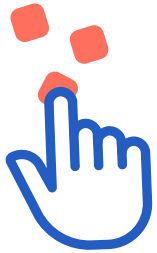
Show, don’t tell

Creating visuals about your research

Koen Van den Eeckhout - Baryon



All the slides and all the links:

baryon.be/visuals-resources

Why visual communication?

ATTRACTIVE

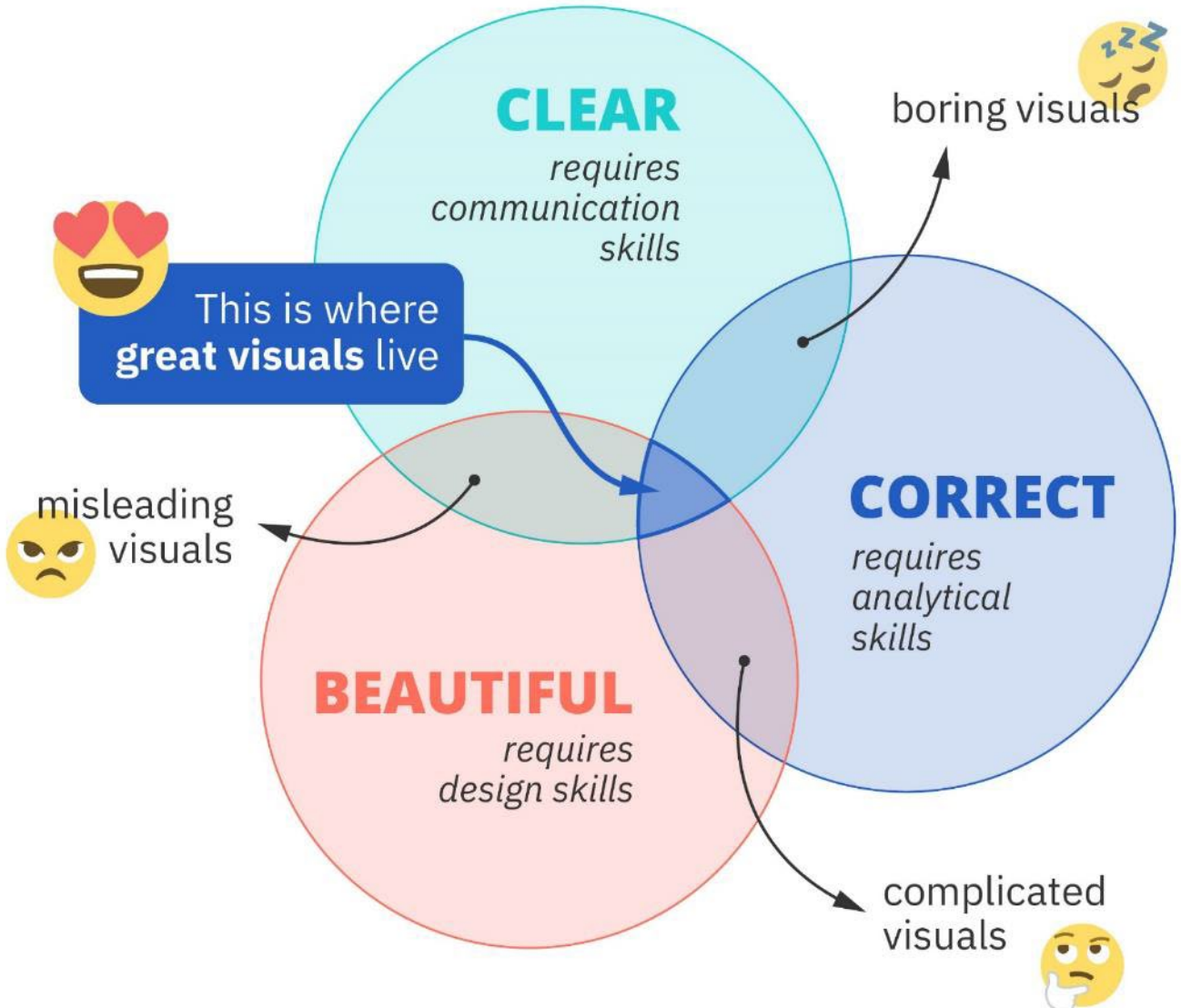
better at catching the reader's attention

INFORMATION DENSITY

better at summarizing large amounts of information

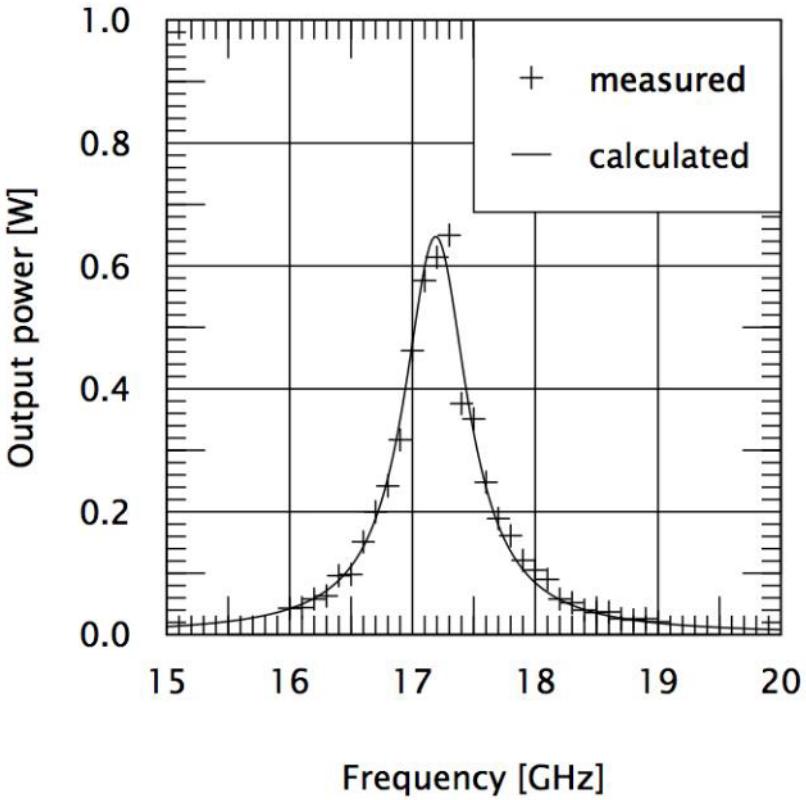
EASIER TO UNDERSTAND

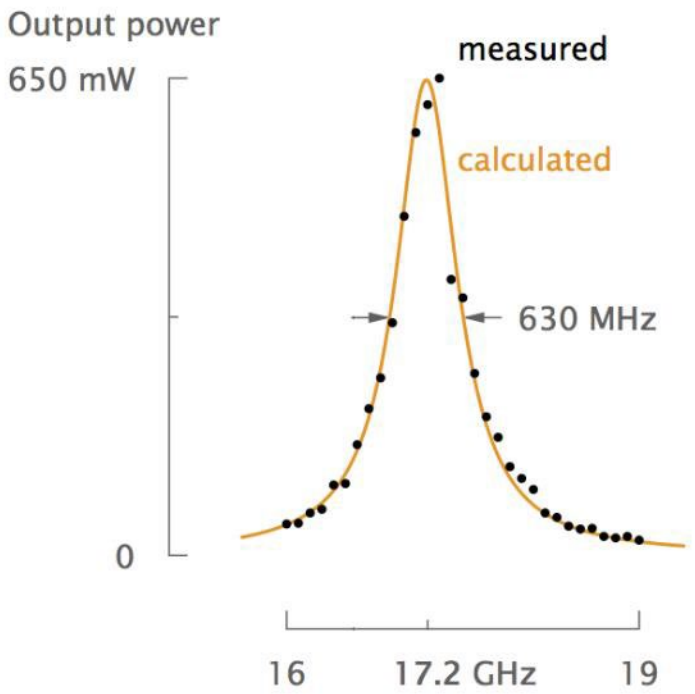
thanks to dual coding and better knowledge retention


CLEAR
requires communication skills
boring visuals
This is where great visuals live
misleading visuals
CORRECT
requires analytical skills
BEAUTIFUL
requires design skills
complicated visuals

Communication principles

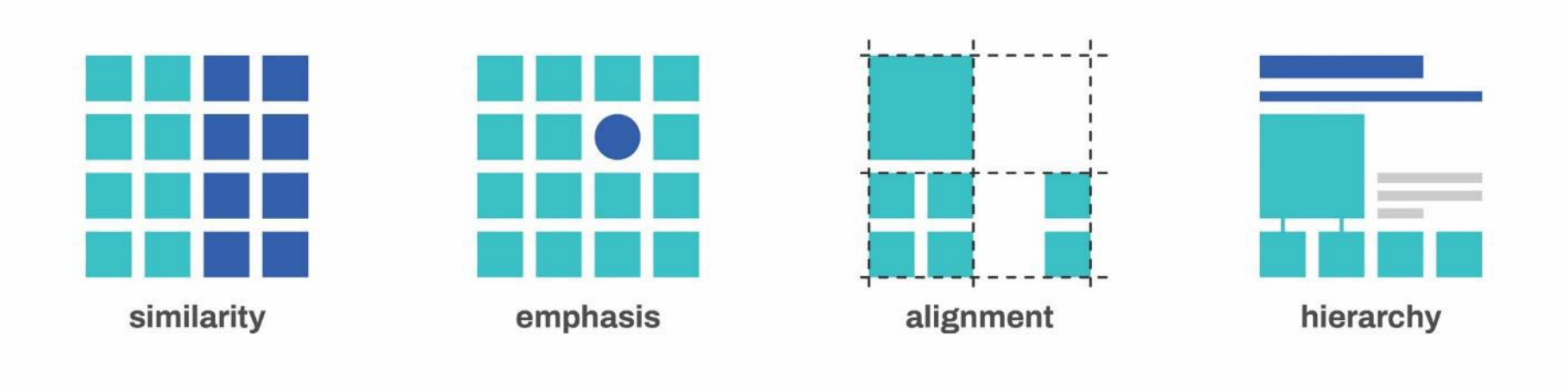
1. Identify your **message**
2. Adapt to your **audience**
3. Improve the **signal-to-noise** ratio

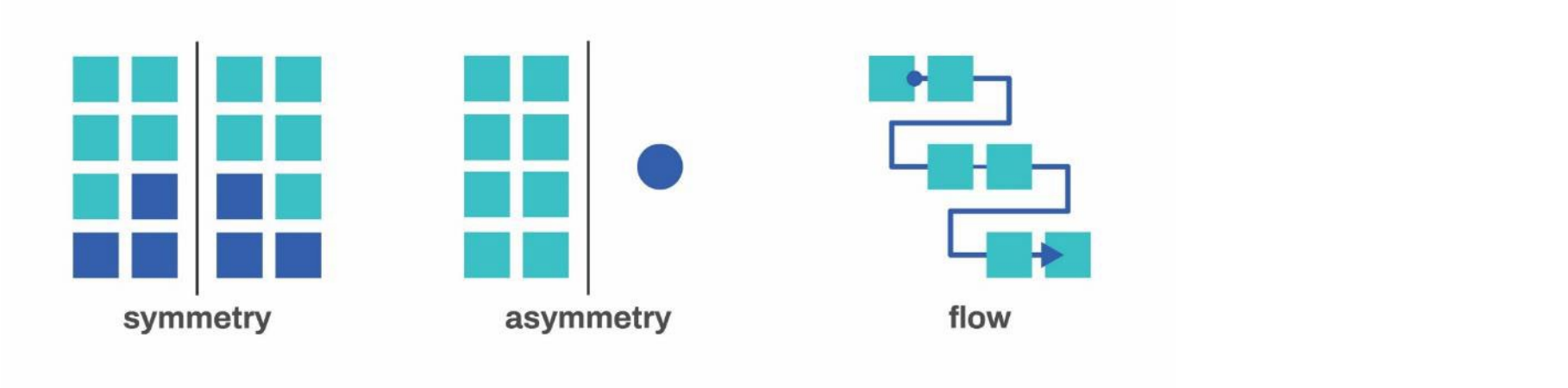


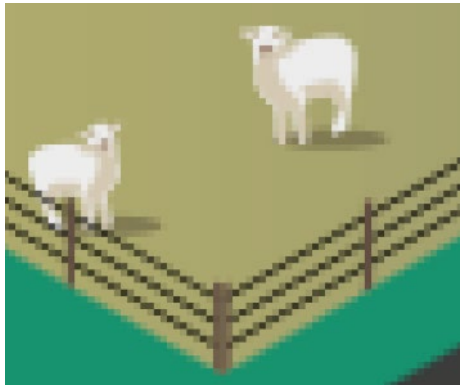


Jean-Luc Doumont, Optics & Photonics Focus 2010

Design principles





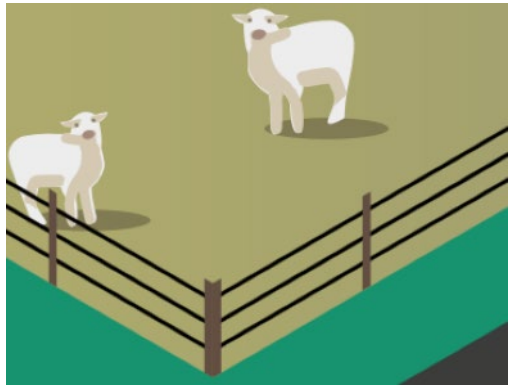


bitmap image

jpg, png, bmp, tiff, gif, psd,...

- built from **pixels**
- photographs
- illustrated made by hand
- illustrations with lots of textures, brush strokes,...

- tools: Photoshop, GIMP, Paint.NET,...



vector image

svg, pdf, eps, ai,...

- built from **shapes**
- illustrations made digitally
- (large-scale) printing
- easier to edit, recolor,...

- tools: Illustrator, Inkscape,...

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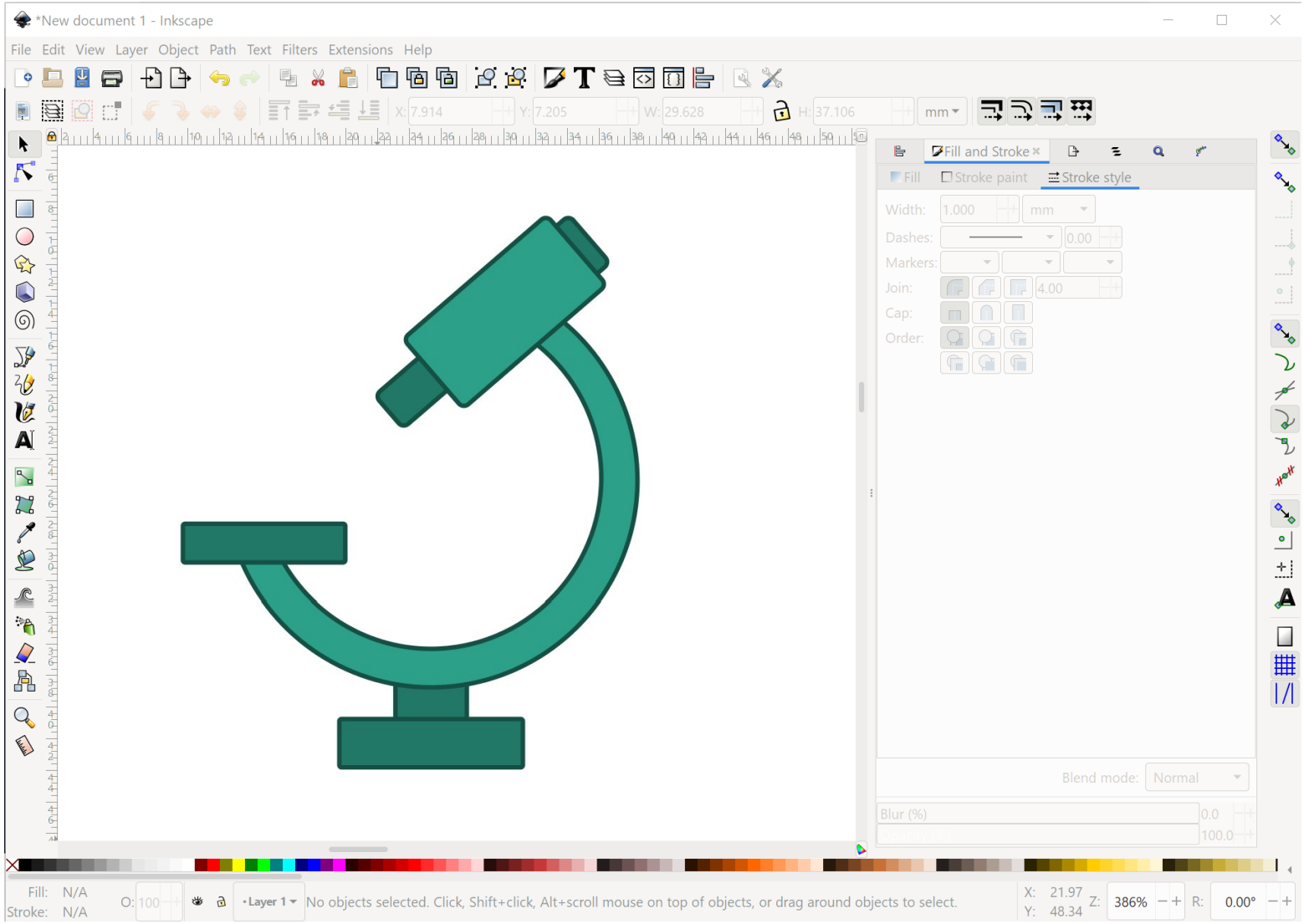
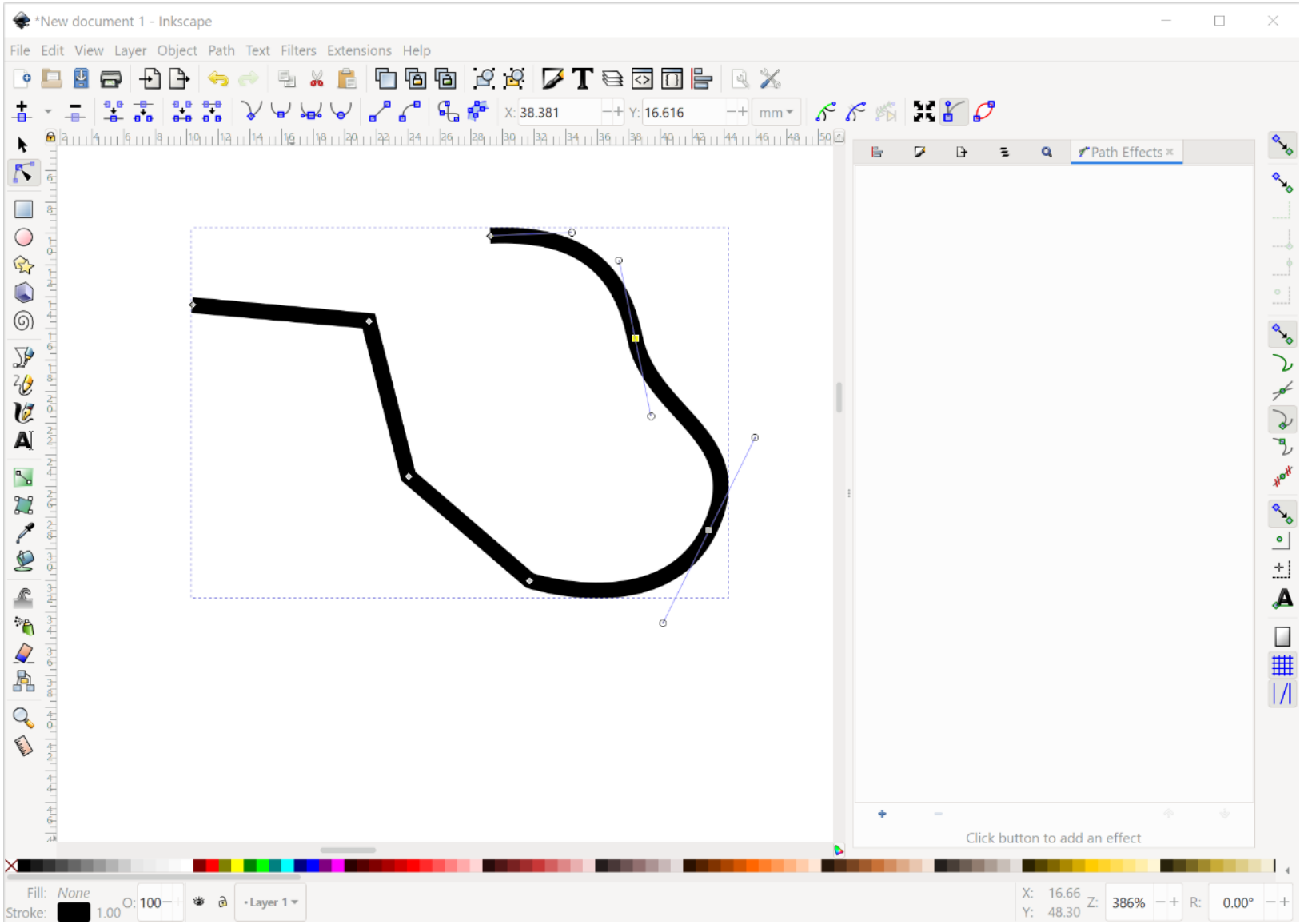
Exercise: advanced shape manipulation

Recreate the following icon as good as possible:



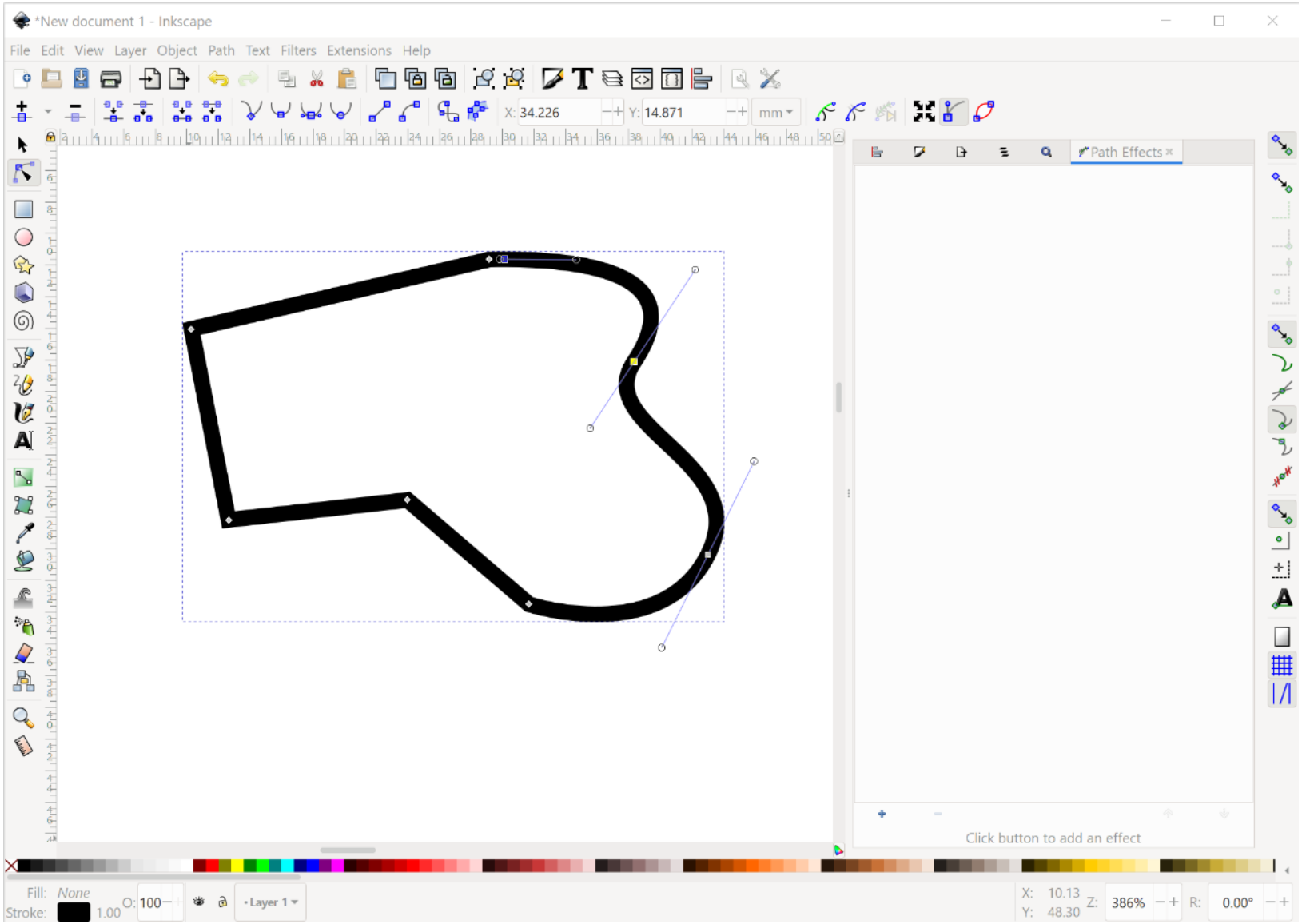


Draw your own paths using the **Bezier** path drawing tools:

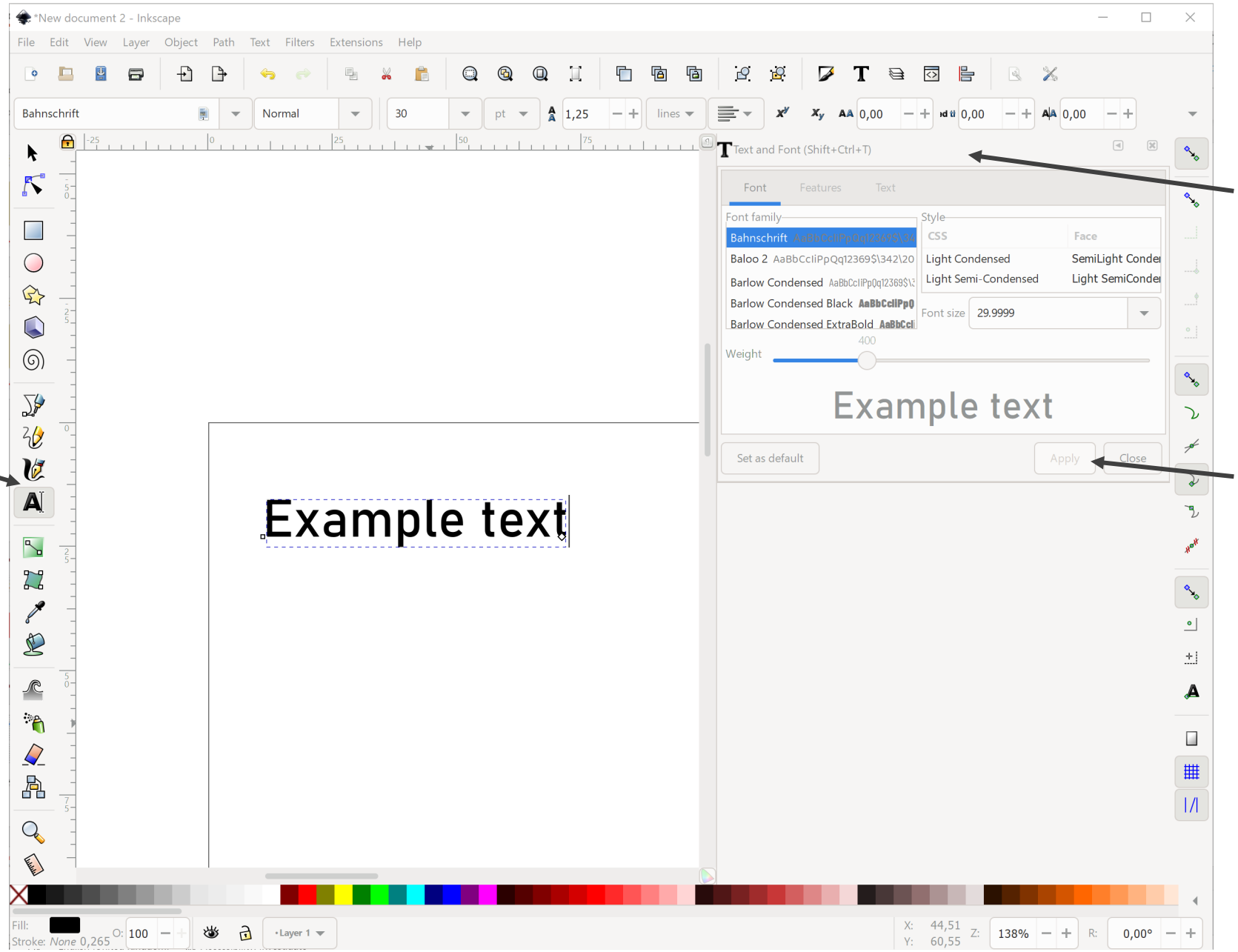
- click for a corner point (consists of only an anchor)

- click and drag for a bending point (consists of an anchor with handles)

Manipulate the anchors and handles using the **Node** tool



Add text using the text tool

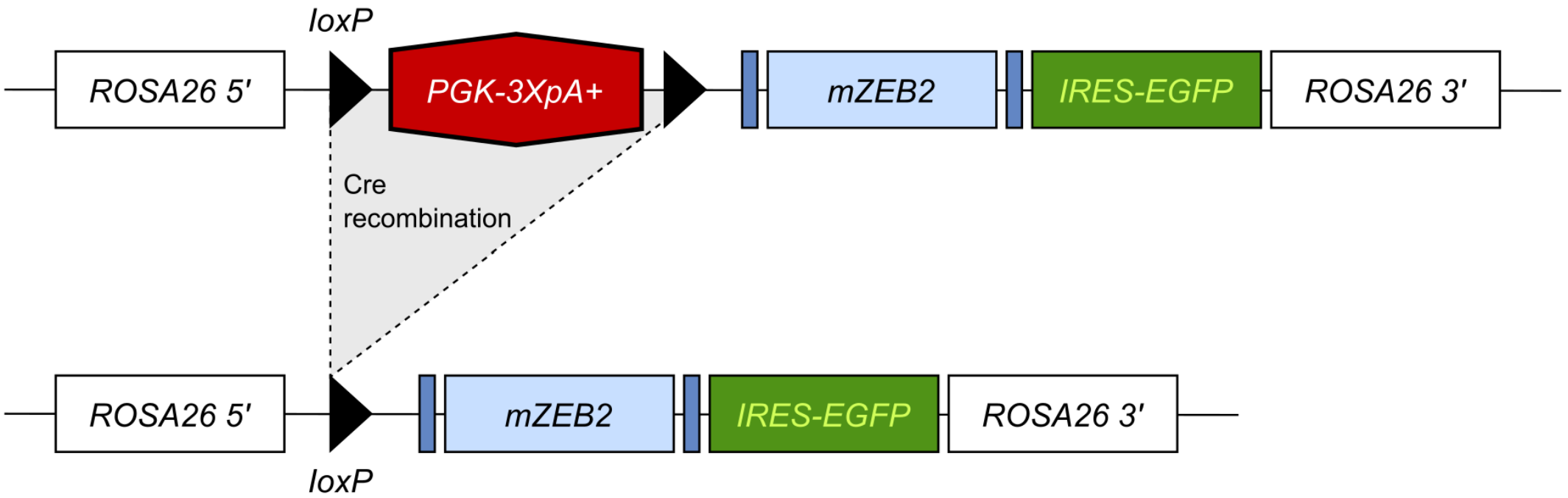


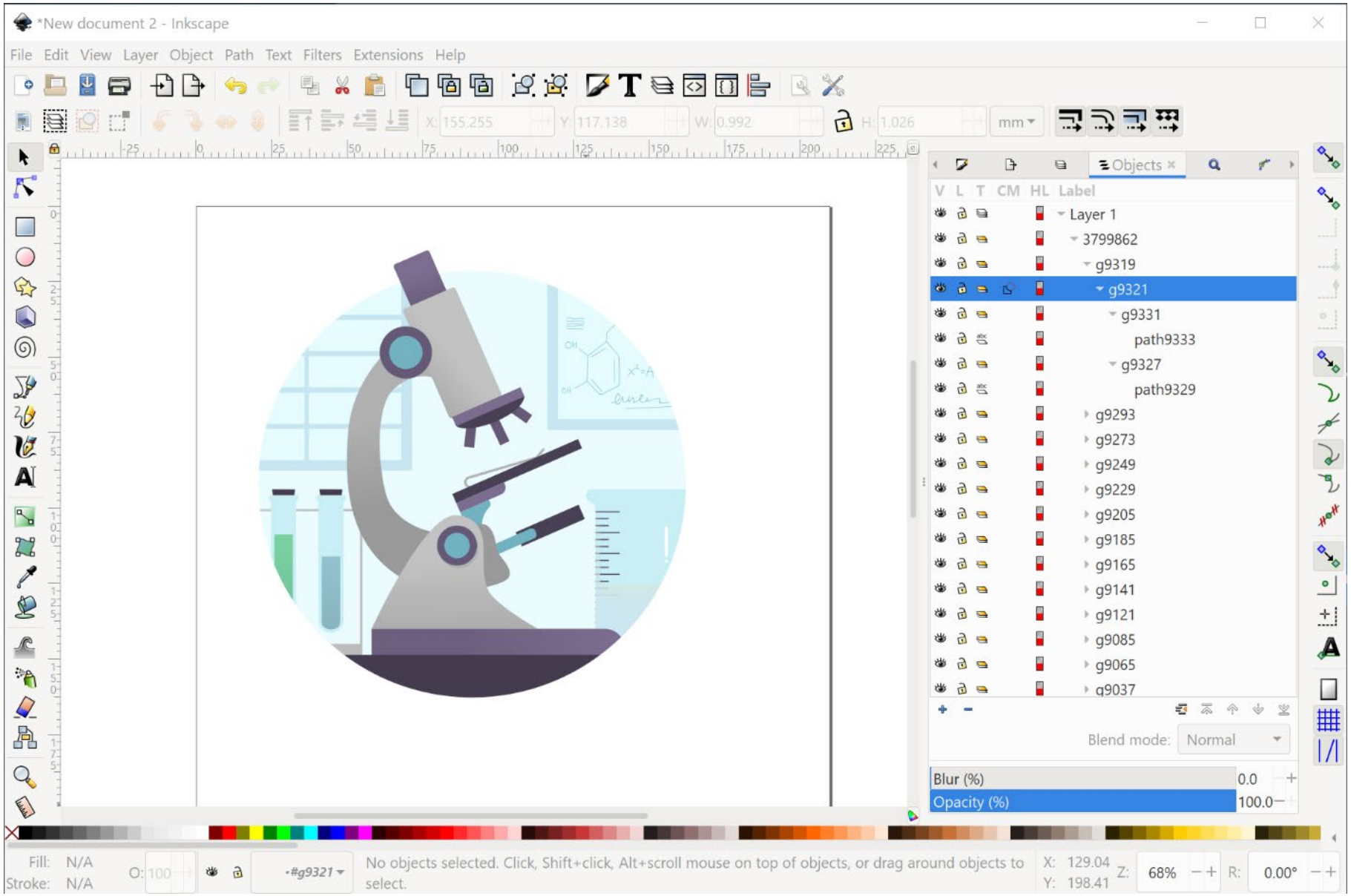
Change settings in the ‘Text and Font’ panel or the tool controls bar

Hit ‘Apply’ to update the text

Exercise: shapes, text and alignment

Recreate the following flowchart as good as possible



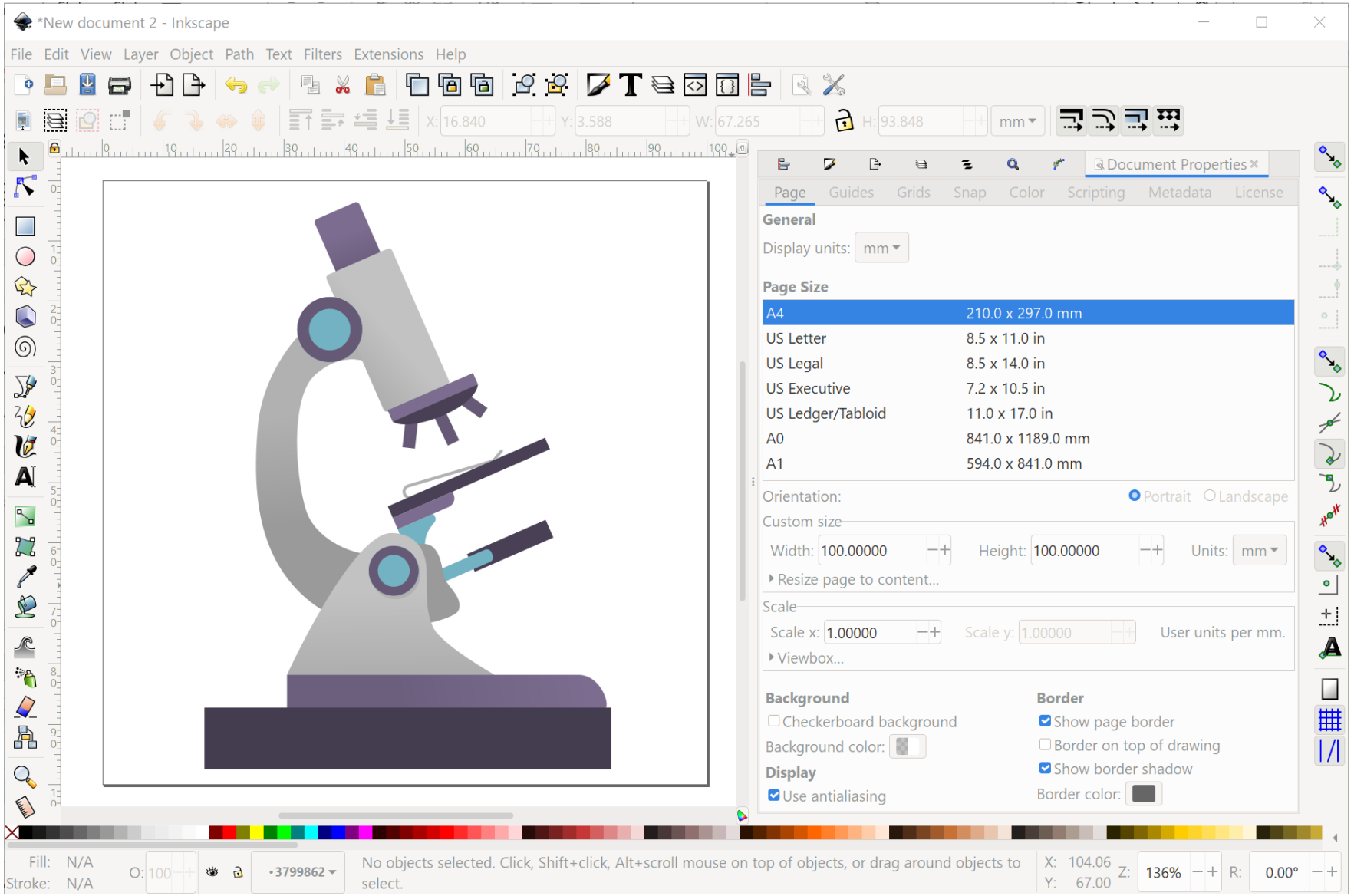


Edit an existing vector image (e.g. one you downloaded from Freepik) using **File > Import**

Some troubles you might run into:

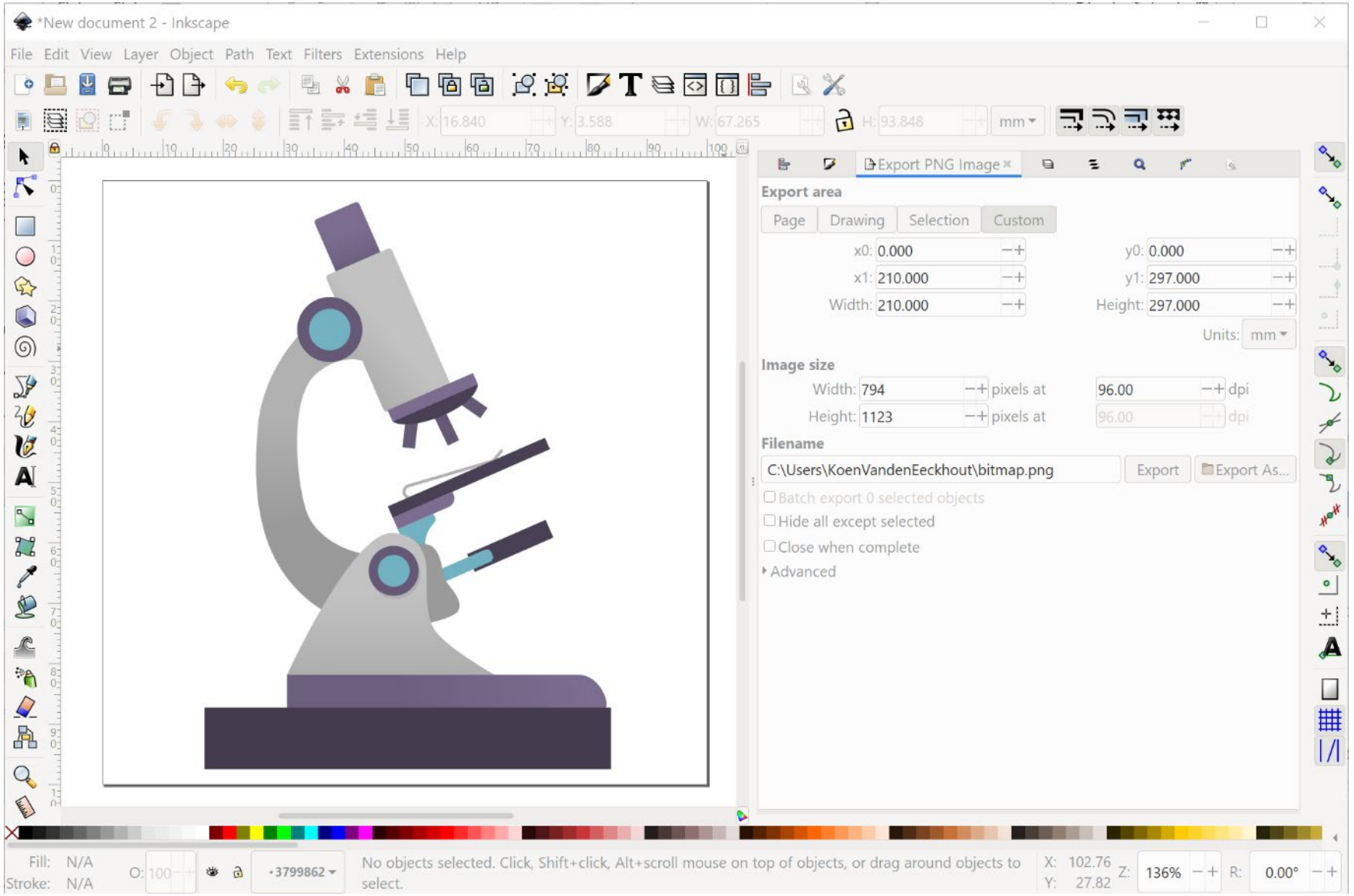
- Inkscape doesn’t always support .eps files
  - if you have an .eps file, use these steps to get it into Inkscape, or an online tool to convert it into an .svg file

- Some downloads come in .ppt format (e.g. from smart.servier)
  - open the .ppt file and copy-paste the image into Inkscape
  - or save the .ppt file as a .pdf file and open it in Inkscape



