



GYMNASIUM

INFORMATION DESIGN AND VISUALIZATION FUNDAMENTALS

Lesson 4 Transcript

Tools Of The Trade

ABOUT THIS HANDOUT

This handout includes the following:

- A list of the core concepts covered in this lesson.
- The assignment(s) for this lesson.
- A list of readings and resources for this lesson including books, articles and websites mentioned in the videos by the instructor, plus bonus readings and resources hand-picked by the instructor.
- A transcript of the lecture videos for this lesson

CORE CONCEPTS

1. Information Design and Visualization covers many areas of design and with this, a very wide range of skills and toolsets. It is important to remember that most information designers have a particular skill focus, and then work in teams to bring a variety of skills to bear on a project.
2. Data handling tools is a major aspect of information design, and there are a number of tools available for handling, parsing, cleaning, and preparing data sets for visualization.
3. Charting is a major component of information design and visualization and there is no shortage of tools to help turn data into revealing charts (both static and interactive).
4. Programming plays a significant role in many interactive designs and even static designs. Examples include assigning event actions to data displays, sketching with data, creating complicated animations in motion graphics, or building out worlds in 3D, to name just a few.
5. Mapping is a fundamental part of the information design and visualization field. Accordingly there are a number of dedicated mapping tools that perform tasks such as presenting election results, or changes in demographics across a county, or migration patterns, or presenting any data that needs to be geo-located.
6. Illustration has long been a fundamental aspect of information design, and with so much media being consumed on screens, animation is playing an increasingly important role as well. At their core, both illustration and animation help tell stories whether it be diagrammatic work, multimedia storytelling projects or other forms of visuals.

ASSIGNMENTS

1. Quiz
2. For assignment 2, now that you have plans for both a static and an interactive version of a graphic from the past lessons, use what you've learned in this lesson to determine the right tools to actually create it.

Make a list of the tools you think would work best to realize your design, with an explanation of why each tool fits your needs.

Next, make a plan on how you could learn to use these tools, whether it be through reading some of the books I've suggested, or other online resources, for any of the tools that you don't currently know how to use.

3. When completed, post your plan on the form and be sure to comment on one of your classmates forum posts as well.

INTRODUCTION

This is lesson four of “Information Design and Visualization Fundamentals,” an online course developed by Aquent.

Now that we’ve broadly examined the field of information design and visualization, reviewed many examples, learned a variety of approaches, let’s take a look at the tools of the trade. As we’ve seen, this discipline covers many areas of design, and with this, a very wide range of skills.

Don’t let this lesson stress you out, and make you think that you need to know how to use all of these tools. If you plan to learn all of these, then you’re probably doing it wrong. Most information designers have a particular skill focus, and then work in teams to bring a variety of skills to bear on a project.

The purpose of this lesson will be to give you a broad awareness of what’s out there, so that you’ll know what your options are when focusing on your particular skill area, as well as being able to communicate intelligently with those in other skill areas.

I’m going to devote a chapter each to a few major tool categories, and introduce you to some of the better tools being used in each. The categories we will look at are data handling tools, charting tools, programming tools, mapping tools, and illustration and animation tools. Again, no designer is expected to know everything, and I similarly cannot claim to know all these tools intimately, or in some cases at all.

I’ve researched some of the best and most prevalent ones being used, and I’ll provide descriptions and an explanation of what they can be used for. Note that many of the tools do not fit neatly into one category, or the other, but overlap. So, let’s get started in the next lesson, and take a look at some data handling tools worth considering.

DATA HANDLING TOOLS

In this chapter, we’ll take a look at some of the data handling tools being used by information designers. Working with data, as we know, is a major aspect of information design. Luckily, there are some great tools out there for handling, parsing, cleaning, and preparing data sets for visualization.

One tool to consider is Mr. Data Converter. This tool was developed by a colleague of mine, Sean Carter. It converts your Excel data into a number of web-friendly formats, including HTML, JSON, and XML. To use the converter, simply copy and paste data from Excel into the field at the top. Then,



Another interesting data-handling tool is Streamtools. And this comes out of the New York Times R&D department. Streamtools is open source, and provides a general-purpose graphical tool for dealing with streams of data. It provides a vocabulary of operations that can be connected together to create live data processing systems, without the need for programming, or complicated infrastructure. These systems are assembled using a visual interface that affords both immediate understanding, and live manipulation of the system. You can check out demos of this online.



