data visualization guidelines

THE CATO INSTITUTE

LUIS AHUMADA ABRIGO & GUILLERMINA SUTTER SCHNEIDER

introduction

SETTING A HIGHER STANDARD

This stylebook marks the beginning of a new phase in data visualization across Cato publications. Thanks to Cato's extensive presence on digital platforms, its publications have received increasing exposure during the last several years. Not only must we have standards in line with what the digital market today demands but we must also make Cato's brand more recognizable.

This stylebook is meant to improve the quality of data visualization in order to create a more appealing experience for the reader and to more effectively communicate Cato's mission and message to the public. This style guide will present that new look and its implementation.

You will find graphic guidelines for each figure and table as well as the justification for each one's design. All figures and tables created for Cato publications should meet the design standards specified in this stylebook.

We will look into the process of decision making that leads us to choose a particular type of chart. Along the way, we will introduce useful insights to the visual quality of our figures and tables, including different types of fonts, colors, sizes, and typographies.

We invite you to pay closer attention to graphic details during your day-to-day activities, such as reading the news or reviewing policy papers. It's a good exercise to imagine yourself as an ideally satisfied reader. As you do so, ask yourself some basic questions: What kinds of devices do you use for reading? What kinds of graphics look clearer? What graphic elements make certain figures more attractive and understandable than others? Empathy, curiosity, and common sense are essential for improving our insight into higher quality data visualization.

Our main goal is to make the consumption of Cato products an enriching, comfortable, and easy-to-understand experience. The graphic content of each written piece should play an important role in conveying what the author wants to communicate. Similarly, the user should find that interactive data tools provide a useful and pleasant experience. The higher the quality of our reading process, the higher the engagement in our platforms, which consequently will enhance Cato's brand and influence.

At the same time, we wish to simplify the production process; for both policy analysts and research assistants, the process must be expeditious, roles must be well defined, and timing must be in line with the expectations of the media and other users to the extent possible.

Simplifying visuals, sometimes with less information, can make communication clearer and more effective. Every figure and table is important and can have a significant impact on the distribution of the research. Each figure is an opportunity to communicate a greater message with fewer words.

As you familiarize yourself with these guidelines, we are sure that practice will enhance your skills and creativity.

LUIS AHUMADA ABRIGO
GUILLERMINA SUTTER SCHNEIDER

table of contents

ITC Franklin Gothic

DESIGNED BY **MORRIS FULLER BENTON** & **VICTOR CARUSO**.

THE FONT

The ITC Franklin Gothic™ family embodies true American grit: it's square-jawed and strong-armed, yet soft-spoken. The family suite of typefaces is large and adaptable, and is as well-suited to web content and small screens as it is to billboards and hard copy display ads.

ITC Franklin Gothic is a reimagining of Franklin Gothic, a design that dates back to 1902. It retains the personality and of the original typeface, with only a slight increase in character height and width to distinguish it from the first version. Although newer typeface families, such as Helvetica®, Univers®, and Frutiger®, have the same basic proportions and attributes as Franklin Gothic, the similarity ends there. ITC Franklin Gothic retains all the strength and vitality typical of early American sans serif typefaces.

Capitals are wide (typographers would call them "square"), lowercase letters share the proportions and letter shapes of serif typefaces –and character stroke weights echo serif-styled counterparts with their obvious contrast. For example, the left side of the A is lighter than the right, and the first stroke of the M is lighter than the other three.

While ITC Franklin Gothic is essentially a display design intended for larger size settings, it's also easy on the eyes in short blocks of text copy. A natural for interactive design, it will bring a subtle, handcrafted quality to pages and screens. Combine ITC Franklin Gothic with an old style or slab serif typeface and you'll have copy that's inviting and classic as an old pair of jeans.

Source: *ITC Fonts at myfonts.com/fonts/itc/franklin-gothic/*

Why are we using this font?

