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Color in data vis
73 min

March 30th, 2022

A detailed guide to colors in data vis style guides

How to create an organizational color palette

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I've heard you're interested in creating a color palette as part of a data vis style guide. Maybe you decided to use a custom design theme at Datawrapper to make your charts more consistent-looking, and our support team asked you for some colors. Maybe you're the first proper data vis designer at your organization, and want to bring order to chaos. Or maybe you want to redesign an existing palette because your requirements have changed.

This guide is very extensive — and can be a bit overwhelming. If you're designing your very first color palette, **don't sweat. It's simple:**

A quick how-to

Choose 3-10 different colors. These can be your logo color(s), or colors from your website (you can use or install a color picker to get their hex

codes). If you still have too few colors, play around with extra colors until you get some that fit well with the ones you already have.

And that's it. You just got a color palette that you can use for your bar charts, line charts, scatterplots, etc. Try to create some visualization with it, see how it goes. If, in a few weeks, you feel that your colors don't work after all, just change them.

YouGov tried this approach successfully a few years ago. They created a limited color palette  "just to test things out," data journalist Graeme Bruce from YouGov told me. To their surprise, it worked better than expected: **"We find we can get 90% of our simple charts done with this simple palette."** (They recently adjusted their colors after a change in branding. Now they use , and for political parties.)

If, like YouGov, you're happy with this method, you can stop reading now.

What follows is for people who really want to get into it. Who want to end up feeling: "This is the best color palette I could have come up with."

Here's what this guide will cover:

Every time I refer to another section in this guide, I'll use an arrow like this one ↙. And if you're new to the topic, it wouldn't hurt to read this refresher on what words like lightness, saturation, and hue mean.

All good? All right! Let's start:

Do you even need a fixed color palette for your data visualizations?

There are lots of good reasons to set colors in your data vis style guide. Once a good color palette is decided:

- Consistent colors will help to **build a brand** and hence more trust. Readers will know they can trust a chart — no matter where it appears — when it looks like it comes from you.
- Visualizations will look **more consistent no matter which tool you're using** to create them. In the best case, a chart created in Adobe Illustrator will look the same as a chart created in Datawrapper.
- You and your team members will be able to **think less about colors** while creating charts.

> *"Keeping the order of colours in the palette consistent helps non-designers create basic charts in a fast-paced environment* ***without having to spend time on yet another design decision****."*
>
> Caroline Nevitt, user experience editor at the Financial Times

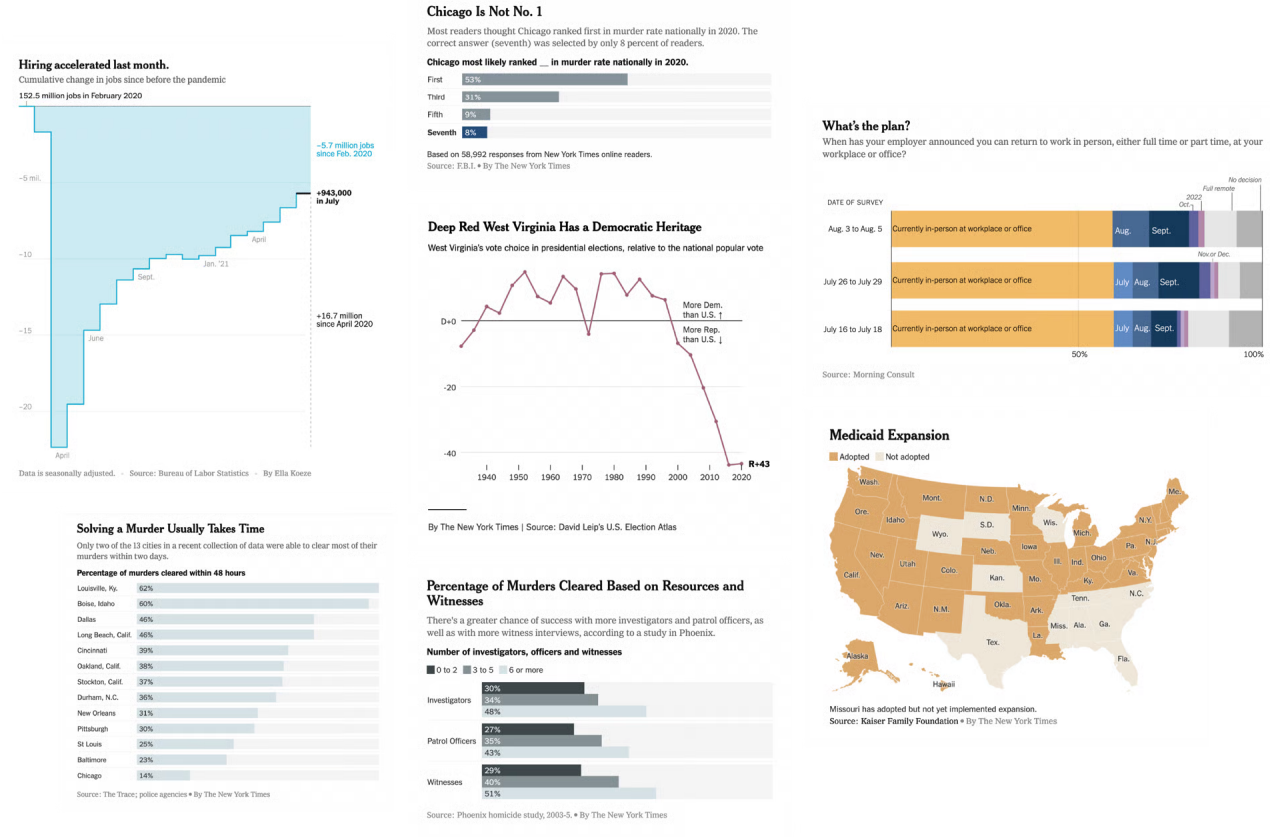
- Consistent, well-thought-through colors can **look better** than what you would choose in the three minutes before a deadline.
- People in your organization can create visualizations even if they're **not trained** in it. You'll save work because you won't need to help coworkers to choose colors on an individual basis.

> *"When we decided to use Datawrapper, first and foremost we were looking for uniformity and consistency in our chart styles, so* ***even those who have limited experience creating charts could make a chart that looks like a YouGov chart.****"*
>
> Graeme Bruce, YouGov business data journalist

But not having a strict color palette is an option, too. There are good reasons for it:

- You might not have the **capacities** yet — and the time you would spend formulating and testing a new palette might be better spent creating great data visualizations or helping others do so.
- You're a **one woman/man graphics department.** Your visualizations already look consistent because you and your sense of color are the only one designing them.

- Your charts already use **other strong visual elements** (e.g., a typeface or a background color) that help people recognize your brand. Maybe the best example? The New York Times and their iconic typeface Cheltenham:



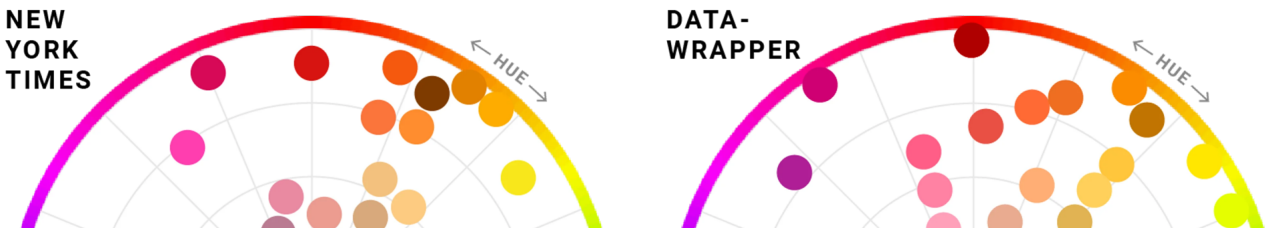
New York Times visualizations from different articles in summer 2021 (1, 2, 3, 4, 5, 6). The visualizations all use different colors, but are held together by the title font Cheltenham.

