Font-face in CSS2 was used for grayscale anti-aliasing. It worked well for system fonts that were optimized for screen, but other screen fonts did not exist at the time and print fonts made the web look even worse. IE’s font-face rule was short lived and ahead of its time and by the time CSS2.1 was released just two years later in 1999, font downloading was abandoned. We would not see it again for twelve years when CSS3 was released in 2011 with the @font-face rule. (Teague, 2011)

A.3. Complexity

If the digital age had to be confined to one word, it would be speed. Typography on the other hand was a time consuming precise craft. The speed of the digital age has left less and less time for the craft of typography. At the same time the digital age increased complexity, requiring more and more outside knowledge. Today, software automates craft; type is often left in the hands of software and set to default. In return, designers are less aware of the details and typography often lacks a human element. The fundamentals of typography no longer seem essential. Typography, like many crafts, is in danger of being forgotten. We rely too much on the

computer; typography is more than inputting content and applying algorithms. It seems it is no longer important to know the difference between a hyphen, an en-dash and an em-dash or to kern a headline. The computer may do an acceptable job at text sizes but relies on the human eye for a successful headline. Perhaps no one has time to notice these details or our expectations themselves have been lowered.

There is no doubt that typography and design are complex subjects; they always have been. Increasing complexity, brought about by new technology, expands the boundaries of typography and increases that complexity daily. Typography is charged with bringing a sense of order and identity to a complex world. From the caves of Lascaux to today, communication developed alongside technology. If there is one craft that can bring some clarity to our increasingly complex world, it is typography.

A.4. Environmental Properties of the Screen

In contrast to paper, the screen is a dark surface where forms are written with light. Paper is viewable by the reflection of light whereas screens project images through the emission of light. This backlit surface calls for new ways of thinking and changes in deep-rooted typographic standards.

Safari 3.1 re-sparked web fonts and brought the forgotten @font-face rule back into the limelight. It wasn't because of an influx of screen fonts, but big advancements in the medium, the screen. LCD displays had become the norm; we all stared in awe at high-resolution flat-panels that performed anti-aliasing via subpixel rendering. Most displays today have pixels made up of multiple subpixels (red, green, and blue). This is known as the additive color system. On paper, colors are perceived by the absorption and reflection of light off the pigments of ink on the surface. This is known as the subtractive color system.

In a subtractive color system like print, the contrast of black on white is very legible. However, in an additive color system, the color white is produced with each red, green, and blue sub-pixel at full intensity. This is why black on white is harsh on the eyes on screen (Hume, 2005). The light radiating from pure white is so bright it can bleed right into the fine details of glyphs.

A.5. Font Rendering Strategies

A big difference between type displayed on screen versus paper is the way the text is rendered. A glyph's outlines get pixelated on screen; type is converted into pixels, the medium. That conversion process varies across operating systems, devices, and various PPI (pixel-per-inch) screens and often results in a lack of consistency (Ahrens, 2012). This conversion happens through rendering engines. Each operating system and browser controls which rendering engine is used. Therefore, two browsers on the same system can produce different results.

On screen aliasing displays diagonals and curves in a glyph as horizontal zigzags and vertical lines. Anti-aliasing is a method systems use to reduce aliasing by shading the pixels along the edges of glyphs. This is known as grayscale rendering. The edge pixels of each glyph are not black but shades of gray; this makes the counters appear smoother (Hume, 2005), and lets a typeface’s details and personality shine through the pixels. This was a big step for type on screen, it was more than just a legible glyph; a typeface could now have character.

Subpixel rendering allowed for control of each individual pixel to carry the visual weight from its neighboring pixels, producing subtle color shifts along the edges of glyph (Mashing Media, 2011). Subpixels significantly improved the rendering of text, especially at small sizes while @font-face enabled us to choose practically any typeface and font style—just like print design.

A.6. PPI vs. DPI

In print we carefully and accurately set static content, whereas on screen, that content is dynamic; it is always changing. On top of that, content is presented at variable resolutions on screen. Print can have up to 2400 dots per inch (DPI) on a laser printer and the screen's 72 pixels-per-inch (PPI) pales in comparison. In addition, the light radiating from the screen environment can bleed into the fine details of glyphs. This back-lit low resolution environment along with a lack of screen optimized fonts led to poor legibility. This DPI-PPI gap has led the Webs typographic standards from day one and values such as 72PPI still pave the way of typography even though most desktop displays today are in the 100s. Mobile devices are even higher such as 132 PPI iPads, 326 PPI retina displays, and 438PPI 4k screens. More pixels per inch is allowing for more and more typographic detail and continues to blur the line between the printed page and screen technology. This is no longer the language and problem of the developer and web designer but a fundamental characteristic of the medium. Designing a square of 100x100px will have a physical size of one inch on a 100PPI screen. But if that same design is displayed on 72PPI screen, the square will appear bigger. Since the PPI is 72, the screen will need approximately an inch and a half to display that 100px.

A.7. Selecting and Pairing Digital Fonts

Not every font is screen suitable yet almost every font is now available as a webfont. But the reality is, it takes a rock star web font to justify using a webfont at all. A webfont needs to stand up to the tried and true fonts like Georgia or Verdana to be worthwhile in text. Typeface design for screen is different from the text treatment a graphic designer performs on a web page for example. However, the principles, proportions, and metrics that drive a screen fonts construction

helps designers of all kinds select the right face for the job. No matter the font, how well it performs depends on the designer's decision to use and execute a typeface in a particular context.

When choosing a typeface for screen there are certain features to look for: ample space between letters, words, and lines; lower stroke contrast; a taller x-height; and open counters. However, factors like the line length, leading, or the contrast between the foreground and background allow a well designed screen font to perform the task it was designed for.

Pairing fonts for screen use is not very different than how we pair fonts in print. As we have learned, a tall x-height is the main identifying feature of a screen font. Matching that height as closely as possible between the text and heading fonts is the best solutions. So the way to pair screen fonts is by comparing their vertical proportions or x-heights, the height of the lowercase letter *x*. Another great way to pair fonts is to use a typeface that has both a Sans and Serif version, like Droid Sans and Droid Serif. This will be the closest match possible as they were built using the exact same metrics and proportions.

A.8. Transitioning the rules of type to the web.

The following table depicts thirty core rules of traditional typography transitioned to the web. Three (X) rules do not apply to the Web, nine require specialist knowledge/adaptation (»), and twenty five transition directly (√).

1	Insert a single space after punctuation.	√	
2	User proper em & en dashes	√	HTML unicode UTF-8 – —
3	Use proper quote and apostrophe marks.	√	<meta charset="utf-8" /> or unicode
4	Use true small caps	√	font-variant: small-caps;
5	Add letter-spacing to capitalized text and small caps if needed	√	
6	Use old style figures when appropriate	»	CSS3 font-feature-settings can access OpenType features but support is limited.
7	Use caps properly	√	
8	Use bold text properly	√	

9	Use copyright, register and trademarks properly.	√	
10	Use ellipsis character when appropriate	√	… HTML entity
11	Avoid underlined text	»	Exception: hyperlink accessibility
12	Increase line spacing to improve readability	√	
13	Choose an appropriate body size	»	14–24 pixels.
14	Don't alter fonts	√	
15	Choose the appropriate font	»	
16	Decrease line length and increase margins	»	
17	Avoid letter spacing lowercase body text.	√	
18	Keep word spacing fairly close	√	
19	Choose the idea column width	»	
20	Use justification when appropriate	»	
21	Choose the alignment that best suits the text	»	
22	Follow the rules of hyphenation	X	control limited
23	Avoid beginning three consecutive lines with the same word.	√	
24	Always, always spell check	√	
25	Avoid widows and orphans	X	control very limited
26	Establish clear hierarchy	√	
27	Use kerning in headlines	X	control very limited
28	Indents	»	
29	Don't indent first paragraphs	√	
30	Items in a series	√	
31	Capped script fonts	√	
32	Leading and all caps	√	
33	Hanging quotes	√	
34	Numbers flush right	√	
35	Dollar Listings	√	
36	Emphasis	√	
37	Natural breaks	√	

LIST OF FIGURES: APPENDIX B

APPENDIX B:
TotallyType.com

B.1. TotallyType

Based on a medium independent model, *TotallyType.com* presents a holistic view of typography that focuses on delivering global concepts first, followed by medium and discipline specific knowledge. *TotallyType* was developed to assist educators in adapting their curricula to meet the needs of a changing landscape. *TotallyType* currently contains seventeen lessons that both stand as a resource for educators to expand their curricula and as a crash course for practitioners entering new mediums or students learning typography for the first time. *TotallyType* is a permanent work-in-progress, an organic project that will continue to expand alongside advancements in publishing (see fig B1).

Fig. B1. Landing page of TotallyType.com

B.2. Overview of features.

