

1. What We Talk About When We Talk About Visualization

No matter how clever the choice of the information, and no matter how technologically impressive the encoding, a visualization fails if the decoding fails. Some display methods lead to efficient, accurate decoding, and others lead to inefficient, inaccurate decoding. It is only through scientific study of visual perception that informed judgments can be made about display methods.

—William S. Cleveland, *The Elements of Graphing Data*

In the introduction, I threw around terms such as “visualization,” “infographics,” “information graphics,” and so on, without defining them. Each book about visual communication on my shelves uses these terms with a slightly different meaning. So, for consistency and to avoid confusion later, let me set down some definitions—while not claiming that my definitions are better than anybody else’s.

“Visualization” is my umbrella term. **A visualization is any kind of visual representation of information designed to enable communication, analysis, discovery, exploration, etc.** Almost every picture I’ll show is, therefore, a visualization. In this book I don’t cover all branches of visualization, just those intended to communicate effectively with the general public. I will barely mention visualizations created exclusively with artistic purposes, for instance, which belong to the realm of data art.

A chart is a display in which data are encoded with symbols that have different shapes, colors, or proportions. In many cases, these symbols are placed within a Cartesian coordinate system. The word “plot” is a synonym of “chart” in this book, as it’s commonly used to refer to a few specific charts in the professional literature (“scatter plot” sounds more familiar than “scatter chart”).

See **Figure 1.1** for a few examples of charts. Yes, I know—*lollipop chart*. You read that right. I think that it was Tableau’s visualization designer and data analyst **Andy Cotgreave** who came up with this term. Who said that designers and statisticians don’t have a sense of humor?

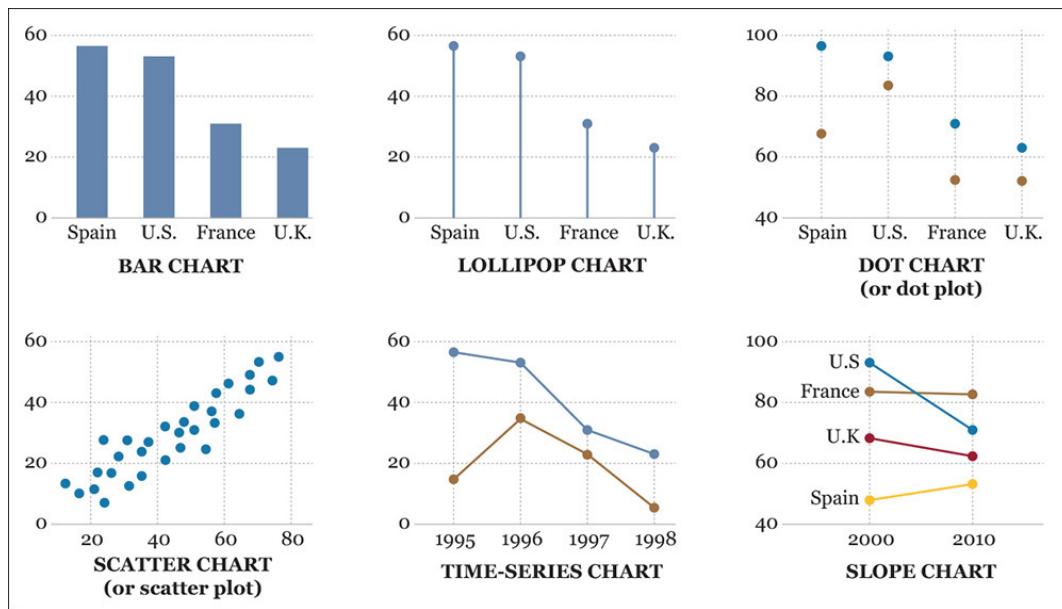


Figure 1.1 Examples of charts. Not all charts have an X-axis and a Y-axis. Pie charts, for instance, aren’t based on a Cartesian coordinate system.

In some cases, visualization designers prefer “diagram” to “chart.” For instance, in the introduction you read about a Sankey diagram¹ designed by Moritz Stefaner. If I were 100 percent consistent, I should call that example a “Sankey chart,” but I acknowledge that Sankey diagram is a popular name. I’d be fine with calling this a “flow chart,” too.

¹ Sankey diagrams are named after Matthew Henry Phineas Riall Sankey, an engineer who used this graphic form to display the efficiency of a steam engine. Sankey was not the first one to use Sankey diagrams, by the way. Charles Joseph Minard, a French cartographer, became famous in the middle of the nineteenth century thanks in part to the many flow charts and maps he designed. See Michael Friendly’s “Visions and Re-Visions of Charles Joseph Minard” at <http://www.datavis.ca/papers/jeps.pdf> (<http://www.datavis.ca/papers/jeps.pdf>).

A side note for scientists and statisticians: I know that many of you prefer “graph” when you refer to charts built on a Cartesian coordinate system, but some mathematicians might claim that they own that word in reference to connection and network graphics—that is, “graph theory,” which is a branch of mathematics. I’m not willing to unleash a turf war, so I’ll just say that you’re both right and that we can all get along, even after considering that this author is a journalist.²

² If you have friends who are scientists, ask them what they think about journalists. Have an umbrella (or a shield) handy.

