



Data and Information Visualization: Typography & Data Visualization Design

Semester 2 2018/2019

Created By: Jeffrey A. Shaffer
(Modified slightly for Data and Information Viz)





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Goals

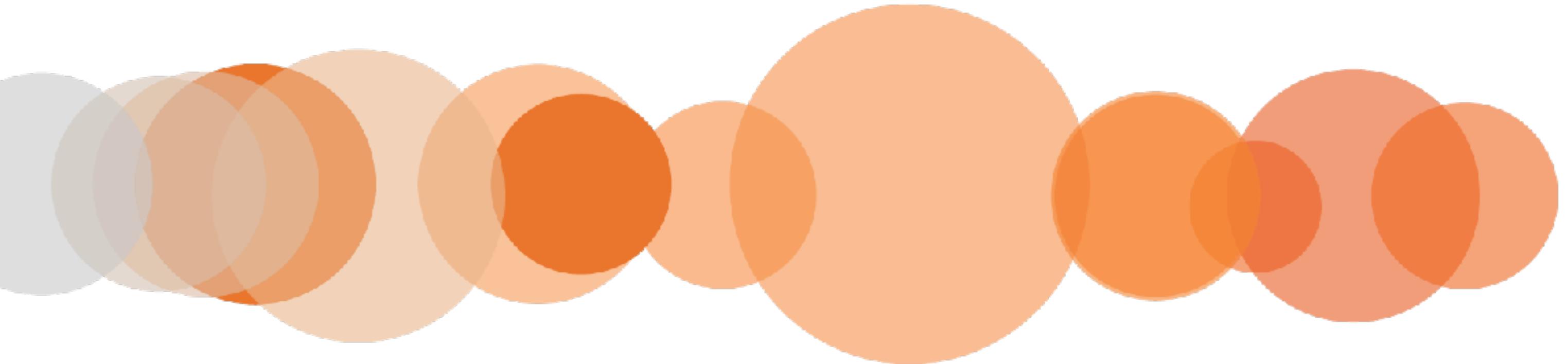
By completing the course modules, students will:

- Understand the fundamentals of typography and graphics
- Explore the use of font and its effect on emotion
- Learn how typography is used in data visualization.



Typography & Data Visualization Design

Who gives a *font*



Sennas
HALLOWEEN



FLICKER FRIGHT LIGHTS

50 Purple Lights



16.3 Ft. Lighted length (4.96 m)
Indoor/Outdoor Use • Connects End-to-End



Specially Designed Purple
Candles & Flickering Fun Effect

Ironic Sans

February 19, 2008

Idea: A new typography term

keming. *noun.* The result of improper kerning.

keming. (kĕm'!-ĭng).

n. The result of
improper kerning.



What is Typography?

- Typography - the art and technique of arranging type to make written language:
 - Legible
 - Readable
 - and appealing when displayed.
- Designing and arranging letters and characters.

The arrangement of type includes:

- Adjusting the space between pairs of letters
- Selecting
 - Points sizes
 - Leading
 - Line lengths
 - Letter spacing



Point Size

- A font is typically measured in **pt (points)**.
- Points dictate the height of the lettering.
- There are approximately 72 (72.272) points in one inch or 2.54 cm.
- For example, the font size 72 would be about one inch tall, and 36 would be about a half of an inch.

6 pt
8 pt
9 pt
10 pt
11 pt
12 pt
14 pt
18 pt

24 pt

30 pt

36 pt

48 pt

60 pt

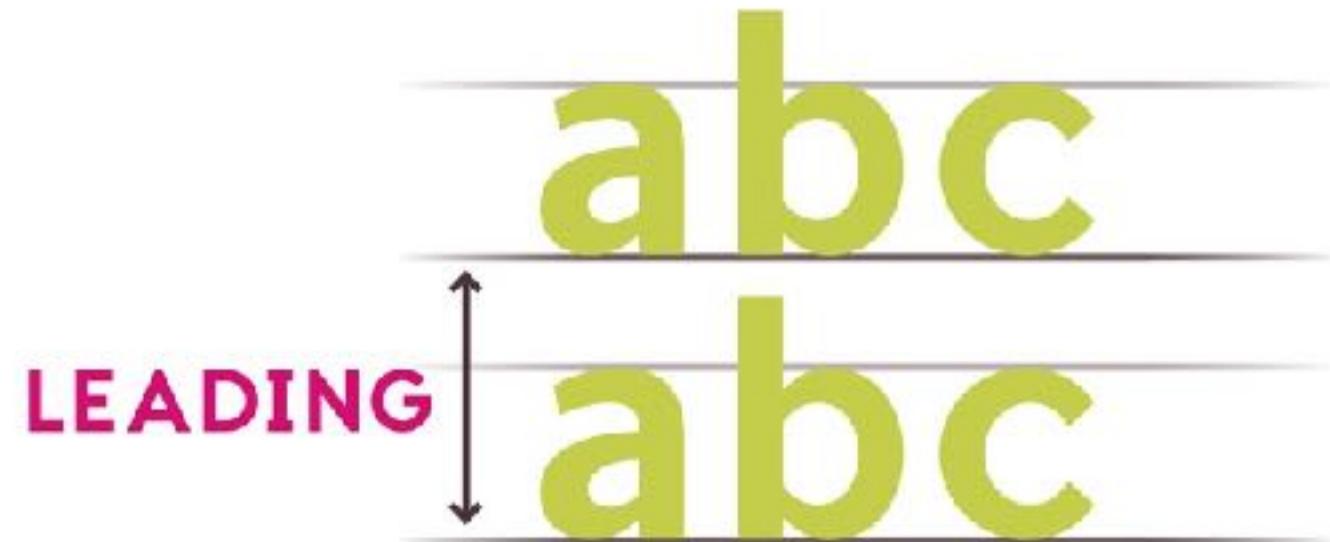
72 pt

84 pt

Leading

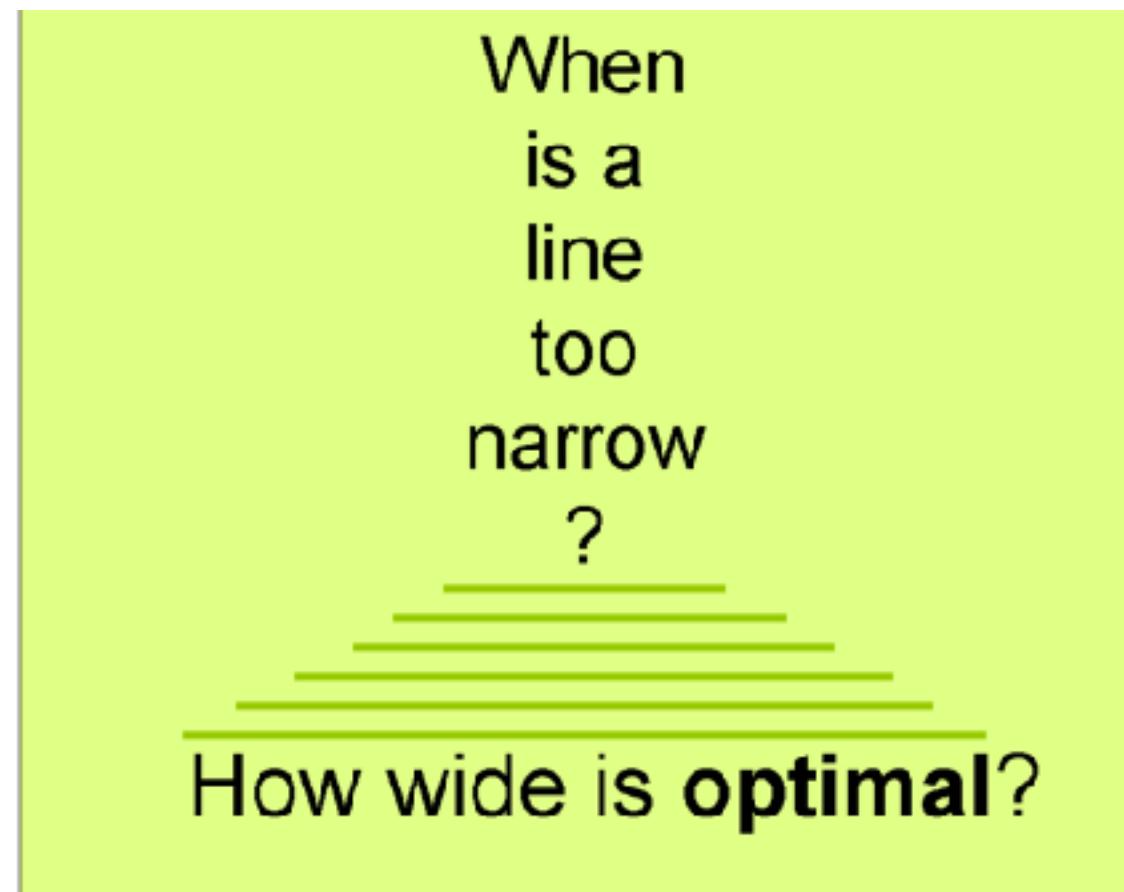
Leading is a typography term that describes the distance between each line of text.

It is pronounced *ledding* (like "sledding" without the "s").



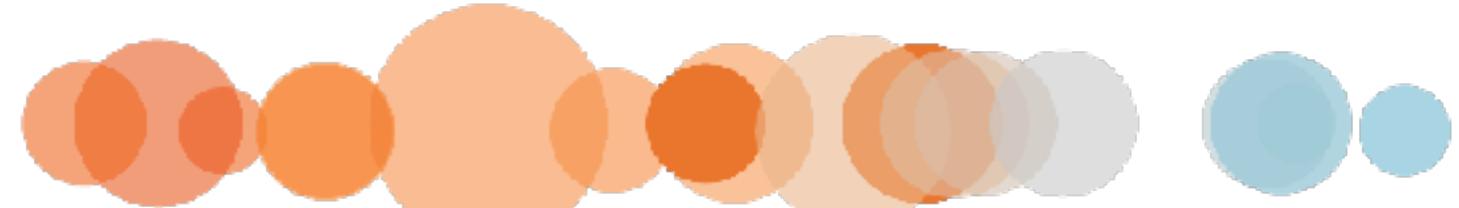
Line Length

The distance between the left and right edges of a text block.