Accessibility

TotallyType is fully accessible; text meets Level *AAA* of the W3C Web Content *Accessibility* and interactive elements meet Level *AA* and Level *AAA* on hover. TotallyType was built on a completely custom typographic framework designed for multiple environments including screen, print, hand-held, and TV (see fig. B2).

Fig. B2. TotallyType was designed for multiple screen environments.

Additionally, the site is fully accessible to screen readers. Most visual examples are themselves fully accessible scalable live text. Additionally, a set of tools is available from the drop down settings panel (see fig. B3).

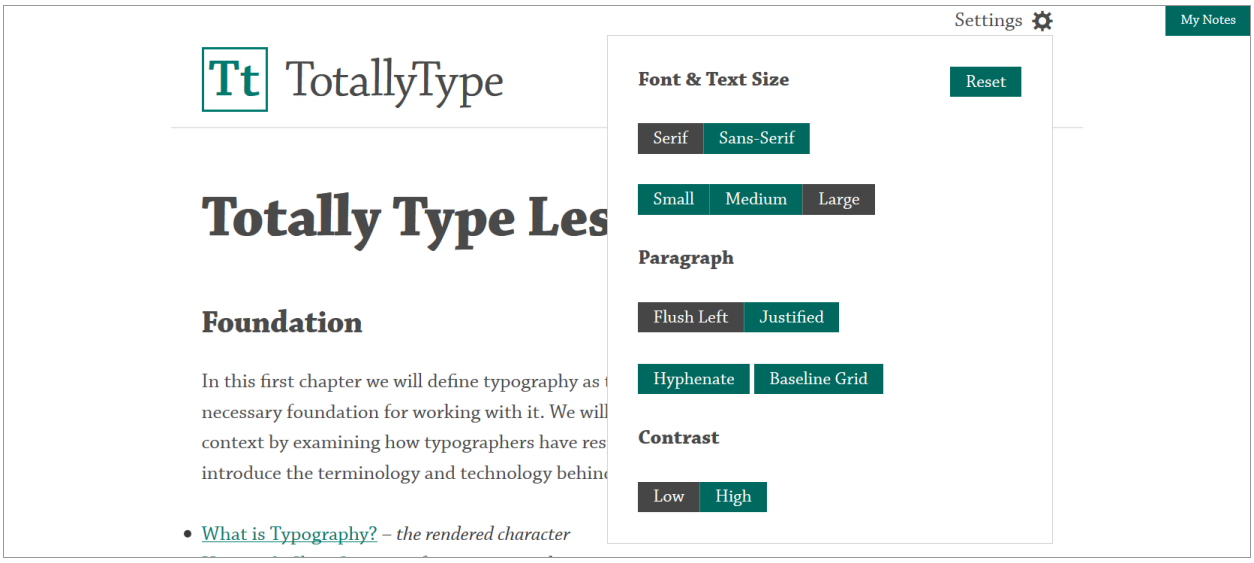


Fig. B3. TotallyType Accessibility Tools.

These tools let the user customize their reading experience. The following options are available: Switch between a Serif and Sans-serif typeface. Set type size (sets the base font size at 14px, 16px, or 18px). Switch between flush left of justified type. Toggle hyphenation on or off. Toggle the baseline grid on or off. Switch between a low or high contrast view (see fig. B4).

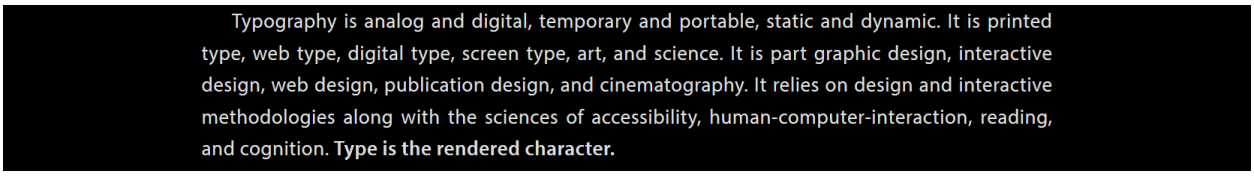


Fig. B4. Text shown with sans-serif, small text size, justified and hyphenated paragraphs, and the high contrast view enabled.

Typography

The typographic framework developed for the site puts accessibility, cross media design, and typography at the forefront. The entire website stands as an example of both print and screen typography. Designed with a modular scale based on the golden mean and an underlying baseline grid, the type incorporates every rule the content discusses (see fig. B5).

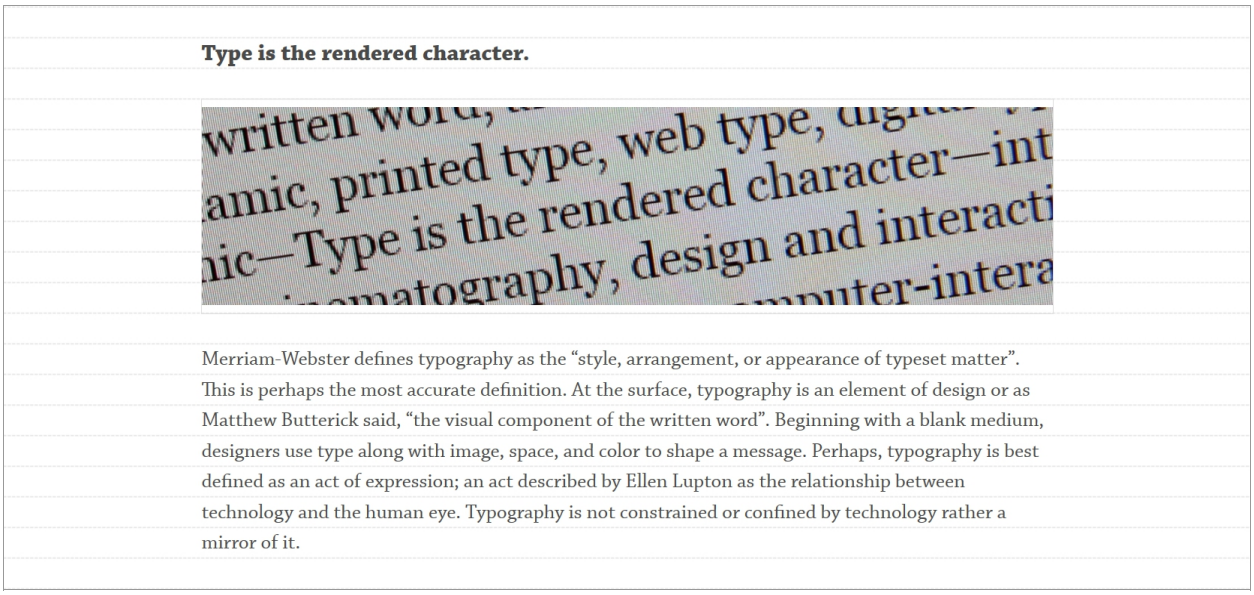


Fig. B5. Shown with baseline grid visible.

Images or various sizes are snapped to the grid through a custom script available in the resource section. Once TotallyType reaches a final state of development, the source code will be included as a resource and the typographic frame as a boilerplate for starting type-based web projects.

In browser printing

A document usually needs a larger font-size on a screen than on paper, and sans-serif fonts are easier to read on the screen, while serif fonts are easier to read on paper. The print version of the site resets the type for print including the use of a different font, font-size, modular scale, and page layout. The version printed from the bowers converts both links and interactive elements to printed version. For example, the interactive relative versus absolute units table is converted to a static table for print (see fig. B6).

Root Font Size

It's easy to understand the difference between absolute and relative units when you see them in action.

Base	font-size: 100 %
12pt	The quick brown fox jumps over the lazy dog.
16px	The quick brown fox jumps over the lazy dog.
1em	The quick brown fox jumps over the lazy dog.
100%	The quick brown fox jumps over the lazy dog.

Generally, 1em = 12pt = 16px = 100%. If you increase the base font-size to 120% in the interactive table above, you will see how both relative units — the em and percent units — get larger as the base font-size increases, but the fixed units, pixels and points, do not. For this reason, the em and percent units are preferred on the web.

Root Font Size

It's easy to understand the difference between absolute and relative units when you see them in action.

Base	body {font-size:100%;}	body {font-size:120%;}
12pt	The quick brown fox jumps	The quick brown fox jumps
16px	The quick brown fox jumps	The quick brown fox jumps
1em	The quick brown fox jumps	The quick brown fox jumps
100%	The quick brown fox jumps	The quick brown fox jumps

Generally, 1em = 12pt = 16px = 100%. If you increase the base font-size to 120% you will see how both relative units — the em and percent units — get larger as the base font-size increases, but the fixed units, pixels and points, do not. For this reason, the em and percent units are preferred on the web.

Fig. B6. Root Font Size, online version (top) versus printed version (bottom); interactive table is replaced by static table and content is altered (bottom paragraph) for context.

The print function was implemented for several reasons: for educators who would like to print the material for either their own resources or as handouts for their students. In interactive applications like "Font selection and pairing", tests intended for print use can be printed individually and tested in context.