A map is a depiction of a geographical area or a representation of data that pertains to that area (Figure 1.2). I may use the term “data map” every now and then to refer to this second kind of map.

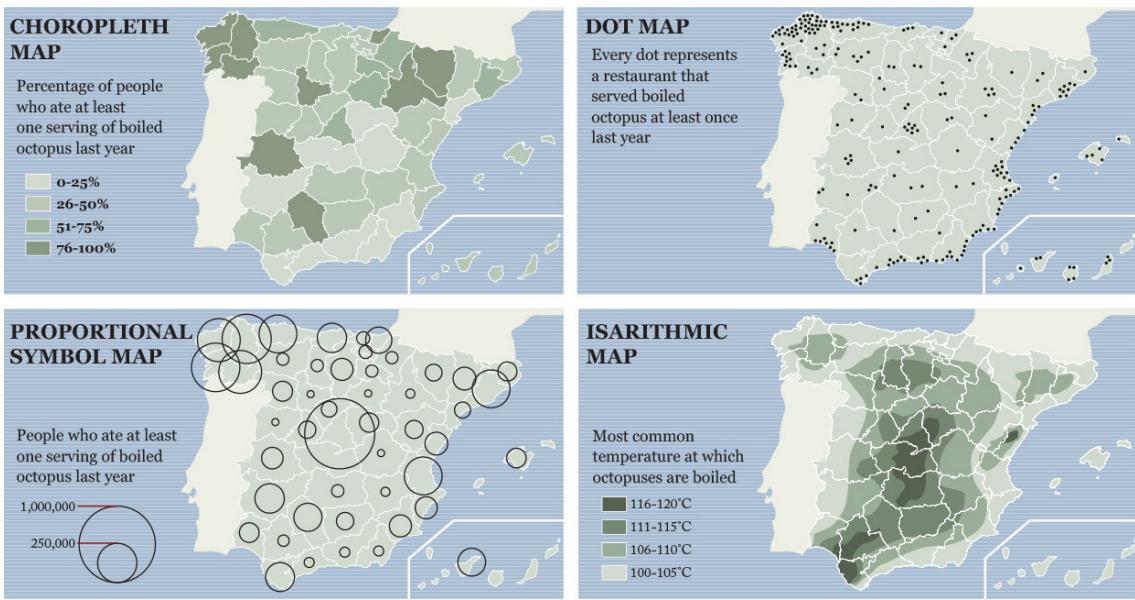


Figure 1.2 Examples of data maps. I was born in Galicia, that region in northwestern Spain where people seem to be so fond of eating boiled octopus (it's delicious, if properly cooked). All data here are fake, of course.

An infographic is a multi-section visual representation of information intended to communicate one or more specific messages. Infographics are made of a mix of charts, maps, illustrations, and text (or sound) that provides explanation and context. They can be static or dynamic. What defines an infographic is that its designer doesn't show all information she gathered, but just the portion that is relevant for the point (or points) that she's trying to make. See [Figure 1.3](#).