Letter Spacing

- **letter-spacing**, also called tracking, refers to the amount of **space between** a group of **letters** to affect density in a line or block of text.
- **Letter-spacing** can be confused with kerning.
- **Letter-spacing** refers to the overall **spacing** of a word or block of text affecting its overall density and texture.



Why is it important?

Typography is **everywhere**.

- Phones
- Computers
- Billboards
- Social Media
- Newspapers
- Advertisements



Even your Chipotle has aspects of typography that makes it more appealing to the consumer.

Recent Examples of Typography

- September 2015 – Google famously changes its logo to a san-serif type making it easier to scale. This slight change caused a social media uproar.
- June 2016 – Facebook changes its typeface from Helvetica to Geneva. The difference was noticeable even though Geneva is only slightly thinner and lighter.
- January 2017 – Apple changes its website and iOS 9 operating system from Helvetica Neue to a new typeface they created, called San Francisco, to increase the design appeal.

Google

Google

Geneva
Helvetica

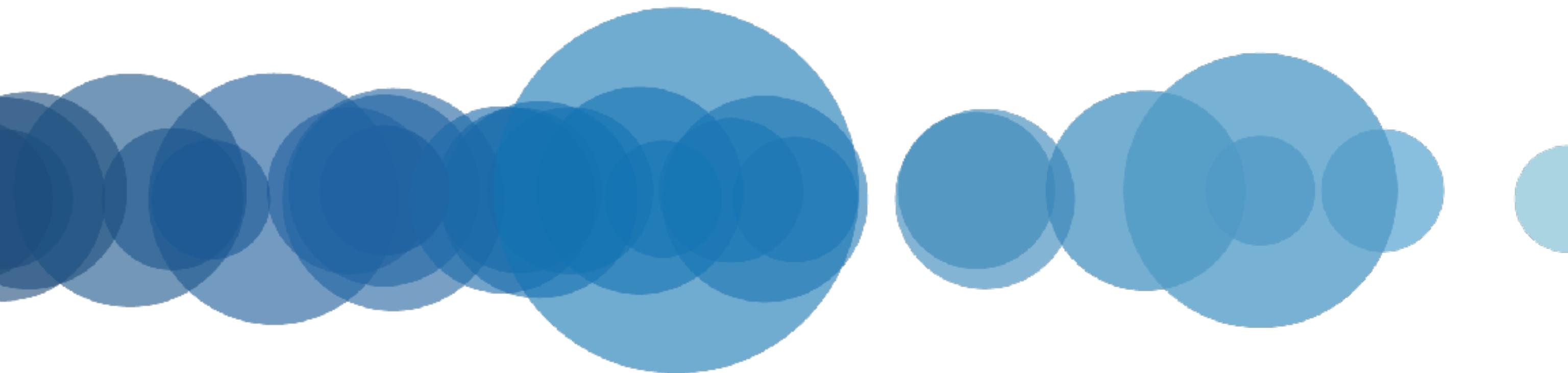
iOS 9

iOS 9

“If I had never dropped in on that single course in college, the Mac would have never had multiple typefaces or proportionally spaced fonts.”

- Steve Jobs

Typeface vs. Font



Typeface vs. Fonts [A Song vs. an MP3]

These two words are commonly used interchangeably, but they have two very separate meanings.

- **Typeface** is used when describing the what you see. It is an abstract way of describing the way a specific collection of letters or characters looks or feels.

“This **typeface** really pulls the whole design together” [A Song]

- **Font** describes the physical embodiment or tangible representation of the collection of letters and characters.

“You should change the **font** size to 14pt so it fits in the box” [an MP3]



Example using Garamond Typeface

Agnóstick
garamond

Agnóstick
Garamond 3

Agnóstick
adobe garamond pro

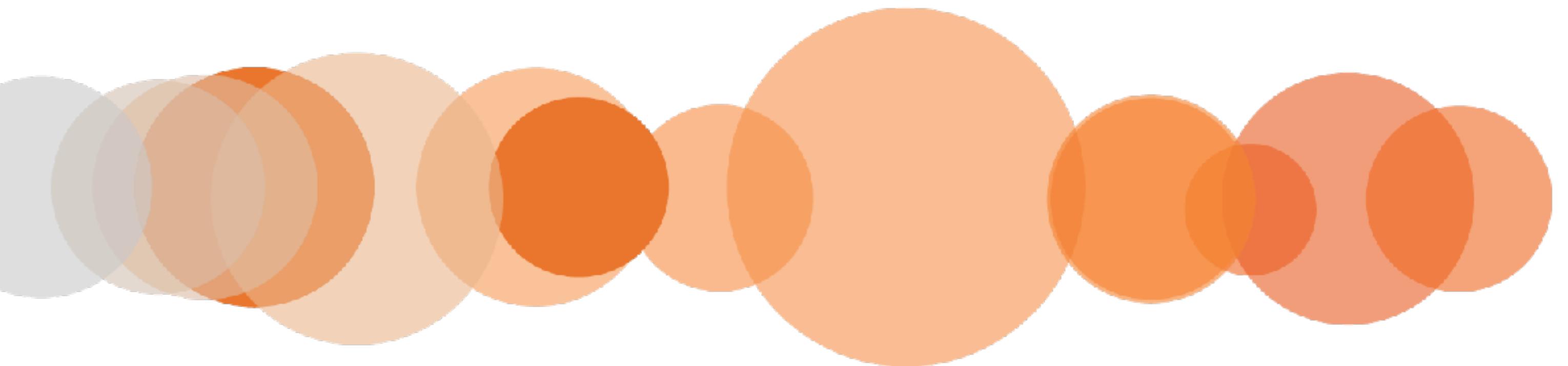
Agnóstick
Garamond BE

Agnóstick
granjon

Agnóstick
ITC Garamond

These are all the **same typeface** – Garamond, but each one of these is a **different font**.

Serif vs. Sans-Serif



The Anatomy of a Typeface



The Basics of Type Classification

serif

Old Style (Adobe Jenson)
Transitional (Times New Roman)
Modern (Dido)
Slab-serif (American Typewriter)

sans-serif

Grotesque (News Gothic)
Neo-Grotesque (Helvetica)
Humanist (Gill Sans)
Geometric (Futura)



Calibri 32 Point

Arial 32 Point

sans serif

Verdana 32 Point

Tahoma 32 Point

Garamond 32 Point

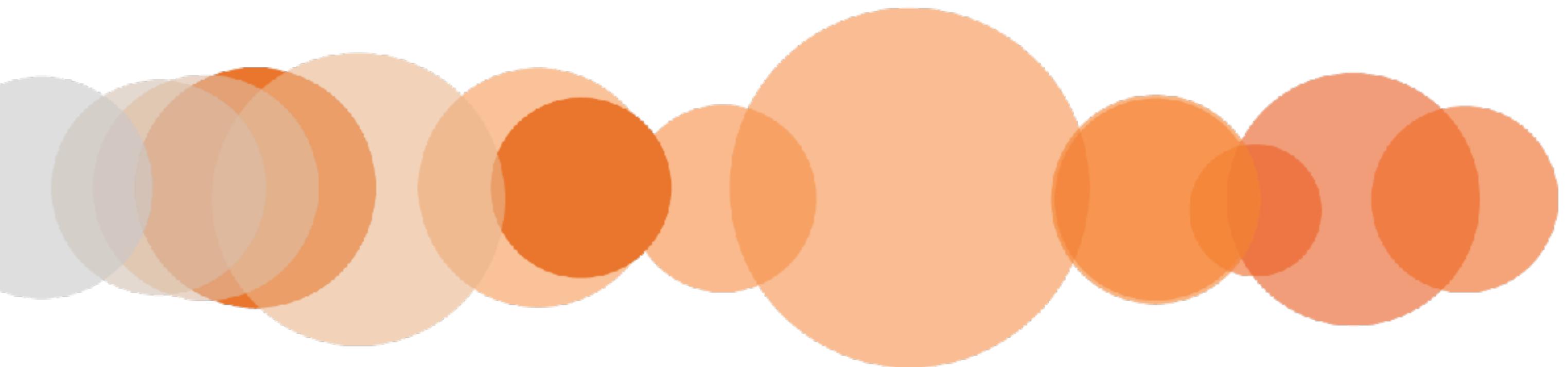
Courier New 32 Point

serif

Georgia 32 Point

Times New Roman 32 Point

Anatomy of a Typeface



The Anatomy of a Typeface



Adapted from A Crash Course in Typography: The Basics of Type

Source: <https://www.noupe.com/essentials/icons-fonts/a-crash-course-in-typography-the-basics-of-type.html>

Cap height: The distance from the baseline to the top of the capital letter.

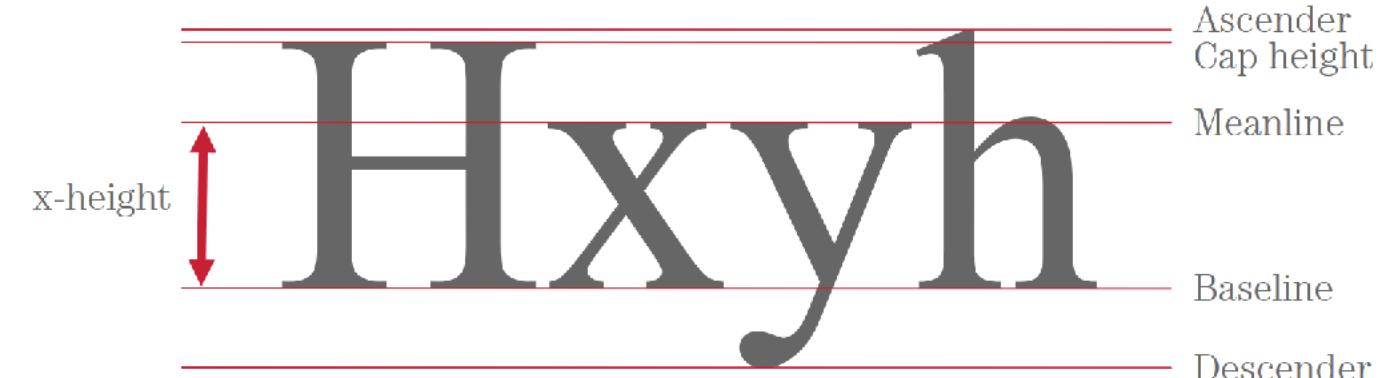
Meanline: the line that fits most of the lowercase letters. This is known as the x-height, which is the height of the lowercase x.