ITC Franklin Gothic was adopted from the Infogram style Cato uses.

font

ITC Franklin Gothic Std

ITC Franklin Gothic Std

ITC Franklin Gothic Std

BOLD	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
	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
REGULAR	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
	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
DIGITS	0 1 2 3 4 5 6 7 8 9 0
SPECIAL CHARACTERS	! “ § $ % & / ( ) = ? ` ; : ¡ “ ¶ ¢ [ ] | { } ≠ ¿ ‘
	« ∑ € ® † Ω ¨ / ø π • ± ‘ æ œ @ ∆ º ª © ƒ ∂ , å ¥ ≈ ç

color palette

PRIMARY COLOR SYSTEM

Color should play an important role in Cato's branding. The colors in this section should be used in all Cato publications. A palette of primary colors has been adopted from the Infogram style Cato uses.

Cato has three official colors:

- dark purple
- orange
- grey

These colors should become a recognizable identifier for the organization.

Consistent use of these colors will contribute to the cohesive and harmonious look of Cato's brand across all relevant media. Kindly use this handout as a guide when using Cato colors so they are always consistent.

PRIMARY COLOR
DARK PURPLE

dark purple
#28223C

COLOR TONES

#716A8A

#A9A4BD

PRIMARY COLOR
ORANGE

orange
#ED8B00

COLOR TONES

#F4C684

#FBDEB5

PRIMARY COLOR
GREY

grey
#C7C7C7

COLOR TONES

#E5E5E5

color palette

ALTERNATIVE COLOR SYSTEM

Explanation:
Alternative colors are complementary to the official colors, but are not recognizable identifiers for Cato. Alternative colors should be used sparingly.

Usage:
Use them to visualize gender or election data, for example.

ELECTION DATA

#B72025	#D26563	#2565AA	#739CC8
Republican	A subset of Republican	Democrat	A subset of Democrat
#F5AA1C	#F9D083		
Independent	A subset of Independent		

GENDER DATA

#C01E65	#DC7EA9	#117AB3	#7CB6D6
Female	A subset of female	Male	A subset of male

GREY SCALE

#131313	#696A6A	#9C9C9C	#D9DAD9

cato publications

PRODUCT DIVERSIFICATION

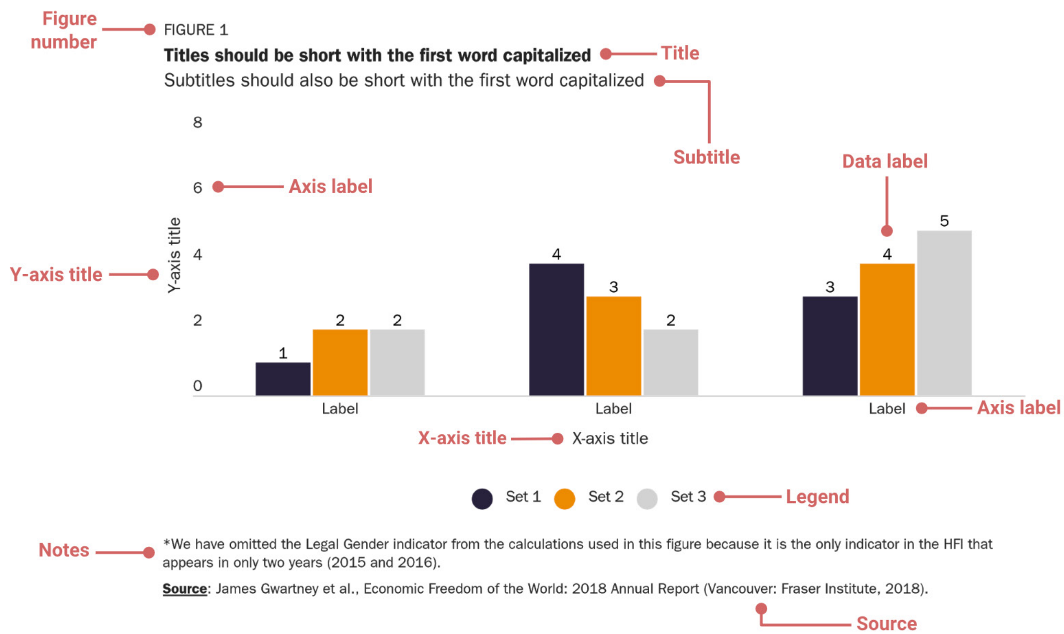
The Cato Institute produces multiple written reports which can be classified into two categories: blog posts and studies.