So, to recap, for data-handling tools we took a look at Mr. Data Converter, Python, Scraping for Journalists, Databin, GraphClick, and Streamtools. So, there you have some data-handling tools to keep in mind. In the next chapter, we'll explore charting tools.

CHARTING TOOLS

Charting is, of course, a major component of information design and visualization, as we've learned. There is no shortage of tools to help turn data into revealing charts, taking many different forms. Let's take a look at a few of the best.

Tableau is an application that lets you quickly analyze data. It's a powerful tool for visual analysis, and more. It's based on technology out of Stanford University that lets you drag and drop to analyze data rapidly and fluidly, connect to data in a few clicks, and visualize and create interactive dashboards. I recommend visiting the website, and watching some of the demos to get a sense of how it works.

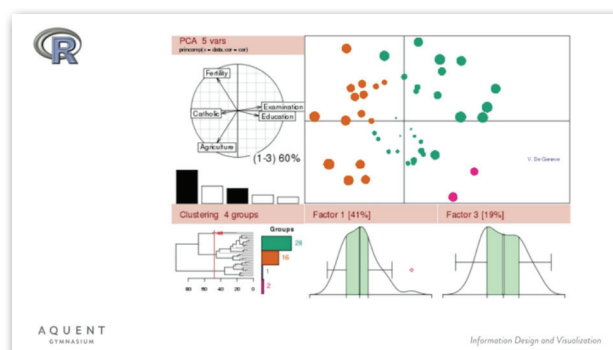
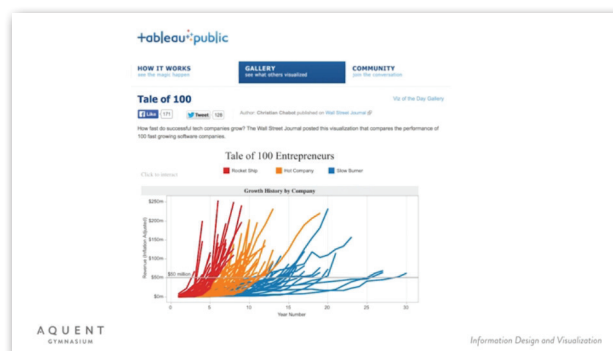
Also worth noting is Tableau Public, which is the free-to-use web-based, publicly accessible, version of Tableau Desktop. This enables you to create interactive visualizations, and embed them into your website, publish them on the Tableau Public gallery, or share within the Tableau Public community.

R is another tool to be aware of. It's traditionally thought of as statistical analysis software. But it's also powerful as a visualization tool. It's an open-source language and environment for data handling, statistical computing, and graphical techniques. It's known for the ease with which well-designed publication-quality graphical plots can be produced.

Microsoft Excel is probably the most ubiquitous tool around for use in charting. Part of the Office Suite, Excel has its drawbacks. But, when used in the right way, can be a useful visualization tool.

In the same category is Numbers, which is Apple's spreadsheet application, and part of the iWorks Suite. One advantage of this is the ability to work cross-device within the Apple ecosystem. Numbers allows you to transform your data into 2D, or 3D bar, line, area, or pie charts. Combine line, column, and area series in a single mixed chart or create two Access charts with different values scales or apply trend lines, and error bars. The charts you create in Numbers can be linked to pages documents, and keynote presentations.

Data Graph is a charting tool that focuses on ease of use. On their site, Data Graph is described as a powerful and easy to use graphing and charting application. Data Graph minimizes the fuss and frustration associated with creating clean and accurate publication-quality graphs and charts. Data Graph also includes powerful func-



tion fitting, and statistical analysis capabilities, which enables high-quality analysis of the data. Import data from files, paste in numbers from a spreadsheet, and enter them in manually. Export graphics to files, or copy and paste into presentations.

Adobe Illustrator is predominately a vector illustration tool but it has powerful charting tools, as well, and has been used to create many Times charts. The nice thing about working in the Adobe Creative Cloud Suite is that your files can be accessible anywhere. Moving your work from one application to another is incredibly easy. Illustrator gives you the complete control to polish existing graphs, create new ones, or combine separate elements into customized infographic designs.