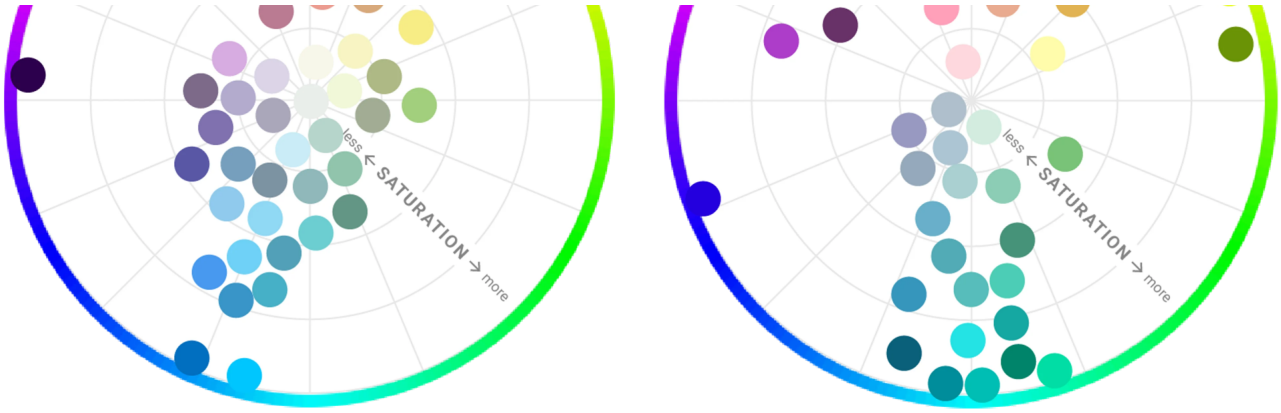
- You're only using **visualizations as part of big, outstanding, very designed projects** — and the visual identity of these particular projects is more important than that of your brand. One extreme example might be The Pudding:

colors used.

- It's **not important** that your visualizations have a strong visual identity, for whatever reason. Example: The very blog you're reading right now, the Datawrapper blog. We want to show people what's possible with Datawrapper, and that includes using different colors.

Here are the colors that a few recent New York Times and Datawrapper visualizations have used:





If you're considering not using a fixed color palette, then it helps if:

- Only people in your organization with a **sense for color** (e.g. graphic designers) visualize data.
- People **work together** a lot, so that the colors are a consensus of multiple opinions.
- There's a deep sense of what it means for a chart to ***look like*** **the organization**. (Stuart Thompson, head of visual journalism at New York Times Opinion: "At The New York Times, the only guidelines/rules I've ever seen are 'Is it Timesian?'")
- At least some people have **worked there for a long time**. ("We used these colors for the last election four years ago, let's use the same ones now.")

Four different approaches to organizational color palettes

"Let's prepare for everything" / "Fewer hues, more shades" (aka "The traditional brand-ists") / "More hues, fewer shades" / "The minimalists"

If you're still reading this article, you seem to be more convinced by the arguments for than against having consistent colors. So let's have a close look at some organizations that do have a color palette. We'll place them into four categories, depending on their approach. Hopefully, these examples and approaches will serve as inspiration for your color palette:

Four different approaches to organizational color palettes — Type 1

"Let's prepare for everything"

The closest thing to not having a color palette at all is having a very, very flexible color palette — one that comes with colors in every corner of the

color wheel, often with multiple shades for each hue. These color palettes are often created and used by big organizations that want to make sure to **cover every use case** — for simple charts as well as complex dashboards.

Examples are the London City style guide and the Eurostat data vis style guide (PDF):

If you do create a very flexible color palette, define in **which order colors** should be used or which colors should be used **primarily** — we'll get back to that idea further down ↓. London City is doing that. Although their palette is very broad, most of the colors used are magenta and light blue:

Visualizations from different reports on london.gov.uk (1, 2, 3, 4)

Four different approaches to organizational color palettes — Type 2

"Fewer hues, more shades" (aka "The traditional brand-ists")

The Brand-ists use only a very few selected hues. If more colors are needed, they use shades of those hues rather than add new ones.

The hues are almost always defined to be used in a certain order. For example, the Financial Times (FT) always uses dark blue first, then magenta, and green only as a last resort — although it seems data visualization designers at the FT like John Burn-Murdoch are more flexible with their colors than people who use the FT's charting tool.

One of the newsrooms that is most consistent in its "brand-ist" approach is The Economist. Their data visualization designers use a business-y dark blue in most of their visualizations, and combine it with turquoise and red (a bright one for lines and a darker one for areas). They rarely use other hues besides these ones. Even entangled line charts (see the second image in the first row below) don't look like confetti spaghetti, because the lines are colored in shades of only blue, red, and turquoise .

Visualizations by **The Economist** (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12)

Using only shades of a few hues instead of individual hues for every category comes with an advantage: Brand recognition through these colors is crazy high. It's basically through the roof. You can't do better. Even if you've never seen an Economist chart before, it's likely you'll recognize one the next time after seeing these 12 charts here.

Before they changed it a year ago, Pew Research had a special approach to brand-ism. Their palette looked as colorful as the "let's prepare for everything"-ists'...

... but not every chart was allowed to simply take any of these colors. At Pew Research, every one of their research teams got its own color: orange for Science, yellow for U.S. Politics, green for Global, etc. They changed their website pewresearch.org and team structure in 2021, but before the redesign, you could really get the idea of the category colors just by clicking through the menu:

Pew Research Center website in 2020

This showed in their charts, too: Each research team used a primary and secondary color (plus their respective shades) in their visualizations:

Pew Research Center colors in 2020

Design director at Pew Research, Peter Bell, explained to me two years ago why the palette was that limited: "Our internal guidance is that 'while color brings life to charts, too many colors can distract from the data. The best approach is to use shades of a single hue in most charts.' These limits take some of the guesswork out of color decisions, freeing researchers to focus on the most effective presentation of data, while still offering visual variety across our site."

Visualizations by the Pew Research Center **Media and News** team (1, 2, 3)

But Pew didn't use this system consistently, even before the redesign. Charts about Republicans and Democrats always used reds and blues (example). And sometimes, a chart simply needed more categorical colors than the two available — "for instance, a line chart showing several

religious traditions, or a scatterplot of countries color-coded by region of the world," Peter explains. Also, "a given topic, like generations and age, might be studied by several research teams, usually collaboratively. So there's not a 1:1 mapping between color and topic." And: "After 8 years, there is some experimentation as well, trying out different combinations within the existing palette."

The research teams had extended over time, too, making the colors inconsistent. The "Science" team grew out of the "Internet" team, so they both use the same green and blue shades in their charts. The menu color of the "Science" section of the website before 2021 was orange, though, while the "Internet" section was the expected blue.

Four different approaches to organizational color palettes — Type 3

"More hues, fewer shades"

Organizations in this category define quite a few hues — a few too many to fall into the previous category with the brand-ists. The U.S. think tank New America defined at least five and the U.K. newsroom The Times, six, with the first three to four being the main colors that are used in almost all of their charts.

And where the brand-ists would use a few shades of the same hue for different categories, New America or The Times would more often opt for completely different hues:

Visualizations by **The Times** from different articles in 2021 (1, 2, 3, 4)

That makes their visualizations look a bit more colorful than the ones by the traditional brand-ists, and also a bit less iconic. Defining so many colors can ensure higher flexibility, though. We'll come back to the question of how many hues a color palette needs below.

Four different approaches to organizational color palettes — Type 4

"The minimalists"

Some organizations are up for a challenge: They have a very, *very* limited color palette.

Two of them are Quartz and McKinsey.

Quartz is known for mostly simple bar charts, split bars, or line charts. There are not many Quartz scatterplots with multiple categories out there (this one by David Yanofsky is one of the exceptions), but they can make them work too, just with their pinks and blues (1, 2):

McKinsey & Company is a management consulting firm that only uses blue and neighboring hues, even in charts with lots of categories:

Using only a small part of the color wheel or only a few hues for lots of categories can bring problems with accessibility and how well readers can refer to your colors.

But it can work. If you don't use lots of categories, a minimalist approach can be a great idea for smaller organizations, especially if they **don't need to prepare for all kinds of chart types and use cases.** You might just create maps. Or bar charts. You might have an audience that won't understand boxplots or scatterplots, so creating them is out of the question. If you're showing four categories tops in your charts, consider a minimalist color palette.

Which colors to define

Colors for categories / **Shades for categories** / **Colors for common categories** / **Accent colors** / **Grays for data** / **Grays for everything that's not data** / **Sequential and diverging gradients** / **Colors for map elements**

After looking purely at inspiration, let's get a bit more practical. Which colors do you need to define for a data vis style guide? See the following as a check list: some of the options might not apply to your organization.

Which colors to define

Colors for categories

When we talk about "organizational color palettes for data visualizations," we mostly talk about different hues. They will be used to tell categories apart:

Categorical colors for

data visualizations defined by **Eurofound**.

Coming up with these hues can be a challenge. They should be **beautiful**. (Visit our blog post How to pick more beautiful colors for your data visualizations for ideas on that.) But they also should be **functional** — meaning, easy for your readers to tell apart.