Blog posts are online publications posted on Cato@Liberty, Cato's blog. They usually consist of comments or short essays relevant to the news cycle. They are not subject to the review and editorial process of studies that go to the Publications department. Figures included in blog posts may have interactive attributes.

Studies are not only published online at cato.org, but printed in a specific format. Therefore, when it comes to data visualization, figures in the studies should meet the standards covered in this style book under the Print (studies) and Web (studies) titles included in the the specification section in the Cato publications chapter. We have included the following Cato publications under the studies umbrella for simplification:

1. Policy Analyses (PAs)
2. Non-Policy Analyses (non-PAs):
   - CMFA Brifieng Paper
   - Economic Development Bulletin
   - Free Trade Bulletin
   - Immigration Research and Policy Brief
   - Legal Policy Bulletin
   - Public Opinion Briefs
   - Research Briefs in Economic Policy
   - Survey Reports
   - Tax and Budget Bulletin
   - White Papers

Both blog posts and studies contain figures and tables that should meet the design standards specified in this style book.



VISUAL CUES

All charts and tables included in Cato publications may consist of the following visual cues:

- Figure number
- Title
- Subtitle
- Y-axis title
- X-axis title
- Y-axis label
- X-axis label
- Legend
- Data label
- Source
- Notes (*)

cato publications

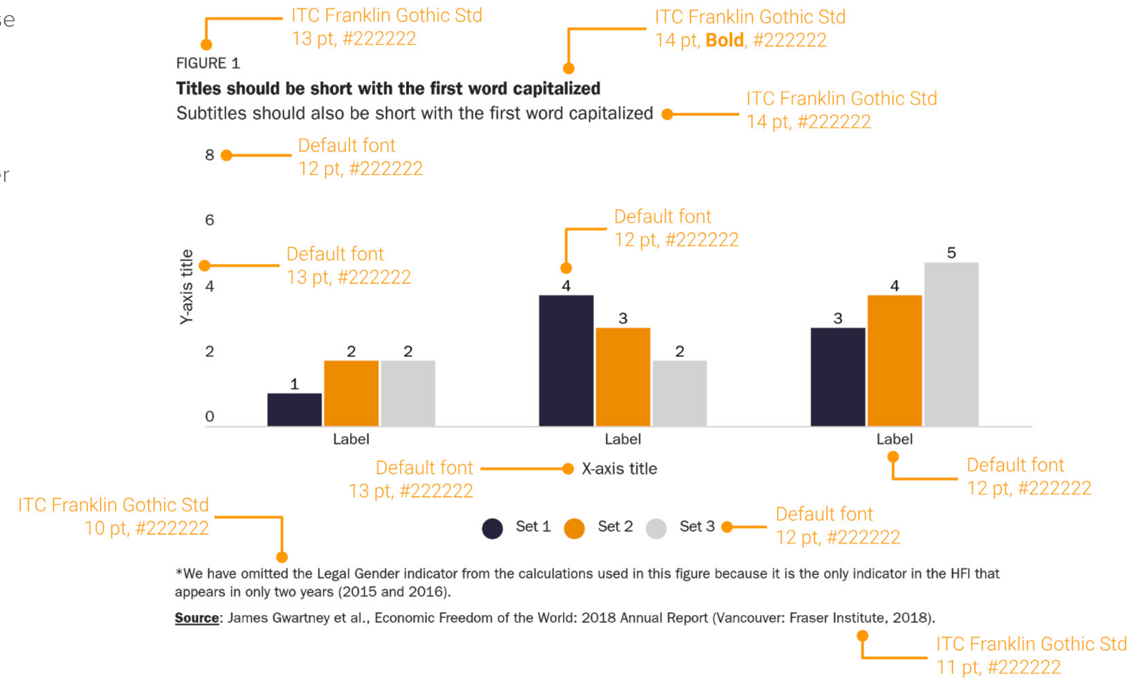
specifications

PRINT STUDIES (FIGURES)

All figures included in the studies must follow these specifications.