X-height: Is the distance between the baseline and the meanline, it's the height of the body of the lowercase letter, for example, the lowercase letter x (hence the name).

Baseline: The line where the letters sit.

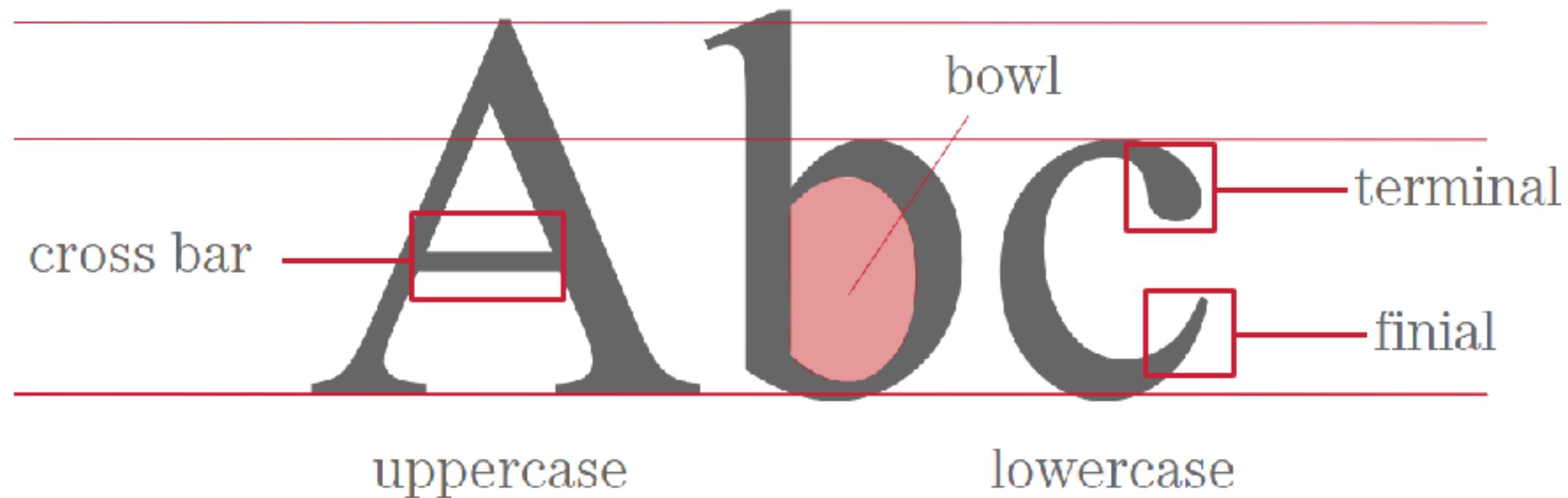
Ascender: The portion of a letter that extends above the meanline of a font

-- i.e., is taller than the font's x-height. (In this case, you'll also notice the letter 'h' is actually taller than the x-height.)



Descender: The longest point on a letter

The Anatomy of a Typeface

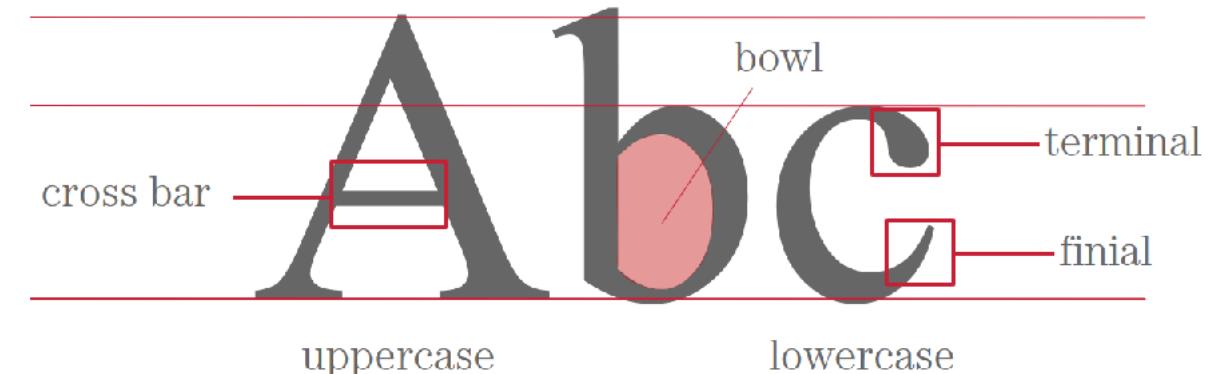


Cross bar: The bar that goes across the inside of the letter and connects one side to another

Bowl: The curved part of the character that encloses the circular or curved parts of some letters, like 'd,' 'b,' 'o,' 'D,' and 'B.' (In this case, it's that round shape of the letter 'b')

Finial: The tapered end of letters such as 'e' or 'c.'

Terminal: A type of curve that you see at the top of the letter 'f' or the end of the letter 'j.'



The Anatomy of a Typeface



ff̄i

character combo



ffi

ligature



st

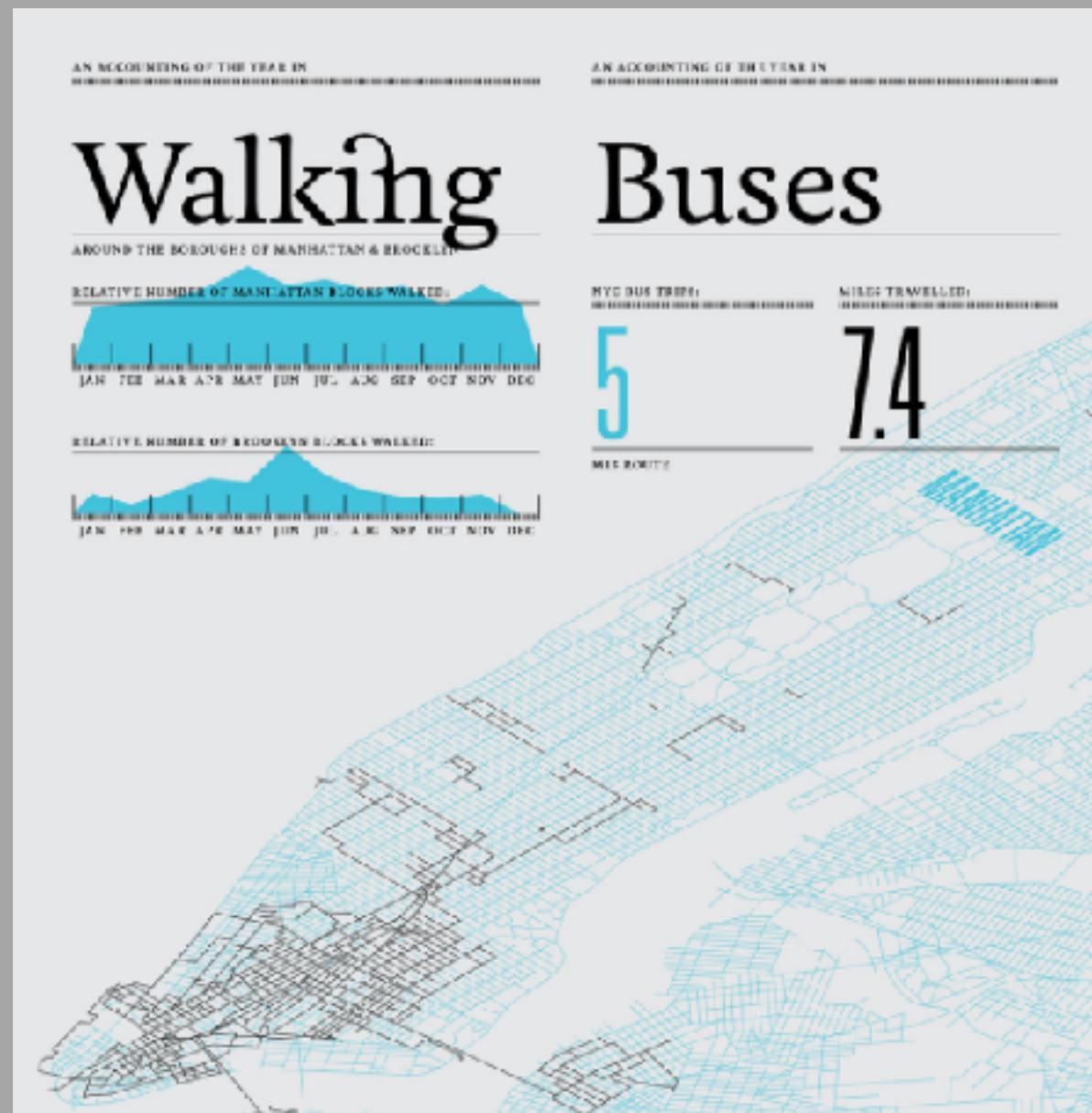


ſt

ligature: two or more letters are joined as a single glyph. This is seen too often in web or even print, but it can create beautiful looks and in some cases increase readability.