There are a few things to keep in mind when choosing distinguishable colors:

- **Your colors should have different lightnesses.** Ideally, your colors can still be told apart when you print them in black and white.
- **Your colors should be distinguishable at every size you'll use them in**: No matter if your colors cover three to ten pixels (like in line charts or scatterplots) or 30 to 50 (like in area charts and column charts), readers should be able to tell them apart.
- **Your colors should be distinguishable for colorblind readers**. Check your colors with a colorblind simulator — like the one we built into Datawrapper, Sim Daltonism for Mac, or Colour Simulations for Windows. Viz Palette also has a built-in colorblindness simulator. You can learn more in our three-part series on colorblindness.

If you only keep three things in mind, these are the ones. But of course, there's more to the topic. So much more that I moved most of it to other sections – on if and how to include your brand color(s), how many colors to choose, how much to dance over the color wheel, which sentiment your colors should have, and how to go about creating hues.

Which colors to define

Shades for categories

When you're creating hues, it makes sense to immediately think about lighter and darker versions of these hues too. You'll need these shades for less highlighted parts, to emphasize an underlying order, or to distinguish between subcategories.

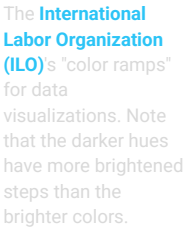
Create them with a tool like the **Tint and Shade Generator**. If you want equally spaced lightness differences between your shades no matter the color, use a tool like the **Interactive color picker comparison** and increase or decrease the L_r value in equal steps (e.g., 15).

Mailchimp defined two darker and two lighter shades for each of their main colors.

When you go darker, try to **increase the saturation** of your colors. You might even need to shift the hue a little bit to make them work. When you go lighter, consider decreasing the saturation.

Some of your hues (like yellow or light green) will be brighter than others

(like blue and purple), so you might need a different number of steps to take them to their darkest and brightest shades:



The **International Labor Organization (ILO)**'s "color ramps" for data visualizations. Note that the darker hues have more brightened steps than the brighter colors.

Which colors to define

Colors for common categories

If you find yourself visualizing the same categories again and again, it can make sense to give them a consistent color. Here are a few categories that are common for many organizations:

- **Political parties** of countries your organization reports about a lot (e.g. Republicans, Democrats, Independents). I wrote about their colors here.
- **Gender**, including men, women, and more. Don't be like Cato and choose blue for men and pink for women. Here are better alternatives.
- **No data**: often gray
- **"Others"**: also often gray
- **Likert scales**: Strongly disagree, Disagree, Neither agree nor disagree, Agree, Strongly agree. They call for shades of two hues and a nice gray for the middle category, like in this YouGov example .
- **Positive/negative** or upwards/downwards trends. If you want to use green and red , test how they look to colorblind readers. Quite a few companies use blue for positive and red for negative instead to get around colorblindness issues. Cultural differences in how people interpret these colors might exist .
- **Warm and cold**, such as for climate visualizations or weather charts.
- **Other categories** that you'll often visualize in your organization, like continents, industries, or companies. The Swiss newspaper NZZ defined colors for energy sources like coal, solar, and gas — it's something they often report on.

Certain colors often appear together, like those for political parties. If this is the case, try to avoid any visual bias and keep the visual intensity of the colors the same, e.g., instead of .

You might not need just one color for each of these categories, but two or more (maybe even a whole gradient). The **Sunlight Foundation** defined two shades of a hue for each common category, one for the main category and one for a subset: Republicans , Democrats , Independents , Con , Pro and Money . **Pew Research** also defined shades of their colors for Republicans and Democrats .

Pew Research article showing their use of two colors per party, February 2021

Which colors to define

Accent colors

Some data vis style guides provide one or more colors that are supposed to be used for charts that only call for a single color. The designers Jon Olav Eikenes and Tomi Nurmi from the Norwegian marketplace finn.no decided to use a slight variation of their brand blues as their "primary" chart color. It's used for charts that just show one color (e.g., a line chart with a single line or a bar chart). Charts with more than one color will use four other colors, and not include the blue:

Finn.no charts

"The reason we skipped the blue in >1 color charts was that it will stand out as more important," Jon explains. "It's so close to our brand color that **users could interpret categories colored in that blue as 'more brand-related**.'"

Mailchimp provides multiple accent colors, depending on the use case. Their *Apple* green is "used to convey 'positive' values or success," they explain in their style guide, while their accent colors *Plum* and *Apricot* "represent themselves as neutral." All of them should only be used as the sole color in charts. "If more than one color may be used to represent data, use one of the pre-defined categorical color combos."

Which colors to define

Grays for data

Gray is the most important color in data visualization. You'll need it to show **less important data**, **missing data**, or **context data**. Consider defining at least one gray. And consider giving it a splash of color.

Neutral gray can quickly seem a bit cold. That's a good look if you have a neutral to cold-ish color palette like the think tank New America — they use pure grays like `RGB(163, 163, 163)` and `RGB(214, 214, 214)`.

But giving your grays a bit of color can also nicely tie them together with color palettes that are especially warm or cold.

If you want to go for a warmer look, try to mix some yellow, orange, or red into your grays, especially the ones you use for data. The Economist does this, using colors like . The two grays both contain less blue than a pure gray does: `RGB(135, 135, 113)` and `RGB(207, 209, 195)`.

Part of an Economist "Graphic Detail" page

The associations of warm gray can also be a reason to choose it, as it has been for designer Tomi Nurmi from finn.no. They show data from the past year in gray when comparing it with current data. "That's why we chose a warm gray," Tomi told me. "The sepia tone gives the gray a bit of historic feel to it."

from November 2018 (PDF).

If you're going for an extra-cold palette, consider adding some extra blue. McKinsey does so for its color palette ●●●●. The gray here has more blue than a pure gray: `RGB(192, 197, 201)`, making it nicely silvery.

Make sure your grays don't come with too much saturation. They should still be perceived as gray, not as an important category.

Which colors to define

Grays for everything that's not the data

Have I mentioned that gray is the most important color in data visualization yet? Besides using it for less important categories, you'll need grays for **axes, gridlines, color key labels, axis ticks, axis labels, regions without data in choropleth maps, the base map in symbol maps, and less important text**.

You'll definitely need more grays than you think for all these non-data elements. And that's ok: Unlike using too many different hues, using lots of different grays won't make your visualization look unprofessional, cluttered, or chaotic. So don't try to make everything the same gray. Grids need a lighter gray than axis labels. The title and description should have an even darker gray.

The different grays in a Datawrapper visualization.

A lot of gray is OK. (It rhymes!) If you don't want to think about the grays of gridlines, axis labels, etc., don't worry — a tool like Datawrapper comes with tried and tested defaults that you can just take on.

Which colors to define

Sequential and diverging gradients

Sequential and diverging color scales are similar to the shades you define for hues ➹. But they won't be used to tell categories apart. You'll use them when you're creating visualizations where every value maps to a color on a gradient, like choropleth maps or heat maps. To make these values easier to read, your gradient should cover a wide lightness range, and maybe even have a subtle shift in hue.

Let's look at an example. Say our color palette has two main colors: magenta and light green ●●. Our first idea might be to take these two colors and interpolate them to white. We can do this with a tool like the

Chroma.js Color Palette Helper.

The swatches show the values for the LCh color space, where LCh stands for Lightness, Chroma (= saturation), and hue.

But that magenta is far darker than the green and will therefore cover a bigger lightness range: The lightness of these magenta shades ranges from 35-95% (60 percentage points), while the green shades cover only a fourth of that range, from 80-95%.

You'll need a **big lightness range** for your gradients to see little differences between data points. The default Datawrapper sequential gradients cover on average 69 percentage points — the winner being *Magma* from the Viridis package, which ranges from 14-98% lightness:

The **Datawrapper default gradients**, compared with the two gradients we just created.

So: We can do better. Our green gradient needs to go darker.

How dark should we go? Not too dark: We should still see some hue in there. The darker (and lighter, by the way) each color gets, the less saturated it becomes. Once it's black, it's 0% saturated.

But not every hue is the same. There are some hues that do better at being dark *and* saturated than others:

- At 15% lightness, a **blue** can still be more than 70% saturated ●. That's why so many of the gradients up there use blue as their darkest color.
- Our **magenta** is less recognizable at 15% lightness — it's just 35% saturated ●.
- Our **yellow green** ● only gets up to 20% saturation at such a low lightness. Who are we kidding: It doesn't look like yellow green anymore. It basically looks like a dirty black.

So for each of your colors, you'll need to decide individually how dark it can be while still looking like a color, not like black.