Size:
Since PAs have pullquote margins that reduce the available width for figures and non-PAs have wider margins, figures in PAs must have a fixed width of 750 px. For non-PAs, figures must have a fixed width of 1,000 px.

Data labels:
Should be placed outside the bar or column. Font size: 12 pt. Color: #222222.



PRINT STUDIES (TABLES)

All tables included in the studies must follow these specifications.

Size:
Since PAs have pullquote margins that reduce the available width for figures and non-PAs have wider margins, tables in PAs must have a fixed width of 750 px. For non-PAs, figures must have a fixed width of 1,000 px.

Alignment:
Text and numbers in the table headers should be left aligned in the first (leftmost) column. In all columns to the right of the first column, all text and numbers should be right aligned.

ITC Franklin Gothic Std
13 pt, #222222

ITC Franklin Gothic Std
14 pt, **Bold**, #222222

Header
background
#28223C

TABLE 1

Titles should be short with the first word capitalized

Subtitles should also be short with the first word capitalized

ITC Franklin Gothic Std
14 pt, #222222

Header Text
Default font, Bold
#FFFFFF

Country of birth	Legal immigrants	Illegal immigrants
Mexico	496	1,112
China	89	62
Philippines	60	134
El Salvador	610	1,310
Vietnam	162	547
Korea	191	108
Dominican Republic	569	969
Guatemala	303	1,340
Canada	268	464

Background
#EBEBEB

Alternate
Background
#FFFFFF

Source: American Immigration Lawyers Association via CBP (2003); Department of Homeland Security (2004); San Antonio Express News (2007); CNN via White House (2018); Border Patrol.

ITC Franklin Gothic Std
11 pt, #222222

Notes: Rates per 100,000 population.

ITC Franklin Gothic Std
10 pt, #222222

Text & Alternate Text
Default font
#222222

cato publications

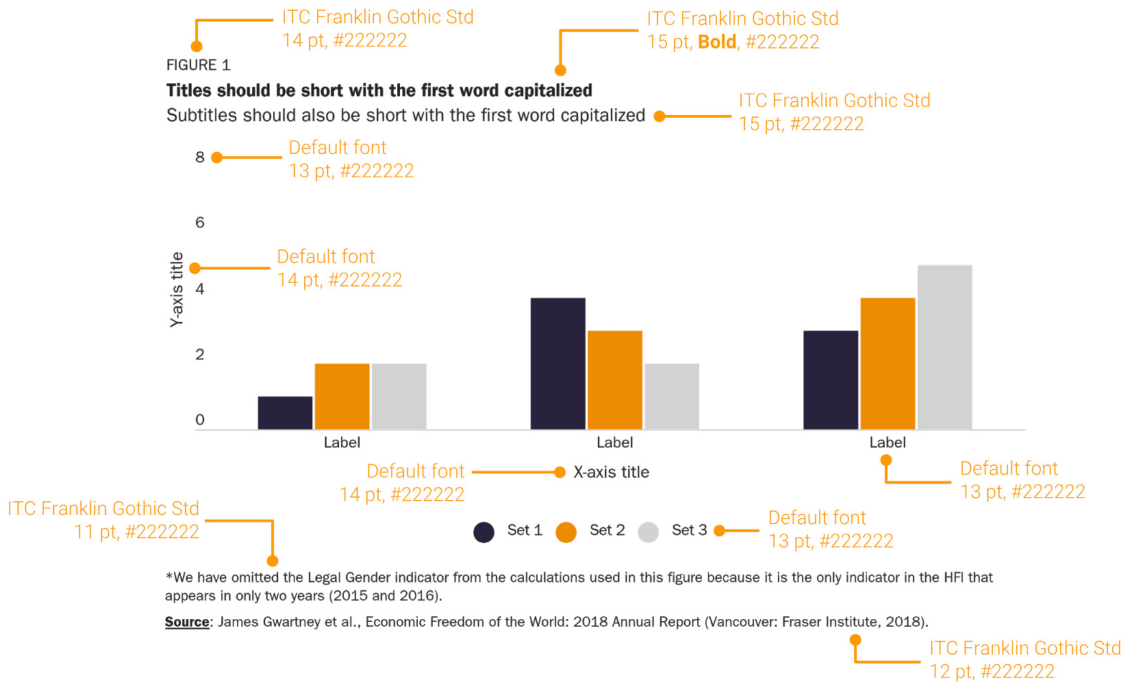
specifications

WEB STUDIES & BLOG POSTS (FIGURES)

All figures included in the web must follow these specifications.