Matlab is a programming language, and interactive environment, for numerical computation, visualization, and programming. Matlab provides the features that are required to visualize engineering and scientific data, including 2D and 3D plotting functions, 3D volume visualization functions, tools for interactively creating plots, and the ability to export results to popular graphics formats.

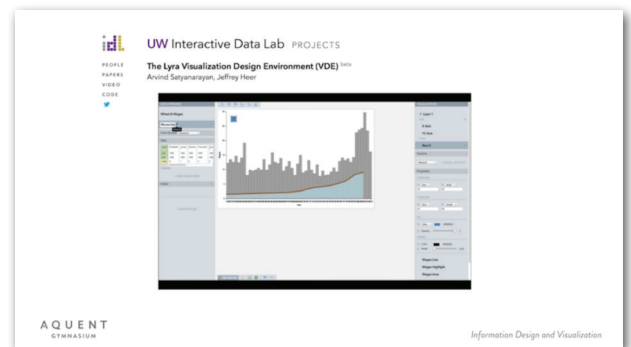
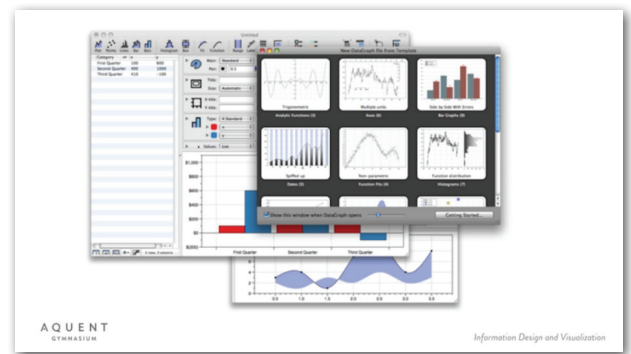
Not so interested in writing code? Lyra might be a tool to consider. In Lyra, graphical marks can be bound to data fields using property drop zones, dynamically positioned using connectors, and directly moved, rotated, and resized using handles. Lyra is more expressive than interactive systems like Tableau, allowing designers to create custom visualizations comparable to hand-coded visualizations built with D3, or processing. These visualizations can then be easily published, and reused on the web.

So, to recap our charting tools chapter, we took a look at Tableau, R, Excel, Numbers, Data Graph, Adobe Illustrator, Matlab, and Lyra. These charting tools should get you started. In the next chapter, we'll explore some essential programming tools.

At all levels of information design and visualization, programming plays a role. Whether assigning event actions to data displays, sketching with data, creating complicated animations and motion graphics, or building out worlds in 3D, some knowledge in this area will serve you well.

PROGRAMMING TOOLS

In this chapter, we'll explore some programming tools to help get you acquainted. Let's start the conversation with D3, since we've already learned a good deal about this in the previous lesson, but it must be mentioned again, as part of this group. D3, as we now know, is one of the most dominant, and important programming libraries for creating dynamic, interactive visualizations.



To review, D3.js is a JavaScript library for manipulating documents based on data. D3 visualizes data by using HTML, SVG, and CSS. D3 emphasizes web standards, and accesses the full capabilities of modern browsers, taking a data-driven approach to DOM manipulation.

It's worth noting other JavaScript libraries here that are relevant to the field. First, Chart.js offers easy, object-oriented, client-side graphs for designers, and developers. It enables you to visualize your data in six different ways, each of them animated with many options for customization, and interactivity. It's HTML5-based using the canvas element, and is supported in all modern browsers. The library also handles automatic resizing, along with changes in browser size.

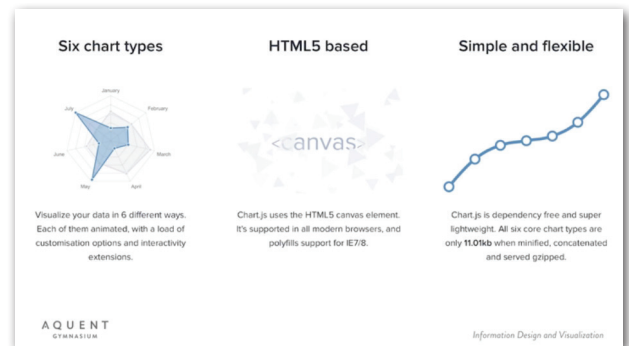
Highcharts.js began as an alternative to flash. It's a charting library written in HTML5 and JavaScript that offers intuitive, interactive charts for use on the web. Highcharts supports a large number of chart types, including line, spline, area, area spline, column, bar, pi, scatter, and many others.