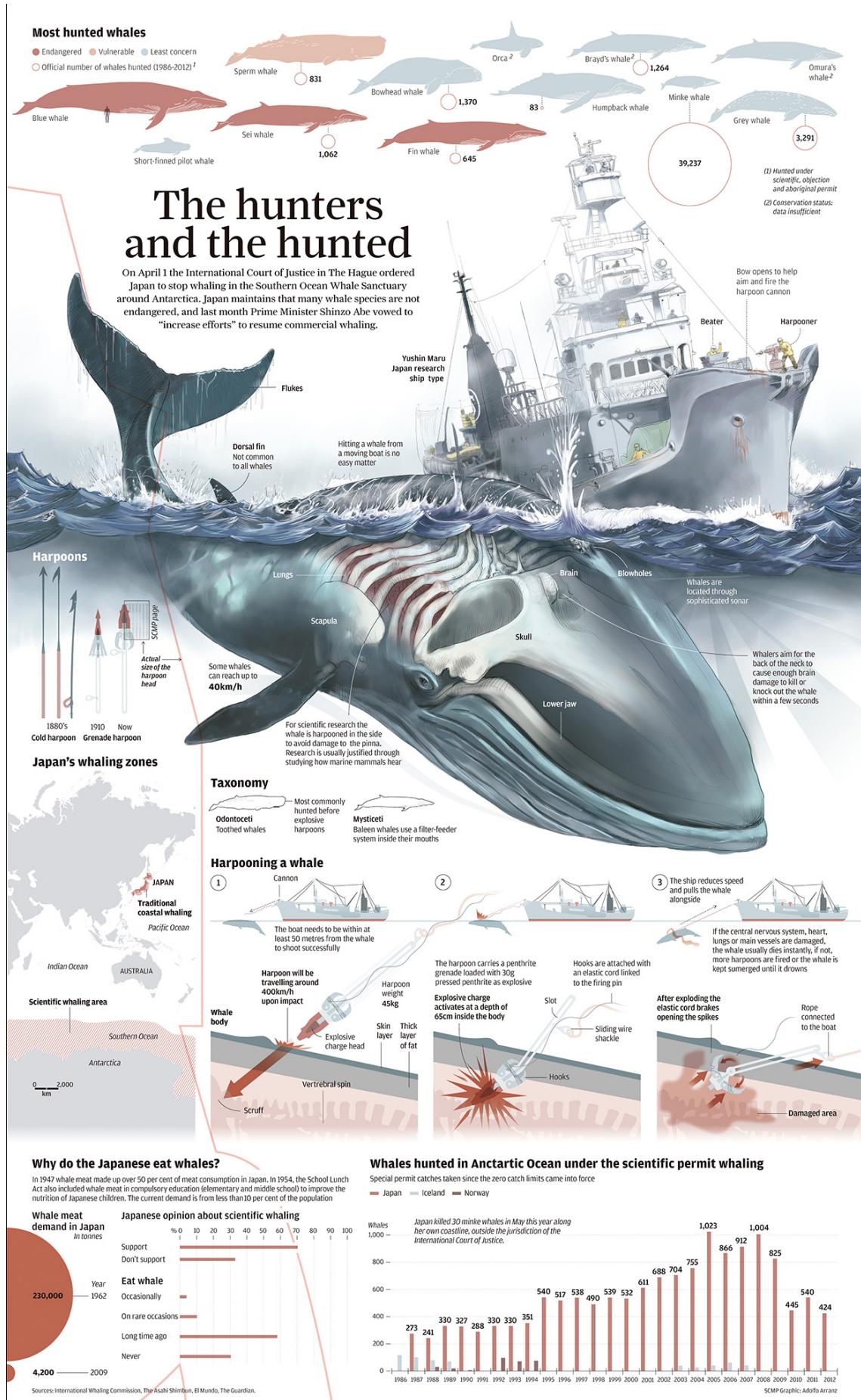


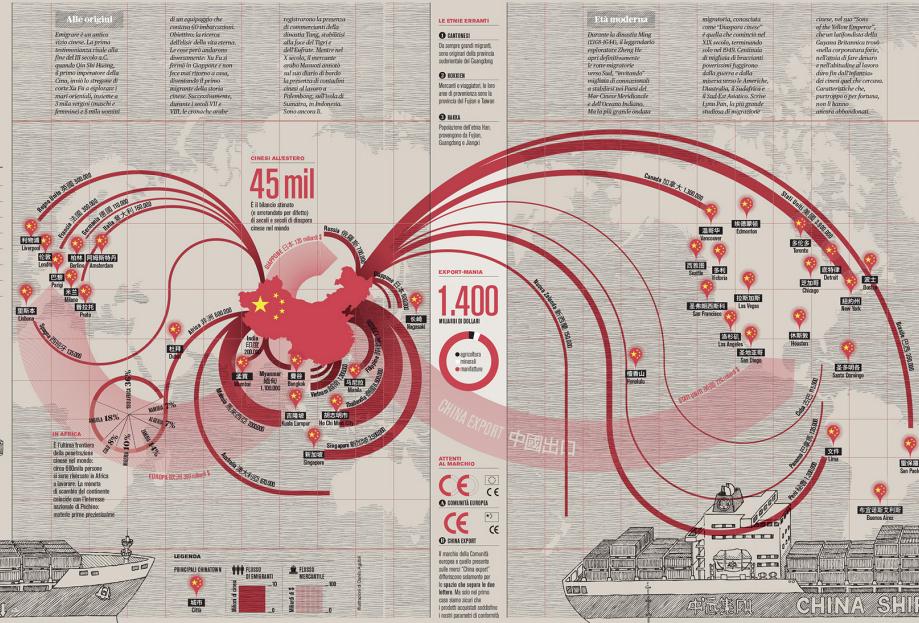
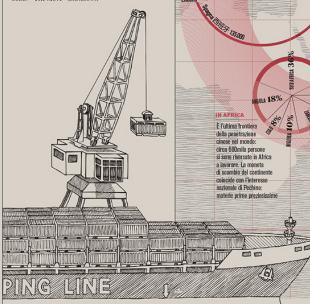
Figure 1.3 Infographic by Adolfo Arranz for the South China Morning Post.

Infographics are sometimes, but not always, organized in a linear fashion, like narratives and step-by-step explanations. They can be rich in detail, and they usually include unobtrusive drawings, icons, and pictograms to increase the visual appeal of the display. Infographics can be lush, colorful, and fun if their designers don't forget that their fundamental goal is to make the public better informed (Figure 1.4). Clarity and depth are paramount in infographics. Bells and whistles are secondary and optional.

Attenti a questo dragone

Hanno attraversato il mondo apendo rotte migratorie destinate a durare nel tempo. Ora sono i nuovi protagonisti degli scambi internazionali. E le loro "chinatown" diventano sempre più grandi. Un trend che appare inarrestabile

L'INFO - Francesco Franchi e Alessandro Giberti
VOLTA - The Move - Clinton



76

77

Figure 1.4 Infographic by Francesco Franchi and Alessandro Giberti. Illustration by Danilo Agutoli. Published by *Il Sole 24 ORE* (Italy).

A data visualization is a display of data designed to enable analysis, exploration, and discovery. Data visualizations aren't intended mainly to convey messages that are predefined by their designers. Instead, they are often conceived as tools that let people extract their own conclusions from the data.