Levels of information

In order to meet the needs of a wide audience of educators, students, and professionals who require different levels of information, lessons are organized into multiple levels of complexity. To keep a linear flow of information levels are kept within the flow. This is made possible by on

page pop-ups and level toggles. For example, in the Measuring Type lesson, users who wish to learn more about how font size is calculated in digital type can click the show advanced button to learn more. In the Figures lesson, users who wish to use Old Style figures online can click *use online* to see the CSS required to enable Old Style figures in OpenType fonts.

Notes

The notes function located in the upper right hand corner on desktop and tablet or in the bottom right corner on mobile lets users take notes. The notes are persistent from page to page. Notes are entered in a WYSIWYG—What You See Is What You Get editor. The users notes will remain active for 30 days or until they clear their browser history. Once complete, users can print their notes (see fig B7).

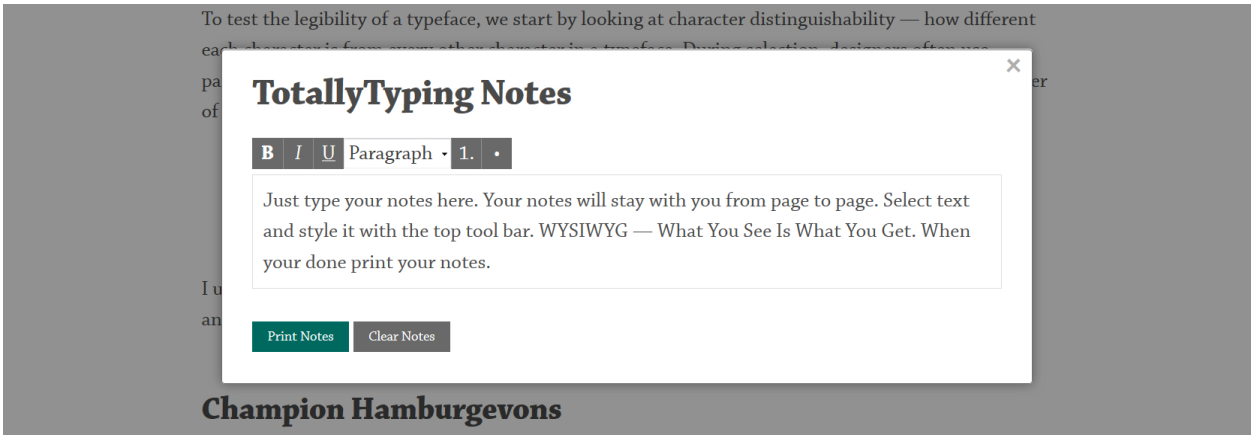
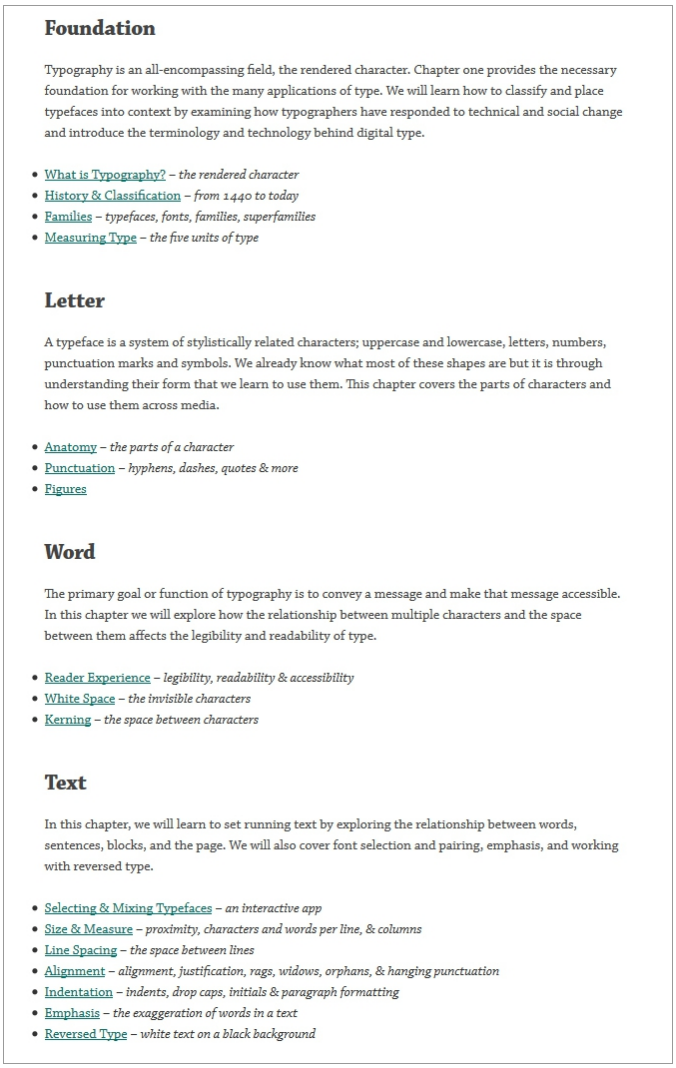


Fig. B7. TotallyTyping Notes.

B.3. Lessons

TotallyType currently contains seventeen lessons that both stand as a resource for educators to expand their curricula and as as a crash course for practitioners entering new mediums or students learning typography for the first time. The lessons are organized into four chapters: foundation, letter, word, and text (see fig. B8).



Foundation

Typography is an all-encompassing field, the rendered character. Chapter one provides the necessary foundation for working with the many applications of type. We will learn how to classify and place typefaces into context by examining how typographers have responded to technical and social change and introduce the terminology and technology behind digital type.

- What is Typography? – *the rendered character*
- History & Classification – *from 1440 to today*
- Families – *typefaces, fonts, families, superfamilies*
- Measuring Type – *the five units of type*

Letter

A typeface is a system of stylistically related characters; uppercase and lowercase, letters, numbers, punctuation marks and symbols. We already know what most of these shapes are but it is through understanding their form that we learn to use them. This chapter covers the parts of characters and how to use them across media.

- Anatomy – *the parts of a character*
- Punctuation – *hyphens, dashes, quotes & more*
- Figures

Word

The primary goal or function of typography is to convey a message and make that message accessible. In this chapter we will explore how the relationship between multiple characters and the space between them affects the legibility and readability of type.

- Reader Experience – *legibility, readability & accessibility*
- White Space – *the invisible characters*
- Kerning – *the space between characters*

Text

In this chapter, we will learn to set running text by exploring the relationship between words, sentences, blocks, and the page. We will also cover font selection and pairing, emphasis, and working with reversed type.

- Selecting & Mixing Typefaces – *an interactive app*
- Size & Measure – *proximity, characters and words per line, & columns*
- Line Spacing – *the space between lines*
- Alignment – *alignment, justification, rags, widows, orphans, & hanging punctuation*
- Indentation – *indents, drop caps, initials & paragraph formatting*
- Emphasis – *the exaggeration of words in a text*
- Reversed Type – *white text on a black background*

Fig. B8. TotallyType Lessons Index. http://totallytype.com/lessons.php

TotallyType scaffolds knowledge to form a holistic view that incorporates the dependencies of each lesson. It became evident that in order to form a holistic view, each rule, step, and element needed to be positioned within the larger system and subsystem it is part of.

B.4. Chapter One: Foundation

Typography is defined as an all-encompassing field and the rendered character. Chapter One provides the necessary foundation for working with type in multiple mediums. Students learn how to classify and place typefaces into context by examining how typographers have responded to technical and social change and get introduced to the terminology and technology behind digital type and current mediums.

Lesson One: What is Typography?

Typography is defined as the rendered character and positioned as an all-encompassing field. To answer the question at hand, typography is explained as analog and digital type, temporary, portable, static, and dynamic. It is printed type, web type, digital type, screen type, art, and science. It is also part graphic design, interactive design, web design, publication design, cinematography, and the many more disciplines it overlaps. It relies on design and interactive methodologies along with the sciences of accessibility, human-computer-interaction, reading, and cognition. The goal of this lesson is to provide a broad view of typography and set the stage for the holistic lessons that follow.

Lesson Two: History & Classification

In this lesson, the long standing relationship between typography, technology, and society is established. The timeline is based on the idea that any significant shift in typography runs parallel to new reading environments, technologies, or social change. The evolution of typography is shown alongside advancements in publishing technology and society. The information is presented as a timeline spanning from c.1400 until today and grouped by typographic classification (see fig. B9).

Venetian

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz

Fig. B9. Heading for Venetian section.

For example, when Mainz, the German printing capital, was sacked in 1462, printers were forced to flee—most went to Italy, particularly Venice, where they were exposed to the Renaissance movement. There printers began to create type (Venetian type) that mimicked the hand of Italian humanist writers (see fig. B10).

CHARACTERISTICS

e — Sloping cross-bar on the lowercase *e*.