2007 Feltron Report

<http://feltron.com>



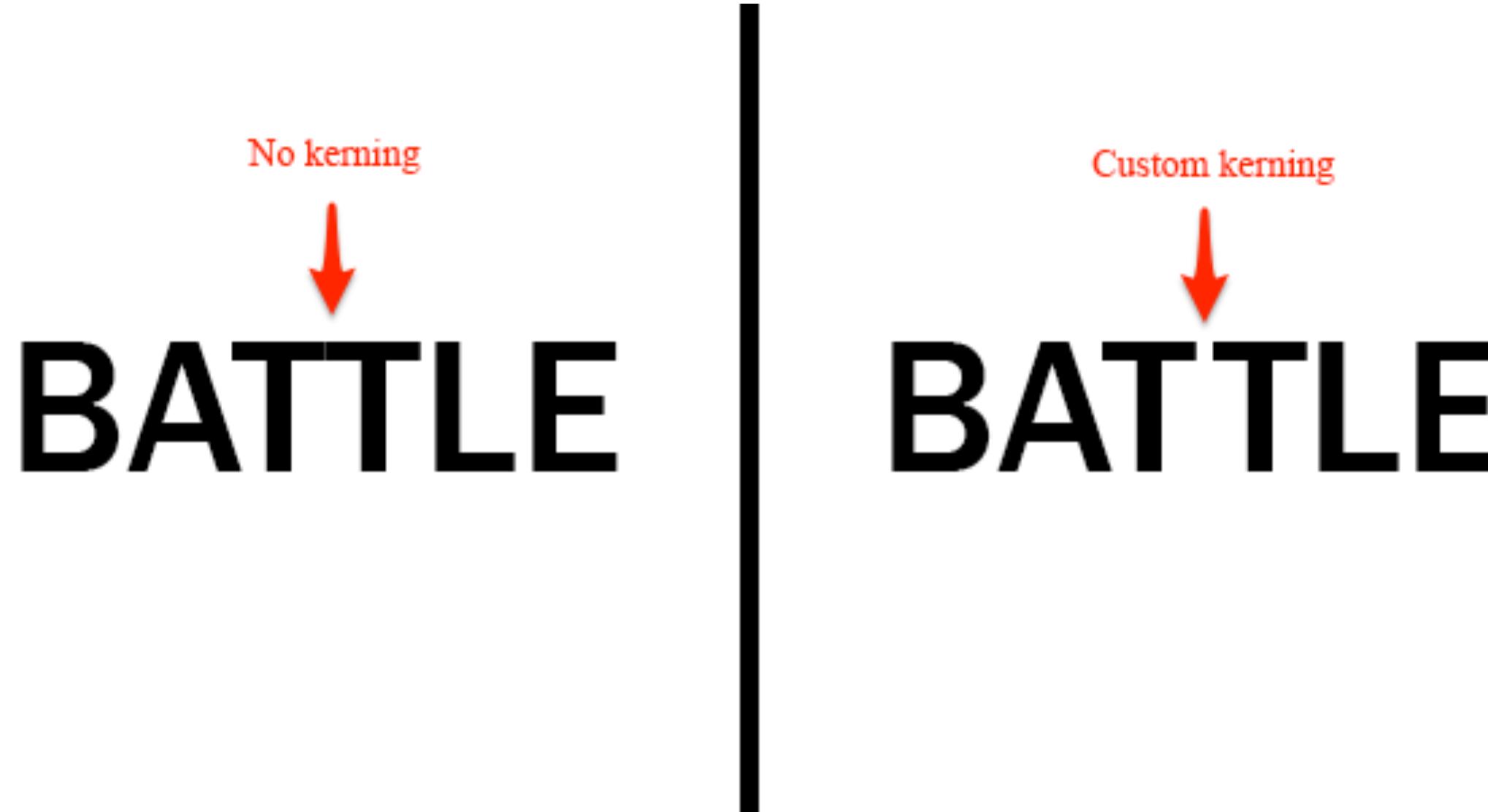
AN ACCOUNTING OF THE YEAR IN

Drinking

AN ACCOUNTING OF THE YEAR IN

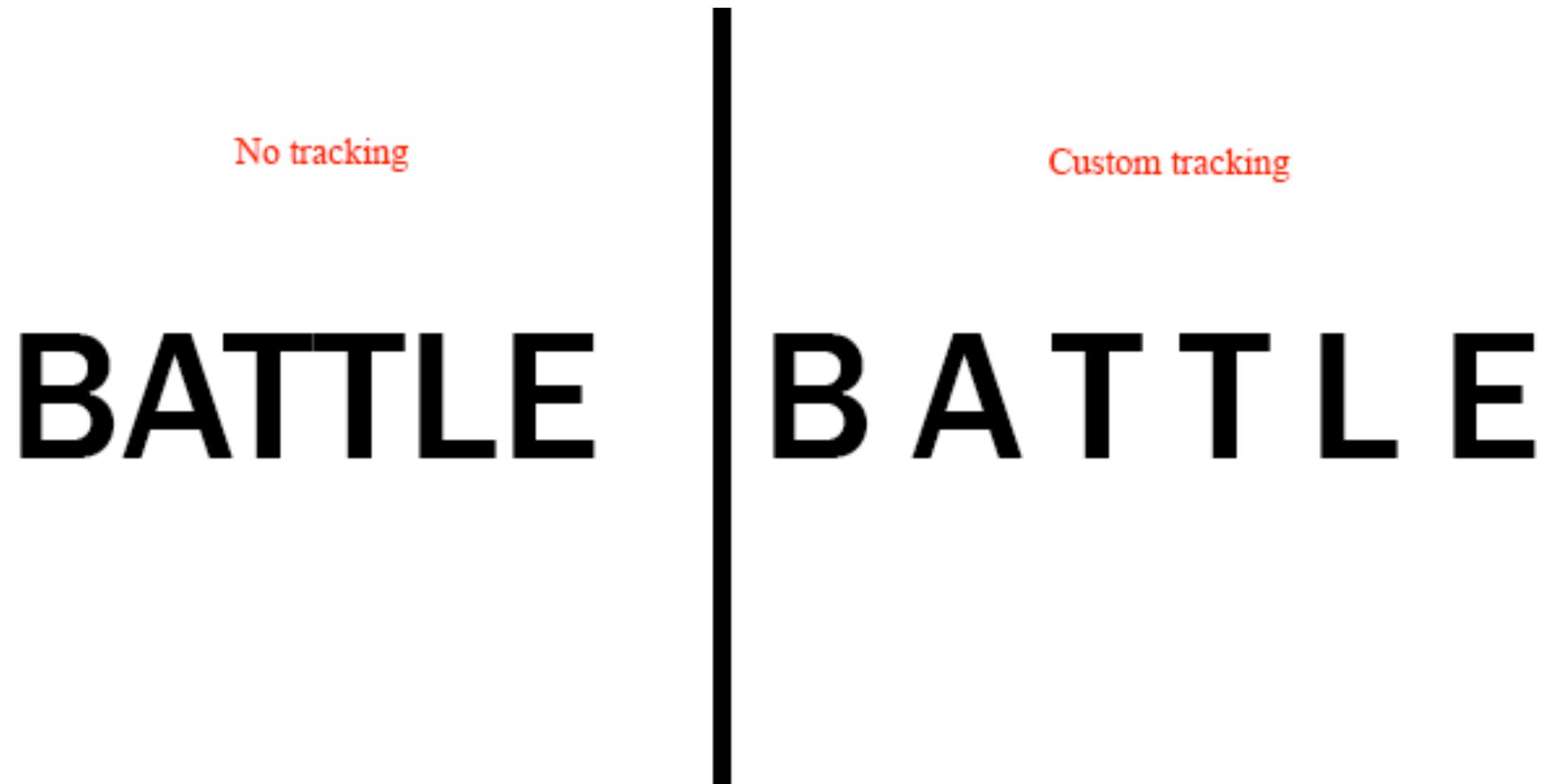
Dining

The Anatomy of a Typeface



Kerning is the modification of the space between two letters.

The Anatomy of a Typeface



Tracking is very similar to Kerning however tracking adjusts the space between all letters to distribute them evenly rather than altering two letters.

The Anatomy of a Typeface

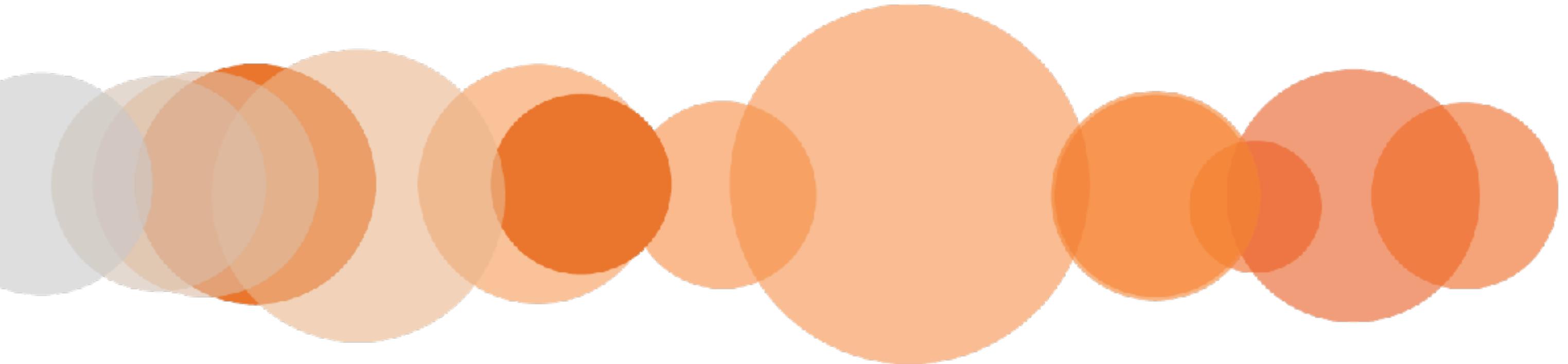
Remember when teachers would ask you to double-space your essays in school? Well, the terms “single-space” and “double-space” are actually referring to leading, which is the distance between the baselines.

12pt leading

Remember when teachers would ask you to double-space your essays in school? Well, the terms “single-space” and “double-space” are actually referring to leading, which is the distance between the baselines.

30pt leading

Does Typography Connote Emotion?



I Love You.

I Love You.

