

# Information Visualization

Monday / Wednesday  
11:45am — 2:30pm  
XARTS 006 (orange lab)

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Office hours:  
Tuesdays 1:00 — 3:00pm  
or by appointment

## Course Description

This course will introduce students to the study of information visualization as a wide-ranging practice for the creation, reproduction, and dissemination of complex visual messages. Information dissemination through visual imagery has been an effective way to communicate both abstract and concrete ideas since the dawn of human existence. Examples from history include cave paintings, Egyptian hieroglyphs, Greek geometry, and Leonardo da Vinci's revolutionary methods of technical drawing for engineering and scientific purposes.

Visualization today has ever-expanding applications in the disciplines of science, education, engineering, and medicine. Through sustained project work using print and/or digital media, students will investigate the ways that illustration, text, photography, sound, and moving image can, in different ways, participate in the process of communicating multi-faceted and multi-dimensional systems of information. Lectures, readings, and student research will supplement project work, introducing students to the concentrated disciplines of mapping, comparative timelines, and the history of information representation. To successfully complete this course, students will be expected to demonstrate fluency with the formal (skill-based) and semantic (knowledge-based) strategies that have shaped the visualization of complex information systems throughout the Modern and contemporary eras.

## Learning Outcomes

1. Exemplify advanced and comprehensive skill with visual representation, emphasizing the defining criteria for representing layered, hidden, and unexpected information connections, through presentations of conceptual project plans, documentation of design process, and completion of successful, final designs.

2. Demonstrate skill using the visual language of mapping, with a focus on the presentation of multiple layers of information, through the conceptualization, design process, and submission of a final mapping project.
3. Explain the workings of new media tools and applications and describe the ways in which these tools allow for the representation of complex data, through participation in group seminars and oral/visual project presentations.
4. Develop a conceptual plan and a research plan that will serve as the primary component of an information visualization project, through presentations of conceptual project plans, the creation of functional project prototypes, and the submission of design process documentation.
5. Explain how the term “information” has changed meaning throughout modern and contemporary history, and describe information as a critical component of the design process in light of these changing definitions, through participation in group seminars.

## **Academic Integrity**

Work done in the Design Program at USF must consist of original work done by the student. Whenever content is appropriated from elsewhere, the original sources of any such borrowed elements, whether text-based (as in written work) or visual (as with photographs or other images) must be clearly credited.

Students will observe and respect the University’s policy regarding academic integrity as noted in the USF Honor Code. As this policy stipulates, all written and visual work submitted for this course, whether in draft or final form, must not represent the words, visuals or ideas of another person without reference or citation. Violations of academic integrity include cheating, plagiarism, false citations, submitting the same work for multiple assignments, submitting false data, and falsifying documentation. Any student who violates the USF Honor Code can expect to receive a failing grade for the project and/or the course.

Plagiarism and creative integrity are not only of vital importance to the University and your academic career, but also to your professional career beyond graduation. Plagiarism of written or visual work is a serious offense punishable by law.

A full copy of the USF Honor Code can be found here:

<http://www.usfca.edu/catalog/policies/honor/>

## Information Visualization and Plagiarism

By definition, information visualization *is copying*. It is the process of taking an original data set and representing it in a changed visual form. The simple act of copying, in this context, does not constitute plagiarism, although *failing to cite one's sources* does.

You will be expected to draw from a wide range of sources — technical, textual, and visual — in order to develop your projects. For each project, you must clearly credit the original sources of any borrowed elements, whether they are text-based, visual, or technical (as with software-based tools or program code incorporated into your own).

## Classroom Standards

Most of this course will be spent in guided discussion as lectures, project critiques, and seminars. This course will follow a hybrid lecture/studio format. A small amount of time for project work will be provided, but the majority of your individual project work must occur outside of class.

In-class work time must be used toward this course only. Please do not use this time for work for another course or extracurricular interests.

**Please** avoid email, text messaging, mobile devices, Facebook-ing, iTunes-playing, YouTube-watching, or other extraneous activities during class. Please turn your phones completely off (not just to “vibrate” or “silent”) when you enter the classroom.

Exceptions can be made if your project somehow incorporates one of the services or devices above.

Feel free to bring your own computer to class if that helps you work efficiently.

## Supply List

Please bring a sketchbook or notepad to *every session*. Other than that, there are no other required supplies.

## Attendance

Attendance in every class session for the full session is vital to succeeding in this course.

Each student will be allowed **two** absences. Three absences will lower a student's final grade by one entire grade level. Four absences will result in an unconditional failing grade for the course.

Students will be counted as late if they appear in class more than ten minutes after class has begun. Two such late arrivals will equal one absence. Students arriving more than ten minutes late for any project critique or final presentation will be asked to leave their work and will be given an absence for that day.