Saving your file

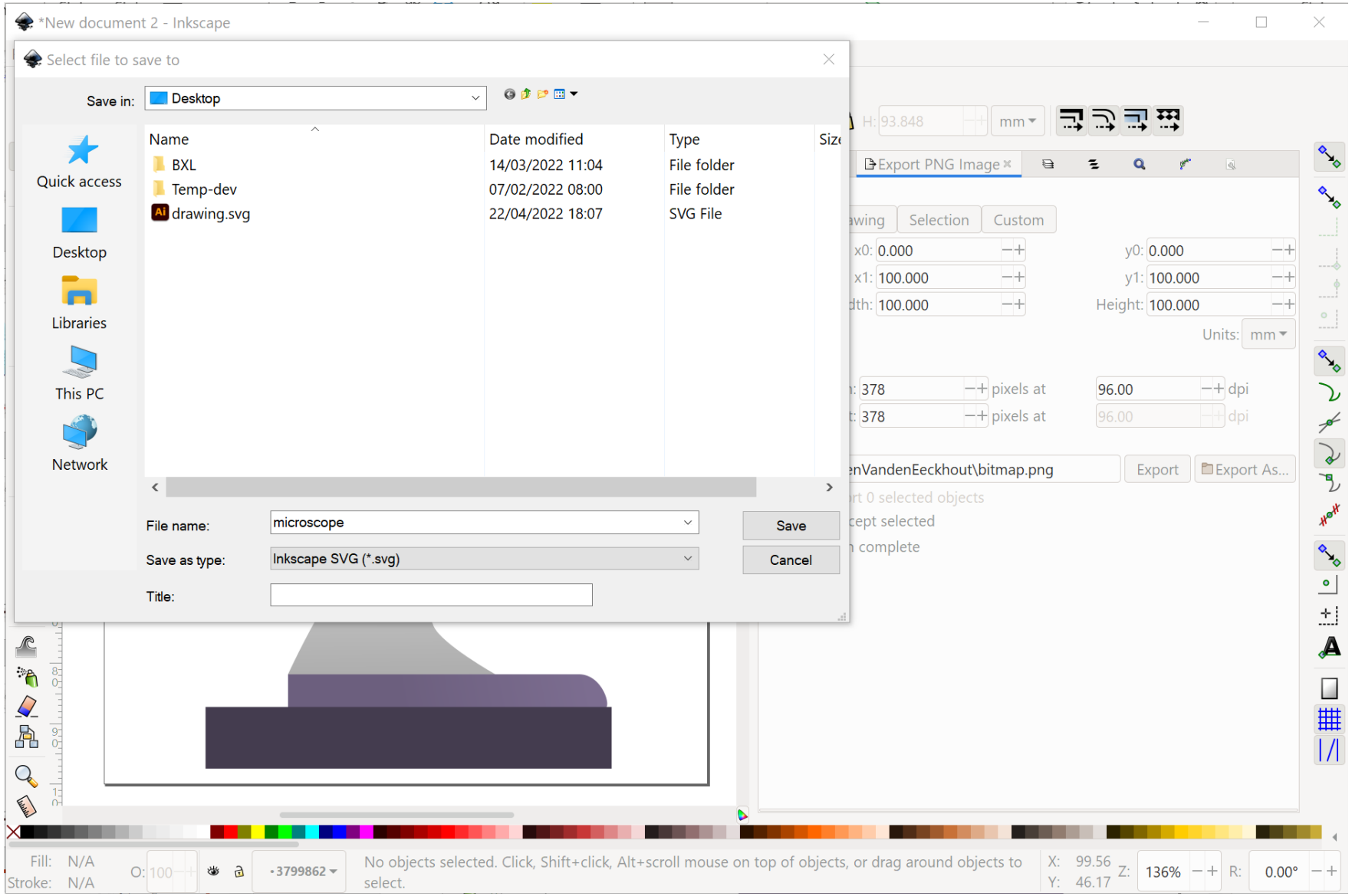
Step 1: set the desired canvas / document size under ‘Document Properties’



Saving your file

Step 1: set the desired canvas / document size under ‘Document Properties’

Step 2: if you want to save as a bitmap image, choose File > Export PNG image



Saving your file

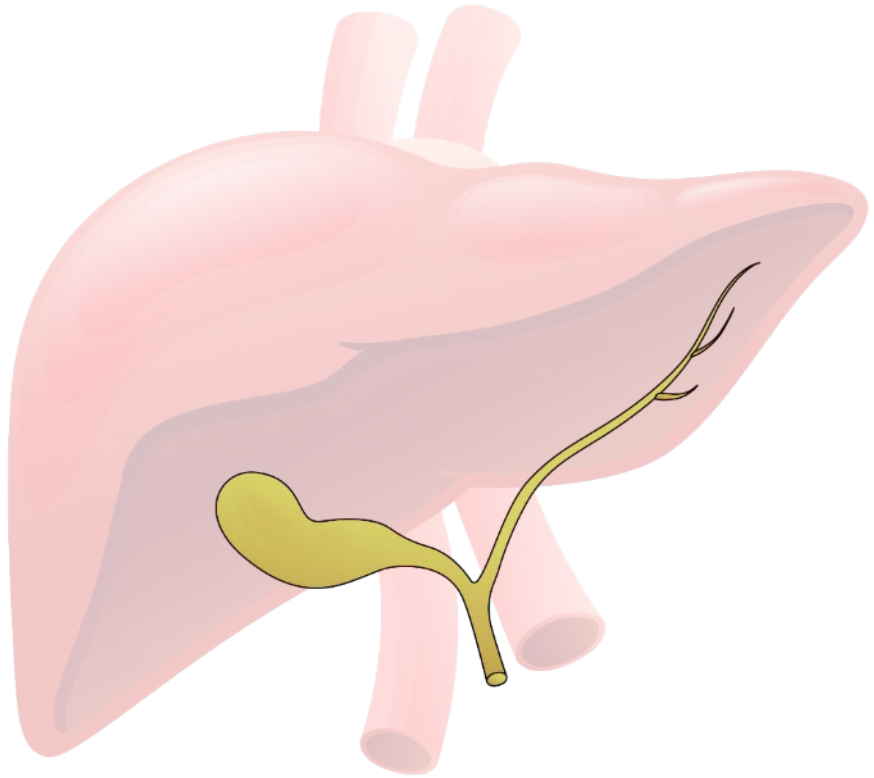
Step 1: set the desired canvas / document size under ‘Document Properties’

Step 2: if you want to save as a bitmap image, choose File > Export PNG image

Step 3: if you want to save as a vector image, choose File > Save

Exercise: editing vector images

Find the following image on freepik.com
(search for ‘liver’):



- Remove everything which is not the liver or gallbladder
- Reduce the liver transparancy to make it lighter
- Give the gallbladder a stroke to make it stand out more
- Save the image as gallbladder.png
  with a transparent background

Exercise: complex layouts

Let’s recreate the following infographic as good as possible:

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Homework: your own graphical abstract

Present your concept sketch to your group members.
Explain your choices concerning key message, layout, hierarchy and flow.

Explain what you like and don't like about your visual, and describe the challenges you encountered.

As a group, try to evaluate:

- Is there a clear **message**?
- Is there a clear starting point and **flow**?
- Is there a clear **hierarchy** – separation between main and side messages?

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Recap and Q&A

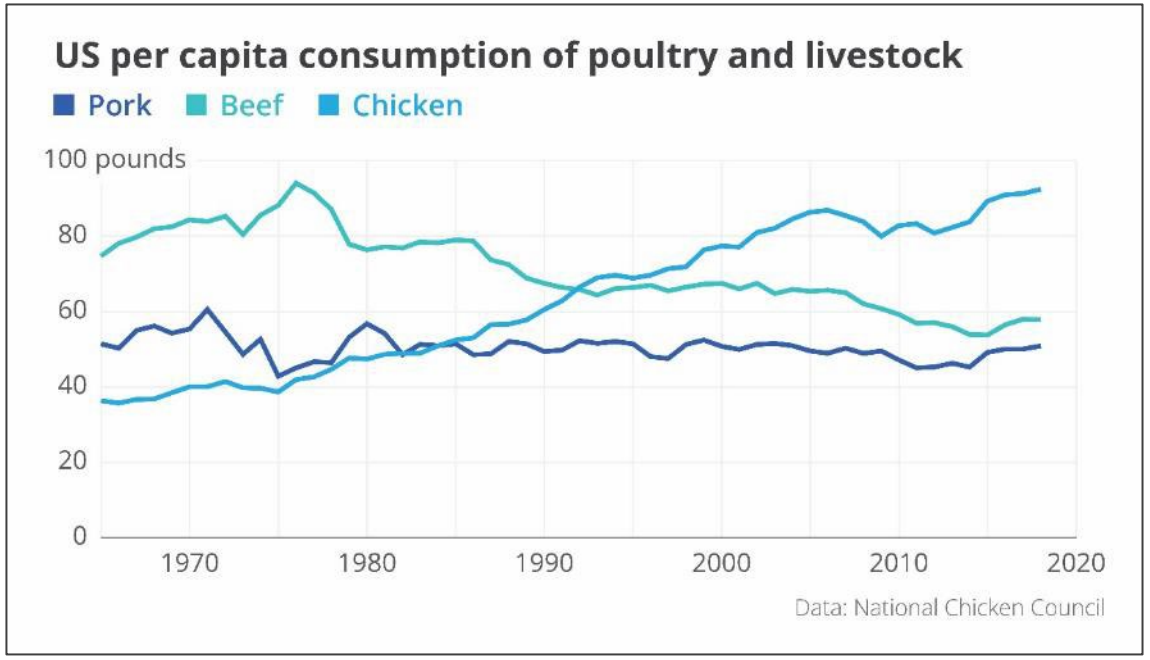
Colours

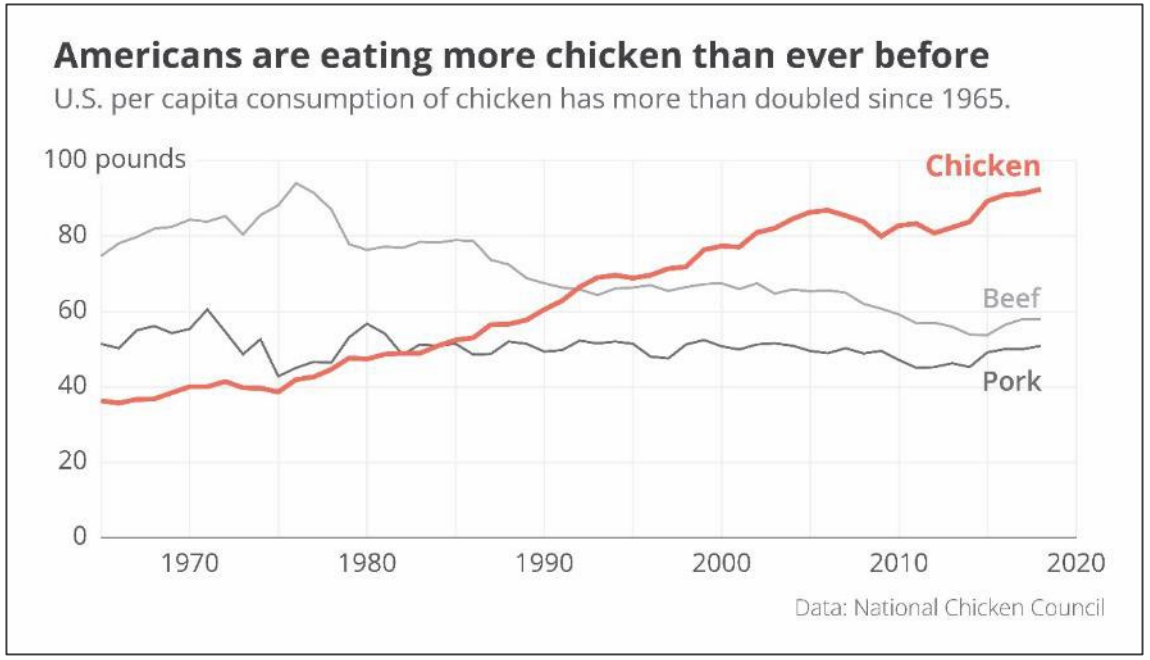
THE IMPORTANCE OF

COLOUR

STEPHENWILDISH.CO.UK

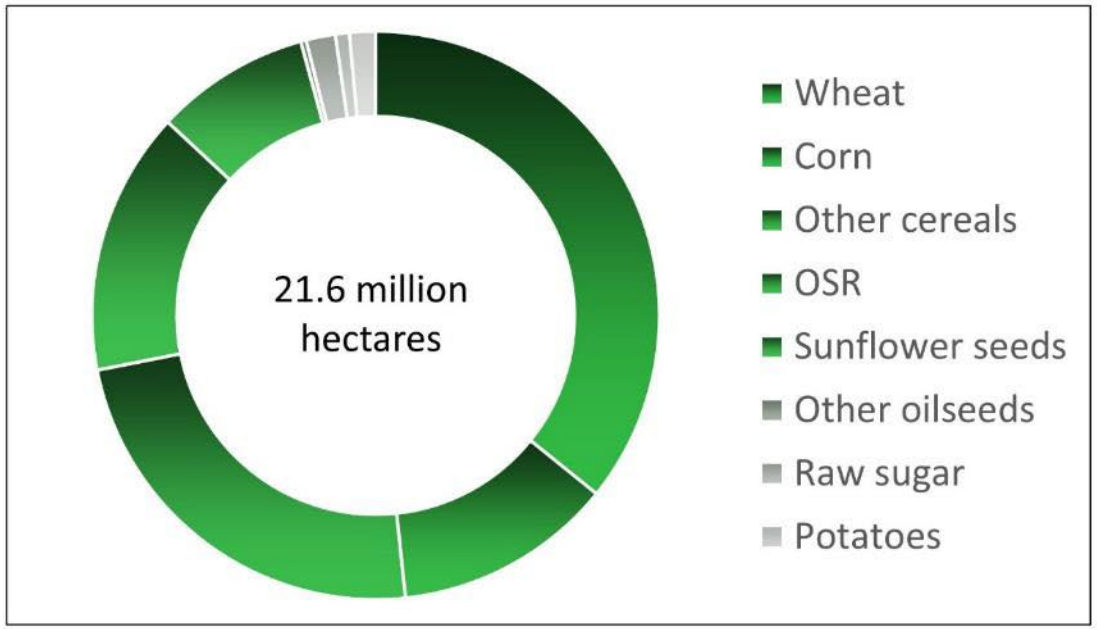
~~data~~ → story


US per capita consumption of poultry and livestock
Pork
Beef
Chicken
100 pounds
80
60
40
20
0
1970
1980
1990
2000
2010
2020
Data: National Chicken Council

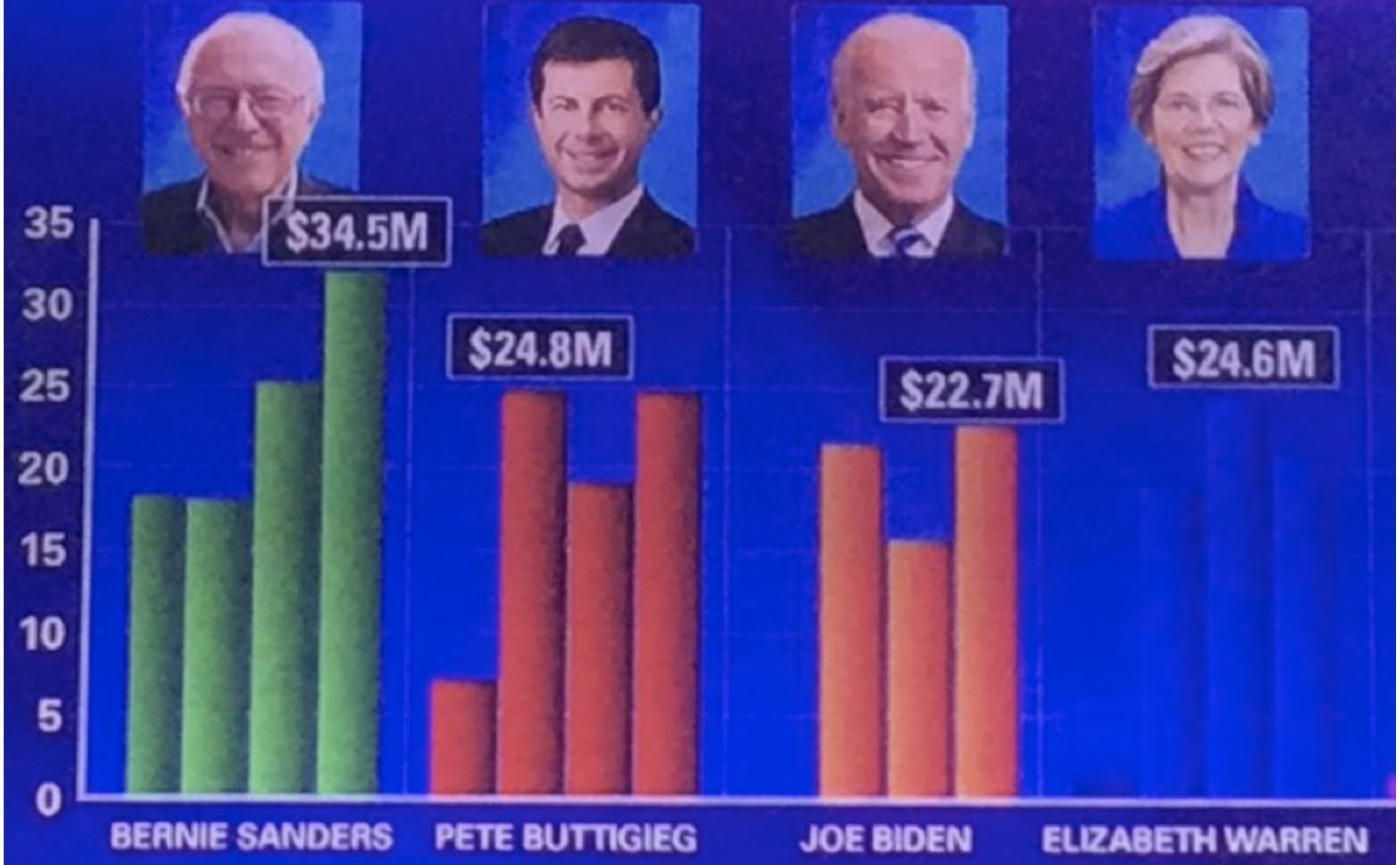

Americans are eating more chicken than ever before
U.S. per capita consumption of chicken has more than doubled since 1965.
100 pounds
80
60
40
20
0
Chicken
Beef
Pork
1970
1980
1990
2000
2010
2020
Data: National Chicken Council

Without 20 years of plant breeding in the EU 22 million hectares of additional land would be needed

Additional global land use without plant breeding in the EU

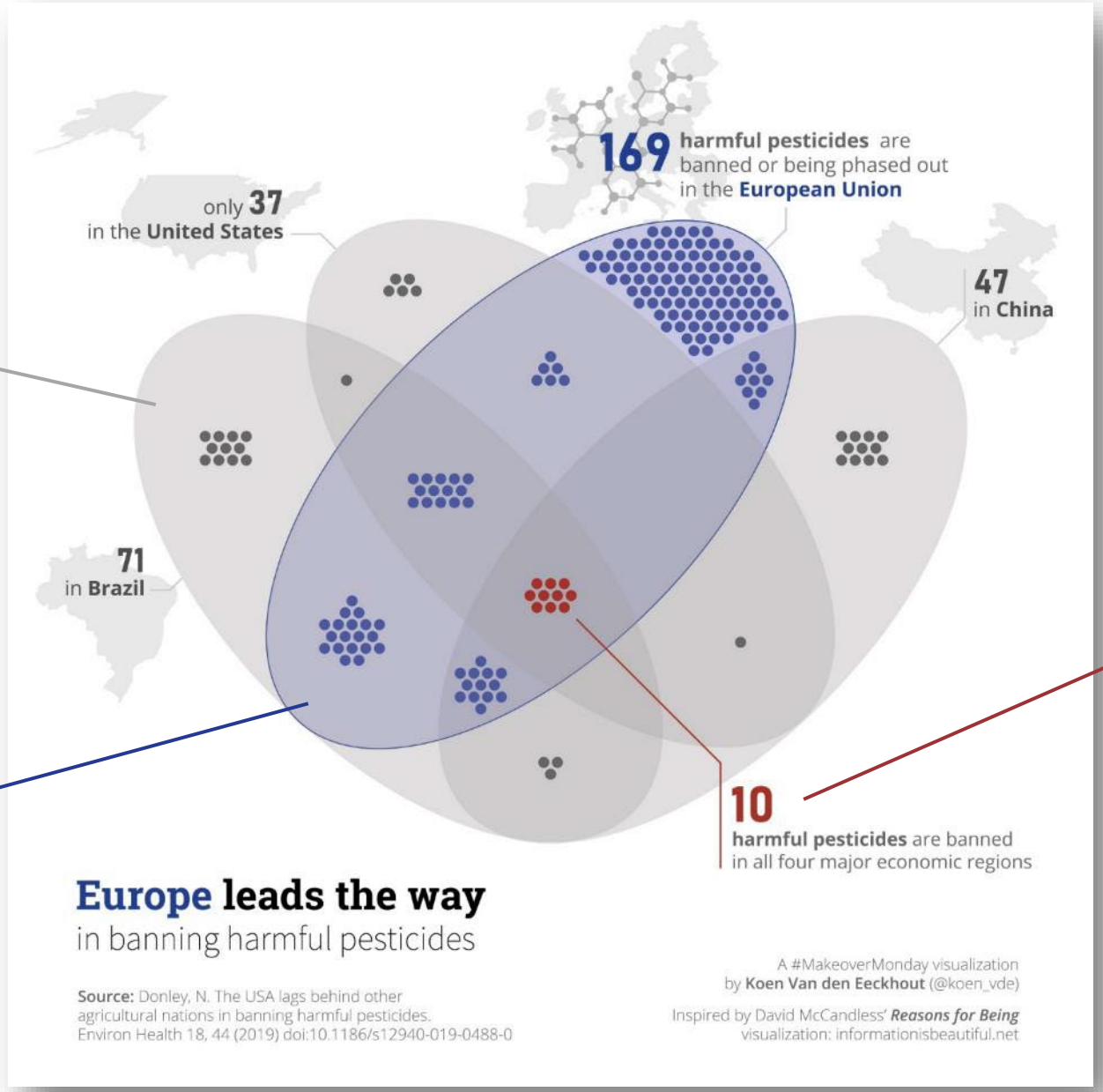


- Without 20 years of plant breeding scarce global resources would additionally be exploited:
  - → N. Am.: 2.4 million ha
  - → S. Am.: 1.8 million ha
  - → Asia: 2.9 million ha
  - → MENA: 3.6 million ha
  - → SSA: 2.3 million ha
  - → Oceania: 2.7 million ha
  - → CIS: 5.3 million ha
  - → RoW: 0.5 million ha