O — an acute `angle of stress'

V — Low contrast between thick and thin strokes.

. — The square full point.

x — Small x-height.

Fig. B10. The identifying characteristics of Venetian type.

In Venetian type, uneven pressure from the screw press and the coarseness of printing surfaces required thicker strokes for type to hold up. Therefore, Venetian type has a dark block color and low stroke contrast (see fig. B11).

IN USE

Suspendisse bibendum sit amet est et eleifend. Suspendisse imperdiet, diam quis sollicitudin ultricies, orci metus mollis mauris, id convallis urna magna eget lacus. Ut ut placerat metus. In non neque sodales, pharetra lectus id, fermentum ipsum. Phasellus cursus accumsan pharetra.

Venetian type has a dark block color; combined with a small x-height, low stroke contrast, and an acute 'angle of stress', Venetian types do not lend themselves to modern design treatments or the screen.

Fig. B11. Venetian type in use.

Lesson Three: Families

The terms *typeface* and *font* are defined. These two terms have became somewhat synonymous since type went digital. Fonts were no longer thousands of blocks—but thousands of bytes that can scale to any size. A typeface is clearly defined as a family of fonts. Lastly, the term superfamily is defined. The traditional family and super family are both represented in a visual that outlines what each variant is intended or most commonly used for (see fig. B12).

Light text in headings can contrast body text.

Light Italic text in headings can contrast body text.

Roman or regular is the core typeface in a family.

Italic letters are used to create emphasis and are based on cursive writing.

SMALL CAPS HAVE A HEIGHT SIMILAR TO THE X-HEIGHT OR LOWERCASE.

Semibold is used for emphasis within a hierarchy.

Semibold Italic is also used for emphasis within a hierarchy.

Bold is used for emphasis within a hierarchy.

Bold Italic is also used for emphasis within a hierarchy.

Display Regular is used for short bursts of copy at large sizes.

Display Regular Italic is used for short bursts of copy at large sizes.

Display Bold is used at large sizes.

Display Bold Italic is used at large sizes.

Fig. B12. Superfamily variants of Chaparral Pro and their intended usage.

Lesson Four: Measuring Type (an example of information architecture)

The third lesson, Measuring Type, covers how we measure type across media and applications. The lesson looks at the five units of type: point, pixel, em, percent, and root-em; categorized as being either absolute or relative. The lesson ensures that users understand how these units relate to one another and what medium(s) they apply to. In return, typographers can not only set font size but understand how to measure and set line-spacing, kerning, tracking, margins, gutters etc. across various media forms (see fig. B13).

unit	abbreviation	medium	type
point	pt	print	absolute
pixel	px	screen	absolute
em	em	fonts & web	internal/relative
percent	%	web	relative
root-em	rem	web	relative

Fig. B13. Table of the five units of type shown with abbreviations, media usage, and unit type.

The lesson starts off by introducing picas and points, the absolute units used in print. The PostScript point—used for setting type size, indents, line-spacing, etc.—is defined as 1/72 of an inch. The PostScript pica—used for measuring the page: measure, margins, graphics, etc.—is defined as a subdivision of 12 points. Next, the *picture element* or *pixel* (pix-el) is introduced as the absolute unit used in screen displays. The pixel is defined as one point on a device, its size dependent on the resolution and pixel density of the screen. Resolution, pixel density, ppi (pixels per inch) and in contrast, dpi (dots per inch) are introduced along with a visual example of the pixel grid and variations in rendering (see fig. B14).

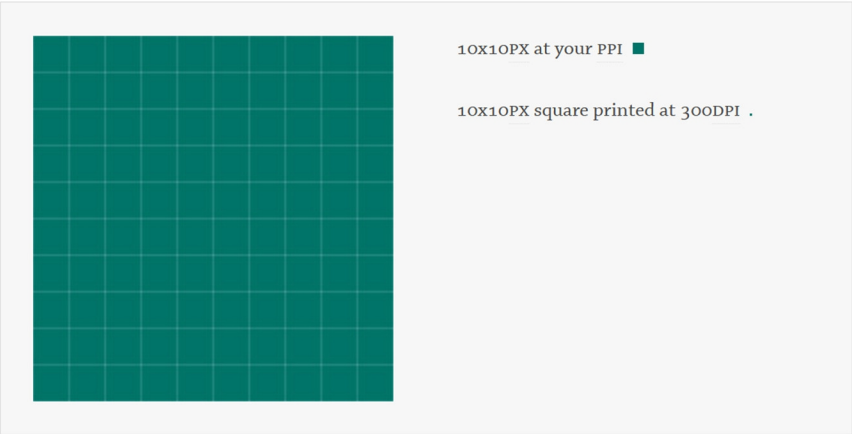


Fig. B14. Visual showing the pixel grid and rendered size across mediums.

Relative units are positioned as a unit that is relative to an absolute unit. The em is introduced as both a relative and internal unit; a unit not defined by the typeface but by the size of the type. This is explained through the analogy that, like HTML and CSS, the em allows for the separation of style (letterform) and structure (size, side bearings, kerning, etc.). This leads to the introduction of UPM. The UPM makes it possible for digital type to scale to any point size. Kerning is used as an example by stating that the the em allows a digital font to have one kerning table. The importance of the em is reinforced by explaining that typesetting, including whitespace, gets resized proportionately when we change the point or pixel size.

In order to meet the needs of a wide audience of educators, students, and professionals who require different levels of information, lessons were organized into multiple levels of complexity. This additional level is accessible through either page pop-ups or level toggles. For example, in this lesson, users who wish to learn more about how font size is calculated in digital type can click the show advanced button to toggle the advanced section (see fig. B15).

Fig. B15. Toggle button for advanced section.

In the advanced section users look at the 1000 UPM of Chaparral Pro. By shedding light on the internal metrics of digital type, it becomes clear that the physical size of letterforms lies in the chosen typeface itself. The yMax, yMin, line gap, and font metrics are examined to explain how a digital font is scaled and how lines of type stack (see fig. B16).

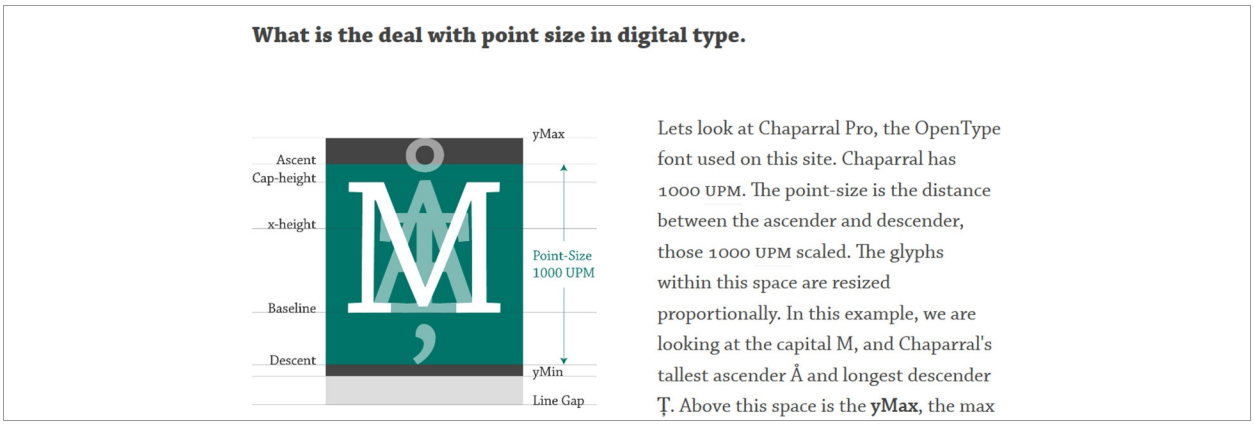


Fig. B16. Advanced article on font scaling in the EM and EM square section.

With the point, pixel and em covered, the lesson moves on to the Web. One of the most confusing aspects of setting type within CSS is the font-size attribute. In CSS, we have four different units—pt, px, em and %—that we can use to set the size of text in a web browser. The percent is introduced followed by the idea of a root or base font size. Understanding the relationship between absolute and relative units is important to type in every medium. It's easy to understand the difference between absolute and relative units when you can both see them in action and interact with the base (see fig. B17).

Fig. B17. Relative versus absolute units with a base font size of 100%.

Generally, 1em = 12pt = 16px = 100%. This illustrates the relationships between points and pixels and absolute and relative units. Users can change the base size to see how—the em and percent—are scaled as the root font-size changes, but the fixed units—pixels and points—do not (see fig. B18).

Base	**font-size: 120**	**%**
12pt	The quick brown fox jumps over the lazy dog.	
16px	The quick brown fox jumps over the lazy dog.	
1em	The quick brown fox jumps over the lazy dog.	
100%	The quick brown fox jumps over the lazy dog.	

Fig. B18. Relative versus absolute units with a base font size of 120%.