Figure 1.5 is an example of data visualization. This is an image of an interactive graphic created by the design firm **Periscope**, showing terrorist groups and attacks since 1970. The display can be rearranged at will: by name of group, by most victims, by how recent the activities of the groups are, and so on. A reader on the Web can also hover over any of the groups and see specific figures. In my case, as I was born in Spain, my point of entry to this data visualization was ETA, the Basque terrorist group that killed more than 800 people between 1968 and 2010. If you live in the United States, you probably focused first on the Taliban or al-Qaeda (or al-Qa'ida, as it's spelled in this project). A good data visualization may yield different insights to each person.

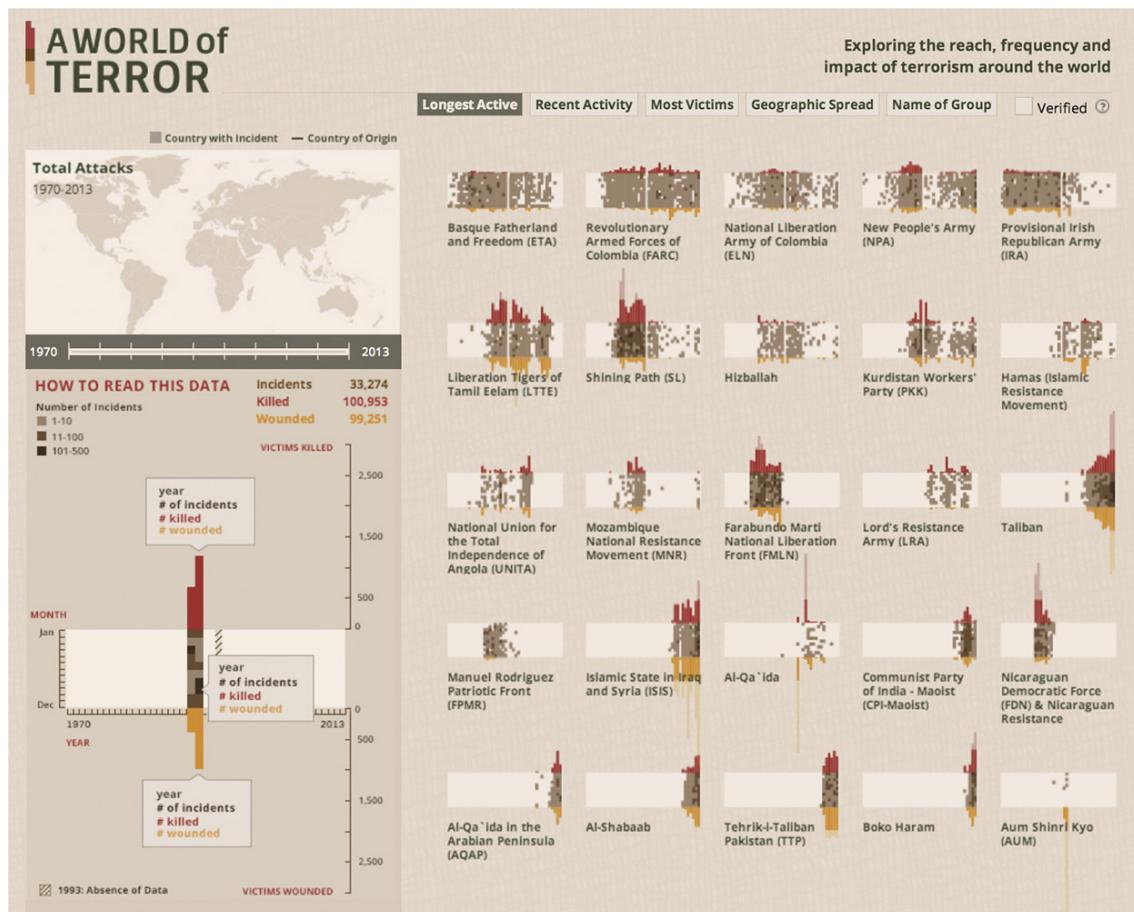


Figure 1.5 Periscope's "A World of Terror" (<http://terror.periscope.com/> (<http://terror.periscope.com/>)).

Finally, I'll be using the term "news application," which I've borrowed from the nonprofit investigative journalism organization ProPublica. **A news application is a special kind of visualization that lets people relate the data being presented to their own lives.** Its main goal is to be useful by being customizable according to each person's needs.

A news application can be a simulator, a calculator, or an interactive visual database like "Treatment Tracker" (**Figure 1.6**), a project that lets *you*, the consumer, see—and I'm quoting here—"payments to individual doctors and other health professionals serving the 46 million seniors and disabled in (Medicare's) Part B program." You can find and compare any individual or set of providers with this application.