For our yellow, let's increase the lightness to 30% to get it to 40% saturation ● and create a gradient out of that:

Including the darker yellow (olive?) definitely covers a bigger lightness range. But it's... not really pretty. Good news, though: We can do something

about that. Something that all Datawrapper default gradients do; something that will increase the reader's abilities to tell similar-colored regions apart, *and* and that will make our map more interesting to look at: **We can shift the hue**. If we shift our darkest color to green (130° instead of 100° on the color wheel), the whole gradient is far more pleasant to look at:

Green also can have a higher saturation when it's dark, so we can even extend the lightness range a bit more:

Here's how the three versions look on a choropleth map:

Shifting the hue might not be an option for your palette — because gradients don't play a big role, or because it's important for better understanding your visualizations that your gradient and categorical colors have exactly the same hue. Many hues also look fine with a simple gradient from a darker version of your chosen color to white.

Besides sequential scales, you might also need **diverging** ones. They're basically two sequential scales glued together on their lightest colors. You can learn more about them in our blog post, When to use sequential and when to use diverging color scales, and create them with the **Chroma.js Color Palette Helper**.

No matter what gradient you create, you'll get some hex codes at the end. They don't even need to include your original color codes, as this 2017 Economist style guide (PDF) shows:

The colors in each row (except the first "MAIN" one) have a similar lightness.

Note that if your colors need to comply with accessibility guidelines (WCAG2), your **light colors need to be fairly dark**.

Which colors to define

Map elements

If you're creating locator maps, you might want to define colors for forests, meadows, water, buildings, streets, and borders.

Three of the four map

Keep in mind that **you'll almost always want to show markers on top of this map**. Light and less saturated map elements will allow for a high contrast with the dark, saturated markers you put on top — which makes those markers easier to spot.

styles that Datawrapper offers by default. If you have a Datawrapper Custom plan, get in touch with us at support@datawrapper.de and we'll be happy to add a map style for you.

The drawback of light map elements is that it becomes harder to decipher the map itself and to see where buildings end and the park begins. They also don't meet WCAG2 accessibility standards ➹.

The very light map elements from the Dallas Morning News Graphics Stylebook (PDF).

Considerations for choosing colors

How to include brand colors / How many colors to choose / Dancing around the color wheel / Color order and combinations / Self-confidence of your visualizations / Sentiments your colors convey / Cultural associations / Medium (print, TV, presentations, …) / Accessibility / Colors for big and small areas / Opacity / How well you can refer to the colors / Background color / Dark mode / Dealing with colors in older data visualizations

No matter which kind of colors you're choosing — colors for common or unknown categories, grays, diverging or sequential color scales — there are some things that you might want to keep in mind. Or not: Half of what follows might not be relevant to your situation. I list them all so that you won't think, "Ooooh, I should've probably also paid attention to *this*," halfway through the process.

Considerations for choosing colors

How to include brand colors

The first question you might ask yourself when designing an organization's color palette is: Should I use the logo colors of my organization?

Your bosses might really like that: as they would say, using the logo colors can contribute to "**high brand recognition.**" People are more likely to associate your charts with your organization when they use its logo colors — and you're "teaching" new readers what your company colors are.

But there might be problems: The logo color might evoke unwanted associations. Or it might be too bright for small areas, or too saturated for big areas.

Let's look at how other organizations solved these problems.

A **Only using the logo color for certain categories**

The logo colors of American public news organization **NPR** are red and blue. These two colors are strongly associated with the Republican and Democratic parties in the U.S. and therefore are less helpful for charts about other topics. And indeed, the NPR Visuals team doesn't use these colors for their data visualizations except in reporting about these parties. For other charts and maps, they use less saturated colors in different hues: (example 1, 2, 3, 4).

NPR charts (like this one) don't use their logo colors, except to represent the U.S. political parties.

B **Only using the logo color for visualizations with one category**

Remember finn.no, who used their brand color only for charts that show one category? Consider doing the same.

C **Only using the logo color for the most important category**

The U.S. immigration research and advocacy organization **New American Economy** has a very bright, saturated green as their logo color. They use it as part of their data visualizations, but only for the most important category — like in this article or in this one:

New American Economy uses its green logo color for the most important category in a chart, e.g. here.

If multiple categories have the same importance (like in this or this article), New American Economy uses other color palettes that don't include their vibrant green:

New American Economy chart with multiple important categories, colored in non-logo colors.

D **Only using colors similar to the logo color**

You could consider relying on shades of a limited part of the color wheel. The management consulting firm **Boston Consulting Group** (BCG) does that. BCG uses a dark green in their official logo. They're flexible, though: The logo on their website uses a darker green. In fact, BCG doesn't seem to care much which green is used, as long it's green — and therefore clearly different than the colors of their competitors McKinsey (blue) and Bain (red).

And while McKinsey's visualizations all use shades of blue and purple, and Bain's charts use shades of red, BCG only uses — you guessed it — greens for their visualizations (like here and here)

Boston Consulting Group uses greens for their visualizations, e.g., in this report (PDF).

Note how it matters less which category is colored in the logo color if all colors are similar to that one. If you're visualizing a lot of **similarly important categories, but must use the logo hue**, using shades and similar hues can be an option.

E **Adjusting the logo color**

You might want to use the logo color — but once you use it in bigger areas like bar charts, it's **too saturated** to look pleasant. Or your colors are **too bright** to use them at all. In this case, it's ok to adjust the colors a little bit: Darken them and decrease the saturation to make them easier for the eye.

Fact checking platform Full Fact does that. Their bright logo color is darker and less saturated in their data visualizations, like here or here.

If your logo includes **very bright colors**, they might work (at least in adjusted form) as a recognizable background for your charts:

F **Using colors that have a similar vibe to the logo color**

If you can't or don't want to use the logo color(s), or if you need to extend your color palette with more colors, try to give them all the same "vibe." If the logo and current marketing materials of your organization show dark, desaturated colors, bright and saturated colors might not be a good fit.

Let's look at two real-world examples:

Bloomberg doesn't seem to have a fixed color palette — but most of their colors look **saturated, pure and bright:** (from here), (from here), (from here) or (from here). I've looked at a lot of Bloomberg charts in my life. Every time I see a visualization that uses colors like these (and the Bloomberg font), I think, "Ah, must be from Bloomberg." It doesn't need to include any specific color for me to think that. The general vibe is sufficient.

The email marketing company Mailchimp uses a **warm, retro look** on their website, thanks to their "Cooper Light" typeface and their **often desaturated,**

often pastel and "off" colors  . For their data visualizations, they adjusted and added some colors and shades to that palette — but they come with the same tonality .

Considerations for choosing colors

How many colors to choose

There's no right answer to how many hues your organization needs. Some organizations need a lot, some only a few. From an organizational standpoint, consider creating more colors for big organizations and fewer colors for smaller ones. Here's why:

The more colors you define in a data vis style guide palette, the more flexible chart creators can be without your help. Defining lots of colors means that whoever visualizes data in your organization, for whatever purpose — simple charts, complex charts, maps, dashboards — will find enough suitable colors in your color palette. That also means that your datavis-excited coworkers come over less often to say "I need a color for X, but can't find a good one in the palette." If you're part of a big, maybe global organization where these coworkers are not even in the same timezone as you are, this can be a crucial advantage. (Note that this also depends on the quality of your documentation.)

But the bigger the color palette, the more you need to train coworkers to use it well.

- You need to **document** the colors more and clarify which ones go well together. A big palette benefits from boundaries — or else half of your organization's visualizations will look like a confetti party. If you have a small palette, however, all color combinations will (hopefully) look fine. Fewer options mean less to explain.
- Even then, people might ignore your documentation and start **picking their favorite colors** from the palette instead of the ones that you intend to go together.
- The more colors you provide, the **more categories** your coworkers can include in a chart. Providing 12 colors lets people create visualizations with 12 categories — something you might not want to encourage.

"It should be very hard to screw up a chart," David Yanofsky from Quartz told me. Quartz's charts only use pink  and blue in different shades. "We have such a limited palette because of the **range of people who make charts in our newsroom**. We have reporters who can code and design custom visualizations — and reporters who can't remember how to calculate percent change." David wants all kinds of reporters to create charts, so his team gives them lots of defaults and limited choices. And it works: "**I highly recommend having such a limited color palette as we do.**"

If you're part of a small to medium organization — where you can help coworkers with their color needs individually, or where only your team creates visualizations — consider starting with only a few colors like Quartz. You can always extend the palette later.

David is happy with the palette at Quartz: "Our limited palette works great the vast majority of the time for us. And if our colors really are too limited for what we need, our data-vis-trained people can pick additional colors."