This knowledge makes it clear why the em and percent units are preferred on the web. By understanding how type size is the base unit used by a fonts internal font metrics, the stage is set for introducing the root-em (rem) that addresses the problem of inheritance in the semantic structure of HTML. The relationship between the em and rem is shown though a live code example that allows users to interact with the code in three states (see fig. B19).

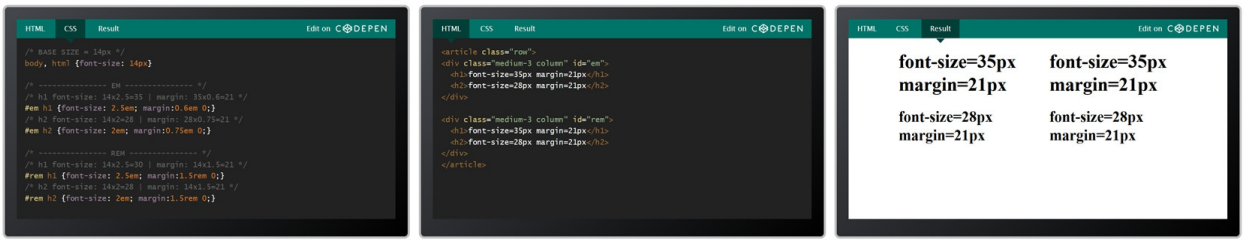


Fig. B19. The three states (CSS, HTML, and Result) of the em versus rem live code example.

The initial views shows commented CSS that explains how the em is relative to the parent element. This illustrates that when setting a font-size in ems on the h1 element, the font size is relative to the base or document font size. However when setting a margin on the h1 element, the em becomes relative to the font-size of the h1 element itself. In contrast, when using rem for the margin, the rem is relevant to the base size. Users can inspect the HTML and see the result, providing a whole picture and a working example of the code needed to execute.

B.5. Chapter Two: Letter

A typeface is a system of stylistically related characters; uppercase and lowercase, letters, numbers, punctuation marks and symbols. Students already know what most of these shapes are but it is through understanding their form that they learn to use them. This chapter covers the parts and types of characters and how to use them across media.

Lesson 5: Anatomy

Typeface anatomy describes the graphic elements that make up letters in a typeface. It is the vocabulary of type, used to describe the parts of a character. Understanding the anatomy of letterforms allows a designer to alter and use type effectively. Anatomy is also a key factor in identifying, classifying, selecting, pairing, and setting type. The lesson starts off by explaining that a line of type aligns on five horizontal lines. This is expressed through an interactive animated SVG (see fig. B20).

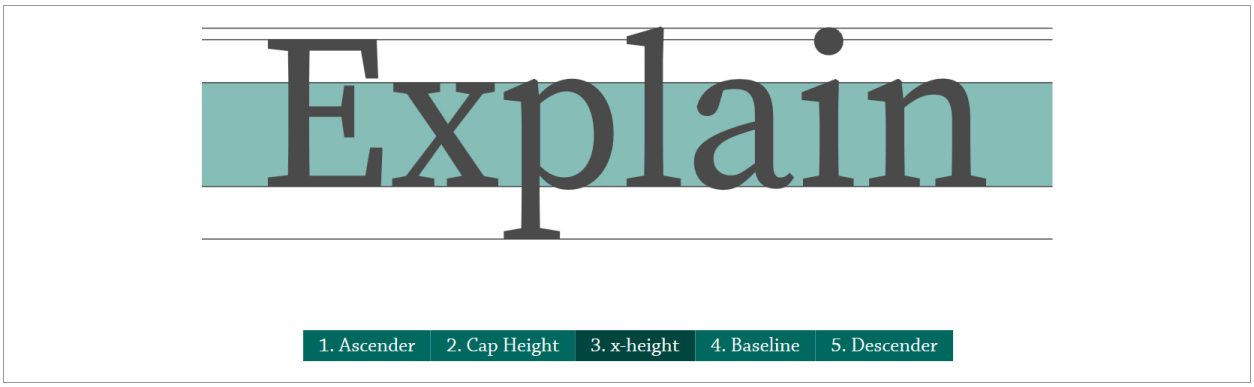


Fig. B20. The five horizontal lines interactive animated SVG, shown with x-height selected.

Anatomy is then divided into five sections: Letters, Strokes, Counter Space, Terminals, and Serifs. Each part is shown using both a serif and sans serif example to illustrate they are global; any part that is specific to a serif or sans-serif is also indicated (see figure B21).

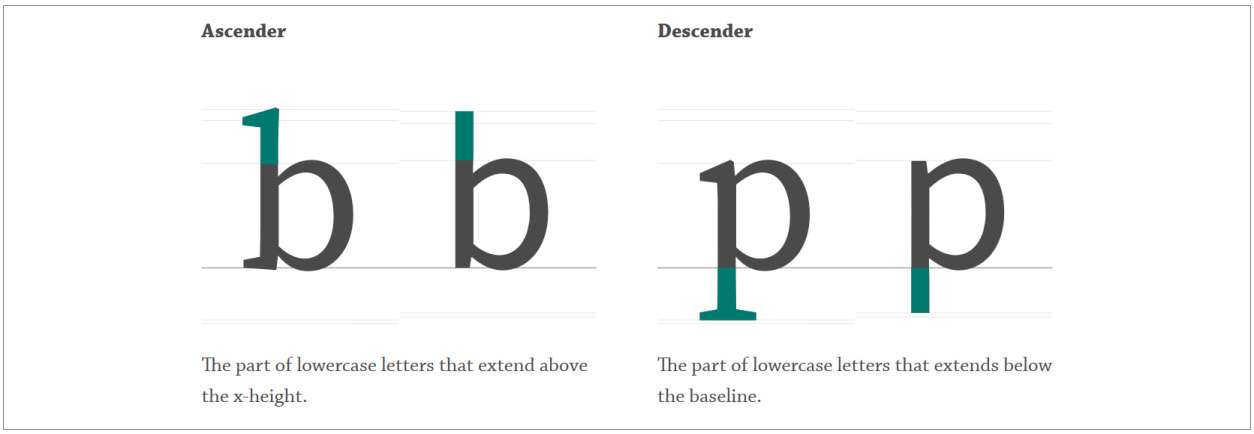


Fig. B21. Anatomy, letters section, ascender and descender.

Lesson 6: Punctuation

Lesson Six covers the proper use of hyphens, dashes, and quotes. The discussion includes how to handle marks in various mediums. For example, both em and en dashes are set flush against letter forms; if they look too cramped it is OK in print and favorable on screen to add a space, or better yet, a thin space before and after the dash. Each mark is shown in a table that included a visual, Windows and Mac shortcut, and the HTML entity to use across media (see fig. B22).

	Name	Windows	Mac	HTML
-	Hyphen	*- key*	*- key*	*- key*
–	en dash	alt 0150	option + hyphen	–
—	em dash	alt 0151	option + shift + hyphen	—
‒	Figure Dash	alt 8210	*glyphs panel*	‒
−	Minus Sign	*glyphs panel*	*glyphs panel*	−

Fig. B22. Hyphens & Dashes table with visual, name and windows, mac and HTML shortcuts.

The chapter concludes with a discussion of fitting punctuation into your workflow by providing a link to *Copy Paste Character*, a website that lets users click a mark to copy and paste it into their document.

Lesson 7: Figures

This lesson covers lining and Old Style figures, tabular or proportional figures, superscript and subscript figures, ordinals, and numerators and denominators. Each variant is shown visually as well as discussed in terms of usage (see fig. B23).

Fig. B23. Old Style figures visual example (live text).

Located at the bottom of the visual examples is the “use online” call-to-action. On selection, a pop-up reveals how to enable it in CSS through the use of OpenType font-embedding (see fig. B23).

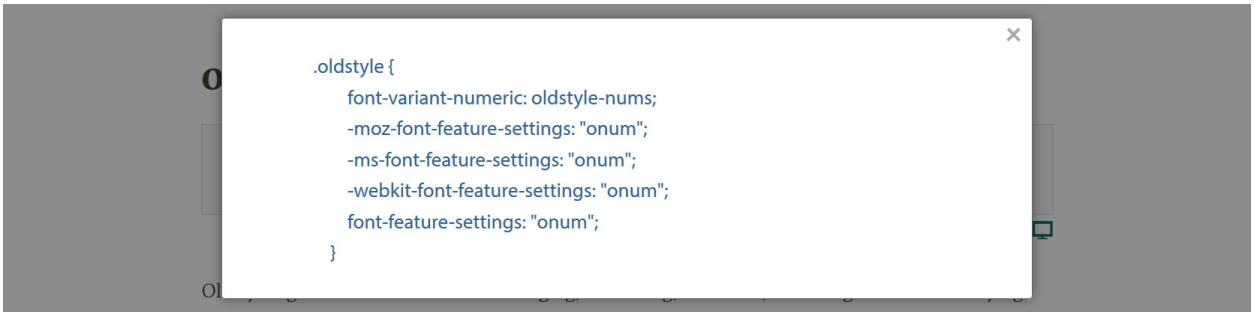


Fig. B24. Use Old Style figures online pop-up overlay.