Raphael.js is a JavaScript library that simplifies the handling of vector graphics on the web. You can create charts, widgets, and other web elements in which every element is part of the DOM, and can therefore be accessed by JavaScript event handlers.

Timeline.js is an open-source tool that facilitates the creation of interactive timelines, and can be used at both beginner, and advanced levels. It can pull in media from a variety of sources, and has built-in support for Twitter, Flickr, Google Maps, YouTube, Vimeo, Vine, Daily Motion, Wikipedia, SoundCloud, et cetera. Easy to use. You simply enter your data into a Google spreadsheet, and the timeline can be embedded into a website, much like you would with a YouTube video.

Moving on from JavaScript libraries, let's take a look at Processing. Although, note that there is also a Processing.js, which is basically a port of the Processing language. Processing is an open-source programming language and development environment. It was initially created to serve as a software sketchbook, and to teach computer programming fundamentals, within a visual context.

But, Processing has evolved into a development tool for professionals. At the Times, we have used Processing to sketch with data. But, it can be also used to develop full interactive applications.



HTML5 should also be mentioned in this section. We've been hearing about the latest version of the native language of the web throughout this class, because with version 5, a lot of graphics capability was added. Especially notable is the Canvas element. This allows information designers to do many of the things that used to be only possible using Adobe Flash, but in a web-native way.

An interesting development environment, created by Adobe in response to many feeling that the Flash product was no longer an option, is Adobe Edge. It's a great option for people who want to work in a similar way as they did in the Flash environment, but ultimately output web-native, animated and interactive HTML5 projects that work across platforms.

Google Charts is another great way to add interactive chart elements to a website. From simple line charts, to complex hierarchical tree maps, the chart gallery provides a large number of ready-to-use chart types. The most common way to use Google Charts is with simple JavaScript that you embed in your web page. Load some Google Chart libraries, list the data to be charted, select options to customize your chart, and, finally, create a chart object with an ID that you choose. Then, later in the web page, you create a DIV with that ID to display the Google Chart.

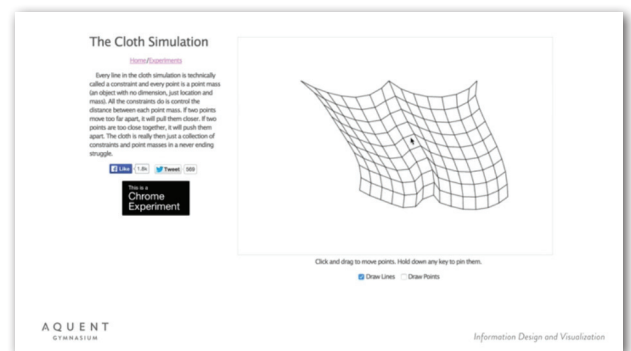
So, to recap, some useful programming tools to consider are D3.js, Chart.js, Highcharts.js, Raphael.js, Timeline.js, Processing, HTML5, Adobe Edge, and Google Chart API.

In the next chapter, we'll take a look at some mapping tools.

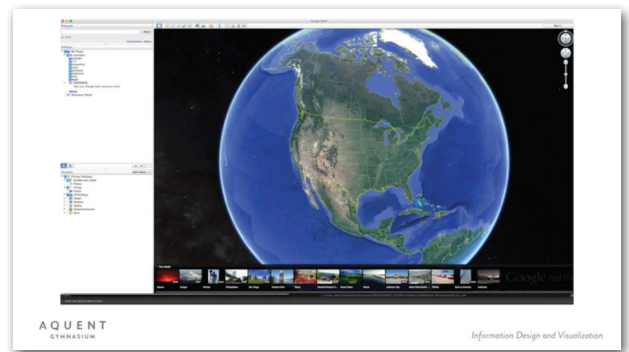
MAPPING TOOLS

Mapping is a fundamental part of the information design and visualization field. Presenting election results, or changes in demographics across a county, or migration patterns, or presenting any data that needs to be geolocated, maps are a key form that you'll want to understand. Let's take a look at some tools that will help.