Absences may be excused only in rare cases, such as if you must miss class for a medical appointment, family emergency or other conflict. If you must miss class, please advise me in advance or immediately thereafter. You will be referred to the Center for Academic and Student Achievement (CASA), who will verify whether or not the absence is excusable, and then relay that information to me.

Field trips, outside lectures, and any other special events that take place outside of the classroom during class time will also count towards final attendance.

## **Student Athletes**

All University Athletes must provide the Professor with an official letter from the Athletics Office noting any excused absences at the start of the semester. Only absences indicated on the official letter will be excused from class.

## **Data Management**

To be a great information designer, you must be skilled at managing your own information. "My hard drive crashed" is not a valid reason for failing to submit work on time. (Imagine yourself giving that excuse to a client or colleague!)

Think about how much work you are willing to lose:

_____	minutes / hours / days / weeks / months
(fill in number)	(circle one)

You should back up all of your digital files *more frequently* than the duration above. I recommend either using an online service (e.g., [backblaze.com](http://backblaze.com) or [mozy.com](http://mozy.com)) or investing in an external hard drive (RAID-1 mirrored) and automated backup software (like Time Machine).

Do *not* rely on a single hard disk or flash drive for your backups.

## Email Communication

On some occasions, I will need to send you course-related information outside of class. My expectation is that you will check your email **at least once each day**. Since I only have access to your @usfca.edu email address, be sure to check that account daily. If you primarily use another email account, I recommend setting your USF account to forward all mail to your primary account, so you never miss a message. (For help with this, please see me after class.)

## Disabilities

If you are a student with a disability or disabling condition, or if you think you may have a disability, please contact USF Student Disability Services (SDS) at 415-422-2613 within the first week of class, or immediately upon onset of disability, to speak with a disability specialist. If you are determined eligible for reasonable accommodations, please meet with your disability specialist so they can arrange to have your accommodation letter sent to me, and we will discuss your needs for this course. For more information, please visit [usfca.edu/sds](http://usfca.edu/sds) or call 415-422-2613.

## Grading

In each course within the Design program, an average amount of work, participation, and progress at the level expected of a college student will earn a “C” grade. “A” and “B” grades will be awarded to those students whose effort or improvement reaches levels above average. Semester grades will incorporate a variety of factors, notably conceptual development, engagement with design process, quality of presentation, effort, and level of interest and participation in class.

Any project that receives a grade below “D” must be reworked. No student will be able to pass the course with an “F” grade for any project, and no student will be able to achieve prerequisite status with a “D” or “F” grade for the course.

Project work assumes that each student will devote an equivalent amount of time to homework assignments as to time spent in class (i.e., **six hours per week**).

Each project must be turned in for grading following the final presentation, and projects cannot be returned until grading is completed. High-resolution, digital files of each

project in its final form (including visuals, text, and any source code) must be submitted to the professor at the end of the semester.

If you ever feel that a given grade does not accurately reflect the quality of your work, please contact me by email *within a week*. Provide a written argument that references the project's grading criteria and explains why a higher grade is justified.

### **Letter Grade Definitions**

- A** Successful fulfillment of the project's communication goals, superlative process documentation, and an original, attractive and cohesive visual aesthetic. Project planning, design, and execution performed at the highest level.
- B** Successful fulfillment of the project's communication goals, excellent process documentation, and a cohesive visual aesthetic. Project planning, design, and execution performed at an above average level.
- C** Successful fulfillment of the project's communication goals, and adequate process documentation. Project planning, design, and execution performed at an average level.
- D** Did not fulfill the project's communication goals, and/or process documentation was absent or inadequate. Project planning, design, and execution performed was below average.
- F** Did not fulfill the project's communication goals, and process documentation was inadequate. Does not meet the minimum requirements for the course.

## Grade Weights by Project

Detailed descriptions of each project will be distributed in class.

5%	<b>Discovery</b>	Find five visualizations, and explain and critique each one.
10%	<b>Perfection</b>	Using the data provided, create “the perfect chart” that clearly and honestly communicates that data and its importance.
20%	<b>Inequality</b>	Choose a social inequality to research, find relevant datasets, and use a variety of tools to design a series of charts to tell the history of that inequality.
20%	<b>Locality</b>	Using data provided by the City of San Francisco, create a map or other visualization that illuminates a socially significant and otherwise unseen aspect of city life.
20%	<b>Personality</b>	Collect data about yourself and your own life, and then interpret it visually to discover and communicate patterns in your own behavior and experiences.
15%	<b>Participation</b>	Come to class well-prepared to present your projects, proposals, and ideas. Ask lots of questions, offer thoughtful, critical responses to the readings, and provide helpful, considered feedback during group critiques.
10%	<b>Readings</b>	Complete each assigned reading, and write thoughtful responses, engaging in a discussion of each text with your fellow classmates.