Size:
Figures must have a fixed width of 650 px.

Data labels:
Because of its interactive nature, Infogram shows data labels when hovering over the bar, column, or line in the chart. Therefore the data label button should be turned off.



cato publications

specifications

ITC Franklin Gothic Std
14 pt, #222222

ITC Franklin Gothic Std
15 pt, **Bold**, #222222

Header
background
#28223C

ITC Franklin Gothic Std
15 pt, #222222

TABLE 1

Titles should be short with the first word capitalized

Subtitles should also be short with the first word capitalized

Search

Header Text
Default font, Bold
#FFFFFF

Background
#EBEBEB

Alternate
Background
#FFFFFF

Countries	List	Muslim	2012	2013	2014	2015	2016	2017	Total
India	'03	14%	642	1,067	1,527	2,578	3,668	3,135	16,979
Brazil	'03	1%	310	355	647	1,344	3,252	2,745	12,925
Nepal	'03	4%	149	349	467	409	551	648	2,908
Bangladesh	All	90%	99	233	294	309	636	574	2,469
Sri Lanka	'03	10%	185	97	71	109	45	65	1,140
Pakistan	03+04	96%	34	40	31	57	321	233	928
Venezuela	'03	0%	44	45	30	28	48	95	658

Source: American Immigration Lawyers Association via CBP (2003); Department of Homeland Security (2004); San Antonio Express News (2007); CNN via White House (2018); Border Patrol.

Notes: Rates per 100,000 population.

ITC Franklin Gothic Std
12 pt, #222222

ITC Franklin Gothic Std
11 pt, #222222

Text & Alternate Text
Default font
#222222

WEB STUDIES & BLOG POSTS (TABLES)

All tables included in the web must follow these specifications.

Turn on the scroll bar option for tables with seven or more rows. If the table has five or more columns and seven or more rows, turn on the search bar option.

Size:

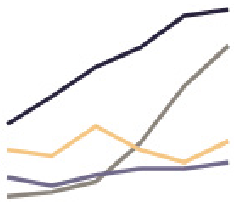
Figures must have a fixed width of 650 px.

Alignment:

Text and numbers in the table headers should be left aligned in the first (leftmost) column. In all columns to the right of the first column, all text and numbers should be right aligned.

charts
types

LINE CHART
Line charts are commonly used for time-series relationships with continuous data. They show trends, acceleration, deceleration, and volatility.

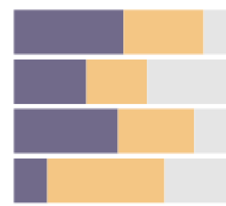

LINE

BAR CHART
Bar charts are best used for data with long category labels. Bar charts are usually used to compare different categories or parts of a whole.

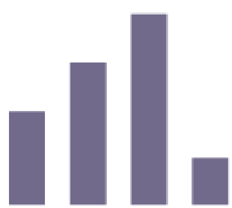

BAR

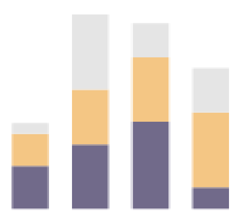

STACKED

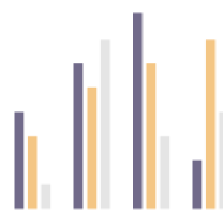

GROUPED

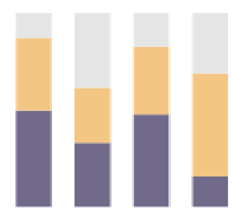

100% STACKED

COLUMN CHART
Column charts are best used to show change over time (percentage variation), compare different categories, or compare parts of a whole.