Kaspar Manz from the Swiss newspaper NZZ created seven categorical colors for their future visualizations and has the same approach: **"We tell our journalists to come to our graphics team if they run out of colors while creating a chart."**

"But I need more colors!" your coworkers might say. Consider including advice on how to reduce the number of colors in a chart, e.g., by grouping categories or using other chart types. You can find more tricks in our article 10 ways to use fewer colors in your data visualizations. Your colorblind readers will thank you too.

Considerations

Dancing around the color wheel

Amy Cesal, who has talked and written about colors in data vis style guides before, wrote about her experience with her client, the Consumer Financial Protection Bureau:

> *At one organization I worked for, before I created a data visualization style guide, the guidance for charts was to "use brand green." This meant that all charts were green, no matter what data they represented: It was hard for readers to tell the difference between graphs in a report, because they all looked the same. Green.*
>
> Amy Cesal

Amy extended her client's green-blue color palette and added warm colors: and another pair of blues .

"But what's the problem with all charts using the same colors? Doesn't that make it easier to recognize the brand?" you might ask. Yes — but that's less of a concern in a report that's hundreds of pages long than in a social media post by a news organization. In a long PDF, charts can and should encourage people to keep reading. That works better if the next chart looks different than the chart before. Different colors are one way to achieve that.

But there are other ways. Let's come back to McKinsey: As mentioned , the

management consulting firm reduced their palette radically — and hence went the opposite direction than Amy. McKinsey redesigned their old chart colors to only blues and purples. To see the effect, compare one of their old reports (PDF) with three visualizations from this recent one.

That homogenous palette works because the *visualization types* are all very different from each other. **The variety does not come from the colors, but from the shapes.**

Considerations for an organizational palette

Color order and combinations

To increase the chances that your charts will look coherent even with a big color palette, define an order to your colors. If a chart only uses one color, which one should that be? How about two colors? Three? Four?

Eurofound does this for up to 36 colors:

The Economist does this too, in their 2017 style guide (**PDF**), and even defines different color orders for different chart types:

But such an order can go against the intuitive use of colors, be inappropriate, or reinforce stereotypes. If your first two colors are blue and red, you might want to use another color combination for gender data. Same with data about emotional topics like catastrophes or deaths (maybe your brand pink or green isn't the best choice there).

To avoid such situations, you can define multiple options for one-, two-, or three-colored charts and more, as the **Urban Institute** does in their style guide:

- For one-colored charts, or are allowed
- For two-colored charts, or or (for political data) or (for sequential data)
- For three-colored charts, or (for sequential data)
- Etc.

Another option is to create color combinations. **Mailchimp** does so in their style guide. For example, here's their "Categorical Combo 1" and "Categorical Combo 2".

Eurostat created mini color palettes that combine their main color with warm and cold colors:

You might now get all excited about building an advanced system of color combinations that will work for every imaginable use case. Don't make it too complicated, though: Your system should be still simple enough that people will want to use it.

Considerations for choosing colors

The attention-grabbing self-confidence of your visualizations

Here are two **Los Angeles Times** charts, one digital, one printed:

Now compare these to the following chart and map by **Bloomberg**:

While the Bloomberg visualizations scream "Look! At! Me!", the L.A. Times charts have the self-confidence of shy people standing in the corner at parties (been there, done that).

Which is ok! We give higher-saturated elements more attention, so it depends on how much of that you want your visualizations to get. Are the visualizations in your publications **essential**? Or are you posting your visualizations a lot on **social media**, where you want them to get some eyeballs? Then choose higher-contrast, higher-saturation colors.

If your visualizations are more like a "**nice to have,**" do the opposite. Many charts will grab attention in an article anyway because they're so visual — using **low-contrast colors might bring their importance down to the same level as the text,** making the whole article or report more balanced.

The L.A. Times charts are **easier to look at** than the vibrant Bloomberg charts, and this can also be an important consideration for, e.g., dashboards. Jon Olav Eikenes from the marketplace finn.no knew he was creating colors for visualizations that car dealers, among others, would look at a lot every day: "Some of our users look at our charts for hours. So it was

one of our early considerations that our colors should be easy on the eyes."

Considerations for choosing colors

Which sentiments your colors convey (and how that fits your brand)

Different colors fit different companies. One person I talked to in the past months told me they used a color palette that was "too boring/bland," so they created a more "fun/engaging" one. Another person told me that they didn't adopt a suggested color palette because it looked "too colorful."

Your company comes with certain associations or "values" (young, old, conservative, trendy, fun, bold, reliable, honest, serious, truthful, transparent, humble, diverse) — and so do colors. It can help to ask silly questions like:

1. If your organization were a car, which one would it be? Which color would it have?
2. If your organization were a person, which profession would they have? What would they wear?
3. If your organization were a house, what would it look like? Where would it stand?
4. If your organization were a cake, what would it look like?

When creating colors and color palettes, take the time to ask: **"Do these colors look like my organization? Do they evoke similar associations?"** Ask coworkers these questions, too.

Four out of eight affects, and the colors that were chosen by participants as "Best," in study 3 of the paper *Affective Color in Visualization*.

Many people have a good sense for that, especially when colors are a bad fit. According to the paper *Affective Color in Visualization* (PDF) by Lyn Bartram, Abhisekh Patra, and Maureen Stone, study participants attributed a **more professional** vibe to less saturated colors. They displayed "consistent use of higher chroma colors for Playful, Exciting, Positive and Disturbing: where Calm, Serious and to a lesser extent Trustworthy were less saturated."

Considerations for choosing colors

Cultural associations

If you're not from the same culture as your audience, test the cultural associations of your colors. Visual journalist at the BBC, Ana Lucía González, did exactly that. As she explained in a talk, cultural differences were one of the challenges when designing a COVID-19 dashboard that also works for China. Like in many of these dashboards, she and her coworkers

used red to show the number of COVID-19 deaths. When the first version was presented to their Chinese coworkers, they mentioned that "red is a celebratory color in China, so that wasn't appropriate for their audiences," Ana recalls. "So we changed it to purple."

English (in red) and Chinese (in purple) versions of the map in the BBC COVID dashboard that shows the number of deaths.

Indeed, a red color in stock exchanges in Japan or China stands for gains, while greens show loses. But it's not the same all over Asia: "Mainland Chinese were more likely to predict good outcomes when scenarios were presented in red, whereas Hong Kong participants were more likely to predict good outcomes when scenarios were presented in green," Feng Jiang et al. reported in their study "Up or Down? How Culture and Color Affect Judgments."

When in doubt, ask a few people from the culture you're designing for. Their responses will be more reliable than overviews like this one.

Considerations for choosing colors

The medium

Think about where your visualizations will appear. **Websites? TV? Glossy magazines? Bad newsprint paper? Presentation slides? PDFs that your readers will print in black and white?**

If your visualizations get **printed professionally**, then you likely will need to deal with CMYK, the most often used color model for print. You can't print all the colors you can see on your screen — colors like will turn into once printed. Plus there are tricky things like color shifts and knock-outs you'll want to take into consideration. Advice like "Use gray for text" might not apply anymore (it's often safest to print text in black). Show professional printers or print designers your color palette and sample visualizations and get their opinions.

If your visualizations are supposed to work on the **web** or in **presentations**, keep in mind that not everybody will see the colors on a shiny new screen like you do. People might have old monitors, need to present with bad projector settings, or use browser extensions like High Contrast. (More than 600,000 people use that one.) (Maybe one of your readers does too.) All of this could lead to bright colors being brighter and dark colors being darker. Which brings us to:

Considerations for choosing colors

Accessibility

You can improve the accessibility of the colors in your data visualizations by making them **colorblind-friendly** and by ensuring **high-enough contrast**

between your colors. The first one will benefit ~8% of men and 0.5% of women; the second one will benefit mostly older readers, and people with high contrast settings and bad hardware. If your readers aren't all 20-year-old women with new laptops, accessibility should be a concern for you.

Caroline Nevitt from the Financial Times told me: "Employing accessibility best practices to our charts improves the experience for all our readers." And Jon Olav Eikenes from finn.no goes as far as saying that "accessibility was our guiding star when designing our color palette."

Ensuring that your colors are **colorblind-friendly** is fairly easy. There are lots of tools out there to test that. A start in the wonderful world of making colorblind-friendly visualizations can be our article, What to consider when visualizing data for colorblind readers.

But how to ensure **high-enough contrast** of colors? The current Web Content Accessibility Guidelines (WCAG) don't mention data visualizations, but state that graphic elements should "have a contrast ratio of at least 3:1 against adjacent color(s)." (Text should have a 4.5:1 ratio.) That means that bright orange or yellow become impossible against the light gray here, or even against white:

Some people solve that with darker strokes, as visible on the right.