The screenshot shows the ProPublica Treatment Tracker page. At the top, there's a navigation bar with links to Home, Our Investigations, Tools & Data, MuckReads, Get Involved, About Us, and social media icons for Facebook and Twitter. A search bar is also present. Below the header, the title "Treatment Tracker" is displayed, followed by the subtitle "The Doctors and Services in Medicare Part B". A byline indicates the story was written by Lena Groeger, Charles Ornstein, and Ryann Grochowski Jones on May 15, 2014. A paragraph about Medicare payments follows, along with a link to a related story. On the left, there's a search form for providers, cities, or zip codes, with a placeholder for "Rebecca Torres, Chicago, 63141" and dropdown menus for state selection and searching. To the right, there are "RELATED STORIES" including "Top Billing" and "Sanctioned Doctors", along with links to a patient guide and a video. The main content area features two sections: "Mental Health Providers Score Highest in Intensity of Office Visits" and "Medicare Payments by State". The first section includes a pie chart showing the intensity of office visits across five levels (1-5) for various specialties. The second section is a table ranking states by total Medicare payments.

State	Payments
NATIONAL	\$77.3B
CALIFORNIA	\$7.86B
FLORIDA	\$7.62B
TEXAS	\$5.66B
NEW YORK	\$5.45B
NEW JERSEY	\$3.56B
ILLINOIS	\$3.39B
PENNSYLVANIA	\$3.13B
MICHIGAN	\$2.79B
NORTH CAROLINA	\$2.78B
OHIO	\$2.47B
GEORGIA	\$2.21B
VIRGINIA	\$2.03B
TENNESSEE	\$1.85B
MASSACHUSETTS	\$1.81B
MARYLAND	\$1.76B
ARIZONA	\$1.59B
INDIANA	\$1.53B
ALABAMA	\$1.49B
MISSOURI	\$1.43B
SOUTH CAROLINA	\$1.34B
WASHINGTON	\$1.24B
KENTUCKY	\$1.14B
CONNECTICUT	\$1.02B
LOUISIANA	\$1.02B
WISCONSIN	\$924M
OKLAHOMA	\$810M
COLORADO	\$775M
ARKANSAS	\$754M
KANSAS	\$734M

Figure 1.6 ProPublica's "Treatment Tracker" (<http://projects.propublica.org/treatment/>).

Another example of a news application is *The Wall Street Journal's "Health Care Explorer"* (**Figure 1.7**). It was launched before President Barack Obama's Affordable Care Act went into effect to help U.S. citizens navigate myriad healthcare options. Input *your* own age, choose *your* state and county, and pick the kind of plan that *you're* more interested in. Click Search, and *you'll* be able to compare plans in your area. Then, *you* can pin the ones that look more promising. To *you*.

HealthCare.gov Explorer

See the rates for health plans available through HealthCare.gov, the federal insurance exchange. Many consumers will also be eligible for federal subsidies to help buy coverage through the exchanges, and may pay lower rates. Plans are labeled Catastrophic, Bronze, Silver, Gold or Platinum depending on the level of coverage.

Interactive by: Martin Burch, Madeline Farbman, Jonathan Keegan, Adam Suharja, Christopher Weaver, Kurt Wilberding/The Wall Street Journal.

Write to the editors at WSJGraphicsEditors@WSJ.com.



How Health-Insurance Subsidies Are Calculated



AGE: 30 PLAN TYPE: Silver STATE: Alabama COUNTY: Autauga OR ADDRESS: Autauga, Ala. SEARCH GEO LOCATE

Range of prices for lowest-cost Silver plans on HealthCare.gov

\$144
\$215
\$409

Allegheny, Pa.
Autauga, Ala.
Worth, Ga.

Alabama: Autauga
Results
Your plans

Leaflet | Map tiles by Stamen Design, under CC BY 3.0. Data by OpenStreetMap, under CC BY SA.

CALCULATE SUBSIDY ▶

Showing < 1 of 2 >

\$150 monthly premium
 ✖

Catastrophic
[PLAN DETAILS »](#)

AGE 30
AUTAUGA, ALA.

BLUE CROSS AND BLUE SHIELD OF ALABAMA
Blue Protect

DEDUCTIBLE
\$6,350

OUT-OF-POCKET MAX
\$6,350

COST OF DOCTOR'S VISIT
\$40

No charge after deductible

[About Catastrophic plans »](#)

\$174 monthly premium
 ✖

Bronze
[PLAN DETAILS »](#)

AGE 30
AUTAUGA, ALA.

BLUE CROSS AND BLUE SHIELD OF ALABAMA
Blue Saver Bronze

DEDUCTIBLE
\$6,350

OUT-OF-POCKET MAX
\$6,350

COST OF DOCTOR'S VISIT
\$40

No charge after deductible

\$215 monthly premium
 ✖

Silver
[PLAN DETAILS »](#)

AGE 30
AUTAUGA, ALA.

BLUE CROSS AND BLUE SHIELD OF ALABAMA
Blue Value Silver

DEDUCTIBLE
\$2,400

OUT-OF-POCKET MAX
\$6,350

COST OF DOCTOR'S VISIT
\$40

About Silver plans »

\$174 monthly premium
 ✖

Bronze
[PLAN DETAILS »](#)

AGE 30
AUTAUGA, ALA.

BLUE CROSS AND BLUE SHIELD OF ALABAMA
Blue Saver Bronze

DEDUCTIBLE
\$6,350

OUT-OF-POCKET MAX
\$6,350

COST OF DOCTOR'S VISIT
\$40

No charge after deductible

\$228 monthly premium
 ✖

Silver
[PLAN DETAILS »](#)

AGE 30
AUTAUGA, ALA.