I Love You.

I Love You.

I Love You.

I Love You.

I Love You.

I Love You.

I Love You.

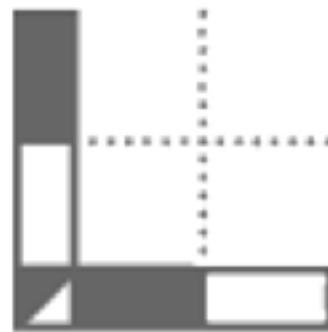
i L o e
v u

I Love You.

I Love You!

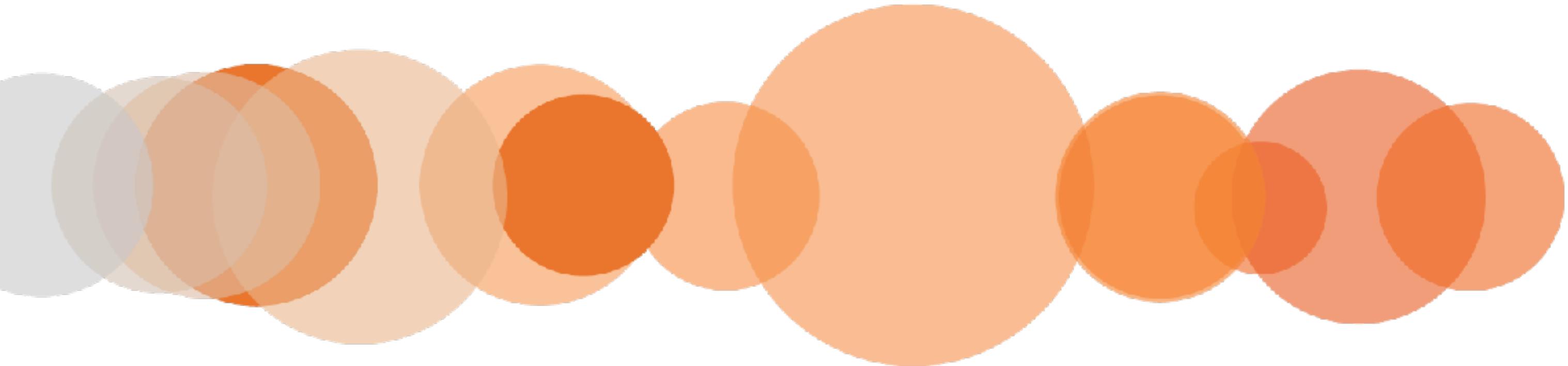
I Λοωε Ψου.

I Love You.



Perception of Fonts

Perceived Personality Traits and Uses



A Research Study in 2006

[Home](#) > [Usability News](#) : Perception of Fonts: Perceived Personality Traits and Uses

Posted on February 14, 2006 by [SURL](#)

Perception of Fonts: Perceived Personality Traits and Uses

By A. D. Shaikh, B. S. Chaparro, & D. Fox

Summary: This study sought to determine if certain personalities and uses are associated with various fonts. Using an online survey, participants rated the personality of 20 fonts using 15 adjective pairs. In addition, participants viewed the same 20 fonts and selected which uses were most appropriate. Results suggested that personality traits are indeed attributed to fonts based on their design family (Serif, Sans Serif, Modern, Monospace, Script/Funny) and are associated with appropriate uses. Implications of these results to the design of online materials and websites are discussed.

INTRODUCTION

Often credited with creating first impressions, fonts are typically classified according to unique typographical features (serif, sans serif, etc) and overall appearance. The combination of appearance and typographical features often lead graphic artists and typographers to describe typefaces using personality traits ("less cuddly, more assertive," Berry, 2001). In a BBC audio program (Peacock, 2005), fonts were depicted as feminine and masculine, among other traits. Feminine fonts were described as fine, serifed, sleek, and elegant, masculine fonts were characterized as being blocky and bold.

Emotions and Personalities associated with different fonts.

serif fonts – “stable”, “practical” and “mature”

sans serif – not positive or negative

script – “feminine”

Modern fonts – “assertive” and “coarse”



— THE —
P S Y C H O L O G Y
BEHIND TYPE CHOICES

EACH FONT TYPE YOU USE FOR YOUR BUSINESS EVOKEES DIFFERENT EMOTIONS.

Get the emotions you want people to feel when you select the right logo font.

SERIF

Tradition

FRIENDLY
RESPECTABLE
Reliable *Comfort*

SANS SERIF

Stability

INNOVATIVE BASED
OBJECTIVE
Clean *Modern*

SCRIPT

Elegance

AFFECTIONATE
CONNECTION

Creativity

UNIQUE
INDIVIDUALITY

MODERN

STRONG

PROGRESSIVE
100% *SMART* *GOALS*
Stylish *Chic*

DISPLAY

Friendly

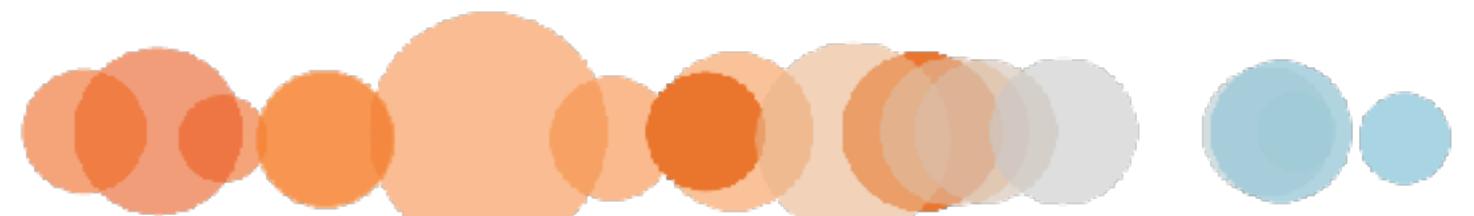
EXPRESSIVE
unique
CHARACTER
Amusing



Top Three Fonts

Stable	TNR	Arial	Cambria
Flexible	Kristen	Gigi	Rago Italic
Conformist	Courier New	TNR	Arial
Polite	Monotype Corsiva	TNR	Cambria
Mature	TNR	Courier New	Cambria
Formal	TNR	Monotype Corsiva	Georgia
Assertive	Impact	Rockwell Xbold	Georgia
Practical	Georgia	TNR	Cambria
Creative	Gigi	Kristen	Rago Italic
Happy	Kristen	Gigi	Comic Sans
Exciting	Gigi	Kristen	Rago Italic
Attractive	Monotype Corsiva	Rago Italic	Gigi
Elegant	Monotype Corsiva	Rago Italic	Gigi
Cuddly	Kristen	Gigi	Comic Sans
Feminine	Gigi	Monotype Corsiva	Kristen

Unstable	Gigi	Kristen	Rago Italic
Rigid	Impact	Courier New	Agency FB
Rebel	Gigi	Kristen	Rago Italic
Rude	Impact	Rockwell Xbold	Agency FB
Youthful	Kristen	Gigi	Comic Sans
Casual	Kristen	Comic Sans	Gigi
Passive	Kristen	Gigi	Comic Sans
Impractical	Gigi	Rago Italic	Kristen
Unimaginative	Courier New	Arial	Consolas
Sad	Impact	Courier New	Agency FB
Dull	Courier New	Consolas	Verdana
Unattractive	Impact	Courier New	Rockwell Xbold
Plain	Courier New	Impact	Rockwell Xbold
Coarse	Impact	Rockwell Xbold	Courier New
Masculine	Impact	Rockwell Xbold	Courier New



A Research Study in 2008

If It's Hard to Read, It's Hard to Do

Processing Fluency Affects Effort Prediction and Motivation

Hyunjin Song and Norbert Schwarz

University of Michigan

People are more likely to engage in a given behavior the less effort it requires. As numerous studies have indicated, high perceived effort is a major impediment to behavior change, from adopting an exercise routine (e.g., DuCharme & Bradley, 1995) to changing one's diet (e.g., Sparks, Guthrie, & Shepherd, 1997). Although previous research has shown that task type (e.g., Buehler, Griffin, & Ross, 1994) and previous experience (e.g., Thomas, Hamilley, & Newstlund, 2007) influence the accuracy of effort predictions, little is known about how people estimate the effort involved in a novel behavior. One possibility is that people run a mental simulation of the behavior and infer effort from the fluency of the simulation. If so, incidental variables that affect the ease with which information about the behavior can be processed may play a key role in effort prediction. We tested this possibility by presenting instructions in easy- or difficult-to-read print fonts. We predicted and found that people misread the difficulty of processing instructions as indicative of the difficulty of executing the behavior, and that this misperception has downstream effects on their willingness to engage in that behavior.

STUDY 1

Method

time. Finally, participants reported whether they were likely to make the exercise part of their daily routine (7 = *very likely*).

At the end of the study, participants answered two factual questions as a memory test, rated the ease with which the print font could be read (7 = *very easy*), and provided demographic information.

Results and Discussion

As shown in Table 1, participants found the Arial font easier to read than the Brush font, but recalled details of the instructions equally well in the two conditions. As predicted, they estimated that the exercise would take less time and feel "quicker" and more fluent when the font was easy to read than when the font was difficult to read. Accordingly, they reported a higher willingness to make the exercise part of their daily routine when it was described in an easy-to-read font than when it was described in a difficult-to-read font. The observed effect sizes qualify as large (Cohen, 1988).

These findings provided first evidence that people misread the ease of processing instructions as bearing on the ease of executing the described behavior. Study 2 replicated this observation using a cooking recipe. Study 3 extended the findings by testing whether the ease of reading instructions influences

"the challenging font choice made the task seem to require more time to achieve."



A Research Study in 2014

Processing fluency effects: Can the content and presentation of participant information sheets influence recruitment and participation for an antenatal intervention?