## Required Books

Cairo, Alberto. *The Functional Art*. New Riders, 2013.

Tufte, Edward R. *The Visual Display of Quantitative Information*. 2nd ed. Graphics Press, 2001.

## Other Required Readings (Electronic Reserve or Online)

Bertini, Enrico. "Research: How to Tell Stories with Data?" January 5, 2001. [http://infosthetics.com/archives/2011/01/research\\_telling\\_stories\\_with\\_data.html](http://infosthetics.com/archives/2011/01/research_telling_stories_with_data.html)

Branigan, Edward. *Narrative Comprehension and Film*. Routledge, 1992.  
➔ Chapter 1: "Narrative Schema"

Felton, Nicholas. Feltron Annual Reports. [feltron.com](http://feltron.com). 2005–2009.

Fry, Ben. *Visualizing Data*. O'Reilly Media, Inc., 2008.  
➔ Chapter 1: "The Seven Stages of Visualizing Data"

Gleick, James. *The Information: A history, a theory, a flood*. Pantheon Books, 2011.  
➔ Chapter 5: "A Nervous System for the Earth"

Groeger, Lena. "Design Principles for News Apps & Graphics." May 30, 2013. <http://www.propublica.org/nerds/item/design-principles-for-news-apps-graphics>

Hall, Stuart, ed. *Representation: Cultural Representations and Signifying Practices*. The Open University, 1997.  
➔ Chapter 1: "The Work of Representation"

Illiinsky, Noah. "Properties and Best Uses of Visual Encodings." January 24, 2012. <http://complexdiagrams.com/properties>

Manovich, Lev. *The Language of New Media*. MIT Press, 2002.  
➔ Chapter 5: "The Forms" and "The Database"

Mars, Roman. "The Periodic Table: Infographic Apotheosis." *99% Invisible*. February 4, 2011. <http://99percentinvisible.org/post/3102071088/episode-14-the-periodic-table-infographic>



Munroe, Randall. “Color Survey Results.” May 3, 2010. <http://blog.xkcd.com/2010/05/03/color-survey-results/>

“The Great Divide” series of posts on *The New York Times’s Opinionator* blog. 2013–2014. <http://opinionator.blogs.nytimes.com/category/the-great-divide/> especially: Noah, Timothy. “The 1 Percent Are Only Half the Problem.” May 18, 2013. <http://opinionator.blogs.nytimes.com/2013/05/18/the-1-percent-are-only-half-the-problem/>

Norman, Donald. *Things That Make Us Smart: Defending Human Attributes in the Age of the Machine*. Basic Books, 1993.

➔ Chapter 3: “The Power of Representation”

Ortiz, Santiago. *45 Ways to Communicate Two Quantities*. 2012. <http://blog.visual.ly/45-ways-to-communicate-two-quantities/>

Rosenberg, Daniel, and Anthony Grafton. *Cartographies of Time: A History of the Timeline*. Princeton Architectural Press, 2010.

➔ Chapter 1: “Time in Print”

Segel, Edward and Jeffrey Heer. *Narrative Visualization: Telling Stories with Data*. 2010. *IEEE Transactions on Visualization and Computer Graphics*, 16(6): 1139–1148. <http://vis.stanford.edu/files/2010-Narrative-InfoVis.pdf>

Shannon, Claude. July/October 1948. “A Mathematical Theory of Communication.” *Bell System Technical Journal*, 27(3): 379–423.

Stefaner, Moritz. *Interview: Nicholas Felton from feltron.com*. *Information Aesthetics*, 2010. [http://infosthetics.com/archives/2010/05/interview\\_nicholas\\_felton.html](http://infosthetics.com/archives/2010/05/interview_nicholas_felton.html)

Ware, Colin. *Information Visualization: Perception for Design*. 2nd ed. Morgan Kaufmann, 2004.

➔ Chapter 5: “Visual Attention and Information that Pops Out”

➔ Chapter 6: “Static and Moving Patterns”

## Supplemental Readings

Booth, Wayne C., Gregory G. Colomb, and Joseph M. Williams. *The Craft of Research*. 3rd ed. The University of Chicago Press, 2008.