BLUE CROSS AND BLUE SHIELD OF ALABAMA
Blue Saver Silver

Figure 1.7 News application by Martin Burch, Madeline Farbman, Jonathan Keegan, Adam Suharja, Christopher Weaver, Kurt Wilberding/The Wall Street Journal (<http://graphics.wsj.com/health-care-explorer>)

You may have already realized that the boundaries that separate all these kinds of visualizations are blurry. Some visualizations are designed to spread a message or to tell a story based on a subset of the information available to the designer. We can use the word “infographics” to refer to these visualizations. Other graphics are designed mainly, but not exclusively, to enable exploration, and so we may want to call them “data visualizations.”

But what do you call a project like “Beyond the Border,” by *The Guardian* (Figure 1.8)? This image belongs to one of the many graphics integrated within a multimedia package that also showcases photos, video, and abundant text.

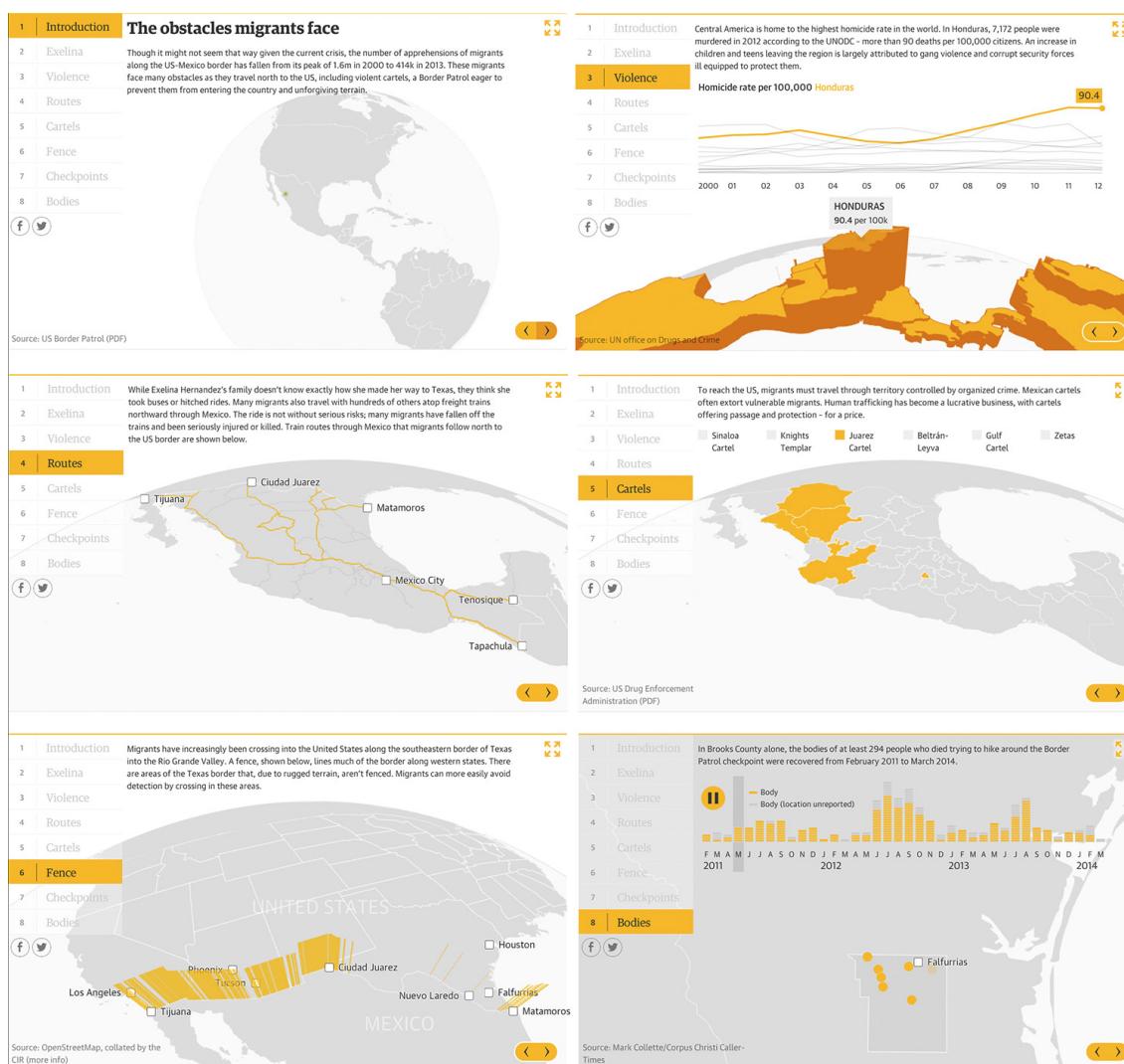


Figure 1.8 Visualization by Feilding Cage for *The Guardian* (<http://www.theguardian.com/world/ng-interactive/2014/aug/06/-sp-texas-border-deadliest-state-undocumented-migrants>). <http://www.theguardian.com/world/ng-interactive/2014/aug/06/-sp-texas-border-deadliest-state-undocumented-migrants>).