COLUMN


STACKED

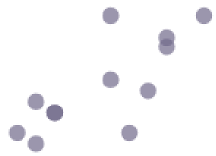

GROUPED


100% STACKED

charts
types

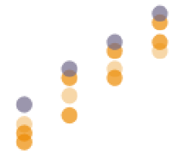
SCATTER PLOT

Scatter plots show the relationship between groups based on two dimensions. They are best used to show correlations between two sets of data.



SCATTER

GROUPED SCATTER



DOT PLOT

PIE CHART

Pie charts are best used for making part-to-whole comparisons with discrete or continuous data. They only do well when working with a small dataset.

PIE

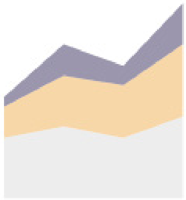
DOUGHNUT

SEMICIRCLE

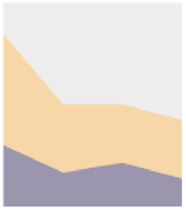
AREA CHART

Area charts show time-series relationships, but they are different than line charts in that they can also represent volume.

AREA



STACKED



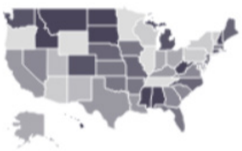
100% STACKED

STREAM AREA

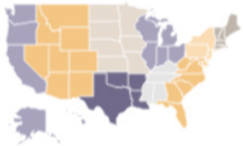
charts
types

MAPS

Maps can display both categorical or continuous data using intensity of color to represent values of geographic areas.



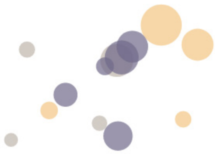
HEAT MAP



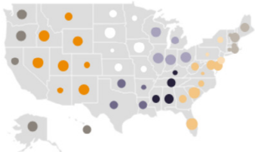
GROUPED

BUBBLE CHARTS

Bubble charts are good for showing nominal comparisons or ranking relationships.



BUBBLE PLOT

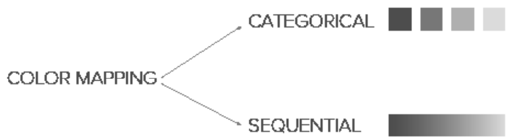


BUBBLE MAP

COLOR AND TYPES OF DATA

This section shows the Cato color palette in use across a variety of data visualization types.

When selecting colors for figures and tables, consider the type of data that will be presented. Usually, data can be grouped into either of the following groups: categorical or sequential.



Categorical palettes are best for distinguishing discrete chunks of data that do not have an inherent ordering.

A sequential palette is commonly used for data that range between high and low values. It is usually represented with a single color that shifts from higher levels of opacity to lower levels of opacity.

The color combinations on the next page should take some of the guesswork out of the process of assigning colors to charts.

charts

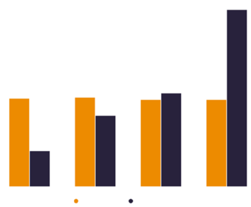
implementation

ONE CATEGORY

For one color group, use dark purple.

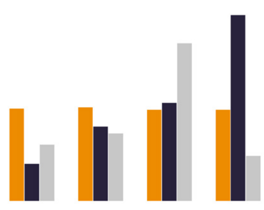
TWO CATEGORIES

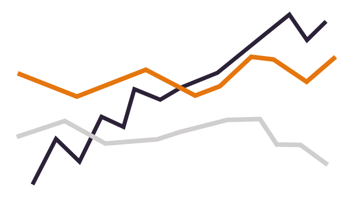
For two color groups, use both dark purple and orange. Legends should be placed at the bottom of the chart.



THREE CATEGORIES

For three color groups, use dark purple, orange, and grey. Legends should be placed at the bottom of the chart.