$34.5M
$24.8M
$22.7M
$24.6M
35
30
25
20
15
10
5
0
BERNIE SANDERS
PETE BUTTIGIEG
JOE BIDEN
ELIZABETH WARREN

background color

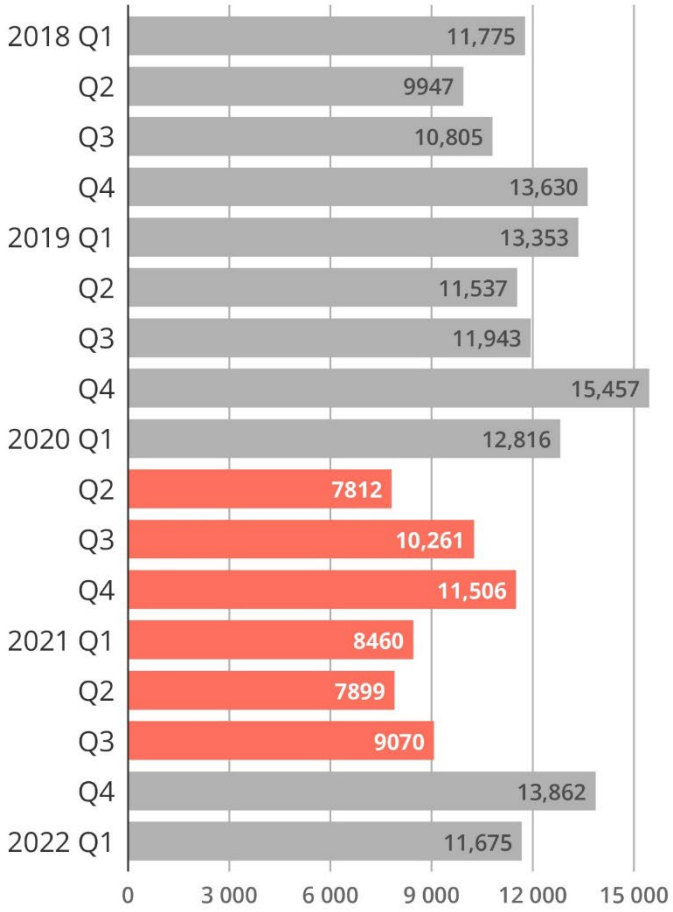
thematic color



accent color

Immigration in Flanders

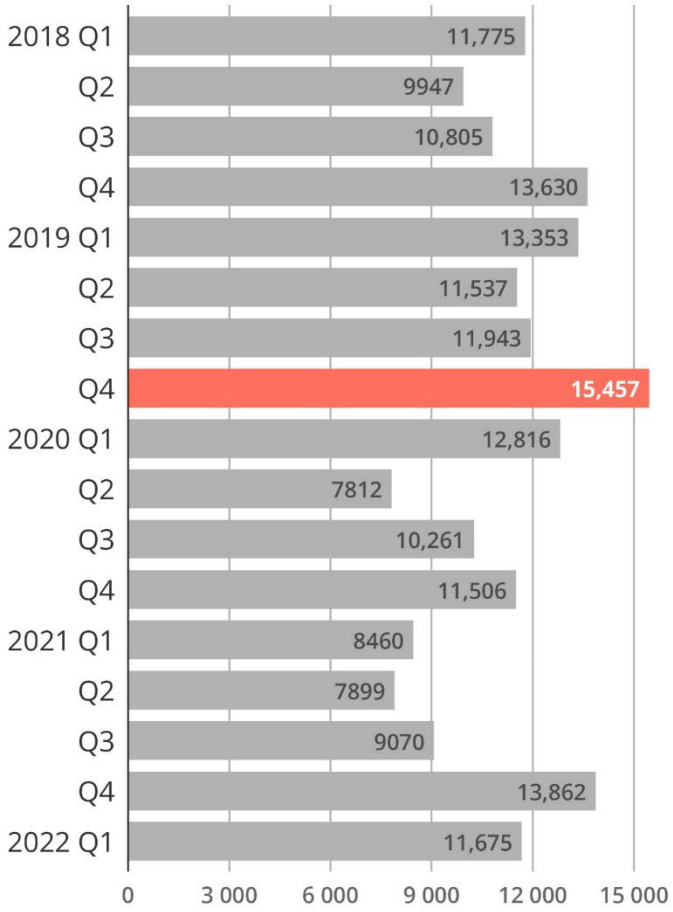
Source: Agentschap Integratie & Inburgering



'Because of the pandemic, the number of immigrants dropped to an all-time low in 2020 and 2021.'

Immigration in Flanders

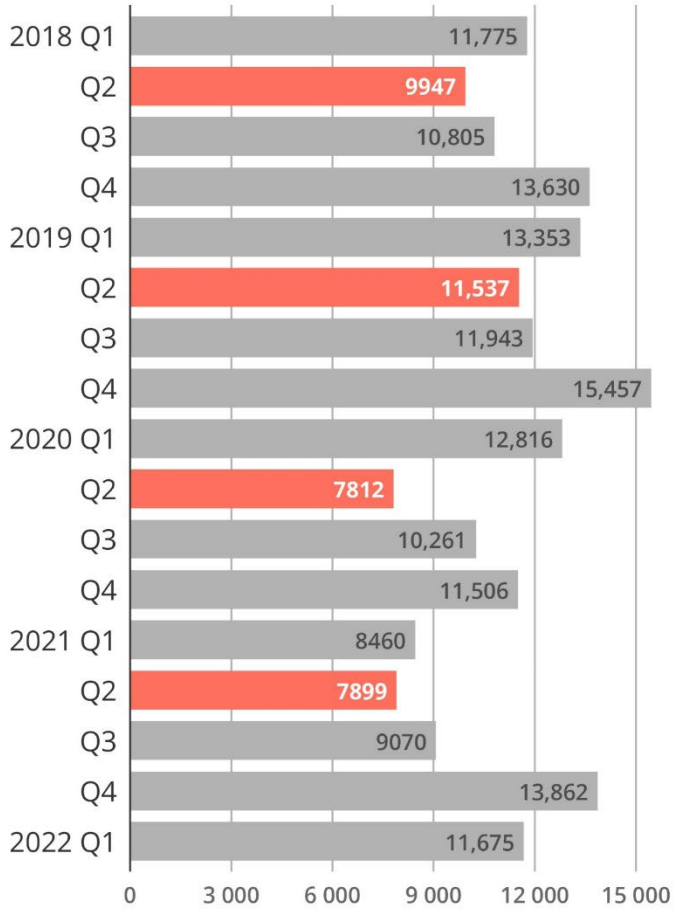
Source: Agentschap Integratie & Inburgering



'In the final months of 2019, we saw an unusually high number of immigrants.'

Immigration in Flanders

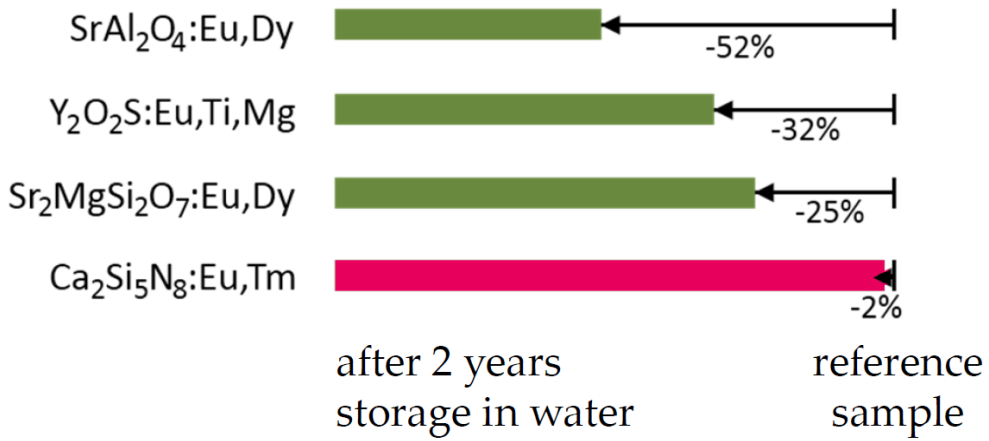
Source: Agentschap Integratie & Inburgering

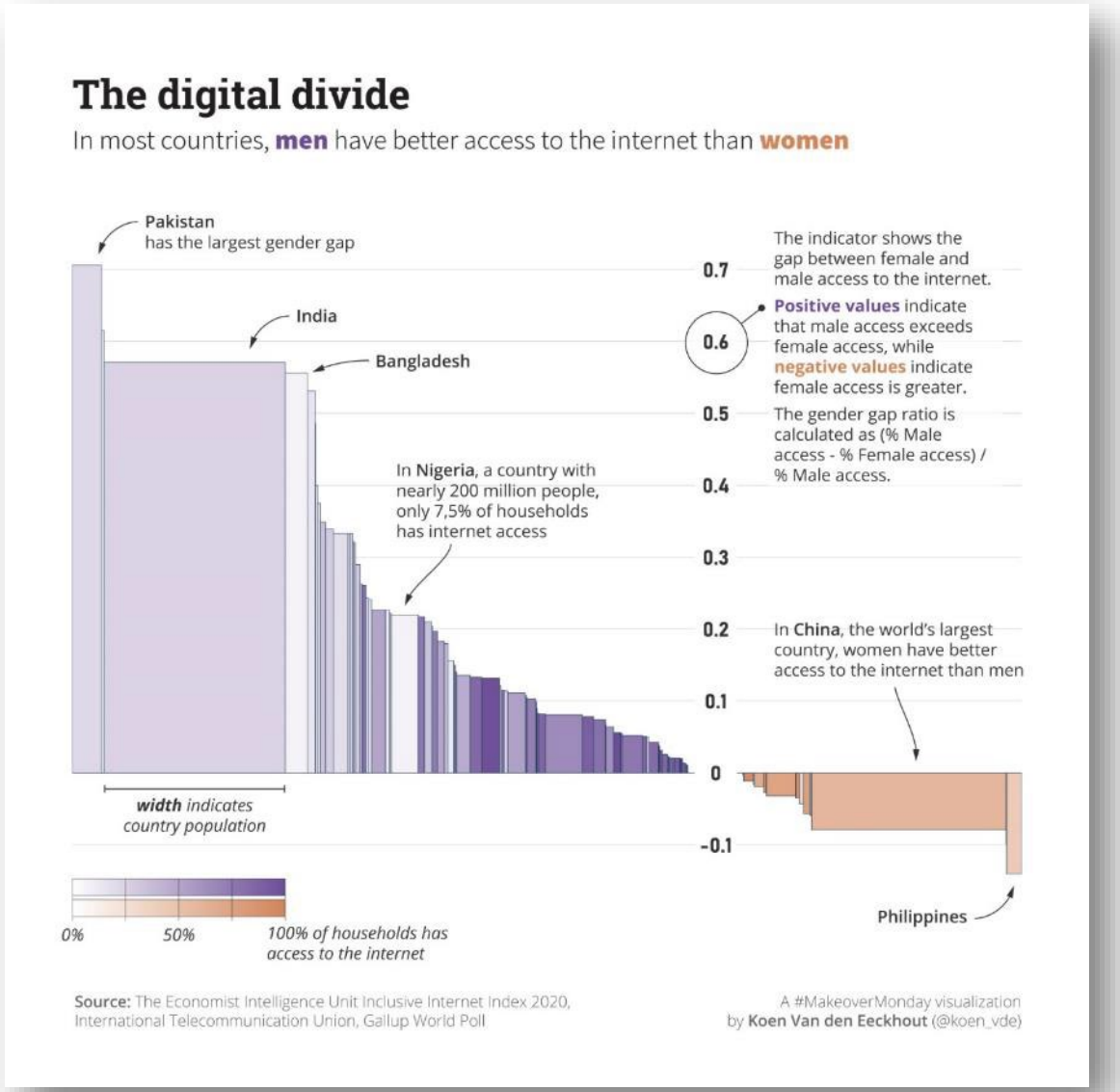


'Each year, the number of immigrants is lowest during spring.'

Clever color use

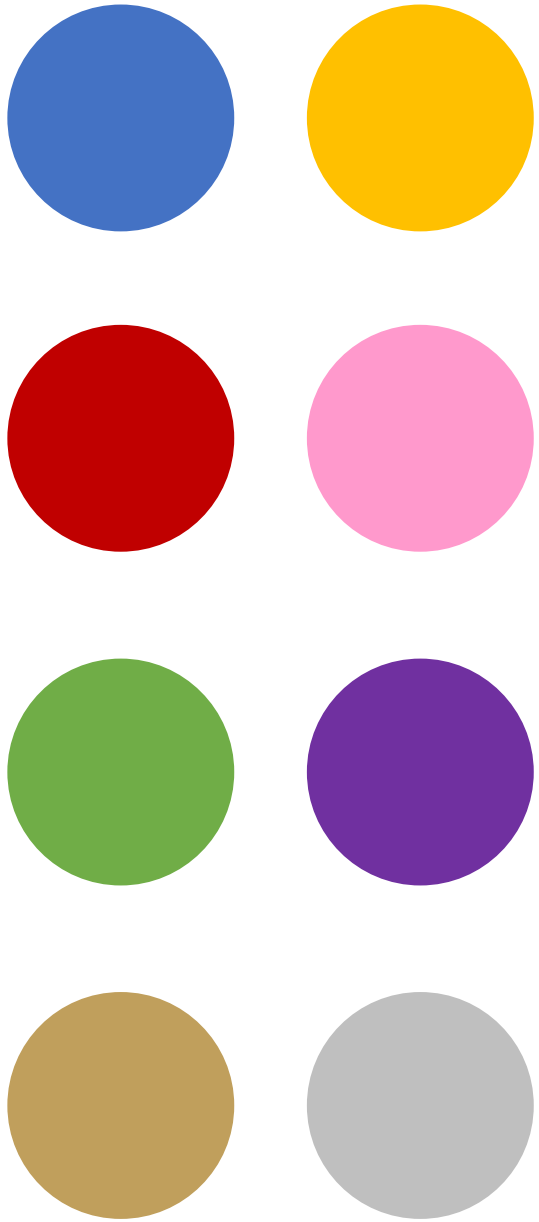
Compared to other common host materials, the nitrido-silicates are **very stable** and hence well suited for *in vivo* applications.





Finding a color scheme

What do colours represent?



Jul 10, 2018
by Lisa Charlotte Rost

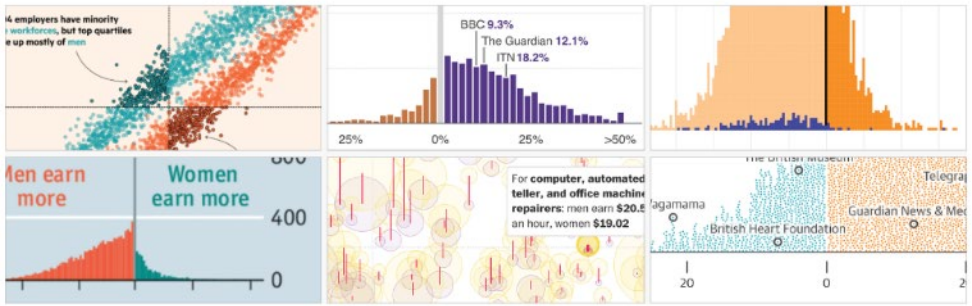
Thoughts & How To's

An alternative to pink & blue: Colors for gender data

JeongMee Yoon's "The Pink & Blue Project"

blog.datawrapper.de/gendercolor

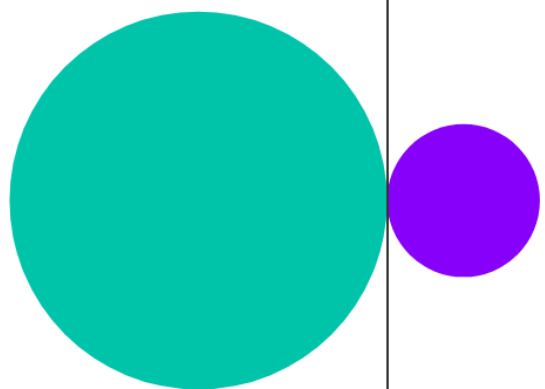
2 Many newsrooms stay away from pink & blue



Here's the good news: While some still use it, **pink & blue isn't the norm anymore, at least not in big news organizations.** When the gender pay gap data came out in the UK this year, graphics reporters used a very diverse color palette. I had assumed they would still use blue for men and just a rather warm color for women. But I was surprised: The Economist, Guardian, Telegraph, Washington Post, and others **used a cooler color for women than for men**. Respect! You can't go further away from the norm. Here are some examples (not exclusively from this year's gender pay gap data).

https://blog.datawrapper.de/gendercolor/

Of the 884 English Heritage blue plaques

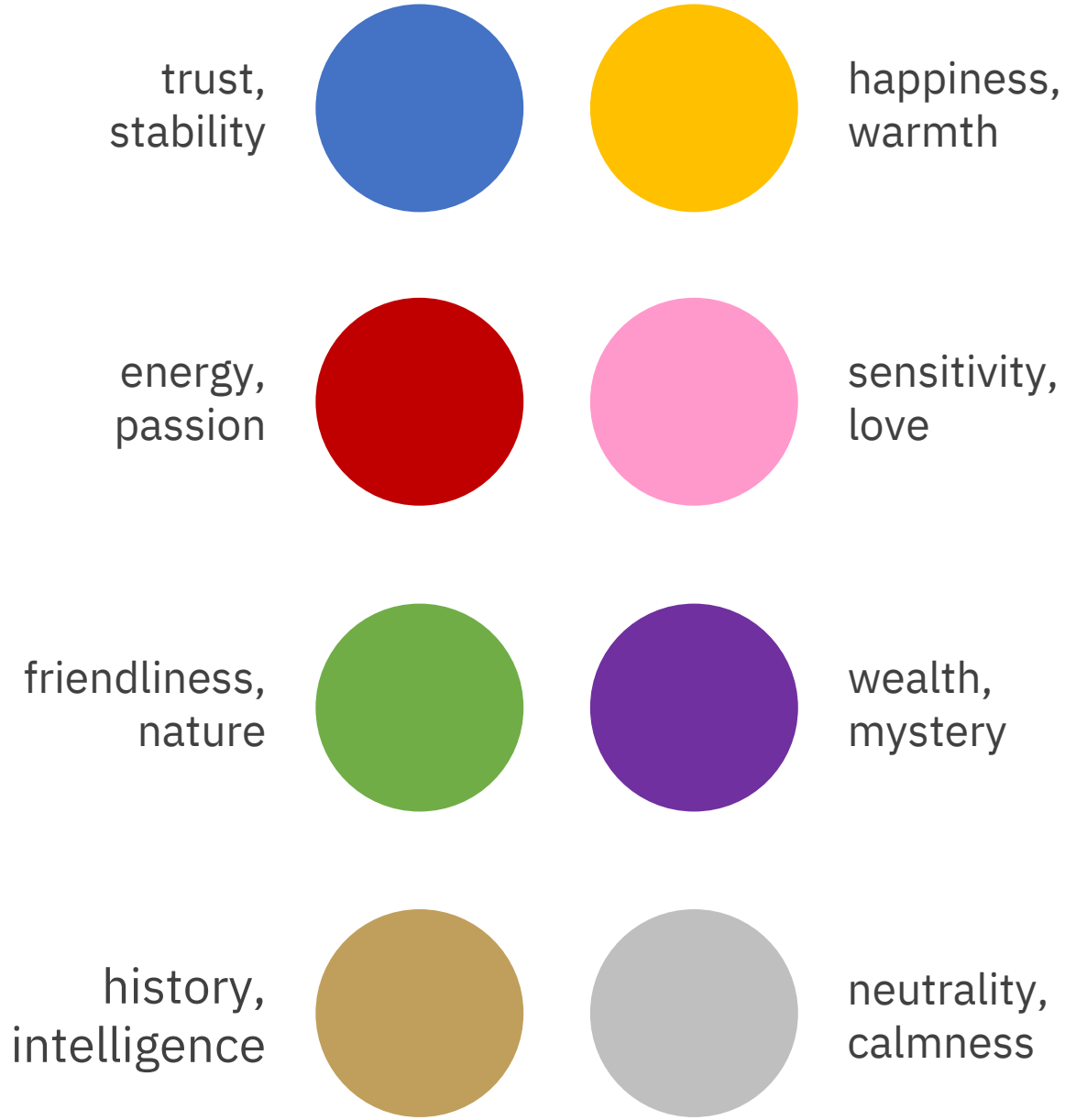


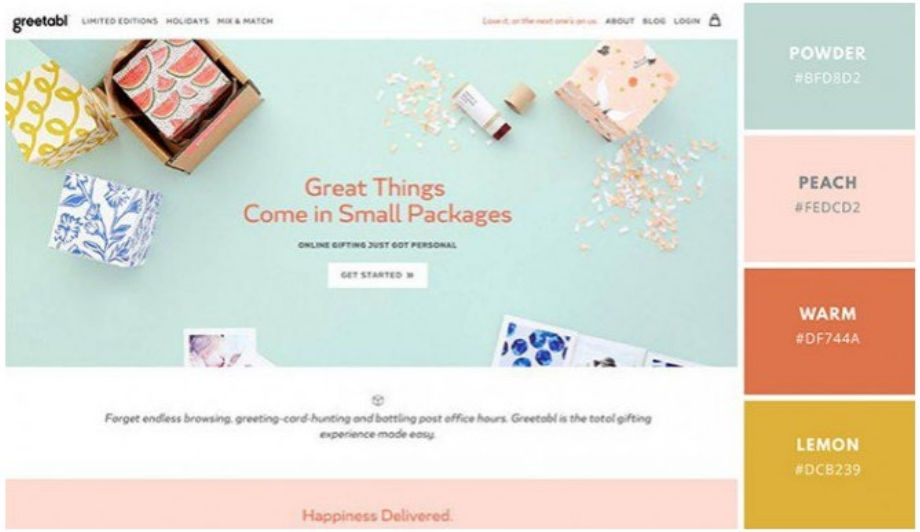
The fight for gender parity in the UK is set against a cultural history of inequality. English Heritage's Blue Plaques are an example of this; the vast majority commemorate men. While many deserving women are undoubtedly missing out, positions of more obvious influence have traditionally belonged overwhelmingly to men.