This *Guardian* graphic is, in part, an infographic, as it's a step-by-step narration that walks you through the key obstacles that undocumented migrants face in the United States. But according to my own definition, it's also a data visualization, as some of the charts and maps can be explored at will. Besides, most scenes in this hybrid product show a link to the sources of the data: the U.S. Border Patrol, the U.S. Drug Enforcement Administration, the United Nations, etc.

The boundaries aren't very clear even when we talk about static graphics. **Figures 1.9** and **1.10** are two visualizations by the *South China Morning Post*. Are they infographics? Well, yes. But aren't they also data visualizations? Don't you feel compelled to spend time poring over them, digging for curious facts and connections?

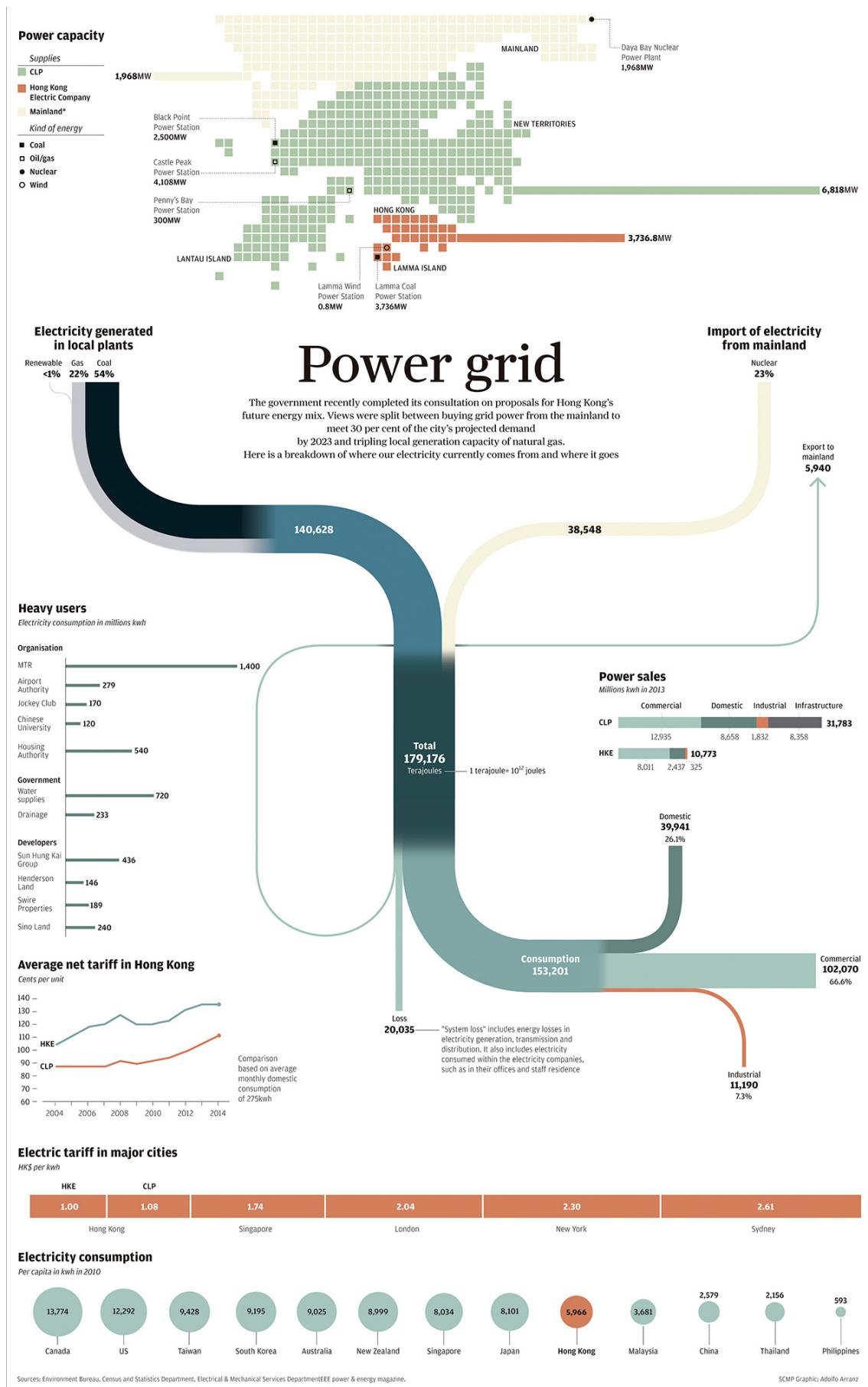


Figure 1.9 Graphic by Jane Pong for *The South China Morning Post*.

How to read this infographic
 Each year is represented by a row of vertical lines, one for each day. The height of the line indicates the average daily rainfall in millimetres. Triangles show the highest tropical cyclone warning signal for that day

- ▼ Signal 1: stand-by
- ▼ Signal 3: strong winds
- ▼ Signal 8: gale or storm force winds
- ▼ Signal 9 or 10: increasing strong force winds, hurricane

Rain patterns

May marks the start of the monsoon season, when umbrellas and wellington boots are everywhere and sunshine is a novelty. Tropical cyclones and typhoons will soon follow, dominating the skies and news channels. Here we look at some of the wettest and driest days since 1990.