- Few, Stephen. *Show Me the Numbers: Designing Tables and Graphs to Enlighten*. Analytics Press, 2004.
- Freyer, Conny, Sebastien Noel, and Eva Rucki. *Digital by Design: Crafting Technology for Products and Environments*. Thames & Hudson, 2008.
- Ford, Brian J. *Images of Science: A History of Scientific Illustration*. Oxford University Press, 1993.
- Hankey, Stephanie, Tom Longley, Marek Tuszynski, and Maya Indira Ganesh. *Visualizing Information for Advocacy*. Tactical Technology Collective, 2013.
- Harmon, Katharine. *The Map as Art: Contemporary Artists Explore Cartography*. Princeton Architectural Press, 2009.
- Harmon, Katharine. *You Are Here: Personal Geographies and Other Maps of the Imagination*. Princeton Architectural Press, 2004.
- Kamvar, Sep and Jonathan Harris. *We Feel Fine: An Almanac of Human Emotion*. Scribner, 2009.
- Klanten, Robert, et al. *Data Flow: Visualizing Information in Graphic Design*. Gestalten, 2008.
- Klanten, Robert. *Data Flow 2: Visualizing Information in Graphic Design*. Gestalten, 2010.
- McLuhan, Marshall and Quentin Fiore. *The Medium is the Massage*. Random House, 1967.
- Nunberg, Geoffrey. "Farewell to the Information Age." In *The Future of the Book*. Edited by Geoffrey Nunberg. University of California Press, 1996.
- Rendgen, Sandra. *Information Graphics*. Taschen, 2012.
- Tufte, Edward R. *Envisioning Information*. 1st ed. Graphics Press, 1990.
- Visocky O'Grady, Jennifer and Kenneth Visocky O'Grady. *The Information Design Handbook*. How Books, 2008.
- Vesna, Victoria. *Database Aesthetics: Art in the Age of Information Overflow*. University of Minnesota Press, 2007.

## Online Resources

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### General

- [chartsnthings.tumblr.com](http://chartsnthings.tumblr.com)
- [datastori.es](http://datastori.es)
- [informationisbeautiful.net](http://informationisbeautiful.net)
- [infosthetics.com](http://infosthetics.com)
- [vimeo.com/eyeofestival](http://vimeo.com/eyeofestival)
- [visualcomplexity.com](http://visualcomplexity.com)
- [visualizing.org](http://visualizing.org)
- [visual.ly](http://visual.ly)

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### Design Firms

- [fathom.info](http://fathom.info)
- [periscopic.com](http://periscopic.com)
- [pitchinteractive.com](http://pitchinteractive.com)
- [stamen.com](http://stamen.com)

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### Individuals

- [aaronkoblin.com](http://aaronkoblin.com) (Aaron Koblin)
- [benfry.com](http://benfry.com) (Ben Fry)
- [datatelling.com](http://datatelling.com) (Jen Lowe)
- [eagereyes.org](http://eagereyes.org) (Robert Kosara)
- [fakeisthenewreal.org](http://fakeisthenewreal.org) (Neil Freeman)
- [feltron.com](http://feltron.com) (Nicholas Felton)
- [itsbeenreal.co.uk](http://itsbeenreal.co.uk) (Stefanie Posavec)
- [thewhyaxis.info](http://thewhyaxis.info) (Bryan Connor)
- [visualisingdata.com](http://visualisingdata.com) (Andy Kirk)
- [well-formed-data.net](http://well-formed-data.net) (Mortiz Stefaner)

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### Social Good

- [datakind.org](http://datakind.org)
- [good.is/infographics](http://good.is/infographics)
- [tacticaltech.org](http://tacticaltech.org)

## Course Website

<https://usfca.instructure.com>

The course website includes the current schedule, plus links to handouts, project assignments, and other online resources. It will be updated and changed *frequently*. It is your responsibility to read all notifications and stay on top of deadlines.

## Schedule

The schedule below is *tentative*. Always check the website for the current schedule. Also note that each project includes many interim milestones, due dates for which will be announced in class (and posted on the website).

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### Pixels

Week 1	What is Info Vis?	Introduce Discoveries
Week 2	Visual Representation	
Week 3	Data Graphics	<b>Discovery due</b> / Introduce Perfection
Week 4	Types of Information	<i>Guest speaker (TBD)</i>
Week 5	Hierarchy and Structure	<b>Perfection due</b> / Introduce Inequality

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### Lines

Week 6	Process	
Week 7	Mapping and Systems	<i>Guest speaker (TBD)</i>
Week 8	Chartjunk	<b>Inequality due</b> / Introduce Locality
Week 9	Form and Perception	
Week 10	Color and Perception	

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### Pages

Week 11	Telling Stories with Data	
Week 12	Motion and Perception	<b>Locality due</b> / Introduce Personality

Week 13	Interactivity	
Week 14	Data Density	<i>Guest speaker (TBD)</i>
Week 15	Data as Art	
Week 16	Visualization's Future	<b>Personality due</b>

## In the end...

I hope you will:

- be comfortable thinking and talking about **information architecture**
- gain valuable experience with **data visualization**
- understand the limits and abilities of **human visual perception**
- have identified a visualization **process** that works for you
- have developed a system of **managing your own data** that includes regular backups