Article · November 2014 · with 98 Reads

DOI: 10.1007/s10617-014-0105

Cite this publication

1st Andrew Manley
al. 150+ · Leeds Beckett University

2nd Tina Lavender
al. 38+ · The University of Manchester

3rd Debbie M Smith
al. 28+ · The University of Manchester

Abstract

Objective: To assess the extent to which the title and font of participant information sheets (PISs) can influence pregnant women's and trainee midwives' perceptions of an antenatal intervention. **Methods:** Pregnant women ($n=31$) and trainee midwives ($n=36$) were randomly presented with one of four PISs where the title and font of the PIS had been manipulated to create four experimental conditions (i.e., Double Fluent; Double Awkward; Fluent Thin; Awkward Font; Awkward Title-Fluent Font). After reading the PISs, participants rated their perceptions of the intervention (i.e., Attractiveness, Complexity, Expected Risk, Required Effort) using five-point Likert scales. **Results:** A 4x2 factorial multivariate analysis of variance revealed that pregnant women rated the Double Awkward condition as significantly more complex than the Double Fluent ($p=.024$) and Awkward Title-Fluent Font ($p=.021$) conditions. **Conclusion:** Font influenced pregnant women's ratings of intervention complexity. **Practical Implications:** Results have implications for clinical recruitment, and in turn, the optimisation of corresponding interventions.

Processing fluency effects: Can the content and presentation of participant information sheets influence recruitment and participation for an antenatal intervention?

The easier the font was to read, the less complex the intervention was perceived

THE 10 COMMANDMENTS OF TYPOGRAPHY

1 KNOW YOUR FONT FAMILIES EVER HEARD OF GHOTNS?

Geometric Sans

a

Humanist Sans

a

Old Style

a

Transitional

a

Modern

a

Slab Serifs

a

2 COMBINE A SANS-SERIF FONT WITH A SERIF FONT.

Myriad
Minion

AndrewGothic
CASTELLAR

Ocean Sans Std
Garamond

Segoe UI
Lucida Fax

Futura
Minion

Liberal
Garamond

3 COMBINE A SERIF FONT WITH A SANS-SERIF FONT.

Minion
Myriad

CASTELLAR
AndrewGothic

Garamond
Ocean Sans Std

Lucida Fax
Segoe UI

Minion
Futura

Garamond
Liberal

4 COMBINING TWO SIMILAR FONTS IS NOT COOL.

Minion
Nova NY

Colonna MT
CASTELLAR

Garamond
Times New Roman

Agency FB
Agency FB

Futura
Franklin Gothic

Mandingo
Liberal

5 CONTRAST IS THE KEY.

Futura
CASTELLAR

Liberal
AndrewGothic

Myriad
Dreen Sans Std

Novelty
Advantage

OVERHAUL
Friz Quadrata

GENEVA
Futura

6 STICK TO TWO FONTS. ONLY GO FOR THREE IF YOU MUST.

Monogly
Arial Rounded MenusGuide

MANDINGO
souvenir II Arial

GENEVA
Advantage-Ocean Sans Std

Novelty
CASTELLAR Times Roman

AKKA
california MT Dallas

AKKA BIENVILLE
Friz Quadrata

7 DON'T MIX DIFFERENT MOODS.

BOSNIA
MANDINGO GENEVA

ADSO DARK
souvenir II Arial

Black Chancey
MASQUE

AFRICAN
INTRO

Borealis
calibri

GENEVA
BIZCUIT CAPTAIN

8 COMBINE FONTS OF COMPLEMENTARY MOODS AND OF SIMILAR TIME ERAS.

Black Chancey
Papyrus

Amaze
Gothic

FINDES
bouguer

GENEVA
DALLAS

November
Vigil

Valken
VAGrounded

9 USE DIFFERENT WEIGHTS OF FONTS IN THE SAME FAMILY.

Minion
Garamond

Myriad
Future

GENEVA
DALLAS

November
Vigil

Valken
VAGrounded

TRAJAN
Sylfaen

10 AND LASTLY, PLEASE AVOID THE FOLLOWING FONTS...

Comic Sans

Papyrus

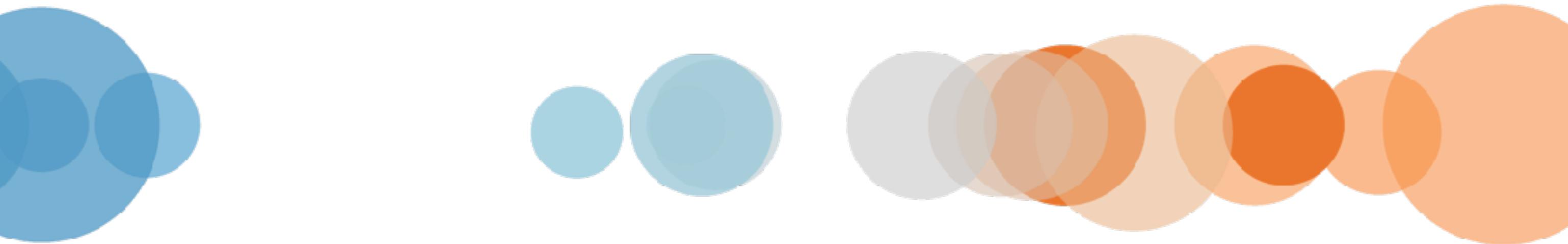
Curlz

Viner

Kristen

Συμβολ

10 Rules for Effectively Combining Fonts



10 Rules for Effectively Combining Fonts

1. Choose complimentary fonts
2. Establish a visual hierarchy
3. Consider context
4. Mix serif with sans serif
5. Create contrast
6. Stay away from font conflict
7. Avoid fonts that are too similar
8. Use fonts in the same family
9. Limit the number of fonts used
10. Practice

1. Choose complimentary fonts



Fonts have different aesthetics to them that create different moods and have different personalities.

1. Choose complimentary fonts



For example you may use bubble letters for a birthday party invitation but it wouldn't be appropriate for a business memo.

A B C D E F
G H I J K L
M N O P Q R
S T U V W X
Y Z

2. Establish a visual hierarchy

Use bold, italics, headlines and subhead lines, and captions to organize how the letters and characters are read on the page.

A good way to organize font based on hierarchy is to determine which information is the most important and make that stand out.



3. Consider context



Keep in mind where your font will be places.

Use fonts that will be easy to read in the space provided as well as use font size to help with readability.

Another aspect of context and realizing when to use a neutral font vs. something that grabs your attention.

4. Mix serif with sans serif



As long as you stay within the same type family serif and sans serif tend to look good together

5. Create contrast

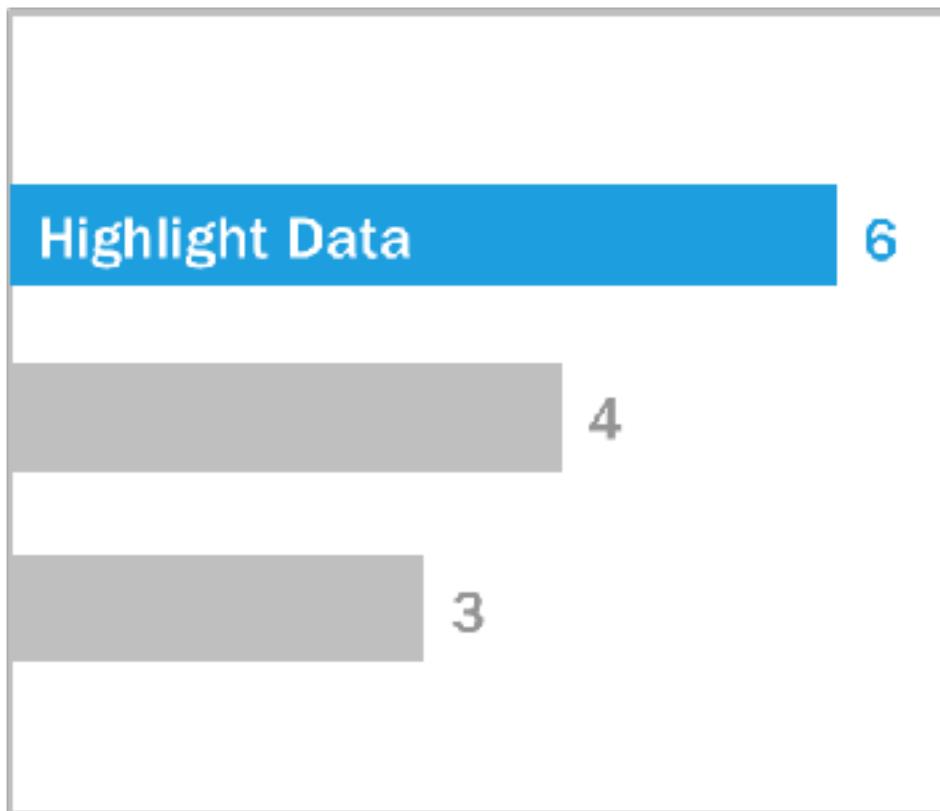
You can achieve contrast in a number of ways such as size, color, serif vs. sans serif, space etc.

Differences in font can help make separate roles for the font letting them show different information.