Annual rainfall
 Size of circles below shows the total annual rainfall for a given year

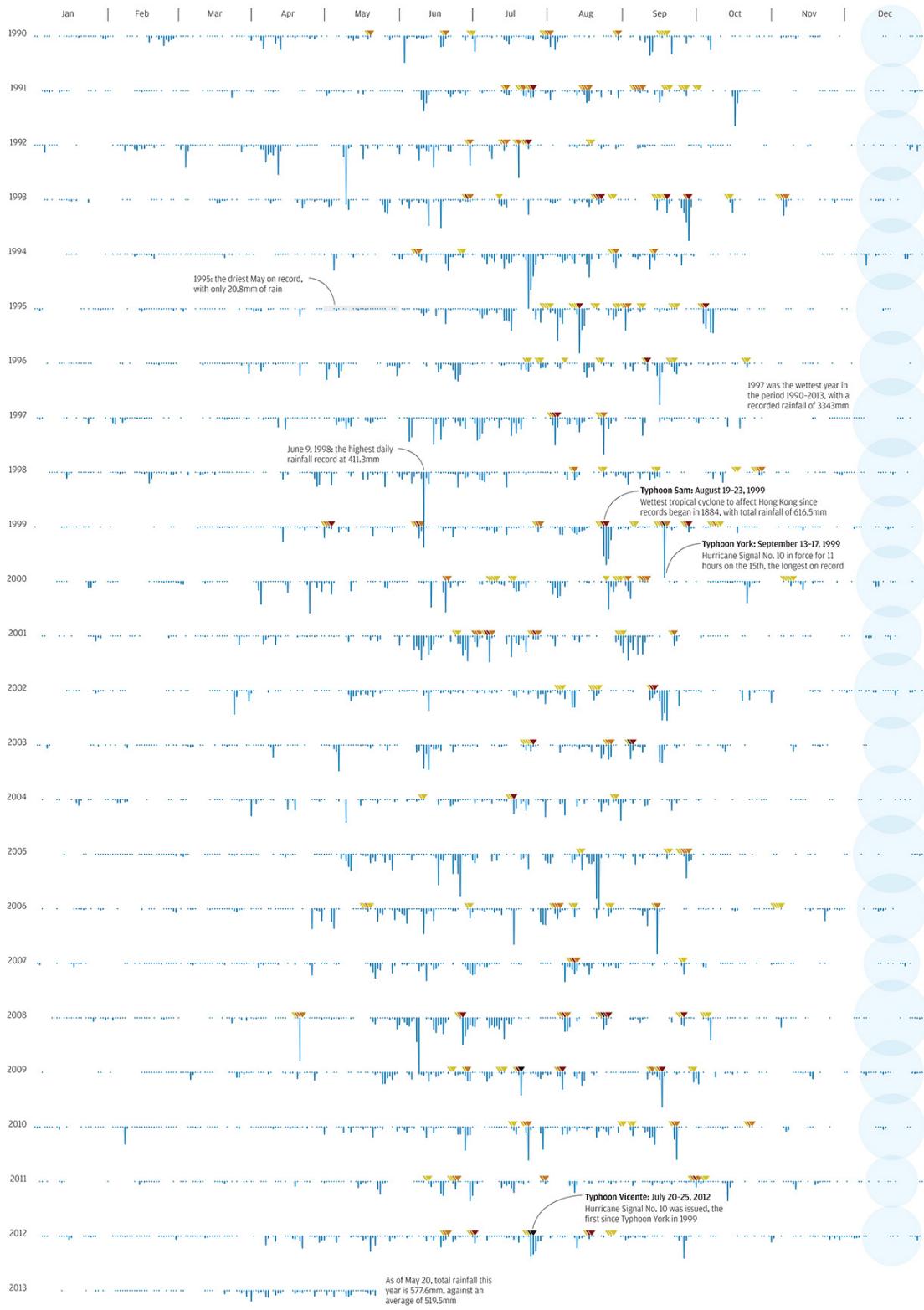


Figure 1.10 Graphic by Jane Pong for *The South China Morning Post*.

In my previous book, *The Functional Art*, I explained that terms like “infographics” and “data visualization” or dichotomies like “explanation” versus “exploration” and “presentation” versus “analysis” aren’t absolutes.

Any visualization presents information and allows at least a limited amount of exploration or even customization, so it may be hard to tell for sure if a graphic is really an infographic, a data visualization, or a news application. You may be able to say, though, that it leans more toward one of those

Source: Hong Kong Observatory SCMP Graphic: Jane Pong

realms, depending on what the main intentions of the designer are.

To be honest, I don't care much about strict taxonomy. What really matters to me is if a visualization is illuminating. For that, the designers need to keep certain important features and principles in mind. We turn to them in the following chapter.

TO LEARN MORE

- Harris, Robert L. *Information Graphics: A Comprehensive Illustrated Reference*. New York: Oxford UP, 1999. This one is a must if you want to learn what most kinds of charts, maps, and diagrams are usually called.
- Rendgen, Sandra (editor). *Information Graphics*. Köln: Taschen, 2012. This massive volume—it weights eight pounds!—will open your eyes to what I like to call “the varieties of the visualization experience.”

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Part I: Foundations

NEXT
2. The Five Qualities of Great Visualizations ▶