B.6. Chapter Three: Word

The primary goal or function of typography is to convey a message and make that message accessible. In this chapter students explore how the relationship between multiple characters and the space between them affects the legibility and readability of type.

Lesson 8: Reader Experience

This lesson is currently under development. Reader experience is the meeting of legibility, readability, accessibility, and user experience. In its current state, legibility is introduced as well as methods to test a face such as panograms, text strings, and an interactive app.

Lesson 9: White Space

The importance of white space is explained by examining how we read. We only see a small amount of text at a time—typically only six letters on either side of out focal point or point of fixation. The farther a word is from that point, the fuzzier it appears. We use white space to recognize where each word begins and ends by making a series of sharp subconscious adjustments called *saccades*. This is why the space between words needs to be greater than the space between letters. At the same time, the space can not be too large or our eyes will need to make more *saccades* slowing down the pace of reading. The following lesson covers the word, em, en, thin, hair spaces, non-breaking, and hard spaces.

Lesson:10 Kerning

After learning about the importance of whitespace, the next lesson looks at the adjustment of the space between character pairs, kerning. The lesson starts off at the roots, discussing where the term kern comes from in metal type. Students learn that kerning was difficult in metal type leading to looser spacing than we see today in digital type. Kerning was placed in Chapter Four, Word, because generally, it is something we do to display type. After introducing the general

rules, the internal spacing of a font, sidebearings, are discussed. After establishing the interstices of kerning, students learn that kerning is difficult and impractical in long text. Therefore, when selecting a text font you need a typeface with good internal spacing. Students learn how to test a face for spacing using an interactive application of Emil Ruder's spacing test (see fig. B25).

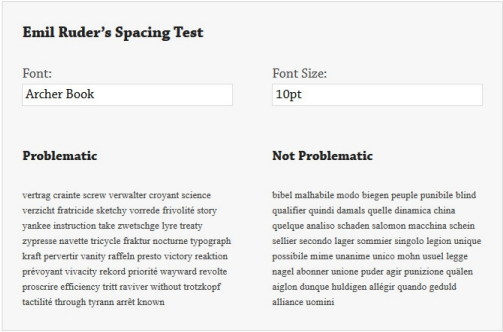


Fig. B25. Emil Ruder's Spacing Test in Kerning Lesson. Shown testing Archer Book, the app allows users to test any font on their system.

Students then learn the units of kerning, 1/1000 of an em, so a kerning value of 15 means an increase of 0.015em. This allows for a complete understanding of kerning values across desktop and interactive publishing software. Kerning in groups and problematic pairs are then covered before students finally learn to kern a line of text (see fig. B26).

Fig. B26. Step-by-step kerning of the phrase “MANY YAWN AT MY LAWN”.

Students learn to spot problems by blurring their eyes and turning the type upside down and the importance of consistent kerning. Lastly, kerning on the Web is discussed by providing an example of the kerning applied to the TotallyType logo. Students learn just how impractical kerning is on the Web by looking at the code and span tags needed to achieve the logo type (see fig. B27).

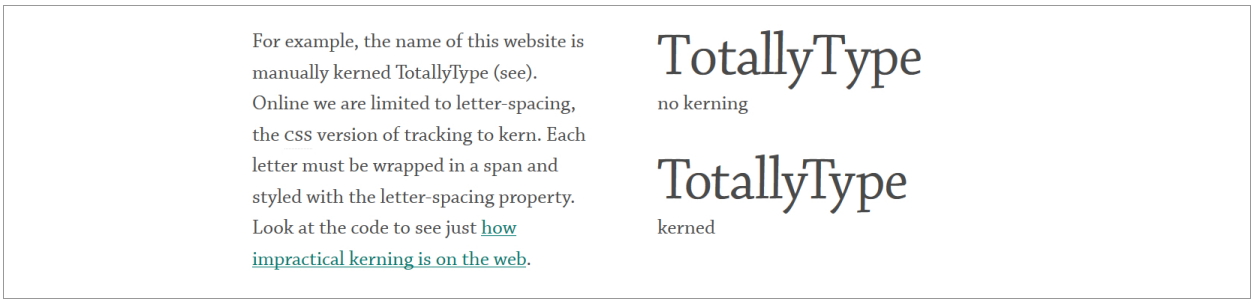


Fig. B27. TotallyType logotype kerning on the Web.

B.7. Chapter 4: Text

In this chapter, students learn to set running text by exploring the relationship between words, sentences, blocks, and the page. The lessons also cover font selection and pairing, emphasis, and working with reversed type.

Lesson 11: Selecting & Mixing Typefaces

The selecting a mixing typefaces lesson is an experimental interactive application rather than a text-based lesson. The app allows the user to compare any two text faces installed on their system that they may be considering for print or screen use. The application takes users through eight steps to select a text face and pair it with a display face.

Step 1: Body size comparison.

Students learn that two fonts at the same size can have vastly different visual sizes. If we recall back to the the Measuring Type lesson, in the days of metal type, point size referred to the size of the metal block—not the impression. This carried over to digital type where point size refers to the size of the bounding box—not the letters. When you set a type size, the bounding box is scaled. Some fonts occupy more of the *bounding box* than others. For this reason, you must rely on your eyes to gauge just how big or small a font is (see fig. B28).

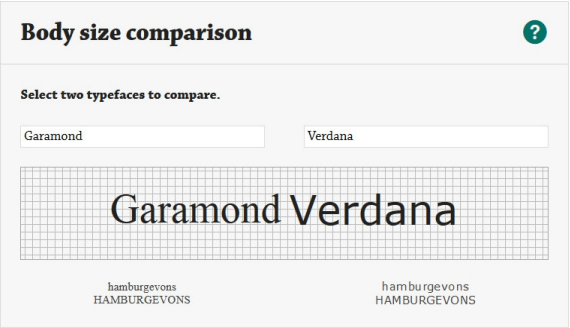


Fig. B28. Step one, body size comparison.

Step 2: x-height comparison.

Students learn how important x-height is to legibility, readability, and the visual size of text. The test helps users compare x-heights and teaches the relationship between x-height, font size, and line-spacing (see fig. B29).

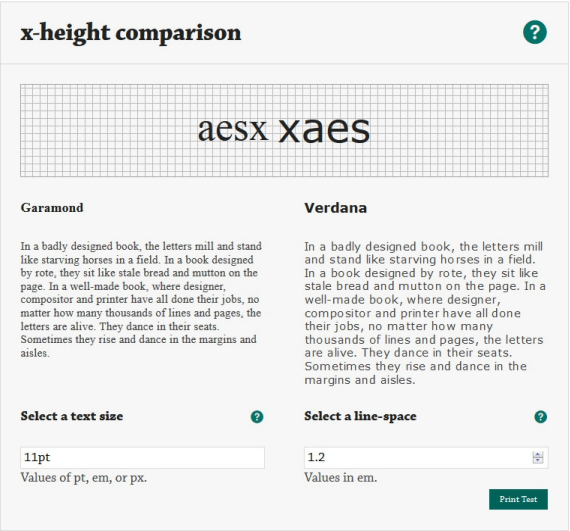


Fig. B29. Step 2: x-height comparison.

Each test has one or more help icons that can be selected to reveal instructions. Each set of instructions cover what to look for in both print and screen based media and/or how set an appropriate value for each medium (see fig. B30).

Fig. B30. Step 2: x-height comparison, instruction overlay.

Students also learn that type must be evaluated in context. Unless you are selecting a face for screen use, it is imperative that you print each test to accurately evaluate the type. The print button located in the bottom right of each test allows a user to print one test at a time allowing the application to apply to both screen and print mediums (see fig. B31).