One of the most common and powerful mapping tools used on visual desks in newsrooms is ArcGIS. It includes a range of powerful and versatile mapping tools that allow you to integrate data layers onto maps, globes, and models on the desktop, and serve them out for use on a desktop, in a browser, or by mobile device. For developers, ArcGIS provides APIs for building interactive applications using JavaScript, allowing you to embed applications into web pages, or launch stand-alone web applications.

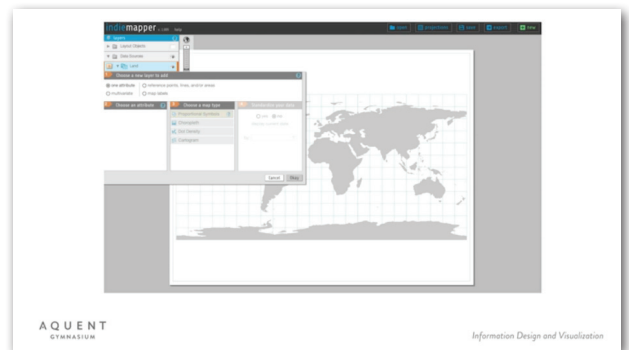


Google Earth provides a 3D interface view of the globe, letting you pan and zoom to explore the earth. Visualizations can be created using Google Earth, through the features of accompanying APIs like Google Maps API, and Google Visualization API, and by combining the maps with KML data, which enables you to overlay your own visual data onto the foundational 2D, or 3D map to views.

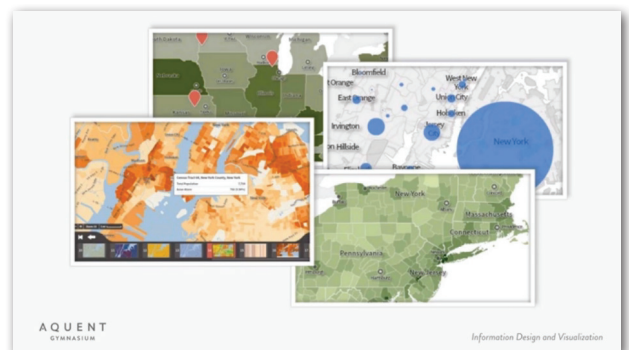


Kartograph is a simple and lightweight framework for building interactive map applications, without Google Maps, or any other mapping service. It was created with the needs of designers and data journalists in mind by a colleague of mine at the Times, Gregor Aisch. Kartograph comes in two flavors, or libraries. One, Kartograph.py generates compact SVG, or vector maps. The other, Kartograph.js helps you to create interactive maps that run across all major browsers.

Indiemapper describes itself as a smarter, easier, more elegant way to make thematic maps from digital data, closing the gap between data and map, by taking a visual approach to map-making. It's a web-based app that loads geodata, allows custom control over map-making, and exports static maps in vector, and raster formats.



Mapbox is a great platform for creating custom maps, and is used on thousands of websites and apps, including many social networks and media outlets. Here's one example of a map created using Mapbox that visualizes taxi trips from JFK and LaGuardia airports in New York City over the holidays.



Social Explorer provides quick and easy access to current, and historical census data, and demographic information. The web-based interface lets users create maps and reports to illustrate, analyze, and understand demography, and social change. Social Explorer includes over 40 billion data elements, 500,000 variables, and more than 25,000 interactive maps.

You can visualize demographic data, create detailed data reports with the reporting tools. Using the side-by-side maps tool, you can display two maps at once for comparison, and exploration. The double map presentation helps you illustrate change over time, relationships between variables, and contrasts between geographies.

So, to recap, some excellent mapping tools are ArcGIS, Google Earth, Kartograph, Indiemapper, Mapbox, and Social Explorer. So, there you have some mapping tools that should get you started. Next, we'll take a look at our final set of tools: illustration and animation tools.

ILLUSTRATION AND ANIMATION TOOLS

Telling stories with illustration and animation, be it diagrammatic work, or a “how it works” kind of project, or an integrated multimedia storytelling project, illustration has long been a fundamental aspect of information design. With so much media being consumed on screens, animation is playing an increasingly important role as well. Let’s look at some of the main tools being used.

Adobe Illustrator was mentioned in our mapping chapter, but it must be mentioned again, here. Illustrator is the industry standard for creating vector illustration work. Pretty much any illustration style you might need can be created with this app. Working with vector artwork will ensure sharp, high-resolution projects that can be used on the web, or seamlessly moved to animation software. Illustrator is one of the main tools we use at the Times, and close to all of our print graphics, and many web graphics pass through Illustrator at one point, or another.