Men	Women
757	127
86%	14%

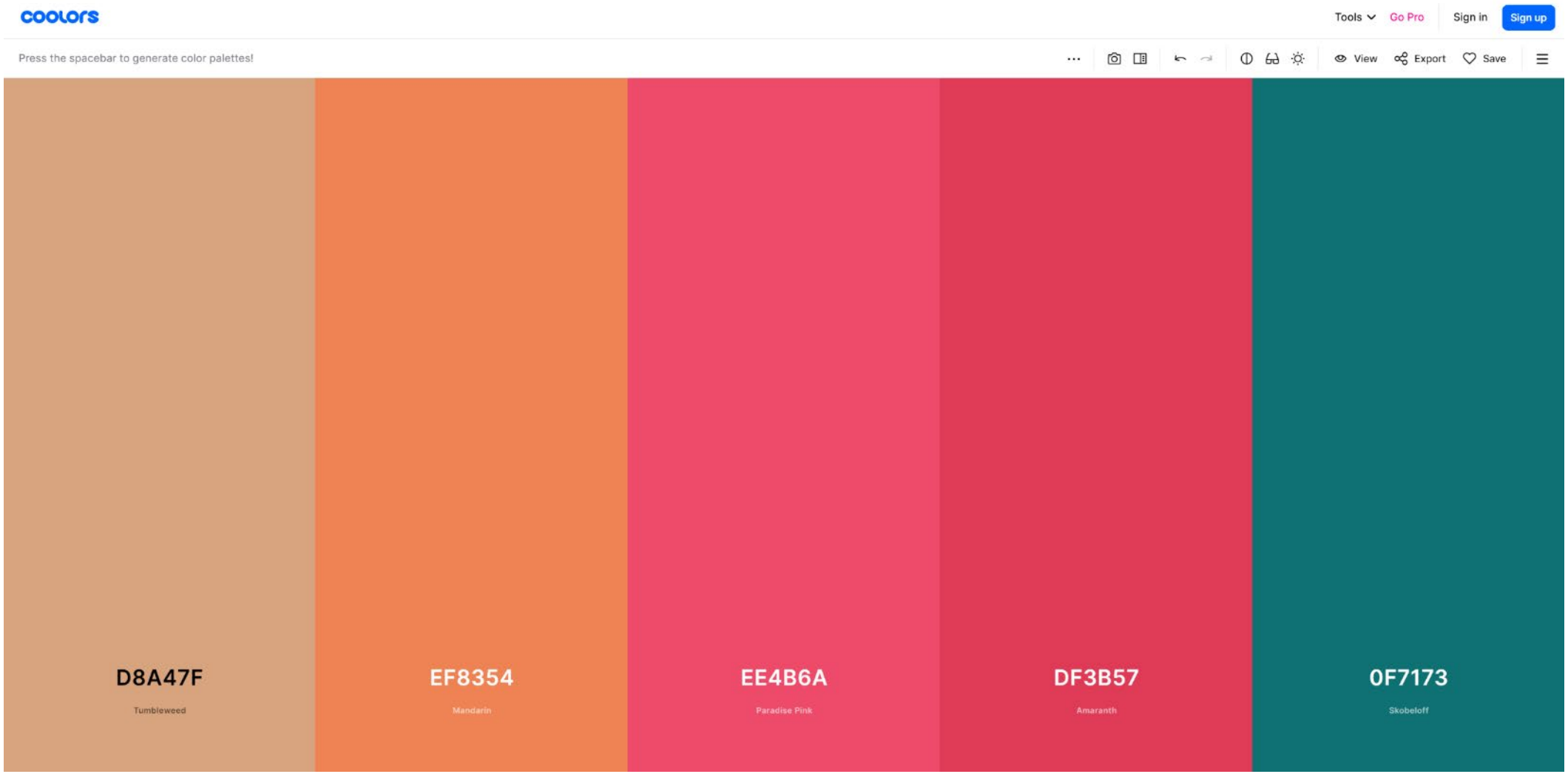
Finding a color scheme

What do colours represent?





canva.com/learn/100-color-combinations


coolors
Tools
Go Pro
Sign in
Sign up
Press the spacebar to generate color palettes!
View
Export
Save
D8A47F
Tumbleweed
EF8354
Mandarin
EE4B6A
Paradise Pink
DF3B57
Amaranth
0F7173
Skobeloff

coolors.co

Adobe Color

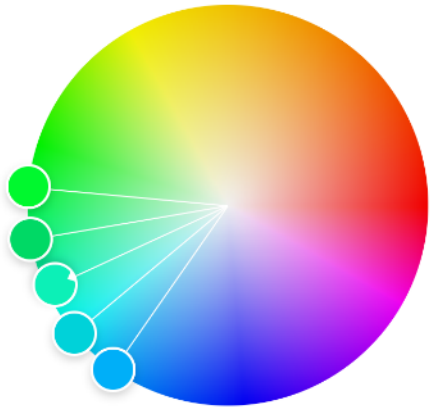
MAKEN VERKENNEN TRENDS BIBLIOTHEKEN

Aanmelden

Kleurenwiel | Thema extraheren | Verloop extraheren | Toegankelijkheidsfuncties | Nieuw

Regel voor kleurharmonie toepassen

- (•) Analoog
- ( ) Monochromatisch
- ( ) Drietal
- ( ) Complementair
- ( ) Complementair splitsen
- ( ) Dubbel complementair splitsen
- ( ) Vierkant
- ( ) Samengesteld
- ( ) Schaduwen
- ( ) Aangepast



	A	B	C	D	E
	#00AFF8	#00D2D9	#0CF0B7	#00D965	#00F82E
R	0	0	12	0	0
G	175	210	240	217	248
B	248	217	183	101	46
☀	97	85	94	85	97

Kleurmodus

RGB

Het kleurenwiel (of de afbeelding op het tabblad Thema extraheren) kan worden gebruikt om een kleurenpalet te genereren dat kan worden opgeslagen nadat je je hebt aangemeld bij Creative Cloud.

Vervolgens kun je je opgeslagen kleurthema's gebruiken in Adobe-producten (Photoshop, Illustrator, Fresco enz.), via het deelvenster met Adobe Color-thema's of via CC Libraries.

Opslaan

color.adobe.com

Captions, titles and annotations

4 Trapping and detrapping kinetics

Some of the results of this chapter have been published in:

- **Luminescence and x-ray absorption measurements of persistent $SrAl_2O_4$:Eu,Dy powders: Evidence for valence state changes**
  Kaileen Korthout, Koen Van den Eeckhout, Jonas Botterman, Sergey Nikitenko, Dirk Poelman and Philippe F. Smet
  Physical Review B **84** (2011) 085140

- **Temperature and wavelength dependent trap filling in $M_2Si_5N_8$:Eu (M = Ca, Sr, Ba) persistent phosphors**
  Philippe F. Smet, Koen Van den Eeckhout, Adrie J.J. Bos, Erik van der Kolk and Pieter Dorenbos
  Journal of Luminescence **132** (2012) 682-689

The XANES analysis in this chapter (section 4.2.4) is part of the PhD research: "Site selective spectroscopy of rare earth doped luminescent materials", conducted by Kaileen Korthout (LumiLab research group) and was performed at the DUBBLE beamline BM26 at the ESRF in Grenoble, France.

To unravel the mechanism of persistent luminescence, we need to know what is happening inside the material during the afterglow, and also during the excitation phase. We want to know how charge carriers escape from the activators, how they move throughout the material to get caught by trap levels, and how they can be released again under the influence of thermal energy. In short, we want to know more about the kinetics of the charge carriers inside the persistent phosphor.

There are two complementary ways to find out more about these kinetics. On one hand, we can look at the behaviour of the luminescent intensity, both during and after the excitation. From the shape of these curves, and from the way this shape changes under various circumstances, we can draw conclusions on the behaviour of the charge carriers.

On the other hand, we can test our assumptions on the kinetics by building a basic model, and predicting how the associated charging and decay will behave. We can then try to modify our assumptions in order to obtain the best possible accordance between the expected and the observed behaviour.

In this chapter, these *bottom-up* and *top-down* approaches are closely intertwined. We will start by looking at the detrapping kinetics, and see how retrapping can influence

the shape of the afterglow decay. We will build some basic models to mimic the trapping kinetics and predict the shape of the emission intensity during excitation. We will probe the valence state changes of the luminescent centers during the excitation phase. Finally, we will try to make an estimate on the number of traps present in a persistent luminescent material.

4.1 Detrapping kinetics

First, we will consider the detrapping process. During the afterglow phase, there is no excitation of luminescent centers. The only charge carriers involved are those that were previously trapped, and are escaping from the trap levels they were caught at.

Even though we can describe this behaviour with a very basic three-level model, the related equations can become complicated very quickly, and it is necessary to make several assumptions in order to keep the problem manageable.

4.1.1 One trap/one center model

In the most basic model, known as the **one trap/one center** model, we only take three levels into account: the *ground state* of the luminescent center, the *trap level*, and an *excited state* which acts as an intermediate stage for the charge carriers. In practice, this excited state is a simplification of the conduction band, allowing transport between the luminescent centers and the traps. Only three processes are possible: *detrapping* (from the trap level into the excited state), *recombination* (from the excited to the ground state), and *retrapping* (from the excited state into a trap level). These three levels and three processes are shown schematically in figure 4.1.

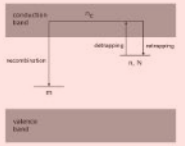


Figure 4.1: In a simple one trap/one center model, only three levels are taken into account and only three transitions are allowed: detrapping, retrapping and recombination.

The model in figure 4.1 assumes that electrons are the charge carriers, and that the transport to the traps occurs through the conduction band. However, all the equations

derived below are equally valid in the case of hole transport, and the transport does not necessarily have to happen through the conduction band.

We can write down rate equations for each of these three energy levels, based on the probability for each of the processes to occur and the occupation of each level. The details of these calculations are beyond the scope of this text, but an excellent explanation can be found in [1]. By assuming charge neutrality, time and temperature independence of the charge carriers concentrations and quasi-equilibrium (the free electron concentration in the excited level is quasi-stationary), we can derive the **General One Trap** (GOT) expression for the emission intensity:

$$I(t,T) = n s \exp\left(-\frac{E_T}{kT}\right)\left[1 - \frac{(N-n)\sigma_r}{(N-n)\sigma_r + n\sigma_{rec}}\right] \tag{4.1}$$

In this equation, σ_{rec} is the cross section for recombination, and σ_r that for retrapping. It is the ratio between these two cross sections that will mainly influence the shape of the afterglow decay. n is the concentration of filled traps, N the total concentration of traps (both filled and unfilled), and n the concentration of ionized luminescent centers, available for recombination (hole states). As usual, s is the frequency factor, E_T is the trap depth, k is the Boltzmann constant and T is the temperature.

Since n in equation 4.1 depends on the time and temperature, the GOT expression is a rather complex differential equation. At this point, it is common to introduce approximations in order to make solving the equation more manageable.

4.1.2 First and second order kinetics

As early as 1945, Randall and Wilkins [2] made the assumption that the retrapping probability is negligible. In other words, every escaped charge carrier will recombine, and $\sigma_r = 0$. This assumption is known as **first order kinetics**, and greatly simplifies the GOT expression to

$$I = n s \exp\left(-\frac{E_T}{kT}\right) \tag{4.2}$$

If we assume a constant temperature, we can predict the shape of the afterglow decay, which in this case will have an exponential shape:

$$I(t) = I_0 \exp\left[-s \exp\left(-\frac{E_T}{kT}\right) t\right] \tag{4.3}$$

The expected exponential decay is shown in figure 4.2 for various trap depths.

In practice, a simple exponential decay is rarely observed in actual persistent luminescent materials. In fact, a power-law like behaviour is much more common [3]. This means that a simple one trap/one center model without retrapping is not sufficient.

Garlick and Gibson [4] therefore explored the possibility of recombination and retrapping having an equal probability. In other words, they assumed $\sigma_r = \sigma_{rec}$. Now, the GOT expression becomes

$$I = s \frac{n^2}{N} \cdot \exp\left(-\frac{E_T}{kT}\right) \tag{4.4}$$

The fact that the intensity is now proportional to the square of the density of filled traps n is the main reason that this assumption is known as **second order kinetics**. Now,

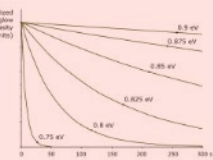


Figure 4.2: Afterglow decay in the case of first order kinetics for several different trap depths. The shape of the decay is exponential, the decay speed is determined by the trap depth. In this figure, $s = 10^{12}\ s^{-1}$ and T = 293 K. The curves are normalized for easy comparison.

the afterglow decay is no longer exponial, but has a power-law like behaviour:

$$I(t) = I_0 \left[1 + \frac{n_0}{N} s \exp\left(-\frac{E_T}{kT}\right) t\right]^{-2} \tag{4.5}$$

This means that, when plotted in a double-logarithmic diagram, the afterglow decay will approach a straight line with a slope of -2. The second order decay shape is shown in figure 4.3 for various trap depths. Upon comparison with the exponential first order decay (figure 4.2), we can see that the intensity approaches zero much more slowly and gradually.

4.1.3 General order kinetics

It is clear from the above discussion that first and second order kinetics refer to two very specific cases: when the retrapping probability is negligable, or when it is exactly the same as the recombination probability. For intermediate situations, May and Partridge [5] and Rasheedy [6] developed an empirical expression based on equations 4.2 and 4.4:

$$I = s \frac{n^b}{N^{b-1}} \cdot \exp\left(-\frac{E_T}{kT}\right) \tag{4.6}$$

where b is the order of kinetics.

This expression, known as **general order kinetics**, leads to a smooth transition between the decay shapes of first ($b = 1$) and second ($b = 2$) order kinetics (and beyond). This is illustrated in figure 4.4 for various orders of kinetics b.

It should be noted that the general order kinetics expression is a purely mathematical interpolation between the cases of first and second order kinetics, and that a certain order b has no direct physical meaning.

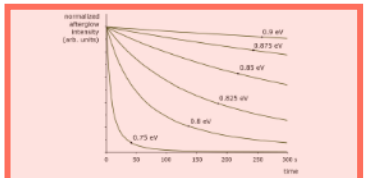


Figure 4.3: Afterglow decay in the case of second order kinetics for several different trap depths. The decay has a power-law like behaviour. On longer timescales, the decay drops to zero much slower than in the case of first order kinetics. In this figure, $s = 10^{12}\ s^{-1}$, T = 293 K and $n_0/N = 1/2$. The curves are normalized for easy comparison.

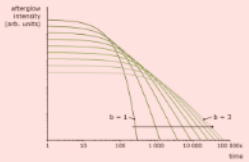


Figure 4.4: Afterglow decay for different orders of kinetics ranging from 1 to 3, assuming general order kinetics. The decay is plotted on a log-log scale. For $b = 1$, an exponential decay is obtained.

It is interesting to verify how well the general order kinetics expression compares to a more physical interpolation between the first and second order expressions. For this purpose, let us introduce the parameter R as the ratio between the retrapping and the recombination probability:

$$R = \frac{\sigma_r}{\sigma_{rec}} \tag{4.7}$$

which leads to the following simplification of the GOT expression:

$$I = s \cdot \frac{n^2}{(N-n)\cdot R + n} \cdot \exp\left(-\frac{E_T}{kT}\right) \tag{4.8}$$

If retrapping can be neglected, $R = 0$ and equation 4.8 reduces to the first order case. For equal probabilities of retrapping and recombination, $R = 1$ and the second order case is obtained.

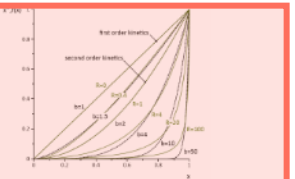


Figure 4.5: Comparison between the functions x^b and $f(x) = x^2/(R - Rx + x)$ for various values of b and R. In the case of first ($b = 1$, $R = 0$) and second ($b = 2$, $R = 1$) order kinetics, the curves overlap.

Even though equation 4.8 is difficult to solve analytically, we can make a comparison with the general order case by comparing the functions x^b (for the general order case) and $f(x) = x^2/(R - Rx + x)$ (for the more physical expression). This comparison is made in figure 4.5. The value $x = 0$ corresponds to empty traps ($n = 0$), $x = 1$ is the situation where all traps are completely filled ($n = N$).

In the case of first ($b = 1$, $R = 0$) and second ($b = 2$, $R = 1$) order kinetics the curves for x^b and $f(x)$ overlap, but for intermediate values of b, and even more for high b values, there is a clear difference between both options. In this region, fitting an experimentally obtained afterglow decay or glow peak to a curve predicted by general order kinetics will yield less accurate results.

4.1.4 Influence of the excitation intensity

Figure 4.6 shows how the afterglow decay in $SrAl_2O_4$:Eu,Dy is influenced by the excitation intensity. The sample was excited by a Xe arc lamp for 1 minute, with intensities varying from 10 to 1000 lux.

The decay profiles are not exponential, but approach a straight line in a double-logarithmic diagram, indicating at least some influence of retrapping, the presence of a continuous trap distribution, or the possibility of tunneling processes. As could be

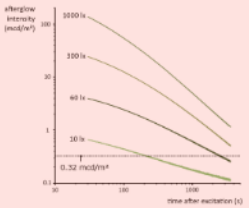


Figure 4.6: Afterglow decay in $SrAl_2O_4$:Eu,Dy for various excitation intensities of a Xe arc lamp (excited for 1 minute). At higher excitation intensities, the light output during the afterglow increases, but the decay becomes faster.

expected, the total light output increases with increasing excitation intensity, because more traps are being filled. However, a second phenomenon can also be discerned. At higher excitation intensities, the slope of the afterglow decay also increases. In other words, the decay of the luminescence becomes faster for higher excitation intensities.

To investigate this more accurately, the evolution of the light output versus the excitation intensity is plotted in figure 4.7, and the evolution of the afterglow duration, defined as the time between the end of the excitation and the moment the intensity drops below 0.32 mcd/m², in figure 4.8.

From figure 4.7, we can see that the light output is proportional to the excitation intensity. In other words, the number of filled traps increases linearly with increasing excitation intensity. However, the afterglow duration does not follow this trend. At around 600 lux, it reaches a saturation value of approximately 4 hours (figure 4.8).

The increasing slope of the decay tells us that the detrapping rate is increasing after excitation with higher intensities. This might mean that either shallower traps are being filled at higher excitation intensities, or that the larger number of filled traps leads to a faster detrapping.

The first explanation assumes that multiple trap levels, or even a continuous distribution of trap levels exist in the material. At low intensity, only the deeper levels would be filled, which explains the slower decay of the afterglow. However, in chapter 5 we will see that the excitation duration does not influence the depth of the traps that are filled, even in the presence of a continuous trap depth distribution. Of course, it is possible that increasing the excitation duration has a different effect on the trap filling

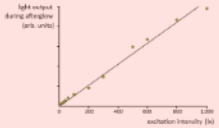


Figure 4.7: Integrated light output during the afterglow in $SrAl_2O_4$:Eu,Dy for various excitation intensities of a Xe arc lamp (excited for 1 minute). For increasing excitation intensities, the light output increases proportionally.

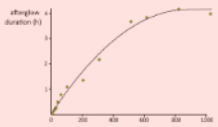


Figure 4.8: The afterglow duration in $SrAl_2O_4$:Eu,Dy for various excitation intensities of a Xe arc lamp (excited for 1 minute). For higher excitation intensities, a saturation value is reached.

than increasing the excitation intensity.

To conclude this section, it is interesting to remark that even for very low excitation intensities, charge carriers can be trapped. In figure 4.9, the emission intensity is shown for a (previously thermally emptied) $CaAl_2O_4$:Eu,Nd sample subjected to a very low excitation intensity. Even though no emission from the sample is observed during the excitation phase, thermoluminescence (TL) reveals a glow peak, indicating that at least some traps were filled by the excitation light (see section 5.1.1 for an explanation of thermoluminescence). This observation indicates a remarkably high trapping probability in $CaAl_2O_4$:Eu,Nd, which will be confirmed in section 4.2.1.

What is a good **caption**?

Make your visuals as **‘self-contained’** as possible.

Captions

Well-crafted captions can make a visual ‘self-contained’.

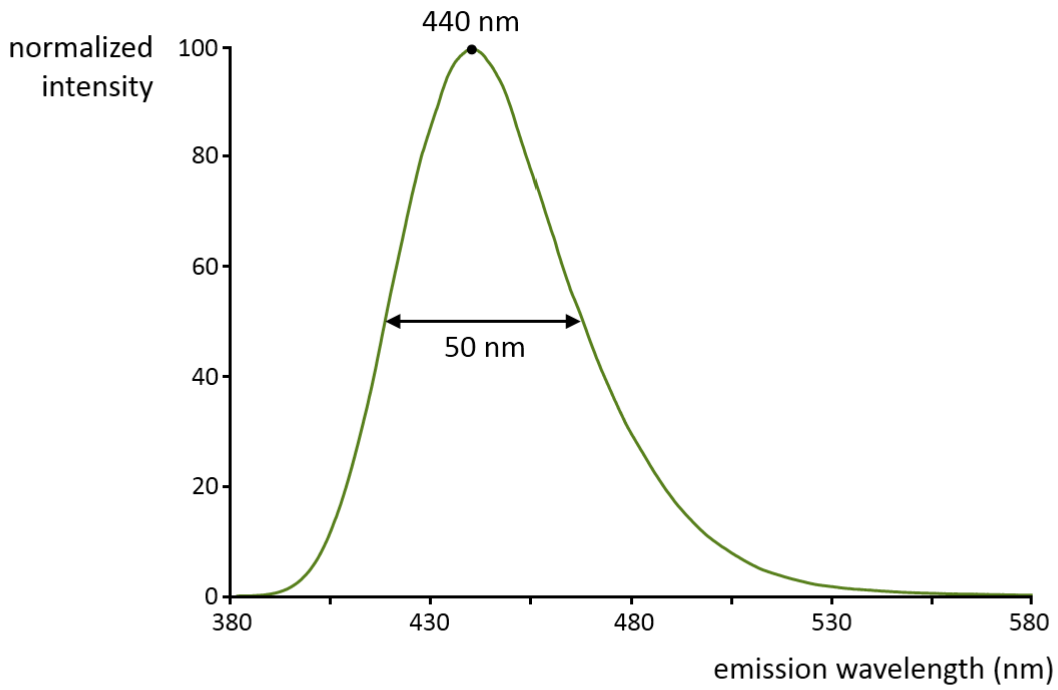


Figure 5.11: The emission spectrum of $CaAl_2O_4$:Eu,Nd consists of a single, unusually broad Eu^{2+}-based peak in the blue region of the visible spectrum, around a relatively low wavelength of 440 nm.