The 3:1 ratio doesn't just have consequences for column charts. Remember the gradient ➹ we built for choropleth maps? A WCAG-compliant one would cover only half of the lightness range, making it actually harder to distinguish between areas:

What's more: According to the WCAG, colors need to have enough contrast to any adjacent color — and often, that's not just the background:

A solution I often see is to give your chart elements white outlines. Choropleth maps (like the ones from Datawrapper) do that a lot.

But fact is, if you look at the organizational color palettes in this article, and data visualizations out there in the wild, you'll find that most don't comply with the 3:1 rule. Our Datawrapper locator map styles ➹ certainly don't (and designing a good-looking locator map style that does, while keeping it easy to spot markers on top, will be tricky). It's also challenging to communicate "calm" and "trustworthy" ➹ with colors that are that dark. The WCAG were

not designed with data vis in mind, its color contrast check has issues anyway, and the often-overcompensating 3:1 ratio shows that. WCAG color contrast critique Andrew Somers has said that the needed contrast depends on the size of an object and provides some guidelines.

When it comes to color contrast, every organization needs to decide how much they will or must follow the WCAG for data visualization elements. Data visualization designer and book author Jonatan Hildén told me that **" we still are in the early days of accessibility in data visualization,"** and I agree. I hope we'll have more clarity and better guidelines on color contrast in a few years. Until then, initiatives like DataViz Accessibility Advocacy and Advisory Group might help.

Considerations

Colors for big and small areas

Colors are differently distinguishable depending on the size they fill. **Over big areas, like in area charts, pie charts, or choropleth maps, it's easier to tell colors apart than over small areas.** Make sure your colors are easy to distinguish at every size you'll use them.

To make it easier to tell colors apart, increase all three kinds of contrast between them:

- **Contrast in lightness**. As mentioned before, your colors should have different lightnesses. Accessibility concerns might limit that option considerably, though.
- **Contrast in hue.** If you don't want to dance all over the color wheel, this option is also limited.
- **Contrast in saturation.** That's sometimes your best bet, and one you shouldn't underestimate.

Increasing the saturation of a few of your colors might make the difference between "not distinguishable" and "a good color palette."

But while lines and symbols with highly saturated colors look great, the same colors over big areas can quickly look **too saturated.**

You have two options: Make your colors work for both small and big areas (check them with the Viz Palette "color report") by increasing the differences in lightness and hue and/or by reducing the number of colors.

Or, **define more saturated colors for small areas and less saturated colors for big ones.** Oftentimes, the differences can be tiny: **The reader should perceive these colors as the same**.

FiveThirtyEight did this for their election forecast 2016. The colors in the bar chart at the top are less saturated than the colors in the line chart at the bottom and .

Parts of the 2016 election reporting by FiveThirtyEight

The Financial Times does the same, using for column charts and the more saturated for line charts. (Direct comparison: .)

That said, lots of organizations don't care and still use great colors. For their election forecast 2020, FiveThirtyEight switched to using just one red and blue . Same with The New York Times: They used the same red and blue everywhere in their US election reporting 2020 (and the years before), be it for thick bars, states in maps, thin lines, or 13px text:

You could also go one step further like the Dallas Morning News did in their (seemingly outdated) style guide from 2005 (PDF). Bar and line charts were supposed to be filled with fairly dark colors , while creators of pie charts should "prefer to use pastel colors" . Note that not one of these pastel colors meets the accessibility guidelines of a 3:1 contrast ratio.

While defining two different colors for small and big areas is an option, it might **complicate things** in your charting tool — and you'll need to document more. Think twice before you decide to go this way.

Considerations for choosing colors

Opacity

Many visualizations benefit from emphasizing only a few categories and **de-emphasizing** the rest. That's often achieved by reducing their opacity. If you're planning on doing that, test it with the colors in your color palette. You might need to make your colors **more saturated and/or darker**, so that

they don't vanish completely into the background once they're de-emphasized. If you only have low-contrast colors, play around with the transparency you're adding instead.

Even if you don't want to de-emphasize categories, you might need to deal with **overlapping elements**, for example in scatterplots or symbol maps. Making your colors more transparent or using a blend mode like "multiply" can be an option there. To make it easier to recognize colors, consider **giving transparent symbols an outline with 100% opacity.**

Considerations for choosing colors

How well you can refer to the colors

Some colors are easy to refer to: Red. Blue. Orange. Yellow. Green. Purple. These are the kind of colors you want in your color palette if people in your organization will **present visualizations** a lot, or if you're expecting your readers to **talk about them**.

As a presenter, you want to be able say, “And this orange bar here shows us...” And you want your audience to be able to ask: "Can you tell us again what the dark blue line there shows?" If there are only shades of one hue, or “greenish-yellow” and “orangy-red” and “dirty red-ish purple I guess that's called aubergine?” in your style guide, it might give some users of your colors a hard time.

Using unnameable colors has other disadvantages, too. "If two colors are called by the same name in a language, speakers of that language will **judge the two colors to be more similar** and will be more likely to **confuse them in memory**" (emphasis mine), Jonathan Winawer et.al. write in their 2007 paper *Russian blues reveal effects of language on color discrimination*. Russian has no generic word for "blue," but two words: one for light blue (goluboy) and one for dark blue (siniy). Winawer and his co-researchers showed Russian- and English-speaking study participants two blue colors and asked them which one matched a third blue:

"Subjects were instructed to pick which one of the two bottom rectangles matched the color of the top rectangle."

"We found that Russian speakers **were faster to discriminate two colors if they fell into different linguistic categories** in Russian (one siniy and the other goluboy) than if the two colors were from the same category (both siniy or both goluboy)" (emphasis mine), the paper concludes. "English speakers tested on the identical stimuli did not show a category advantage under any condition." This insight could be applied to chart colors that get explained with a color key above the chart. **Using colors that have**

distinctive names might make reading a color key easier.

Considerations for choosing colors

The background color of your visualizations

Background color can be a huge brand identifier: If I see a chart with a pink background anywhere on the internet, I immediately know it's from the Financial Times.

Financial Times chart, found on John Burn-Murdoch's Twitter account.

But a background other than white or black means that you have less choice when it comes to colors. Caroline Nevitt from the Financial Times told me: "**Our pink background reduces the limits of lightness our colors can have**: They always need to be darker than this already darker-than-white background. We could use a wider spectrum of colors without it."

Also, **all colors need to look in harmony with the background color**. A normal gray, for example, looks off on the pink FT background. Instead, the FT decided on a beige-ish gray for unhighlighted or missing data.

Considerations for choosing colors

Your visualizations in dark mode

"Dark mode" can mean that all your visualizations just have a dark background. In most cases, though, you only want to show that dark background if readers opted into it (e.g., in the settings of their operating system or their browser). Your website needs to be designed for dark mode too. If both things are the case, **make sure your color palette looks good in dark mode.**

Automatic dark modes like the one by Datawrapper will adjust the lightness of your colors so that the contrast between the background and your chart elements is the same in both dark and light mode. Less important chart elements like an axis tick have a low contrast with the background, so they will be light gray on a light background and dark gray on a black background. The elements that should stick out the most will have the highest contrast.

Automatically converting to dark mode will work better or worse depending on your colors. Most very saturated, dark colors like blue and green don't have equally saturated equivalents if they're very bright: A vibrant dark blue will convert into such a desaturated color that, although very bright on a dark background, it won't get much attention from readers. And the

other way around: An exciting bright yellow on a bright background will turn into a brown on a dark background that just doesn't convey the same energy. You have two options:

1. Create **an alternative palette for dark mode**: To get attention on a bright background, choose colors that can be saturated while being dark: blue, purple, red. In dark mode, clothe the same data in colors that can be highly saturated while being bright: yellow, green, or orange. If you're using a Datawrapper custom theme, get in touch with support@datawrapper.de and we'll make sure these colors will show up in dark mode.
2. **Tweak your palette** so that it will look good with automatically converted colors in dark mode. Your best bet are colors like green and pink that look fairly saturated when either dark or bright. You can check which colors work well by using a tool like Chromaticity. Choose the LCh color space and play around with the lightness slider.

Considerations for choosing colors

Dealing with colors in older data visualizations

You might create a style guide to bring more consistency into your organization. So how should you deal with the data visualizations your company has created before? If they're not viewed anymore (e.g. because they are part of a presentation), or you can't change them (because they're printed), then you don't need to worry about that. But depending on how many views your old reports, articles, or sites get, you might want to replace some of the colors in their data visualizations.