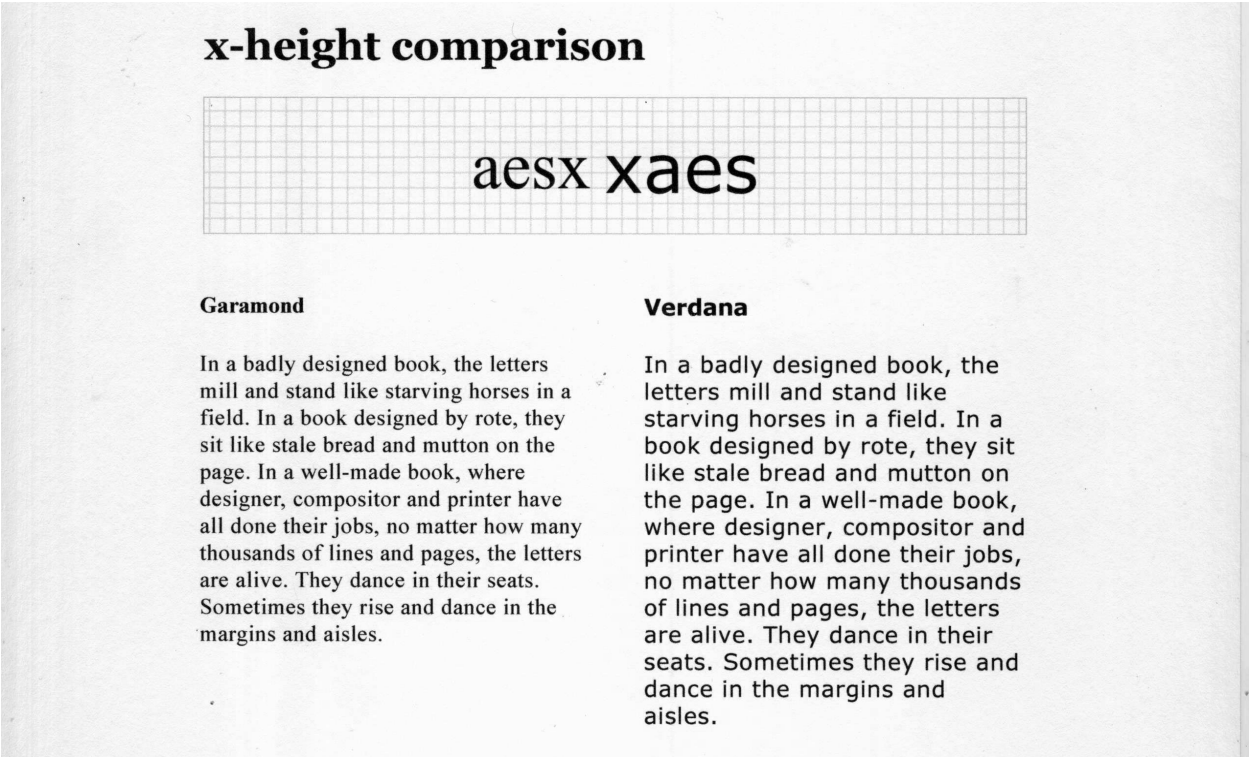


Fig. B31. Step 2: Printed x-height comparison.

Step 3: Legibility test.

Students learn that one of the single most important legibility features of a text font is character distinguishability. This test helps users make sure that each character is easily distinguishable at their intended font size. Over the years, I developed the following character distinguishably test that evaluates a typeface by looking at comely confused characters like *!*, *I*, *i*, *l*, and the numeral *1*, weight contrast, counters, ascenders and descenders, numerals, the lowercase *a*, and the roman and italic relationship (see fig. B32).

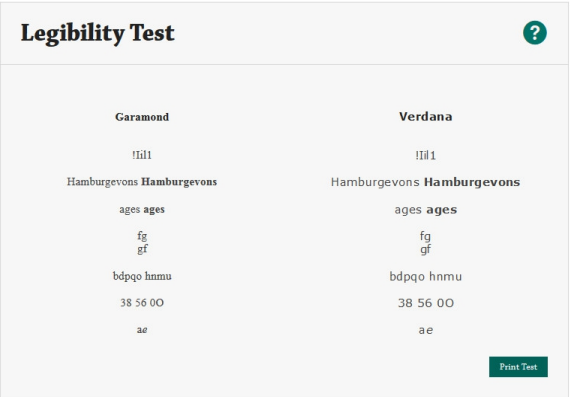


Fig. B32. Step3: Legibility Test.

Step 4: Space and Color Test.

Students learn how to test a face for good internal spacing using Emil Ruder's spacing test while simultaneously learning how to track text (see fig. B33).

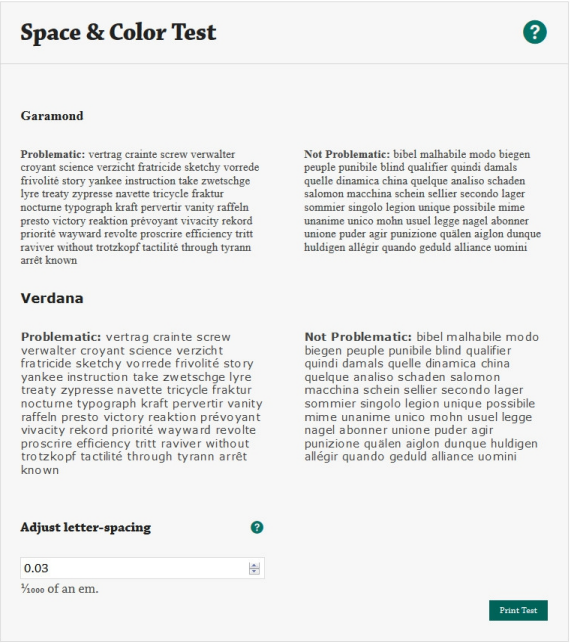


Fig. B33. Step 4: Space & Color Test.

Step 5: Color and Contrast Test

Though the use of a color picker, students can pick a foreground and background color to test their type in context. The colors are evaluated for a compliant contrast ratio using WCAG 2.0 Level AA and Level AAA standards. Users are notified if their color selection passes a level at both text and display sizes (see fig. B34).

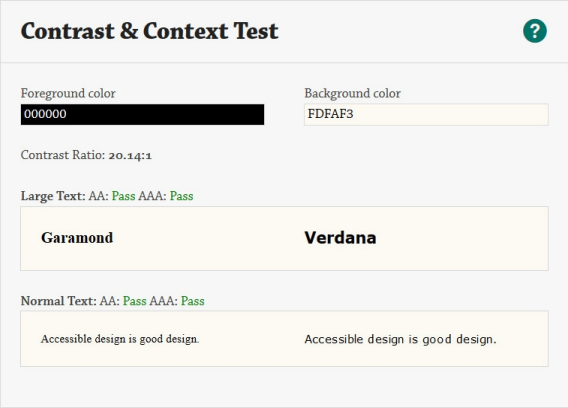


Fig. B34. Step 5: Color & Contrast Test.

Step 6: Selecting a text font.

By now the user should have a good idea which font is best for his or her usage. Users are then asked to select which font they would like to continue with (see fig. B35).

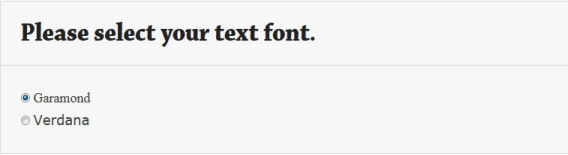


Fig. B35. Step 6: Text font selection.

Step 7: Pairing the text face with a display face.

In this step users are guided through pairing their selected text face with a display face for headings by matching the x-heights as closely as possible (see fig. B36).

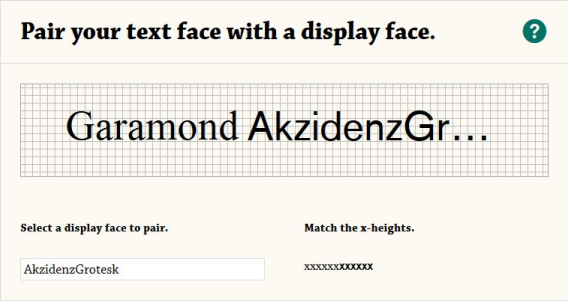


Fig. B36. Step 7: Pairing the text font with a display face.

Step 8: The final test and specimen

Users get to see all their choices in action on the first page of Moby Dick. All settings are listed in the right column; this panel can then be printed for their records (see fig. B37).

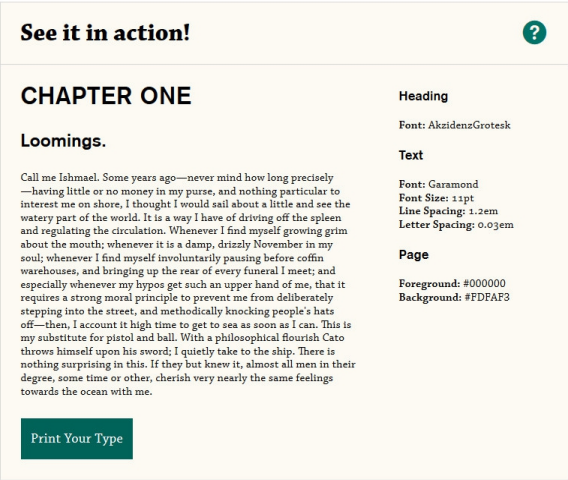


Fig. B37. Step 8: Final test and specimen.

Step 9: Whats next?

With both a text and display face selected and a base size for text, users are introduced to modular scales to establish rhythm and hierarchy (see fig. B38).

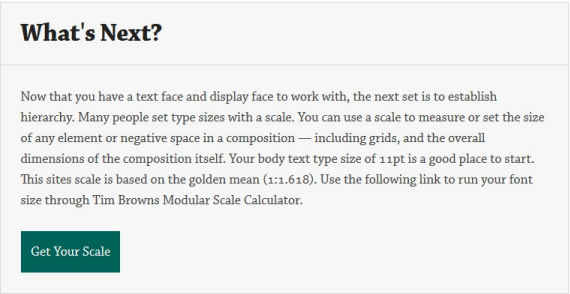


Fig. B38. Step 9: Conclusion and introduction to modular scales.