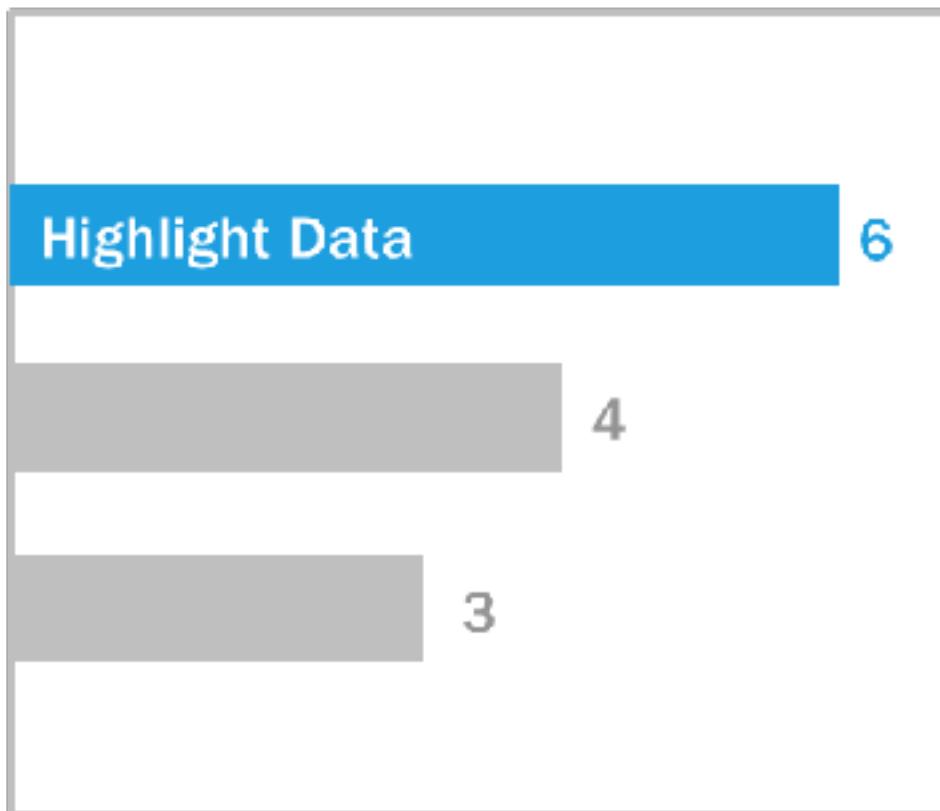
Top Level Font

Mid Level Font



Low Level Font

Mid Level Font



Low Level Font

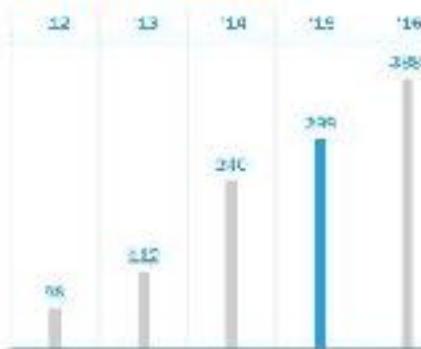
- The mid level font is in blue, which on the Complaints Dashboard is also used to highlight the two most recent rating periods.
- If the top level font were blue it would completely dominate the visualization.
- Having the top level in the lighter gray and the mid level in blue creates a balance of the font levels

Course Metrics

Students



Enrollments



Classes



Ratings



1097

Total students in 2015-2016

687

Total students in 2015-2016

21

Total classes in the years

7.7 of 8

Avg. Recent Instructor Rating (Jul 1st - Oct 1st)

Semesters

2015 Fall Semester 001

Questions

I developed specific skills and competencies

Overall, this was an excellent course

The instructor communicated clearly

The instructor graded fairly

The instructor was well organized

The instructor interested me with students

Overall, this instructor was excellent

2015 Fall Semester 002

I developed specific skills and competencies

Overall, this was an excellent course

The instructor communicated clearly

The instructor graded fairly

The instructor was well organized

The instructor interested me with students

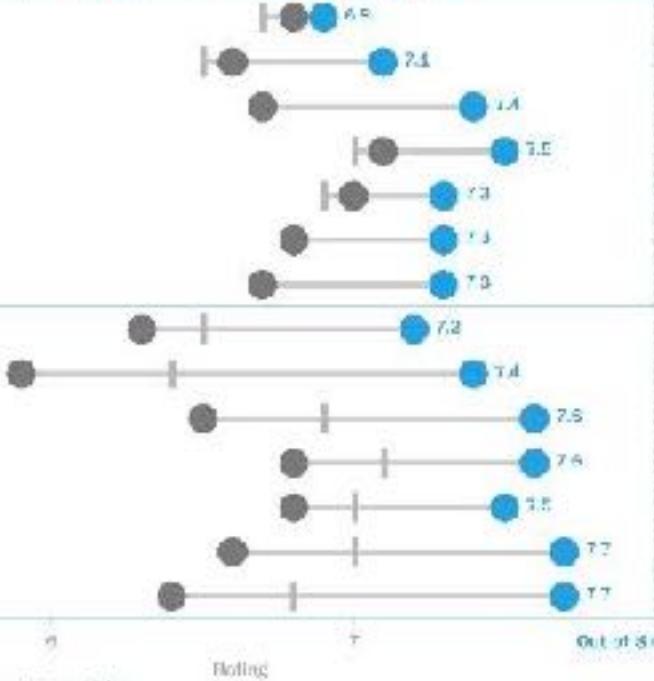
Overall, this instructor was excellent

BANA

College

Shaffer

Ratings

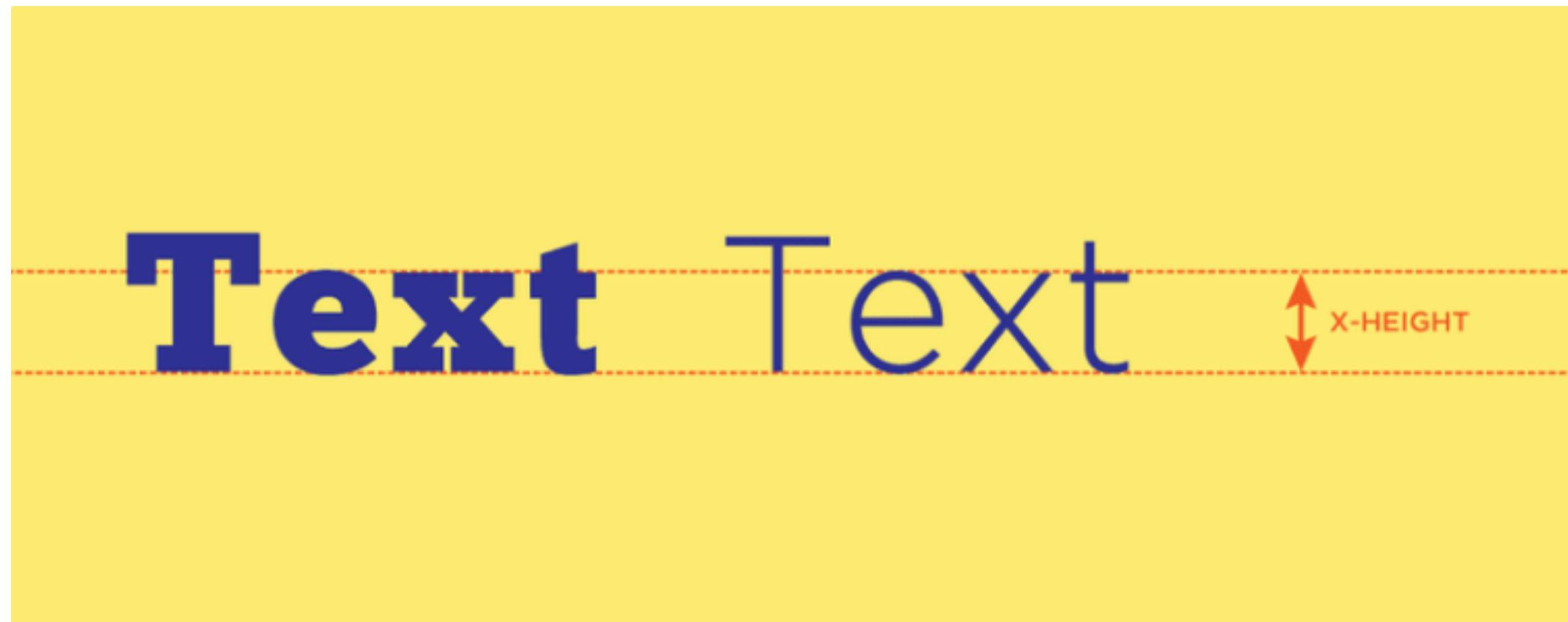


Course Metrics Dashboard created by Jeffrey A. Shaffer. Data from University of Cincinnati Course Evaluations. Blue indicates the 2 most recent grading periods.

Source: *The Big Book of Dashboards* (BigBookofDashboards.com)

6. Stay away from font conflict

Generally speaking, typefaces that share a couple qualities—maybe they have similar proportions, or the lowercase letters have the same height (known as “x-height”)—are more likely to look harmonious together, even if the overall appearance differs.



6. Stay away from font conflict



While contrast can be helpful in font design avoid fonts that are drastically different.

7. Avoid fonts that are too similar

Handgloves

Handgloves

On the flipside you also want to avoid fonts that are too similar because you will be unable to establish the hierarchy and be unable to display those distinct roles of each font.

8. Use fonts in the same family



Chicago

How quickly daft jumping

COMPLETOFIONS

Pâmée de pèze à ce gîte

LATINOTYPE

Cwm fjord-bank glyphs

Belgrano

Portugal con alameda

Sphinx of black quartz

SPHINX

Portez ce vieux whisky

Emilia viene en camino

Fonts in the same family are usually made to work together well, so it is a good idea to merge different fonts from the same family to create the variation needed for a good design.

9. Limit the number of fonts



The rule of thumb is to usually stick to two or three fonts.

A large variety of fonts can look good when going for certain aesthetics but there is a thin line before the amount of fonts looks conflicting and cluttered.