Graphis team lead **Kaspar Manz** from the Swiss newspaper Neue Zürcher Zeitung told me that he defined three "levels" of backward compatibility:

- **Level 1 colors** are specific colors that should stay exactly as they are. In a chart about Facebook, you want to use the Facebook blue — not a darker or brighter or more greenish blue.
- **Level 2 colors** are semantically important, but only roughly. In a chart about hydro and solar power, hydro should be blue and solar yellow — but it doesn't matter much which lightness, saturation, and exact hues these blues and yellows have. You could replace them with your new colors that roughly have the same hue.
- **Level 3 colors** don't convey any meaning and can be replaced with different hues. In a chart about professions, it doesn't matter much if "teachers" or "tailors" are shown in green. They both could also be shown in blue. Or turquoise. If categories don't have strong color associations,

you can just replace them with the new colors in any order.

Depending on how you're creating your visualizations, you might need to change the colors by hand or be able to replace them with a few clicks. The NZZ uses CSS variables, so they can define and adjust `color-green`, `color-orange`, etc. for Level 2 colors and `color-1`, `color-2`, etc. for Level 3 colors.

If you have a Datawrapper custom theme, you can tell us which new colors should replace which old ones (e.g. to replace a green with a green and a blue with a blue) and give us a list of visualizations that we should republish to make the new colors appear in your embedded visualizations.

If you don't have a **system in place yet to automate color replacements**, it might be time to consider one. The next style guide redesign will come for sure.

How to create an organizational color palette — some ideas

Find out what your organization needs / Collect possible colors / Create the color palette / Test your color palette with tools / Show your colors to users and readers / Document your colors / Improve

We talked about what to include and what to consider while doing so — but we haven't yet covered how to go about it. This is what this last part is about:

How to create an organizational color palette

1 Find out what your organization needs

First, it makes sense to be aware of what the new color palette should deliver. I recommend writing it down and checking it from time to time in the process. Some questions that can help:

1. What are the **problems** that you and your coworkers have with the current approach to colors?
2. What do you hope the new colors will do for the **visualizations and workflows** in your organization?
3. What are your **requirements**? Go to the list of considerations ↙ above: For example, in which media do the colors need to work? Is dark mode something to be aware of? What accessibility guidelines do you want to

meet?

4. Should **brand colors** be included or not ? (That might be something you want to talk about with your design team.)

To know which kinds of colors you need to create, consider doing an **audit of the last thirty to fifty data visualizations you've created**. What role did color play in them? Did the visualizations use categorical, sequential, or divergent color scales? Do some categories get visualized again and again and need specially defined colors ?

In this audit, also track **how many colors** each visualization needed. This will let you do a mental (or actual) histogram. Don't take the outliers into account ("We needed 15 colors in one chart and only up to seven in the other ones. So we need 15 colors in our palette!") — creating a data vis style guide is a splendid opportunity to also improve the visualizations at your organization in general, and reducing colors is one way to do that. Scroll up to the part on "How many colors to choose" for more considerations.

How to create an organizational color palette

2 Collect possible colors

It's time for a second audit! In many cases, it makes sense to find out which colors your organizations already uses.

If you're part of a big organization, it probably already has a document called **"company style guide"** or "our org's design language" or "design system" or "brand identity" or "graphics guide" or something like that. Get a hold of it and look at the suggested colors.

If your company doesn't have something like this (or if it's outdated), **go through any designed material your company puts out** — company reports, websites, blog, illustrations, packaging, magazines. Collect the colors these materials are using. (I recommend installing a color picker or using online tools like Photopea.)

ymca.org website. Shown here is a color audit conducted with a color picker, but the YMCA also has a "Graphic Standards Guide" (PDF).

Note down the **style** your company is using, too. Is it businessy cold? Retro warm? Subtly pastel? Brutally neon? Is it rather in-your-face or toned down? What kind of setting does the whole company design make you think of — office building, cake shop, university library, playground, cottage? Scroll up to the parts about the self-confidence and sentiment for more considerations.

If you need more input, here are three options:

- Create a **color workshop**, as Kaspar Manz did at the Neue Zürcher Zeitung (NZZ). He and his team got together for two hours and tried to answer

two questions (first individually, then as a team): What does our organization stand for? And which colors convey these values?

- Try to find **photos or illustrations that you think fit your organization**, and understand what's similar in all these images. (Very saturated? Rather pastel? Mostly blue?)
- Think of **colors that your audience associates with you.** If people who read your newspaper tend to vote for a certain political party, consider using the color that's associated with that party.

Collecting all these colors means you won't start with a blank slate once you're actually creating the color palette:

How to create an organizational color palette

3 Create the color palette

Here's a word of warning: Creating a color palette can be a giant time sink. I spoke to people who tweaked their colors for months, got deep into color theory (there's so much to know!), used three or five different color spaces, got frustrated by all these difficult-to-use color tools... it's a rabbit hole. And it's hard to know what helps and what doesn't.

Of all the colors you want to define, **colors for categories** are the hardest to create. If you don't have months, here are a few tricks that (I hope) can help you find them:

First, understand the importance of **lightness, saturation, and hue** (our article How to pick more beautiful colors for your data visualizations covers that). Design in a color space that lets you tweak these parameters — it doesn't matter much for now if it's HSL, HSV, HSB, or HCL. You'll find one or more of them in any graphics software.

Understanding lightness, saturation, and hue will make choosing colors less of a "let me just randomly generate numbers and hope it'll look good" gamble (I'm looking at you, Coolors) and more of a structured process. And it will give you the words to argue for or against colors. ("This one is too saturated compared to the others... This hue could work if we make it darker...")

You can use your fresh knowledge on lightness, saturation, and hue to **analyze the colors** you got from the audit. Get a feeling for them. How bright are they? What would a more or less saturated version of each color look like?

Let's say your brand colors are these two colors:  . We can use a tool like Adobe Color with the color mode in the bottom left set to HSB to learn that the green is darker than the rose. We also see that both colors are not very saturated. And a look at the color wheel will tell us that they're almost

complementary colors (= on opposite sides) and that the green is closer to the blue than to the yellow side.

Adobe Color. Once switched into the "HSB" color mode, the tool shows us the **H**ue, **S**aturation, and **B**rightness (≈ lightness) of our colors.

Lightness, saturation, and hue are all you need.

That, and trusting your eyes. If you do want to go down the rabbit hole of color spaces, choose a perceptionally uniform color space like Oklab. **But for categorical colors, you don't need fancy color spaces.** You'll see when one color pops out too much compared with the others. If not today, then tomorrow with fresh eyes. If not you, then your designer friend or coworker.

Let's continue with our two colors and learn which colors go well together with them. Put your hex codes into hue.tools and then click through the *Inspiration* and *Images* links at the right to see how others have used your colors:

Designspiration is a design platform that lets you search by up to five colors.

Once we've seen some contexts in which others use our colors, it's time to color pick from those images:

Behance.net is a design platform that lets you search by one color. I picked the colors in Adobe Illustrator.

We can work with that! Now we need to:

- Adjust the **saturation**. Our original colors are very desaturated, and the blue and the red in the middle look too vibrant in comparison.
- Adjust the **lightness**. Some of these colors — like our original rose, or the pale orange next to the red — are too bright to work in line charts on a white background. Our dark blue and green might also be too easily mistaken for black in small areas.
- Adjust the **hue** of colors that are too similar to each other. The dark green could be mistaken for a darker version of our original green. We don't want people think they're more semantically related than, e.g., the blue and the green, so we'll adjust the hue of the dark green a bit.

We'll get to a version that looks like this:

From here, we can move to the testing:

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4 Test your color palette with tools

Depending on your requirements, a categorical color palette needs to check a lot of checkboxes. At the very least, it should be **easy to tell apart for readers (including the colorblind ones)**. Good thing there's a nice online tool called **Viz Palette** that checks that for you:

Once you load your hex codes into Viz Palette, it answers the following questions for you:

1. How **good do your colors look** in actual data visualizations?
2. How easy are your colors to tell apart for readers with different forms of **colorblindness**?
3. How easy are your colors to tell apart at **different sizes**?
4. How easily can readers refer to them verbally? Are there any **name conflicts**?

I don't know of a better tool that checks all these things — even if you're interested in only some of them, try it out.

Our palette looks good — but apparently, a few colors are hard to tell apart when they're used as lines or symbols. That would be especially the case for red-blind readers:

Viz Palette gives you a "color report" below the visualizations. Here you can see how hard it is to tell your colors apart at different sizes, and if there are any naming conflicts between the colors.

So it's back to tweaking the lightness, saturation, and hue. The more different in lightness and the more saturated your colors are, the easier it is to tell them apart.

And no, it's not just you: **It simply is hard to create many colors that are both beautiful and easy to tell apart even at small sizes and for all readers.** Consider going back to step 1 and adjusting your requirements: Do you really need that many colors? Could limited color combinations be a solution? Could your data visualizations use ways besides color to make categories distinguishable?