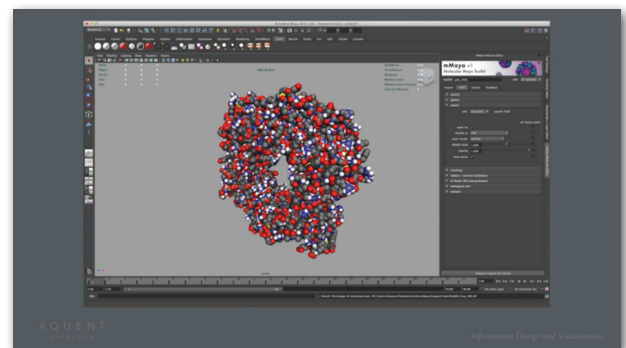
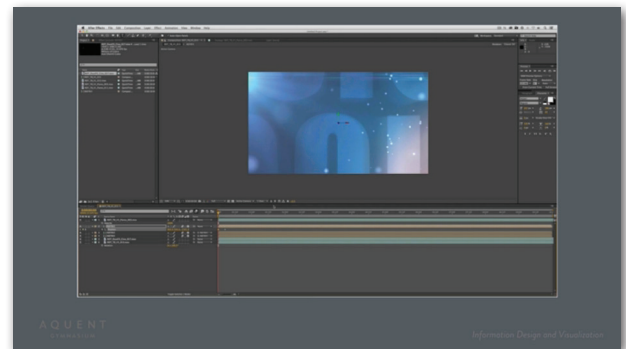
Adobe After Effects is a powerful software package, which focuses on the creation of motion graphics, and broadcast quality visual effects. After Effects acts a bit like a combination of Illustrator, and video editing applications, like Premiere. After Effects operates primarily with images, or video content, offering the opportunity to apply and layer sound, graphic, special effects, and motion.

After Effects ultimately exports video rendered graphic effects. From an information design and visualization perspective, After Effects is often used in the creation of explanatory videos. Many of the motion graphics you may have seen in the Times were created using this tool.

Autodesk Maya is a powerful 3-D modelling, rendering, simulation, and animation tool that can provide a wide range of imagery relative to the information design field. Maya has been used for everything from explanatory animated graphics, to data visualizations, to diagrammatic illustrations. This tool is most common in the film and television worlds, but its versatility in creating polished, high-end visuals makes it a powerful asset in creating information design projects.

Maya’s one of the main tools I use at the Times. And, if you’re interested, I also teach a class on using Maya in the journalism environment to create information design projects, on the online teaching community, Skillshare.

Cinema 4D is another 3D tool to consider. The interesting thing about Cinema is that it integrates directly with Adobe After Effects. So, if you’re just getting into 3D, and need a tool that is based more around the motion graphics workflow, Cinema may be a good choice.



Autodesk 3ds Max is another powerful 3D tool, most similar to Maya. It's hard to say if 3ds, or Maya is the better choice. Each has its advantages, and disadvantages in various workflows. One consideration though, is that Maya works in Mac, Windows, and Linux environments, while 3ds is Windows only.

SketchUp is a great 3-D tool for beginners, and a free version is available for download. It's well-suited to handling architectural modeling, among other things. I found it useful when working with the many models available on Google's free 3D Warehouse library. Many of these models exist in the SketchUp file format. I've also used SketchUp as a go-between between Google 3D Warehouse, and other 3D programs. 3D files can be opened, and exported out into common 3D formats, like OBJ.

Poser is another great animation tool focused on human figures. Information design work often calls for representing people in one way, or another. Building human models from scratch is an incredibly time-consuming exercise, so Poser can save a ton of time.