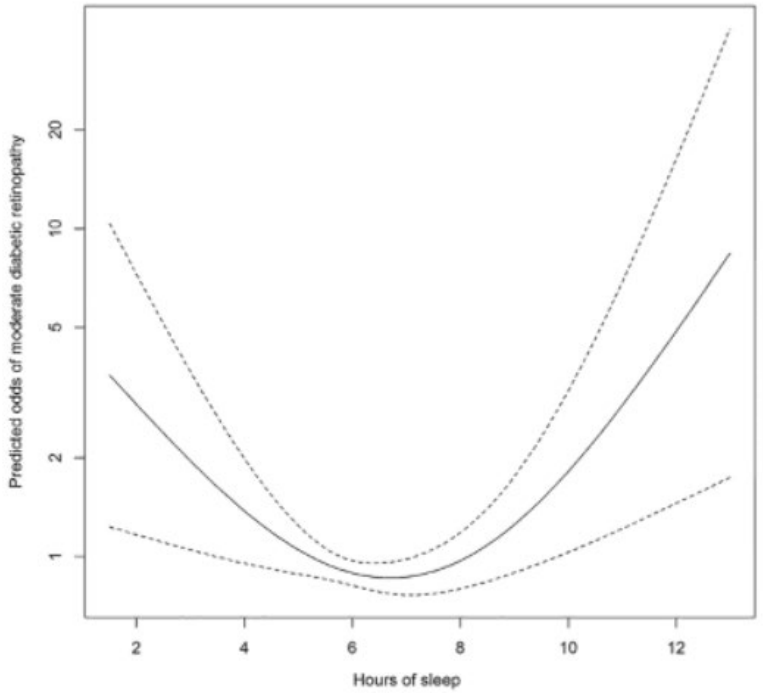


Fig. 1. Multivariable-adjusted odds of moderate diabetic retinopathy according to sleep duration.

what

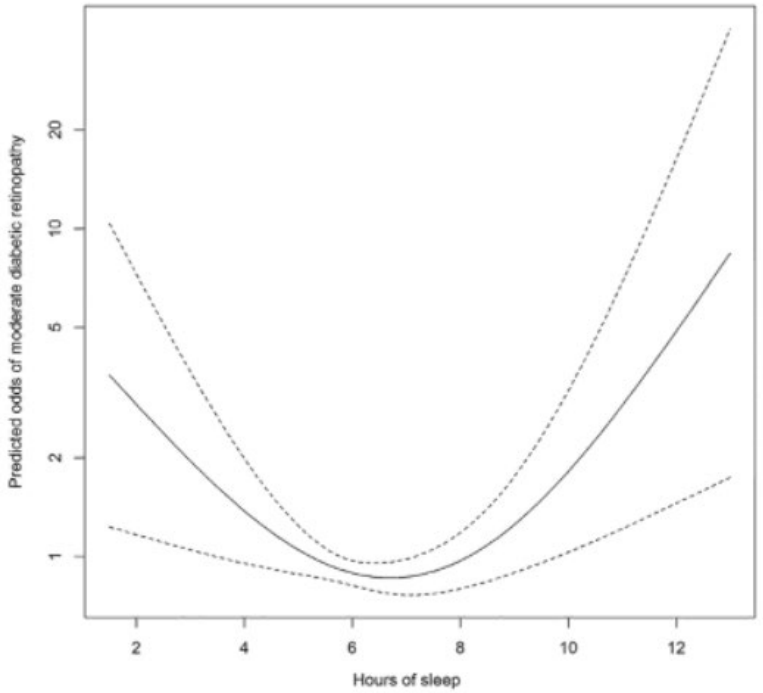
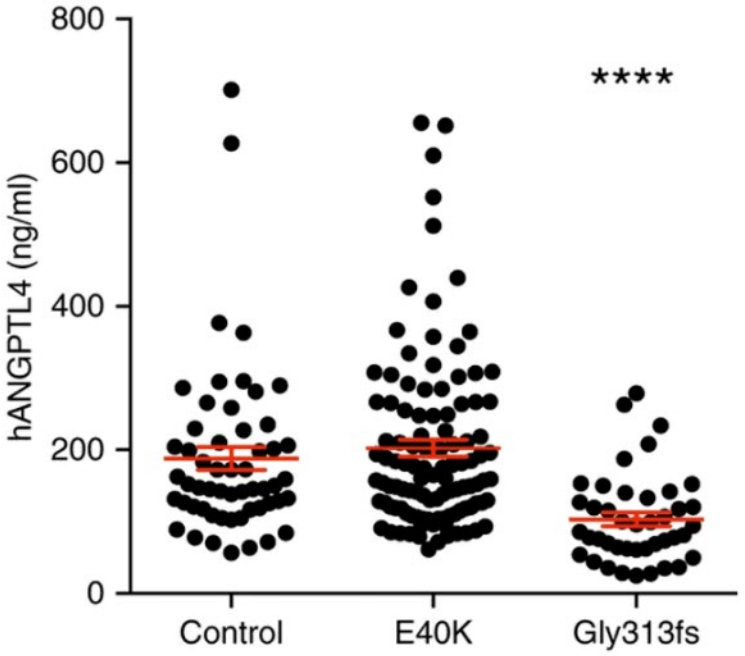
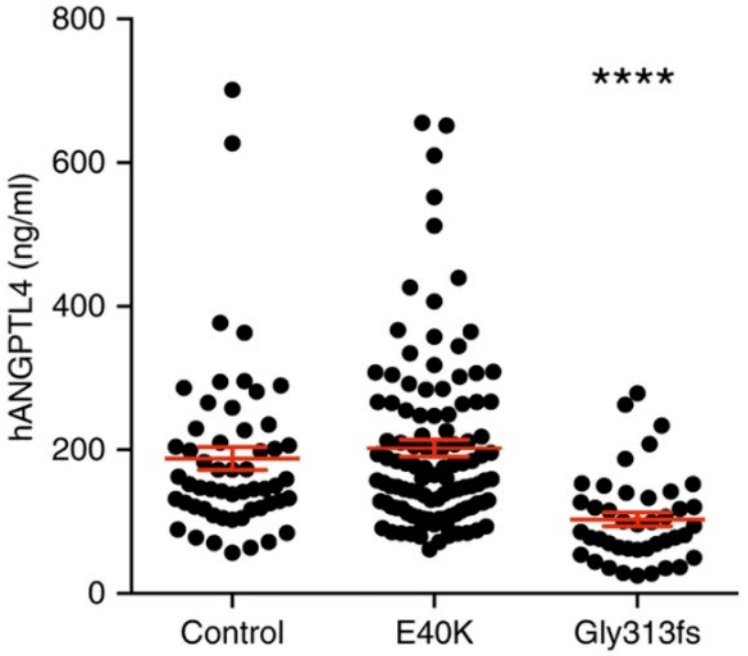


Fig. 1. A total sleep duration of 6–8 h per day was associated with the lowest risk of moderate diabetic retinopathy.

so what





ANGPTL4 plasma levels measured in fasted serum from heterozygous p.E40K and p.G313fs variant carriers

Plasma ANGPTL4 levels were reduced in p.G313fs carriers.

Key message

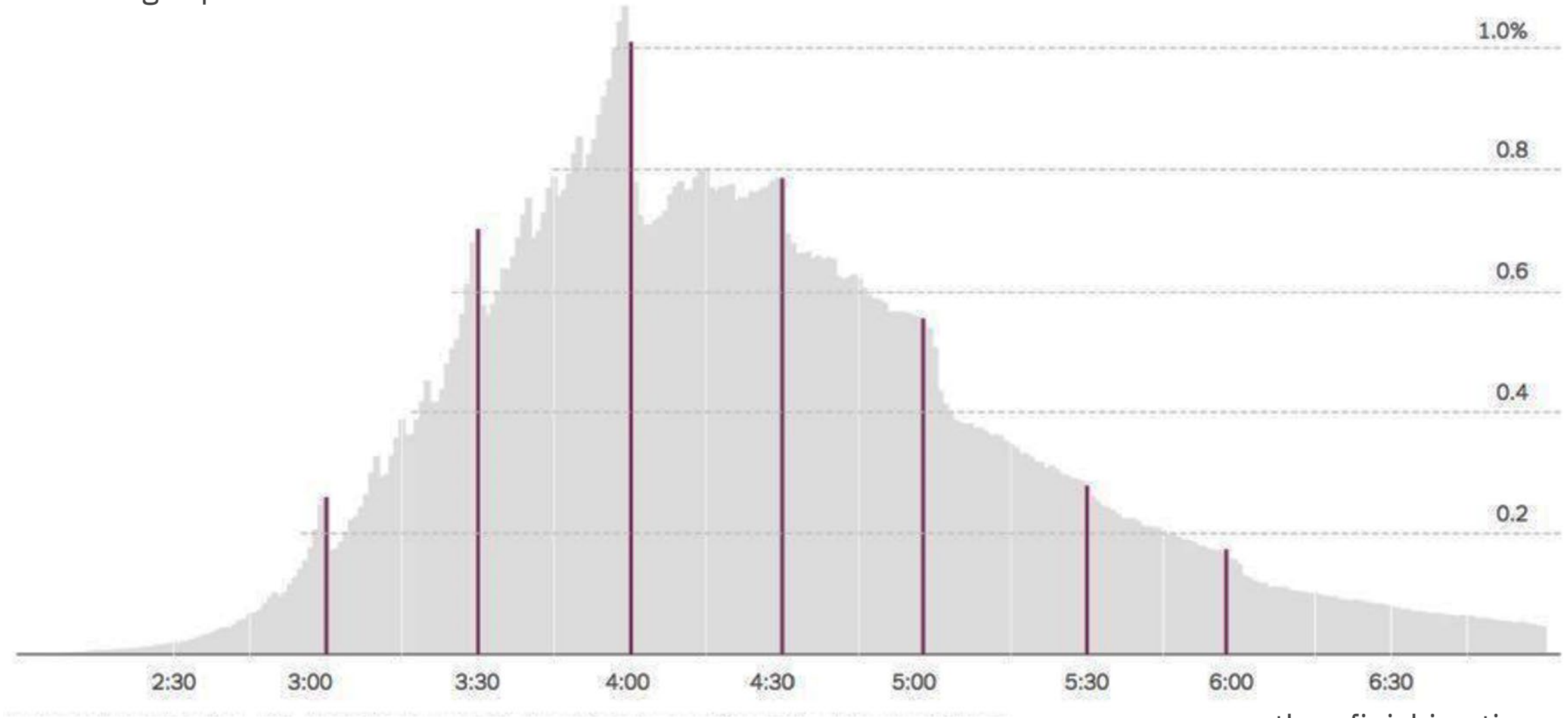
ANGPTL4 plasma levels were measured in fasted serum from 86 heterozygous p.E40K, 42 heterozygous p.G313fs variant carriers, and 55 controls matched for age, sex, and body mass index. Statistics performed by unpaired t-test with Welch's correction, comparing each variant carriers group to controls, ****p < 0.0001

Methods

Additional info (statistics, sources,...)

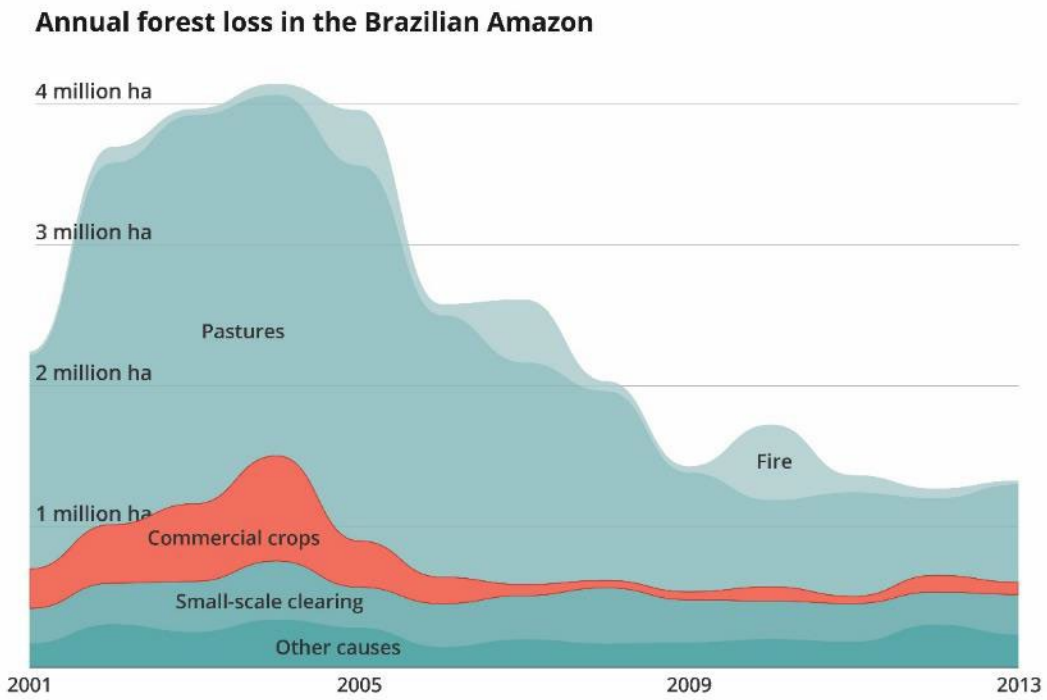
Exercise

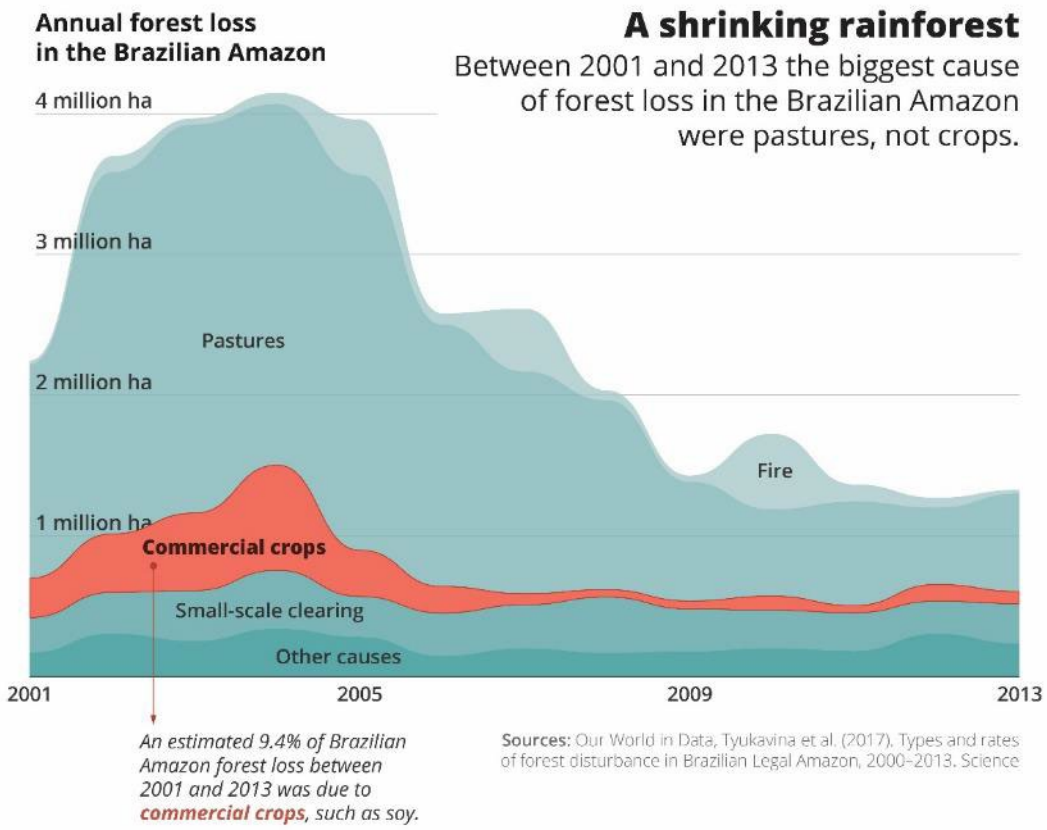
Write a strong caption for this visual



Annotations

Well-crafted titles, captions and annotations can make a visual ‘self-contained’.





Font size

Adapt to the situation – a presentation is different from an article, a poster or a social media post!

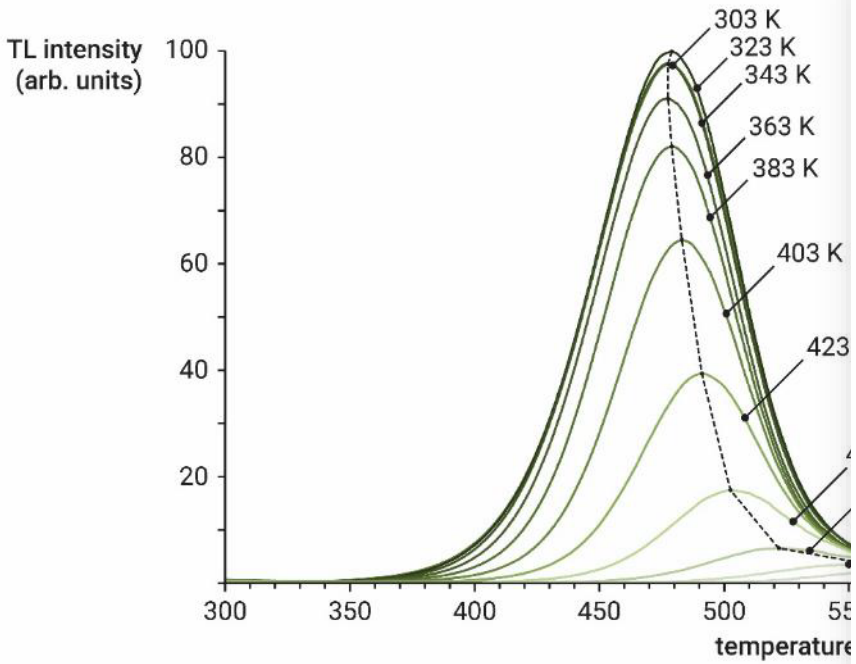
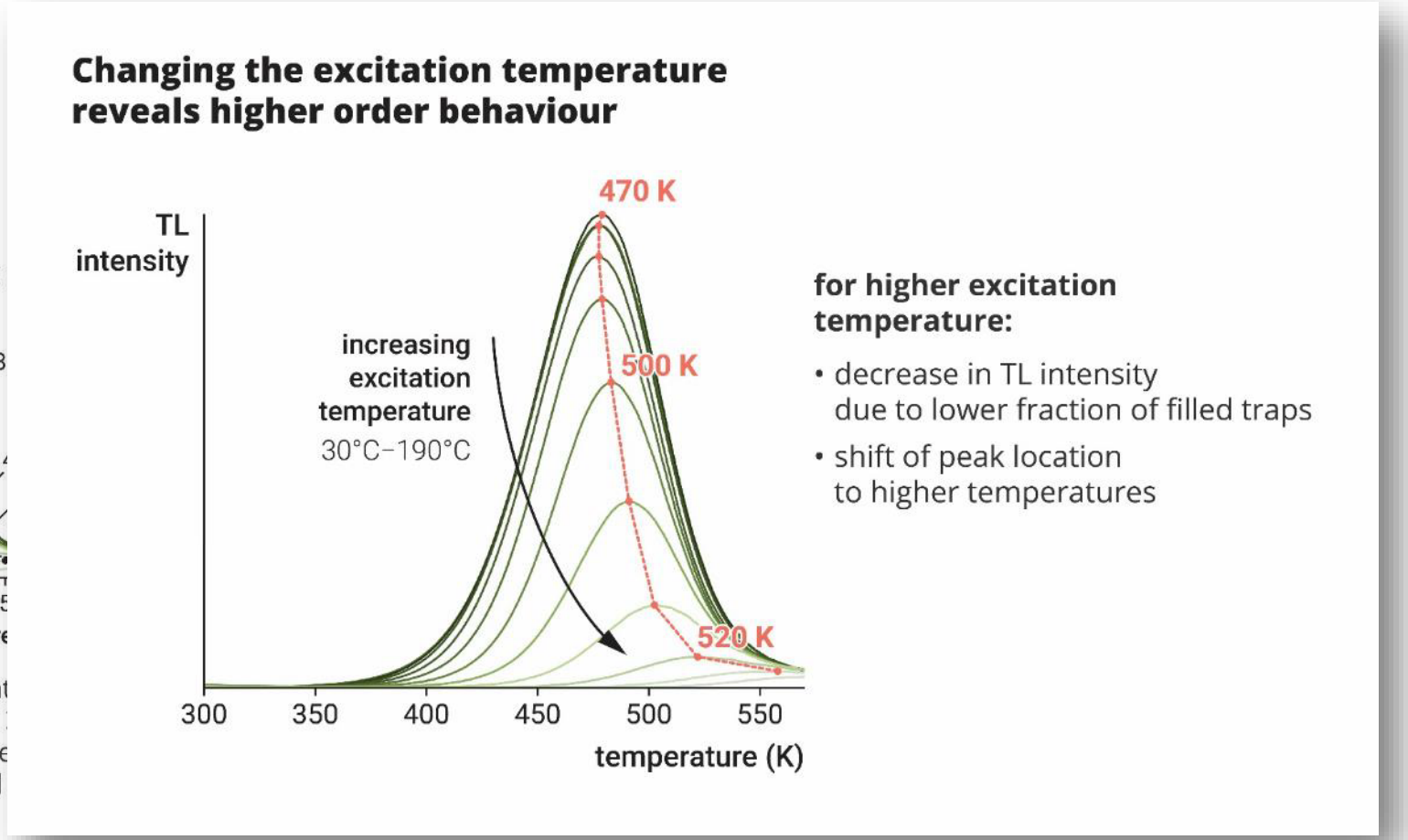


Figure 5.19: TL intensity of $CaAl_2O_4$:Eu,Nd for various excitat temperatures T0, as indicated. Samples were excited at T0 by nm light for 60 s. For increasing excitation temperatures, the intensity decreases due to a lower fraction of filled traps, and peak location shifts to higher temperatures.