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5 Show your colors to users and readers

The more time you spend with your colors, the more you might get attached

to them. (One of the people I interviewed told me: “I spent so much time with the color palette and researching, I feel ownership and pride about it.”) Before you fall in love with your colors because you've stared at them for hours, **include other people in the process:**

- **Create charts and show them to coworkers.** What do they think works better or worse than the current colors? Designer Caitlyn Hampton wrote a good article on how she used a survey to test color preferences and associations.
- **Let other “future users” of your color palette create charts with your new colors** — e.g., other data vis designers in your organization. Ask them what worked well and what didn’t.
- Give your **family, friends, or actual readers of the data vis** the same chart with the old and new color palettes and see how they react. Consider giving them tasks (“What’s the value for Canada in this choropleth map?”)

Don't wait for weeks before including other people. Include them early and often.

A word about **aesthetics**: Some people might tell you that they don't like your colors. That they look boring or bland. If you've done what's suggested in step 1 (Find out what your organization needs) and step 2 (Collect possible colors), you'll have **ways to argue for your colors**: "These colors communicate our company values best because ..." or "We've seen that people had a hard time telling our old colors apart, so we had to increase the saturation ..."

That said: **There will always be a few people who won't like a specific color you chose — but there are also specific colors that most people simply don't like.** "People generally like saturated blues and cyans because they like clear sky, clean water, swimming pools, and most other objects that characteristically are these colors," Schloss and Palmer wrote in their 2010 paper *Aesthetic response to color combinations: preference, harmony, and similarity* (PDF). "They generally dislike dark oranges (browns) and dark yellows (olive-colors) because they dislike feces, rotting food, vomit, and many other (but not all other, consider chocolate and coffee) objects they associate with these colors."

It helps to speak to a lot of people. This way, you can ignore the outliers (the two people out of ten who are not fans of your purple) and listen to the majority (the seven out of ten people who suggest you choose another orange).

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6 Document your colors

You decided on some colors? You tested them on lots of people and charts,

and you're happy enough with them? Congrats! 🎉 It's time to document them. Let's look at the content and format of your documentation:

Content: Your style guide can include the following information:

- **Which colors are used for what.** Include lots of colors codes (hex codes, RGB, CMYK, ...) so that people can copy and paste them. Give your colors names (get inspired by Pantone and these fruit & vegetable-named colors by Mailchimp, or get color names from this tool or hue.tools) — it might make your colors more likeable.
- **Color combinations** ➹, if any.
- **Examples** of the colors in actual data visualizations.
- **Do's and don'ts** of how to use the new colors.
- **Explanations** of why these colors were chosen. This might increase acceptance for them, but might also result in a document that's too long.
- **Exceptions**, if any.

Mailchimp names many of its colors after fruits and vegetables.

Format: Before you go ahead and create a big presentation or 30-page PDF, think about which kind of document would be most useful to people.

- **A one sheet overview** (maybe in addition to your 30-page PDF) can increase the chances that it's read and used. The American Red Cross created a "Brand identity at a glance" poster (PDF), and the first page of OHA's style guide is an overview.
- You can also think about **writing two documents**, a detailed one for data vis designers and a simple one for other people.
- **Design** your style guide in a way that it becomes clear what *everybody should know* and what's only explanations or exceptions. Put the most important pieces of information first, make them bold, give them a colorful background, etc.
- Give a **presentation** about the process, which colors you came up with, and how to use them. Talking about the challenges you overcame, how you tested the colors, and what compromises you had to make can increase the acceptance for your colors within the organization.

The Office of HIV/AIDS (OHA)'s data visualization style guide.

Writing a style guide is one thing — but your coworkers should actually use these colors. Try to **reduce points of friction** standing between "Which colors should I use?" and "Great, I'll use *these* colors."

- **Link** to the style guide aggressively everywhere people might need to use colors: In a data vis template that you prepared or in a "How to design data vis at our org" document.
- If you can, create a **easy to remember URL.** *yourorg.com/colors* or *guides.yourorg.com/colors* is better than *yourorg.com/organization/visualizations/style-guide/colors*
- **Print** the guide out and put it on the office wall to remind people of it.
- **Make the colors the defaults in data vis tools.** "It's hard for me to get our corporate colors," somebody told me recently. "That's why I don't use them." Make it as easy as possible to use your new palette: Make it a named vector for ggplot2 or set of variables for CSS/SASS, or implement it as a theme in Excel. If you're using a **Datawrapper** custom plan, tell us your colors at support@datawrapper.de and we'll show them in our color picker.

Make people's lives easier with your documentation. "If [your data vis style guide] solves problems, then people will want to use it," designer Alan Wilson explains. "Because their life is better with it than it was without it."

To see how others have structured and designed their data vis style guides, scroll down to the list of style guides ↙.

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7 Improve it

There's no need to create a perfect color palette (or perfect documentation!). "Perfect is the enemy of done," as they say. Sure, there's always room for improvement, but it doesn't need to happen now. **Ship the color palette and its documentation, then improve both whenever you get feedback.** HubSpot has a good article on "keeping your design system evergreen."

Director of data vis at the Urban Institute, Ben Chartoff, phrased it beautifully: "The data visualization style guide is a living document. As our team grows and learns, we will continue to adapt and update it, striving to make our charts more legible, more beautiful, scalable across more platforms, and accessible to all."

After a few years, people will get bored of always the same colors. And new people will join your organization, eager to create a new color palette (like maybe you're thinking about right now). The whole process will start again — with a hopefully even better color palette as the result.

Collection of data vis style guides

For a list of data vis style guides, I recommend Jon Schwabish's collection here and this Google Sheet, started by Amy Cesal. Unfortunately, not all of the ones listed there have a section on colors for data vis. Many have a section on interface colors, and all of them have a section on data vis, but often the **"colors in data vis" part** is missing. The following style guides have them. If possible, I linked directly to the color section:

- **The Economist** (PDF)
- **Neue Zürcher Zeitung** (website)
- **MinnPost** (website)
- **Texas Tribune** (website)
- **The Center for Public Integrity** (on GitHub)
- **The Dallas Morning News** (PDF)
- **Sunlight Foundation** (blog post by Amy Cesal, PDF)
- **Office of HIV/AIDS** (on issuu.com)
- **Urban Institute** (website)
- **Greater London Authoritity/City Intelligence** (PDF, website)
- **Alluma** (website)
- **Mailchimp** (website)
- **Salesforce** (website)
- **Cato Institute** (PDF, on GitHub)
- **Pearson** (website)
- **Human Managed** (Figma document)
- **Mixpanel** (website)
- **SPARK** (website)
- **GitLab** (website)
- **intuit** (website)

Thanks to every organization that put their style guide online! They were not just crucial in writing this very guide, but are also helpful to others who are creating a style guide.

Other resources

- Good **additions to this blog post** are Delong's How to Create a Data Visualization Style Guide to Tell Great Stories and Amy Cesal's How to

Create Brand Colors for Data Visualization Style Guidelines.

- If you need more convincing on **why your organization should have a style guide**, read Jon Schwabish's Why Your Organization Needs a Data Visualization Style Guide and watch Amy Cesal's talk Why does Data Vis need a style guide?
- Sadly, there are not many reports yet on "**how we redesigned our data vis style guide**." Jon Olav Eikenes gave a neat explanation of their process at finn.no in this talk, but I couldn't find more. (If you know of any, let me know!)
- There are also good **reports of general style guide redesigns**, e.g., by Hubspot and FOSSA.
- For reports on how people went about **changing a color palette** (for their website, etc.), read these ones by Postmark and UXPin.
- To learn more about **organizational challenges** when it comes to data vis style guides, the Data Vis Society fireside chat on Data Viz Style Guides (also with Amy Cesal and Jon Schwabish) might be helpful.
- For **general help on how to better use colors** in data visualizations, we at Datawrapper have written quite a few articles, e.g. on choosing colors for gender data, colorblind-safe colors, tools, color scales, and how to use fewer colors. Find them all here.

This guide has been in the making for quite some time — and I'm indebted to many people who answered my questions about data vis style guides in emails, video calls, and at an Outlier unconference session that I hosted. Thanks to Caroline Nevitt, Vicky Semaski and Peter Bell, Kaspar Manz, David Yanofsky, Justin Lind, Courtney Babcock, Ben Wylie, Nick Twort, Jacque Schrag, Jonatan Hildén, Ana Lucía González, Jan Dittrich, Max Graze, Jon Olav Eikenses and Tomi Nurmi, Alle Bloom, Graeme Bruce, and many others. This article is better because of you.

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