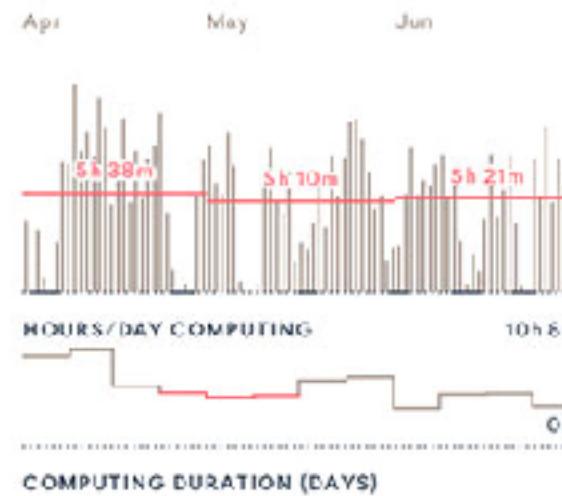
10. Practice Makes Perfect



2008 Feltron Report

<http://feltron.com>

Computing



20.4

11.9 DAYS LESS THAN PREVIOUS QUARTER

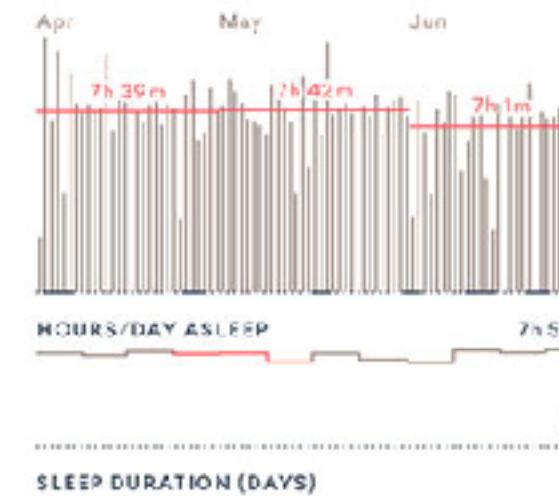
TOP APPLICATIONS	AVG PRODUCTIVITY
Photoshop	105%
InDesign	54%
Mail	47%
Finder	19%
Facebook	18%

LONGEST SESSION
Sketch
4h 55m on Jan 30

MOST PRODUCTIVE
Apr. 9
77% productive for 11h 50m

DAYS OFF COMPUTER
Four
Apr 5, 24, May 8 & Jun 22

Sleep



27.7

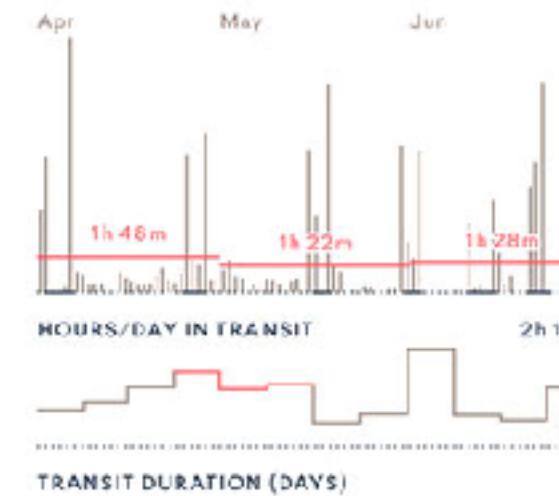
1.4 DAYS MORE THAN PREVIOUS QUARTER

TOP SLEEP TYPES	AVG HEART RATE
Light	37 bpm
REM	15 bpm
Deep	13 bpm
Unknown	51
Interrupted	38

AVG TOSS/TURNS
29
Max: 64 on Apr 2

INTERRUPTIONS
Twenty-four
Undisturbed nights: 67

Transit



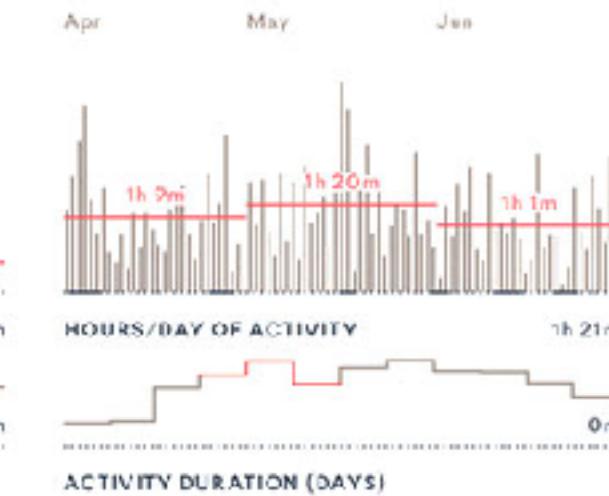
5.9

1.7 DAYS MORE THAN PREVIOUS QUARTER

TOP TRANSIT TYPES	TOTAL TRANSITS
Airplane	57
Car	56
Subway	14
Bus	5

TOTAL DISTANCE
24,450 mi

Activity



4.5

2.1 DAYS MORE THAN PREVIOUS QUARTER

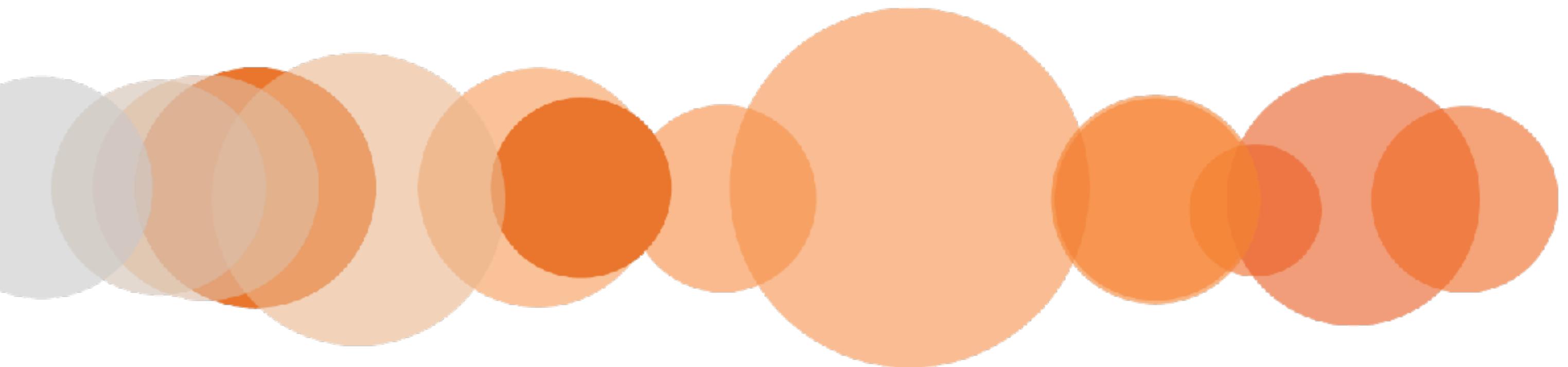
TOP ACTIVITIES	WALKING
Walking	85h
Resting	16h
Cycling	8h
Swimming	2h

MAX: 91 miles on May 10

RUNNING
107.0

It has a very clear hierarchy, contrast, mixing a serif with a sans serif is a beautiful way.

Word Clouds - Caution



Bush State of the Union - 2002

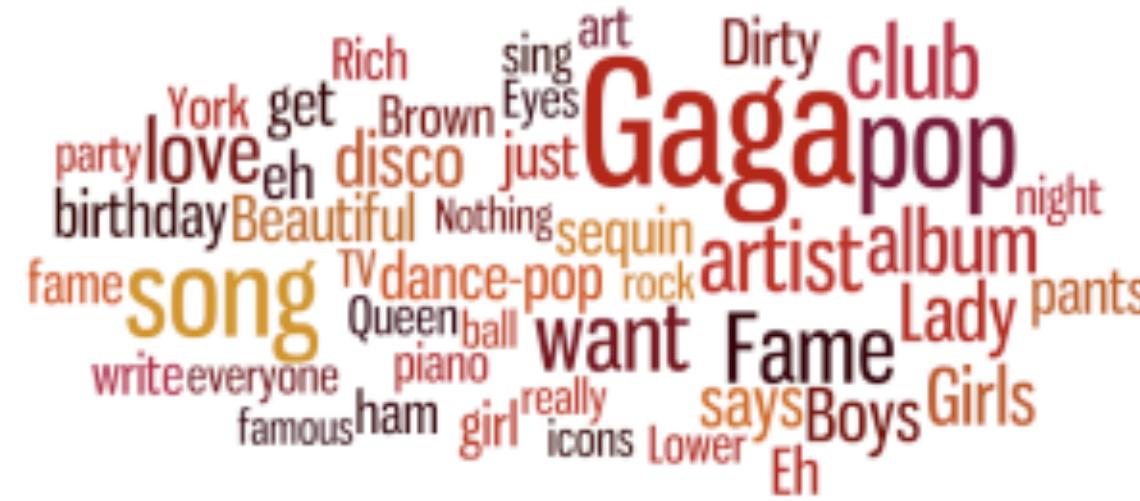
Obama State of the Union - 2010

Word cloud on Student Feedback for the University of Cincinnati

Is this good or bad?



Online Biography of the Pop Singer Lady Gaga



(left) Single-word phrases (unigrams)



(right) Multiword phrases

Source: The Stanford Visualization Group (vis.stanford.edu)

"Without the Clutter of Unimportant Words": Descriptive Keyphrases for Text Visualization
Jason Chuang, Christopher D. Manning, Jeffrey Heer



Last 3 years				Top 10 ...,										
Days with Zero Cmts		Most Active Day		Posts with Comments				Commenters			Comments by Length			Words
2008	66	1 August		Poll on Last Visible Cell	313	Chandoo	1395	Stef@N on 22Feb10	900					
2009	15	4 August		Excel Conditional Formatting	192	Jon Peltier	228	Gert-Jan on 4Apr10	740					
2010	5	29 October		Paste Special Tricks	107	Hui...	186	Daniel Ferry on 18Jun10	704					
				Dynamic Excel Charts	101	Jeff Weir	148	Chandoo on 21Jun09	700					
				VLOOKUP Tutorial	96	Robert	138	Jeff Weir on 9Jul09	641					
				Excel Downloads	94	Jp	62	Jeff Weir on 13May09	626					
				Excel Mouse Tricks	90	Rick Rothstein (Mvp - Excel)	60	Abdul on 8Jul08	606					
				Chandoo.org Startup Story	89	Martin	58	Chandoo on 17May09	572					
				Excel 2010 Review	88	Daniel Ferry	54	Yivek on 30Aug08	561					
				KPI Dashboards	87	Dan L	53	Jeff Weir on 17Jul09	530					

call home plane crashes
please call home
call your mother
twin towers

call me asap
world trade center
complex has evacuated
please be safe

twin towers
white house
significant fire

please call

new york city

white house

signifiant fire

September 11, 2001 10:05 AM

“Perhaps a more useful view of the data is provided by this set of timeline graphs.”