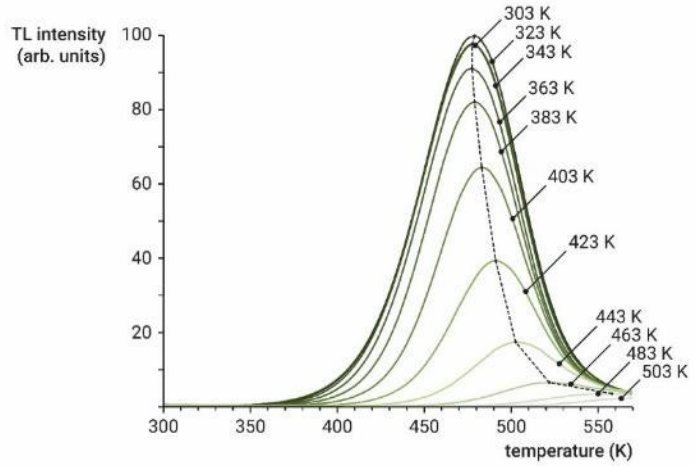
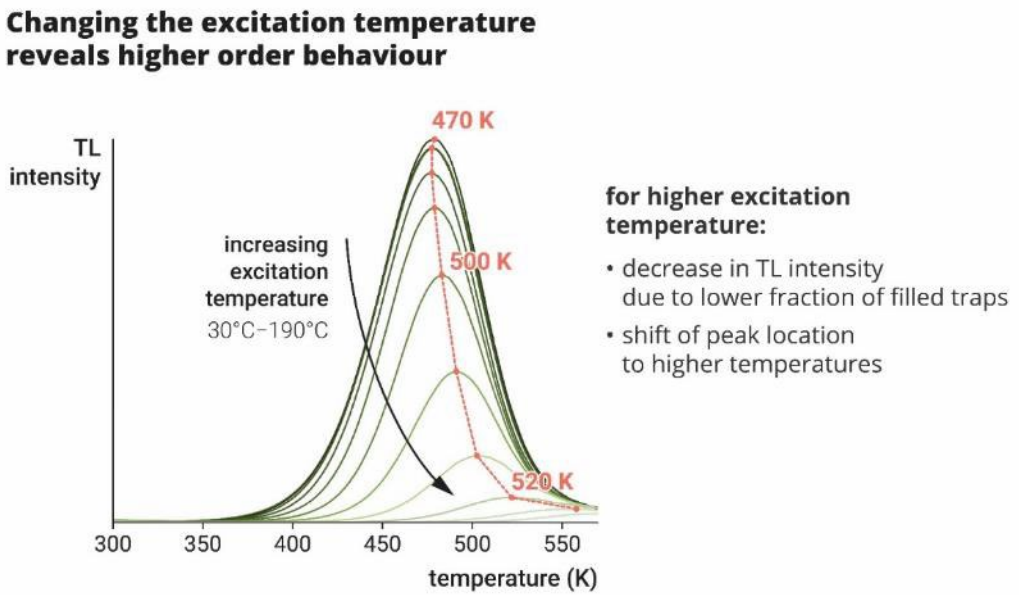


Figure 5.19: TL intensity of $CaAl_2O_4$:Eu,Nd for various excitation temperatures T0, as indicated. Samples were excited at T0 by 365 nm light for 60 s. For increasing excitation temperatures, the TL intensity decreases due to a lower fraction of filled traps, and the peak location shifts to higher temperatures.



For articles

focus on clarity and completeness

- smaller font sizes
- sufficient labels
- strong, ‘so what’ caption

For presentations and posters

focus on clarity and readability

- larger font sizes
- fewer (axis, data, tick) labels
- claryfing annotations, used sparingly
- strong, ‘so what’ title

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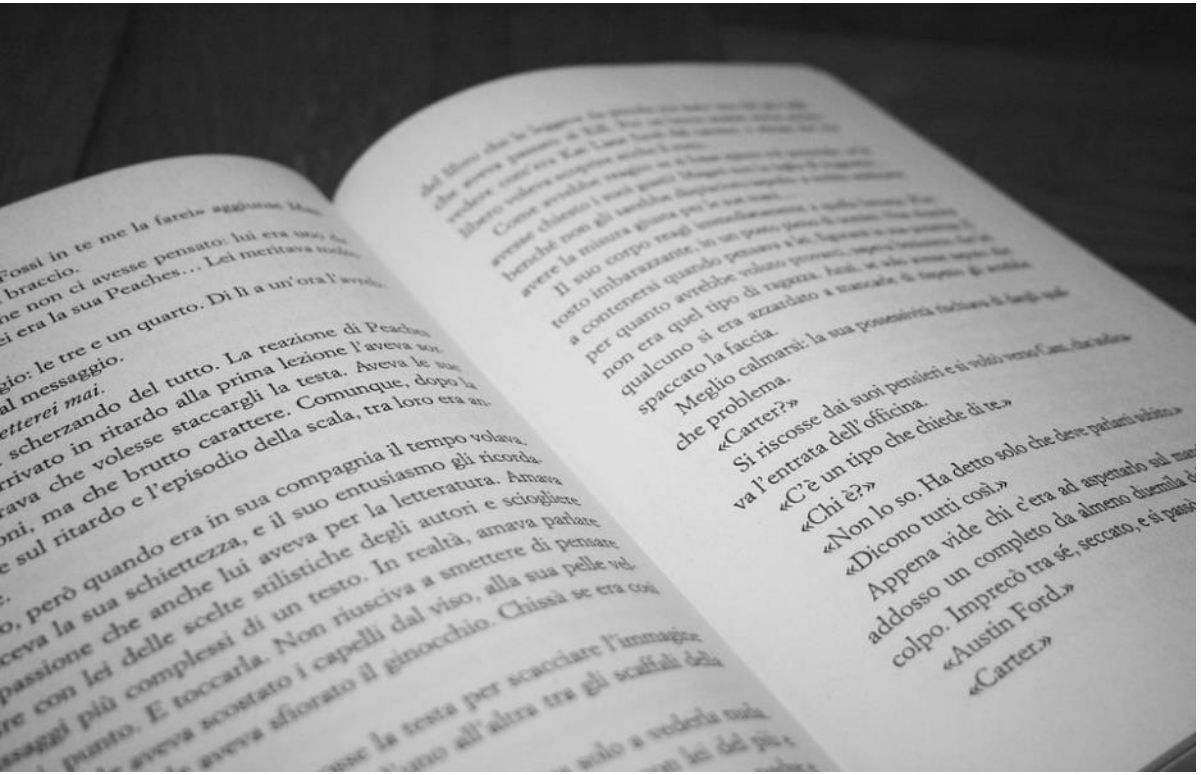

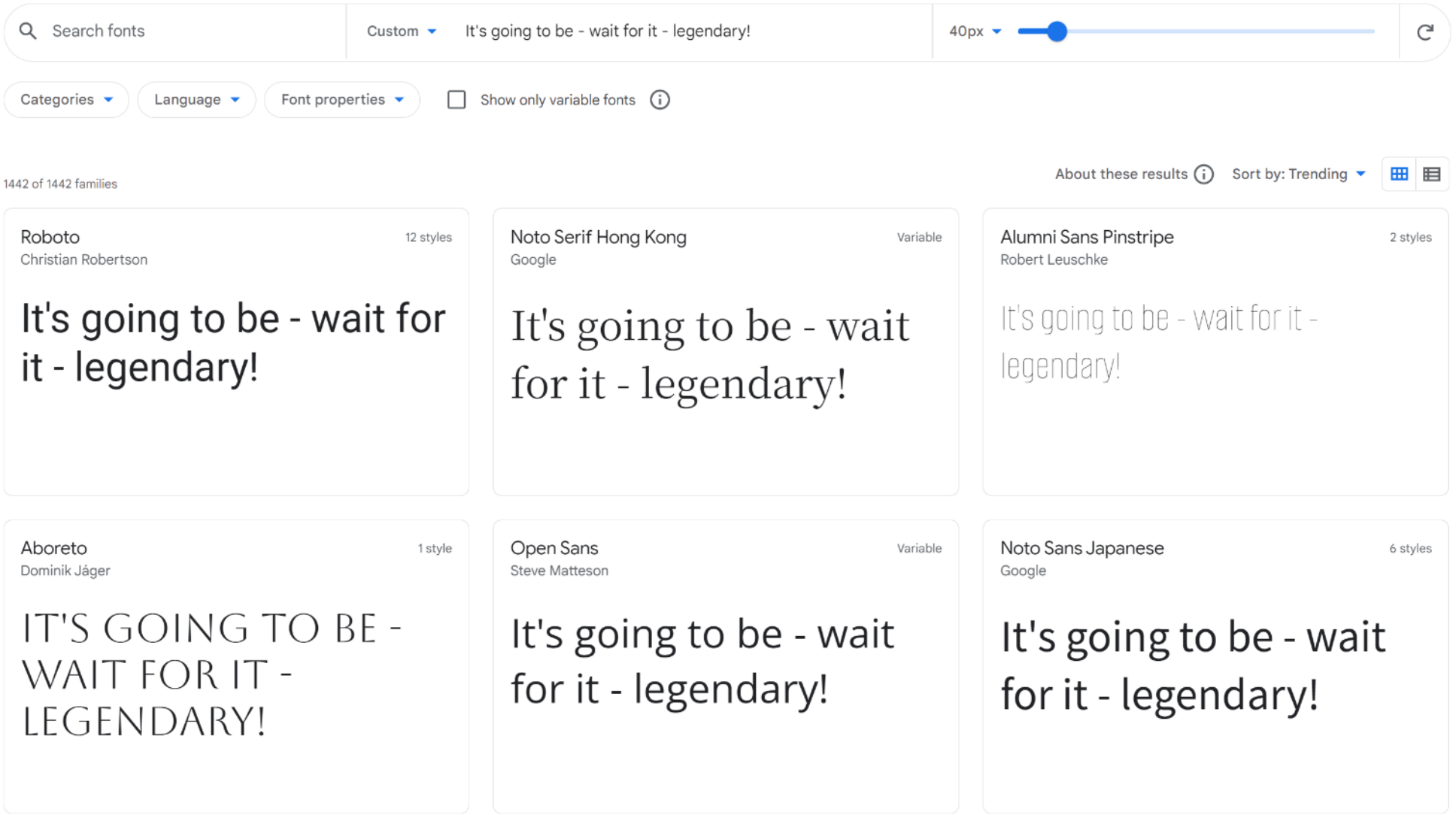

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dress for the occasion

play with contrast ◀ fontpair.co

Typography guidelines

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play with contrast

build a hierarchy

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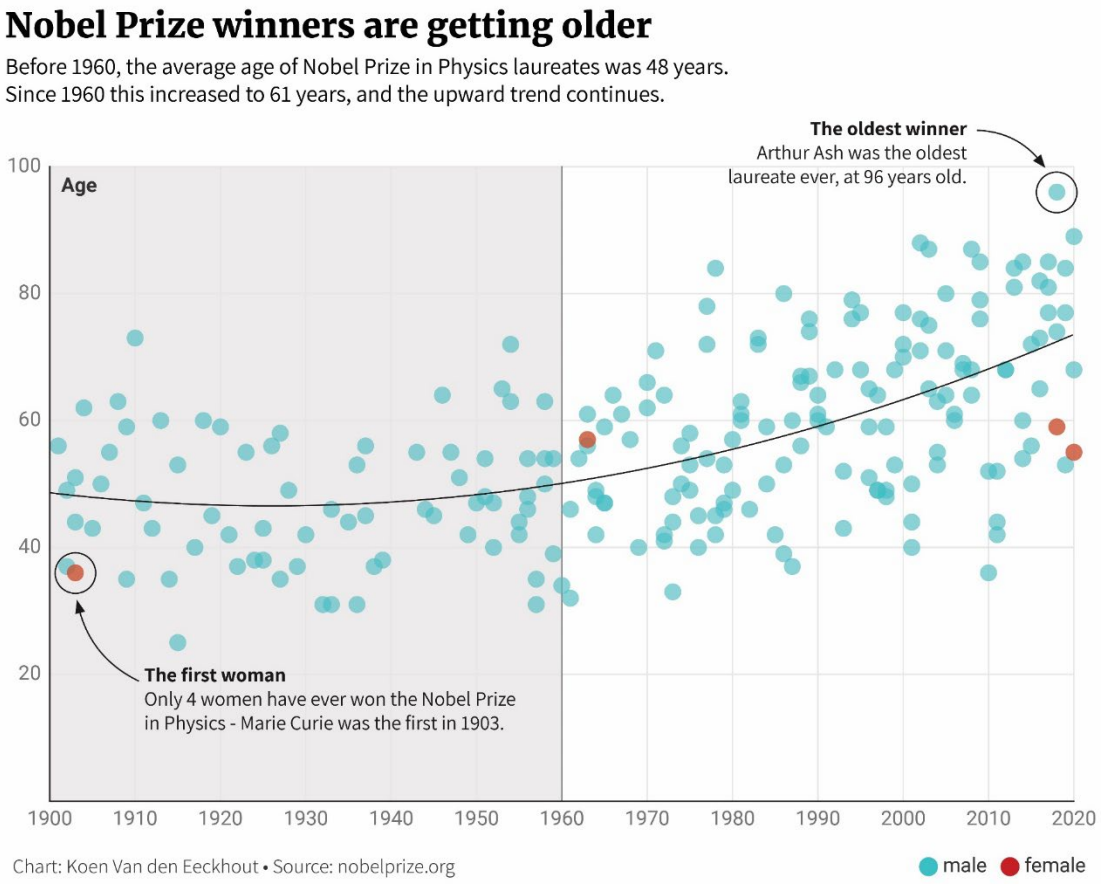
Roboto Medium
Roboto Bold
Roboto Black
Roboto Thin Italic
Roboto Light Italic
Roboto Italic
Roboto Medium Italic
Roboto Bold Italic
Roboto Black Italic

Visual hierarchy



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Subtitle Assistant Regular, 24pt, #000000

Annotation title Assistant Bold, 21pt, #191919

Annotation text Assistant Regular, 21pt, #191919

Source text Assistant Light, 21pt, #515151

Axis title Roboto Bold, 21pt, #515151

Axis ticks Roboto Regular, 21pt, #757575

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Session 1

Introduction

Elements of powerful visuals

Visual communication principles

lunch break

Graphical abstracts/posters

Design principles

Icons and illustrations

Editing vector images

HOMEWORK
Create a graphical abstract

Session 2

Homework feedback

Colours and text in your visuals

Editing bitmap images

Creating layouts

Graphs

Legal and ethical aspects

Recap and Q&A

Photographs


unsplash.com
pixabay.com
picography.co
burst.shopify.com

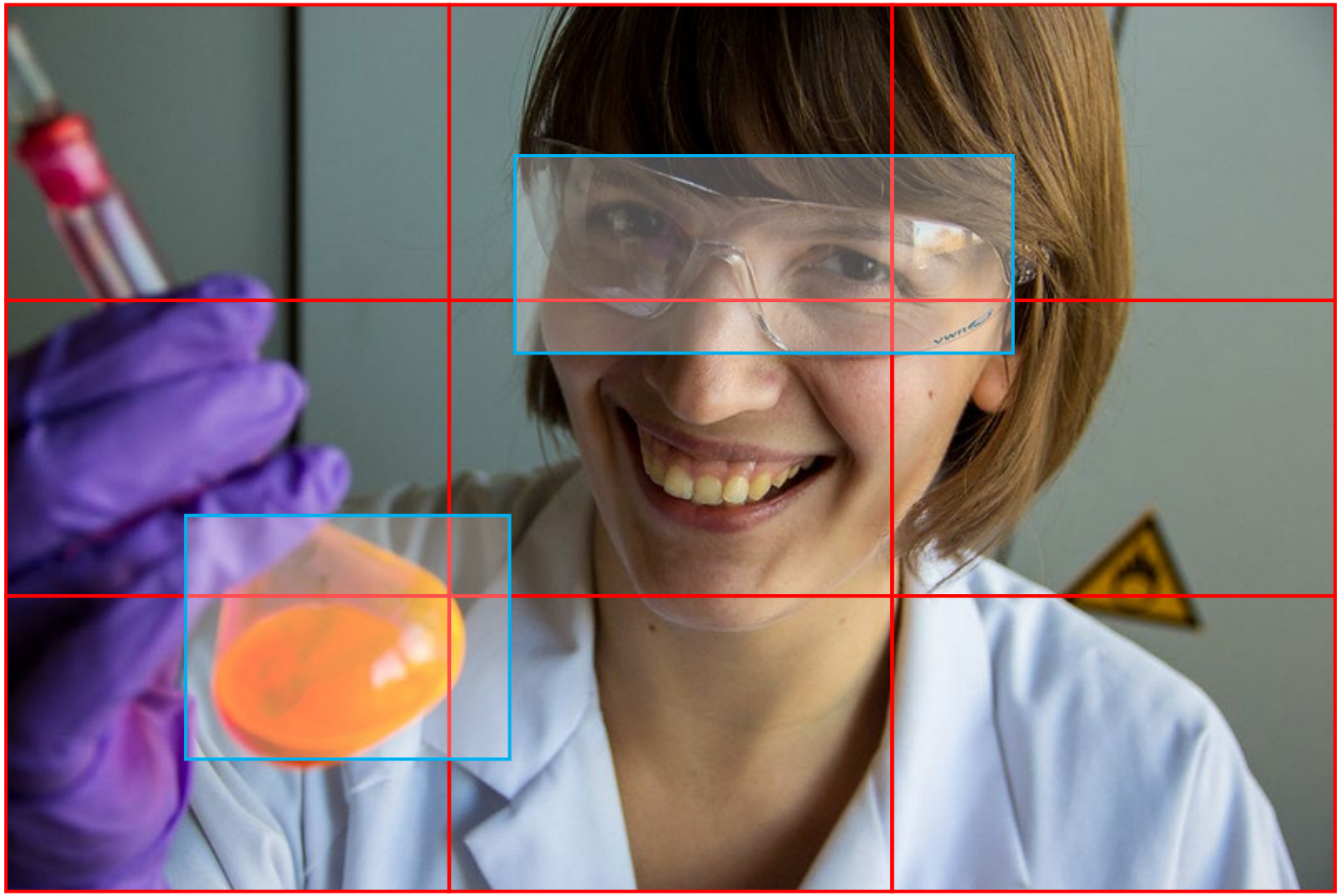
Composition

A

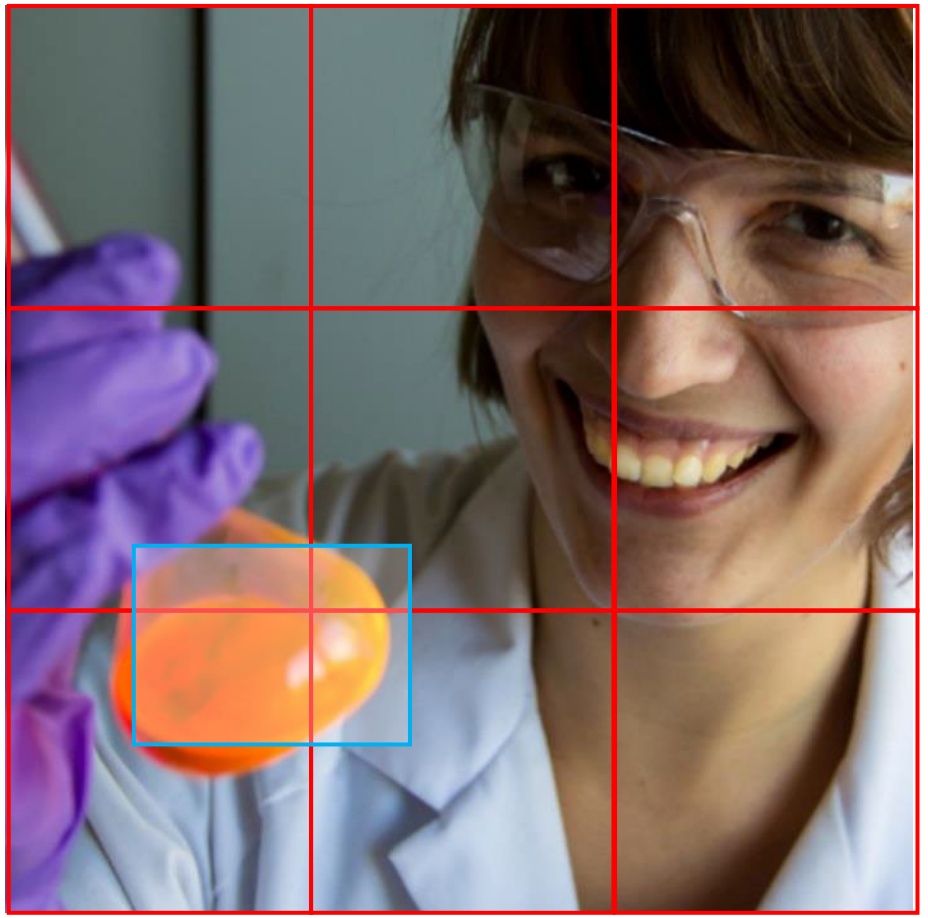
B

Composition

Rule of thirds: place the most important items not in the center, but on a third



A cropped version where the **scientist** gets more of the attention



A cropped version where the **flask** gets more of the attention

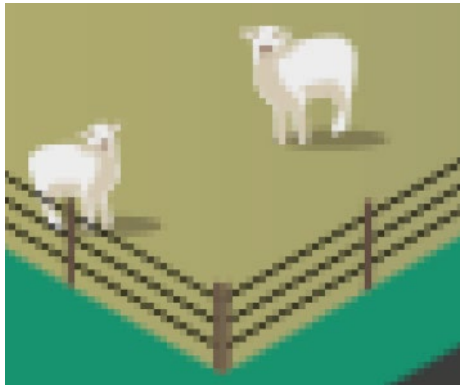
Composition

Create lines or paths
to follow with your eyes

Composition

Use (a)symmetry and balance to your advantage

Editing bitmap images

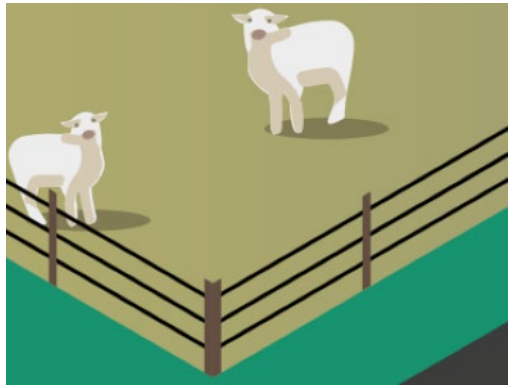


bitmap image

jpg, png, bmp, tiff, gif, psd,...