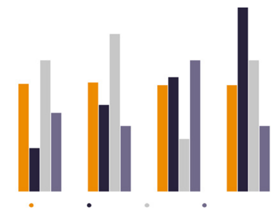


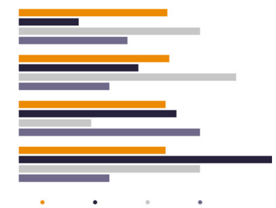
charts

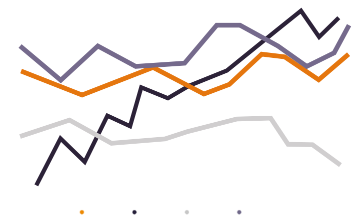
implementation

FOUR CATEGORIES

For four color groups, use dark purple, orange, grey, and light purple. Legends should be placed at the bottom of the chart.

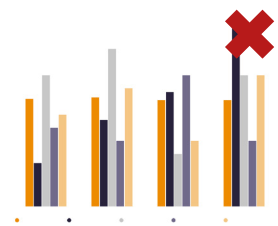


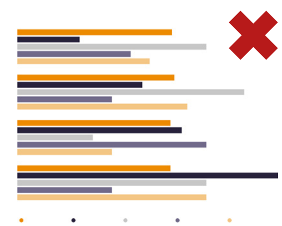


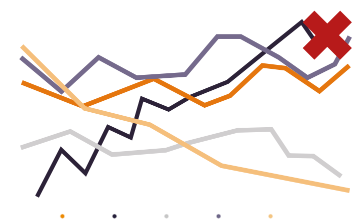


FIVE CATEGORIES

There should not be five or more groups in a single figure. Consider consolidating categories or breaking up the one chart into two or three different charts.

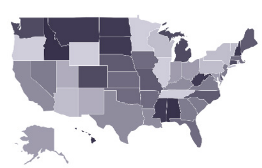






SEQUENTIAL

Sequential colors should be used in maps to represent values of geographic areas. Dark purple is strongly recommended for the highest value and light purple for the lowest value.



#28223C

#D0CDDB

charts

dos and don‘ts

DO USE THE SAME COLORS FOR THE SAME VARIABLE

To not confuse readers and to increase comparability, use the same colors accross all charts in the publication to show data about the same category, country, region, etc.

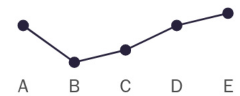
NOT IDEAL

BETTER

DO USE LINE CHARTS ONLY TO SHOW HOW VALUES CHANGE OVER TIME

To show how values develop in different categories, use a bar or column chart instead.

NOT IDEAL

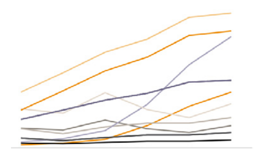


BETTER

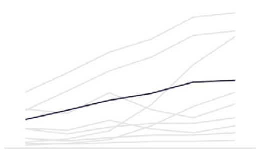
DO CONSIDER USING GREY FOR LESS IMPORTANT ELEMENTS

It makes the primary colors (which should be reserved for the most important data points) stand out even more.

NOT IDEAL



BETTER



DO USE AREA CHARTS TO SHOW MULTIPLE CATEGORIES OVER TIME

If you need to demonstrate the development of one category over time, use a line chart instead.

NOT IDEAL

BETTER

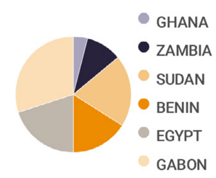
charts

dos and don‘ts

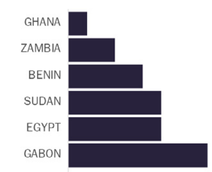
DO USE PIE CHARTS IF YOU ONLY HAVE A FEW VALUES

A pie chart should be divided into no more than four slices. If there are more than four shares, use a bar or column chart.

NOT IDEAL



BETTER

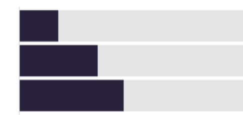


DON’T USE MULTIPLE PIE CHARTS TO COMPARE A SET OF SHARES

Instead, in order to compare a set of shares and their totals with each other, use stacked bars instead.

NOT IDEAL

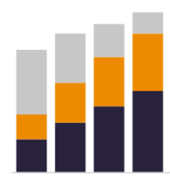
BETTER



DO USE LINE AND AREA CHARTS TO SHOW TIME DATA

If stacked columns are used to show time data, readers will fail to see that the chart is about parts of a total.