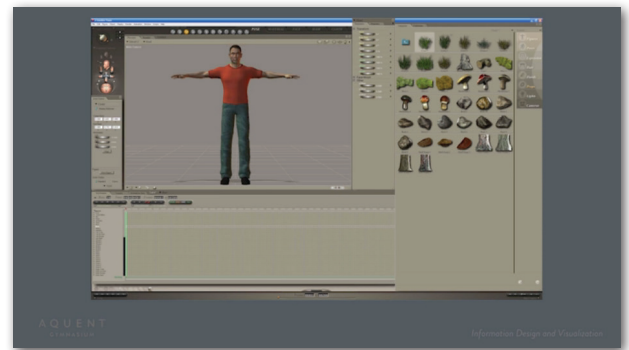
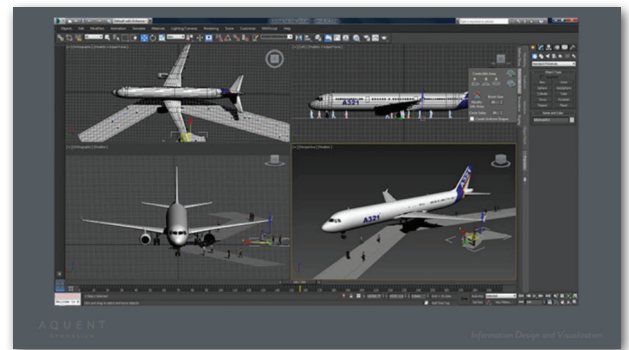
The tool comes with a library of fully-rigged or ready to animate and pose human figures that are highly customizable. I've used Poser for everything, from creating static human silhouettes for print graphics, to animated figures in motion graphics.

So, to recap, we took a look at some powerful illustration and animation tools including Adobe Illustrator, Adobe After Effects, Autodesk Maya, Cinema 4D, Autodesk 3ds Max, SketchUp, and Poser. And here, a look back at all of the tools we covered in this lesson in the five categories of data handling, charting, programming, mapping, and illustration and animation.

These animation, and illustration tools should be plenty to get you started. This concludes our look at tools of the trade. Next up, I'll recommend some reading resources to consider, to go more in depth in your training in information design and visualization.

READING RESOURCES

We've covered a lot of ground so far in getting to know, and understand information design, and visualization. We've worked on defining the field, explored many examples, learned the basics of visual design principles, structured a step-by-step approach toward building projects, examined the fast-evolving world of interactive design, and now taken a broad look at the many different kinds of tools available at our disposal.



Even so, in many ways we've just scratched the surface. So, in this chapter, I'll recommend some reading, and resources you can use to keep learning, and developing skills.

We mentioned this author in lesson one, but a good place to start would be with the information design books by Edward Tufte. As his website explains, Tufte is a statistician, and artist, and professor emeritus of political science, statistics, and computer science at Yale University. He wrote, designed, and self-published four classic books on data visualization. The New York Times has described him as the “Leonardo da Vinci of data,” and Business Week as the “Galileo of graphics.”

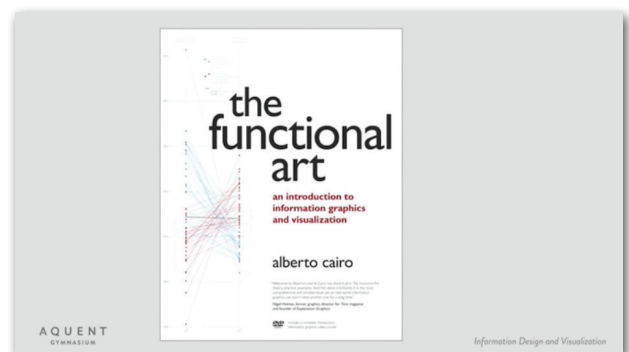
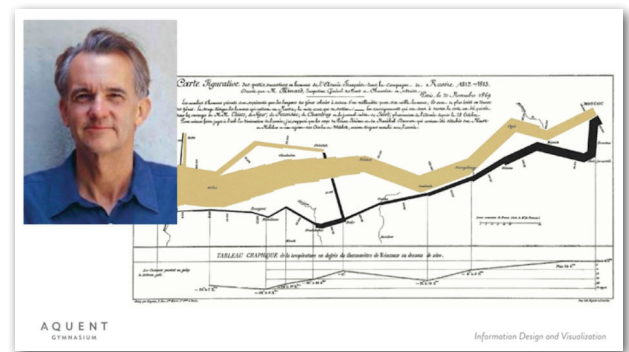
His four books are: “The Visual Display of Quantitative Information”, “Envisioning Information”, “Visual Explanations”, and “Beautiful Evidence”. These books give a fantastic foundation into the theory and practice of data graphics, and explanatory graphics, and are considered classics in the field.