Clicking on “Get Your Scale” forwards the users settings to Tim Brown's Modular Scale Calculator preset to the golden ratio (see fig. B39).

Fig. B39. Step 9: Settings forwarded to Tim Browns Modular Scale Calculator

Lesson 12: Size & Measure

In this lesson, body text in print and on screens is explored in terms of size. By introducing size as an element relative to proximity, or how close a reader is to the type, students learn to handle text size in multiple media. This knowledge applies to all type including logotype, poster, signage, etc. This knowledge is then used to define measure. By looking at the science of reading, how we read in groups of 2–4 words at a time, the ideal measure if identified and supported.

Lesson 13: Line Spacing

Building off the Units, Anatomy, Size & Measure and Selecting & Mixing Typefaces lessons, line-spacing is explained as an element relative to text size, measure, and a typefaces x-height and stroke weight. The lesson starts off with the core rules of line-spacing, followed by some global tips. Rules are explained, visualized, and demonstrated as they interact with the text to see the results of changing the line-space (see fig. B40).

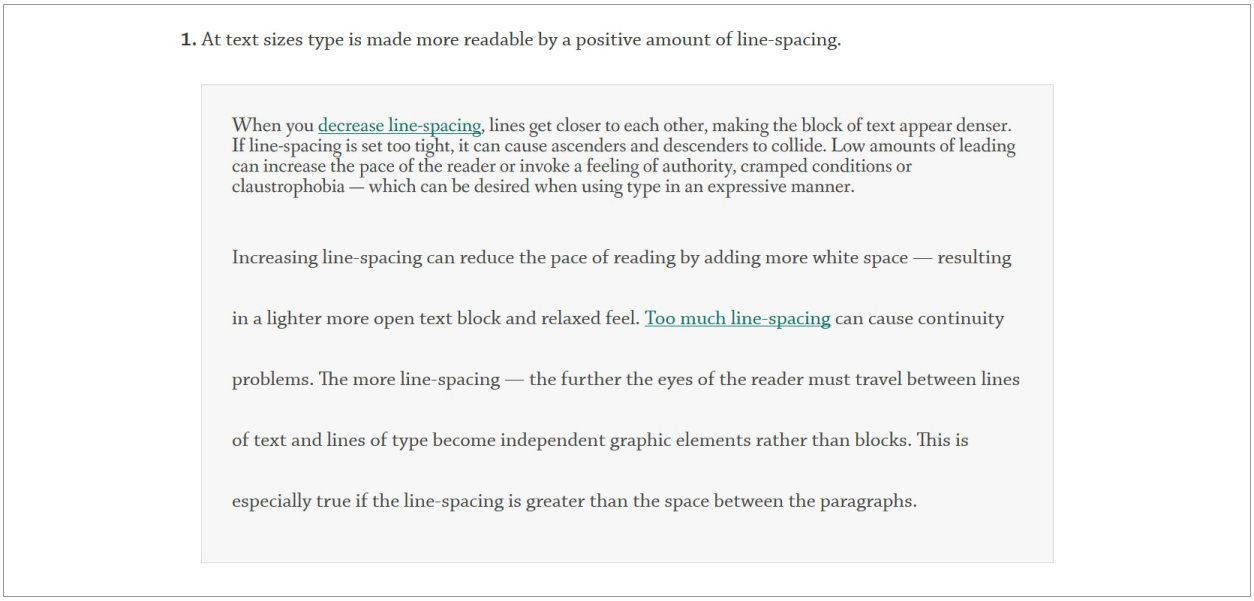


Fig. B40. Line-spacing, core rule #1, shown with in-text demonstrations toggled.

Line-spacing is then split into leading (print) and line-height (Web), both are placed in a historical context and defined before exploring modern application (see fig. B41).

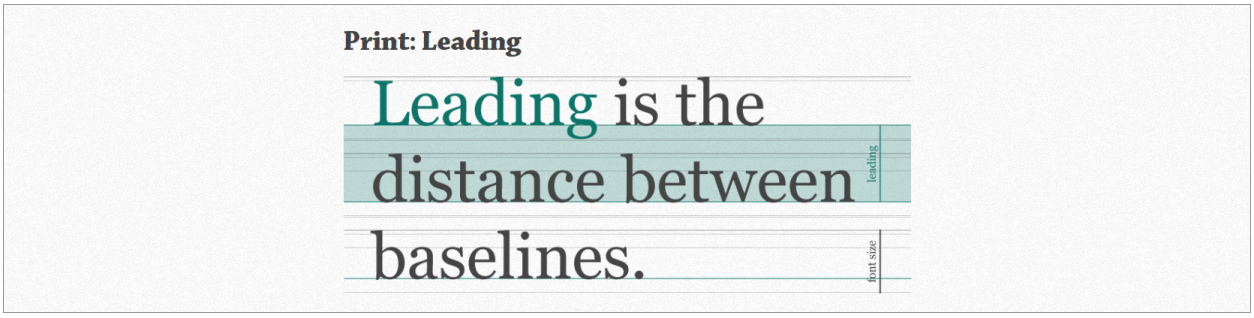


Fig. B41. Visual showing how leading is measured.

In each medium, students see how the core rules change or do not change across mediums. Students learn that a face with a taller x-height or thicker strokes requires more line spacing and that line spacing also increases with measure and text size which is relative to proximity, how close the reader is from the medium and resolution, how clear the forms will render. Students also learn that each medium has certain environmental properties and requirements: for example, stroke weight should be slightly heavier on screen to prevent light bleeding into the thin strokes and that decision is dependent on pixel density. With this knowledge, students can understand how a taller x-height helps text appear bigger, opens counters, and gives a typeface more pixels to work with on screen. Whereas in print, we typically want a more moderate stroke weight to prevent ink pooling and a medium x-height to brighten the page. Understanding the uniqueness of each medium helps students set an appropriate line-space across mediums.

Lesson 14: Alignment

This lesson combines block alignment, justification, rags, widows, orphans, hanging punctuation, and optical alignment. Each alignment is explained through a visual example accompanied by rules and best practices. Methods for hanging punctuation are covered for both print and web.

Lesson 15: Indentation

This lesson covers the building of blocks by exploring paragraph formatting, indents, drop caps, small capitals, and initials in both print and screen environments.

Lesson 16: Emphasis

In lesson fifteen, students learn that emphasis is the exaggeration of words in a text by using a different style from the rest of the text—to emphasize them. Bold and italics are contrasted against Roman text. Students learn when and when not to use bold and italic text. Students learn the core rules including alternatives such as small capitals, all caps, and semi-bold. Emphasis in HTML is discussed in terms of visual and semantic emphasis. The lesson concludes with secondary emphasis such as underlining and hypertext.

Lesson 17: Reversed Type

Reversed type is explored by first looking at the contrast needed between the foreground and background for legibility. Typefaces are explained as being designed for black text and a white background and changing that contrast has a strong effect. First, the global rules such as avoiding italics, are explored before looking at the challenges of using reversed type in print and on screen (see fig. B42).

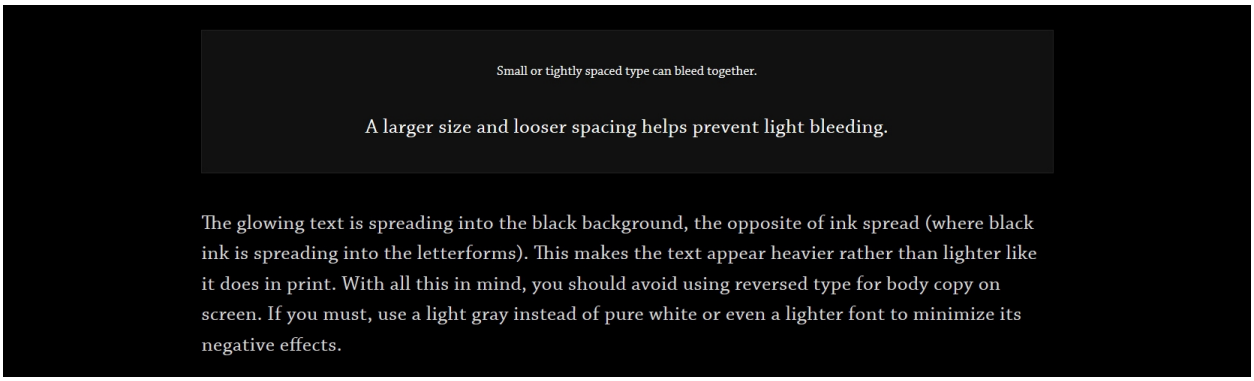


Fig. B42. Reversed type, screen section visual example of a rule.

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