NOT IDEAL

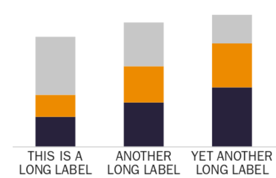


BETTER

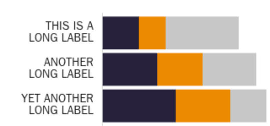
DON’T USE LONG LABELS FOR COLUMN CHARTS

Long labels don’t fit well below the columns of a column chart, especially if there are many of them. Use a bar chart instead.

NOT IDEAL



BETTER



charts

more dos and don‘ts

DO ORDER DATA SETS USING LOGICAL HIERARCHY

For example, make sure to always create a column chart placing the highest value on the left and lower values to the right.

DO KEEP THE CHART VISUALLY SIMPLE

Unnecessary illustrations, drop shadows, or ornamentations distract from the data.

DO USE SIMPLE FONTS AND ELEMENTS

Don’t use distracting fonts and elements such as bold, italic, underline, etc.

DON’T COMPARE MORE THAN TWO TREND LINES

When working with grouped scatter plots and line charts.

DON’T USE MORE THAN FOUR COLORS IN A SINGLE LAYOUT

Consider consolidating categories or breaking up the chart into two or three different charts.

DON’T USE 3D CHARTS

Three-dimentional charts can easily skew the perception of the visualization.

resources

sources

DATA VISUALIZATION · COLOR · CHARTS

- What Does "Visualization Literacy" Mean, Anyway? by Michael Correll
- The Worst Chart In The World by Walt Hickey
- Make Grey Your Best Friend by Andy Kirk
- Data: Continuous vs. Categorical by Robert Kosara
- Continuous Values and Baselines by Robert Kosara
- Viz Palette for Data Visualization Color by Elijah Meeks
- Election Reporting: Which Color for Which Party? by Lisa Charlotte Rost
- Your Friendly Guide to Colors in Data Visualisation by Lisa Charlotte Rost
- An Alternative to Pink & Blue: Colors for Gender Data by Lisa Charlotte Rost
- What to Consider When Choosing Colors for Data Visualization by Lisa Charlotte Rost
- What to Consider When Creating Stacked Column Charts by Lisa Charlotte Rost
- What to Consider When Creating Line Charts by Lisa Charlotte Rost
- What to Consider When Creating Area Charts by Lisa Charlotte Rost
- What to Consider When Creating Pie Charts by Lisa Charlotte Rost
- An Economist's Guide to Visualizing Data by Jonathan Schwabish
- Subtleties of Color: Different Data, Different Colors by Robert Simmon
- Urban Institute Data Visualization Style Guide by Urban Institute

resources

further readings

- Take Care of Your Choropleth Maps by Gregor Aisch
- Graphical Perception: Theory, Experimentation, and Application to the Development of Graphical Methods by William S. Cleveland and Robert McGill
- When Maps Shouldn't Be Maps by Matthew Ericson
- Save the Pies for Dessert by Stephen Few
- When Are 100% Stacked Bar Graphs Useful? by Stephen Few
- Stacked Bars Are the Worst by Robert Kosara
- Understanding Pie Charts by Robert Kosara
- What is Visualization? A Definition by Robert Kosara
- Putting Data Into Context by Robert Kosara
- Blur and Uncertainty Visualization by Robert Kosara
- Treemaps by Robert Kosara
- Data Visualization, Fast and Slow by Elijah Meeks
- What Charts Do by Elijah Meeks
- What Charts Mean by Elijah Meeks
- What Charts Say by Elijah Meeks
- What to Consider When Creating Choropleth Maps by Lisa Charlotte Rost
- What Questions to Ask When Creating Charts by Lisa Charlotte Rost
- What Is an Infographic? And How Is It Different from a Data Visualization? by Payman Taei
- How to Take the "Screaming Cats" Out of Stacked Bar and Area Charts by Steve Wexler
- The Power of the Palette: Why Color is Key in Data Visualization and How to Use It by Alan Wilson