If you're interested in getting started creating interactive graphics with D3, consider Scott Murray's “Interactive Data Visualization for the Web”. The book expands on Scott's online D3 tutorials, and includes more information on basic web development, including comprehensive introductions of all the web technologies behind D3: HTML, CSS, JavaScript, and SVG.

Alberto Cairo is a professor at the University of Miami, teaching data journalism, and visualization. His latest book, “The Functional Art”, is worth checking out. We've looked at many of the ideas from this book in this class, like the visualization wheel, but the book gives some great examples, and expands on these ideas. It also includes some excellent profiles of current experts in the industry.

Gareth Cook is a Pulitzer Prize winning magazine journalist, a contributor to newyorker.com, and the series editor of “The Best American Infographics”. There are two books in the series so far, and both are great for checking out some of the best examples of current information design and visualization work. The first has an introduction by none other than David Byrne of the Talking Heads fame, and the latest contains a forward by statistician Nate Silver of the 538 blog.

Taschen is an art book publisher founded in 1980 by Benedict Taschen in Cologne, Germany. A couple years ago they published a great collection of information design, and visualization projects called “Information Graphics”. It's a hefty volume. Amazon claims it weighs eight pounds, but worth perusing if you can get your hands on one. Beautiful, full-color, high-quality prints abound, and it can be a source of great inspiration.



Nathan Yau is well known as the creator of the Flowing Data blog. His book, “Visualize This”, is a practical guide on visualization, and how to approach real-world data. In Visualize This, Nathan Yau teaches you how to create graphics that tell stories with real data, learn to make statistical graphics in R, design in Illustrator, and create interactive graphics in JavaScript, and Flash, and Actionscript.

David McCandless is a London-based author, writer, and designer. He’s written for The Guardian, Wired, and others, and is an independent data journalist, and information designer. Per the description, his book, “Information is Beautiful”, helps readers make sense of the countless statistics, and random facts that constantly bombard us. Using cutting edge graphs, charts, and illustrations, David McCandless creatively visualizes the world’s surprising relationships, and compelling data, covering everything from the most pleasurable guilty pleasures, to how long it takes different condiments to spoil, to world maps of internet search terms.

Gestalten is a publisher, and creative agency mostly known for their 450 books on art, architecture, design, photography, and typography. They have a two-book series called “Data Flow”, which is worth checking out. These books explore the possibilities of information design, and contain tons of great examples. The newest, “Data Flow 2”, also includes an interview with the Times graphics director, Steve Deunes.

Ben Fry is a principle of Fathom, a design and software consultancy located in Boston. His book, “Visualizing Data”, demonstrates methods for representing data accurately on the web, and elsewhere. Complete with user interaction, animation, et cetera, using the processing environment, which Ben developed.

So, to recap some recommended reading to further your knowledge of, and explore information design and visualization, are the books by Edward Tufte, Scott Murray’s “Designing Interactives for the Web”, Alberto Cairo’s “The Functional Art”, Gareth Cook’s “Best American Infographics” books, Taschen’s “Information Graphics” collection, Nathan Yao’s “Visualize This”, David McCandless’ “Information is Beautiful” and Ben Fry’s “Visualizing Data.”

In the next lesson, we’ll take a look at the thought process, and tools used to develop an animated information graphic, from beginning to end. I’ll be using a New York Times project we published called, “Mariano Rivera, King of the Closers,” which uses data visualization to present, and explore the evidence of why Rivera is one of the best closer pitchers of all time. It includes key tools from most of the categories we’ve looked at in this lesson, listed above.

Homework. The first assignment is a quiz. Each lesson in the course has one, and it’s designed to help you reinforce the concepts covered in the lesson. Quizzes are available on the classroom site, after this video is done.



For assignment two, now that you have plans for both a static, and an interactive version of a graphic from the past lessons, use what you've learned in this lesson to determine the right tools to actually create it. Make a list of the tools you think would work best to realize your design, with an explanation of why each tool fits your needs. Then, make a plan on how you could learn to use these tools, whether it be through reading some of the books I've suggested, or other online resources, for any of the tools that you don't currently know how to use.

After you've finished your assignment, post a link to it in the classroom, and then find one of your classmate's assignments, and take some time to look it over, and offer feedback. That's it, for now. I'll see you in the next lesson.