- built from **pixels**
- photographs
- illustrated made by hand
- illustrations with lots of textures, brush strokes,...

- tools: Photoshop, GIMP, Paint.NET,...



vector image

svg, pdf, eps, ai,...

- built from **shapes**
- illustrations made digitally
- (large-scale) printing
- easier to edit, recolor,...

- tools: Illustrator, Inkscape,...

Adobe Photoshop

“industry standard”

very powerful

steep learning curve

expensive subscription

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Affinity Photo

nearly as powerful
as Adobe Photoshop

still a steep learning curve

one-off payment
(currently € 49)

affinity.serif.com

GIMP

free alternative

steep learning curve

dated, complex interface

gimp.org

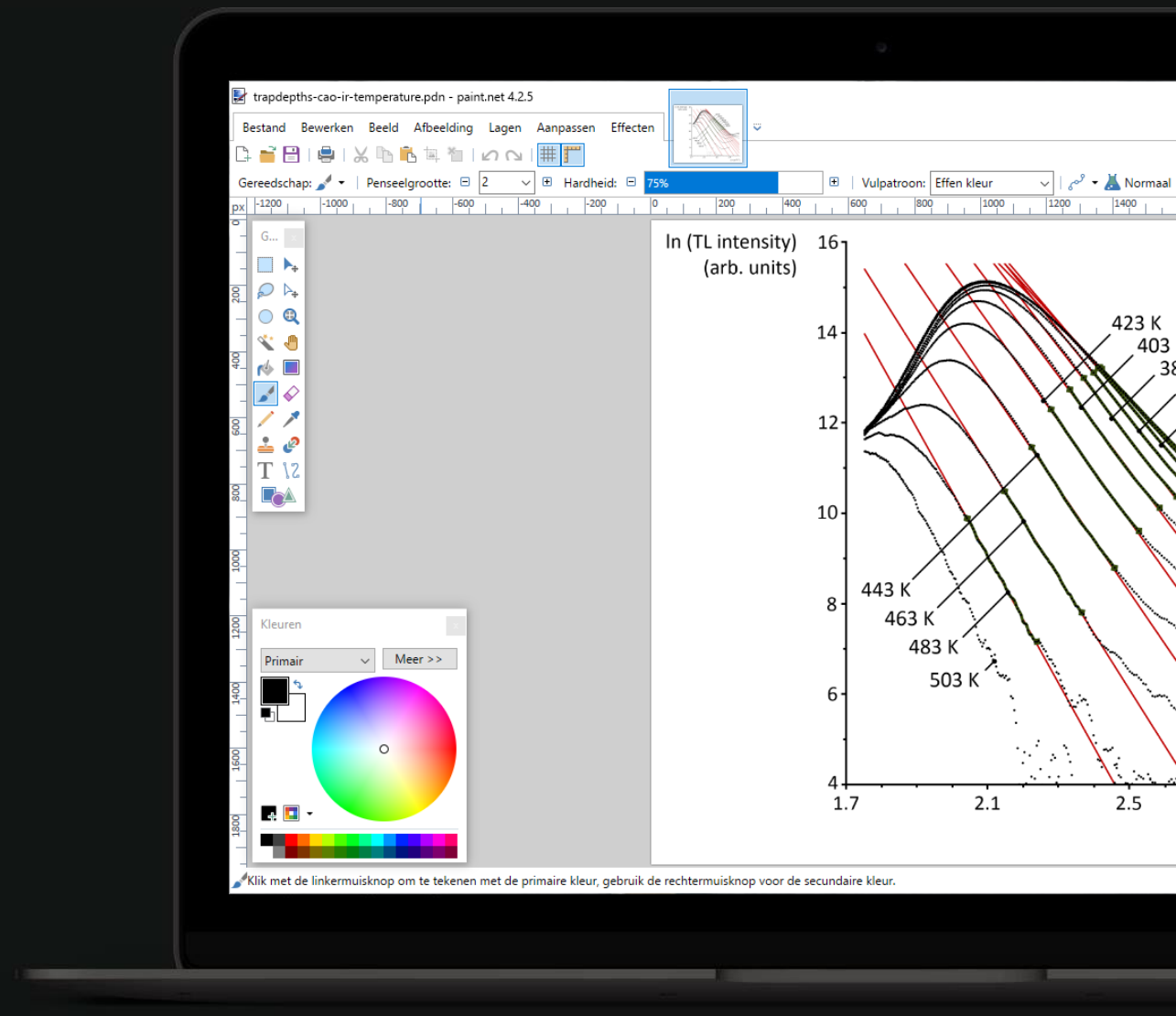
Paint.NET

free alternative

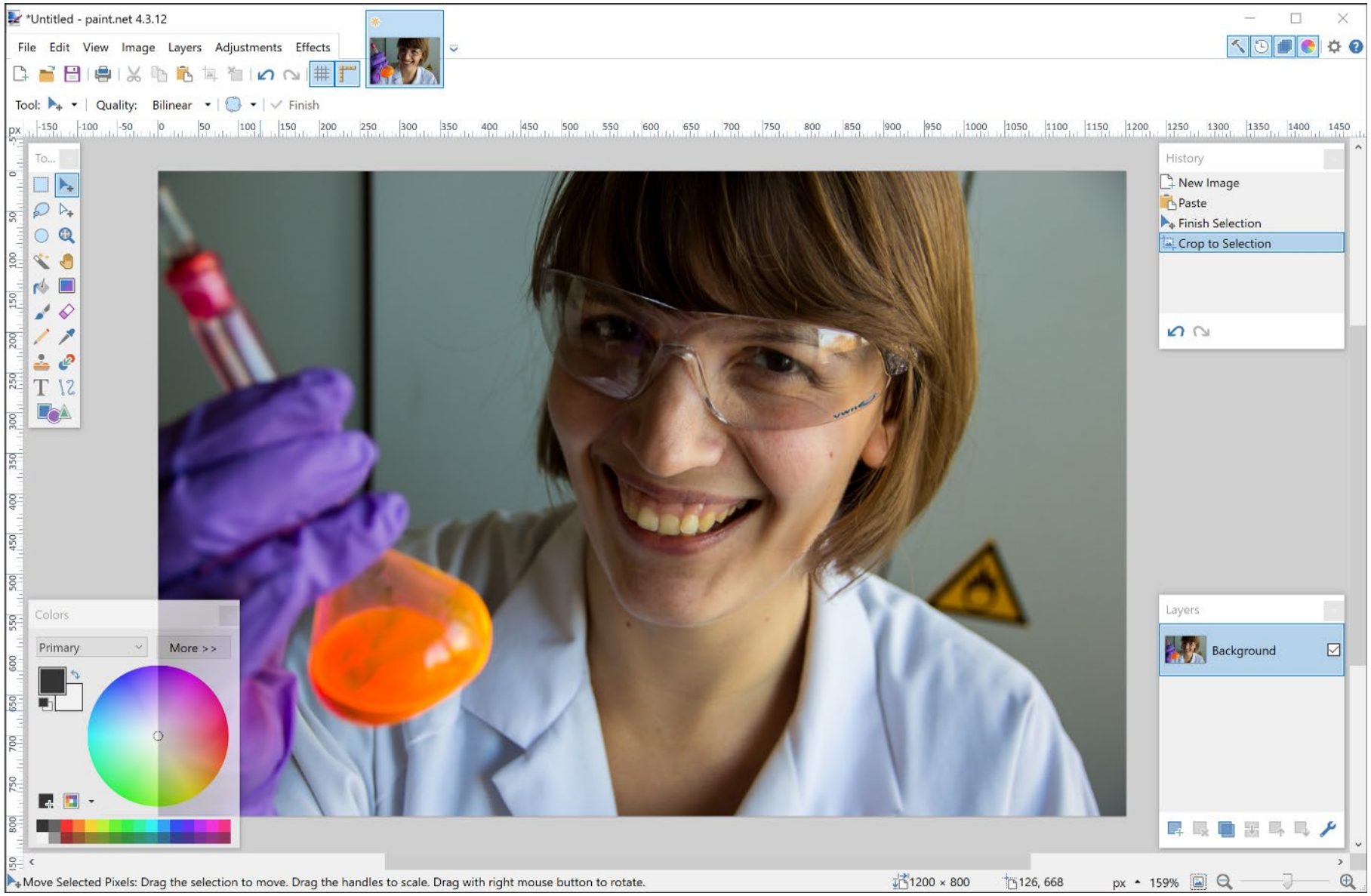
“Paint on steroids”

image editing with layers

getpaint.net

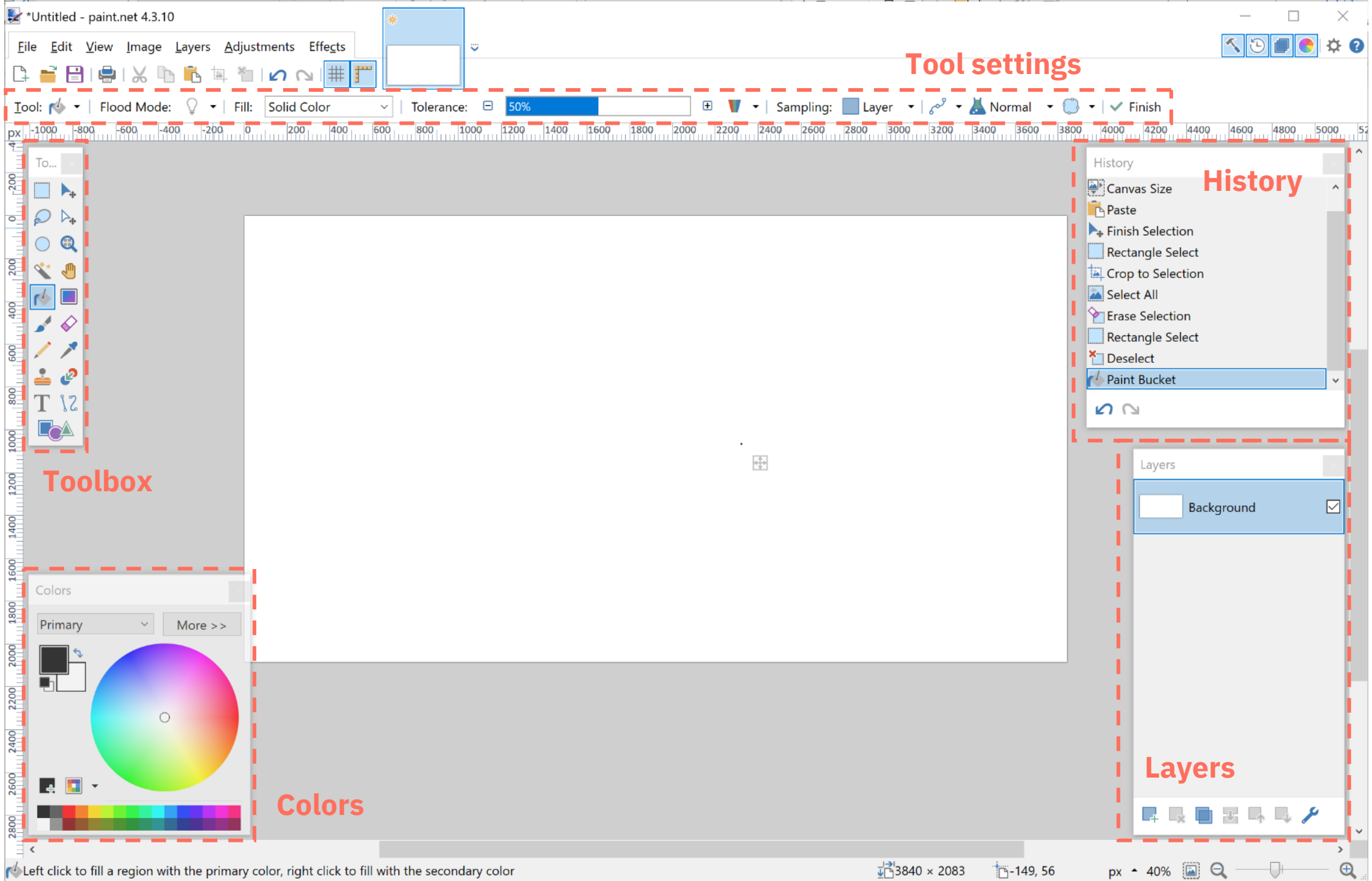


Tool intro: Paint.NET



getpaint.net

Mac/Linux alternative:
pinta-project.com


*Untitled - paint.net 4.3.10
File Edit View Image Layers Adjustments Effects
Tool settings
Tool: Flood Mode: Fill: Solid Color Tolerance: 50% Sampling: Layer Normal Finish
History
Canvas Size
Paste
Finish Selection
Rectangle Select
Crop to Selection
Select All
Erase Selection
Rectangle Select
Deselect
Paint Bucket
Toolbox
Colors
Primary
More >>
Colors
Layers
Background
Layers
Left click to fill a region with the primary color, right click to fill with the secondary color
3840 × 2083
-149, 56
px 40%

Resizing

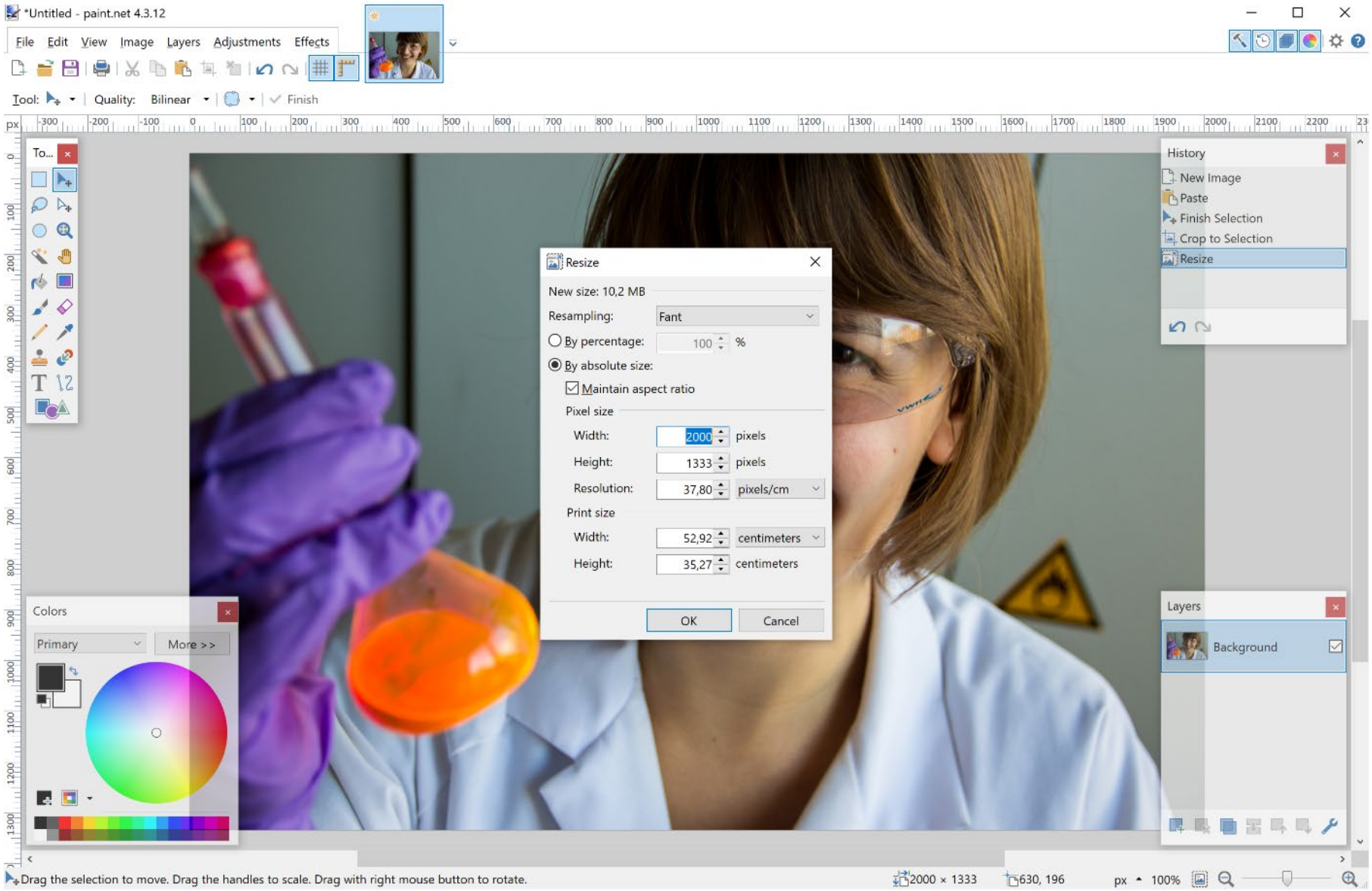


Image > Resize
(Ctrl + R):
resize the entire image

Resizing

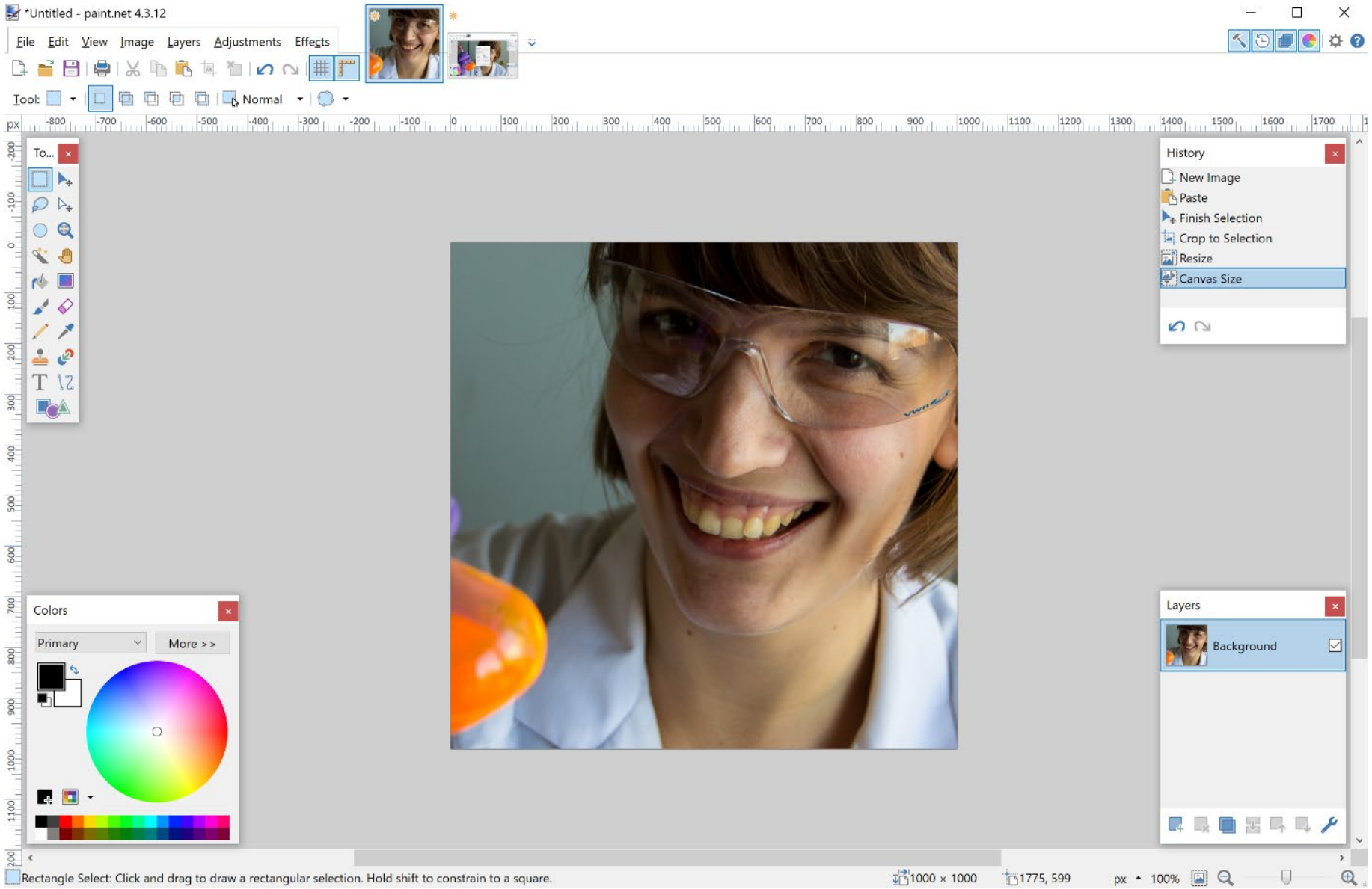
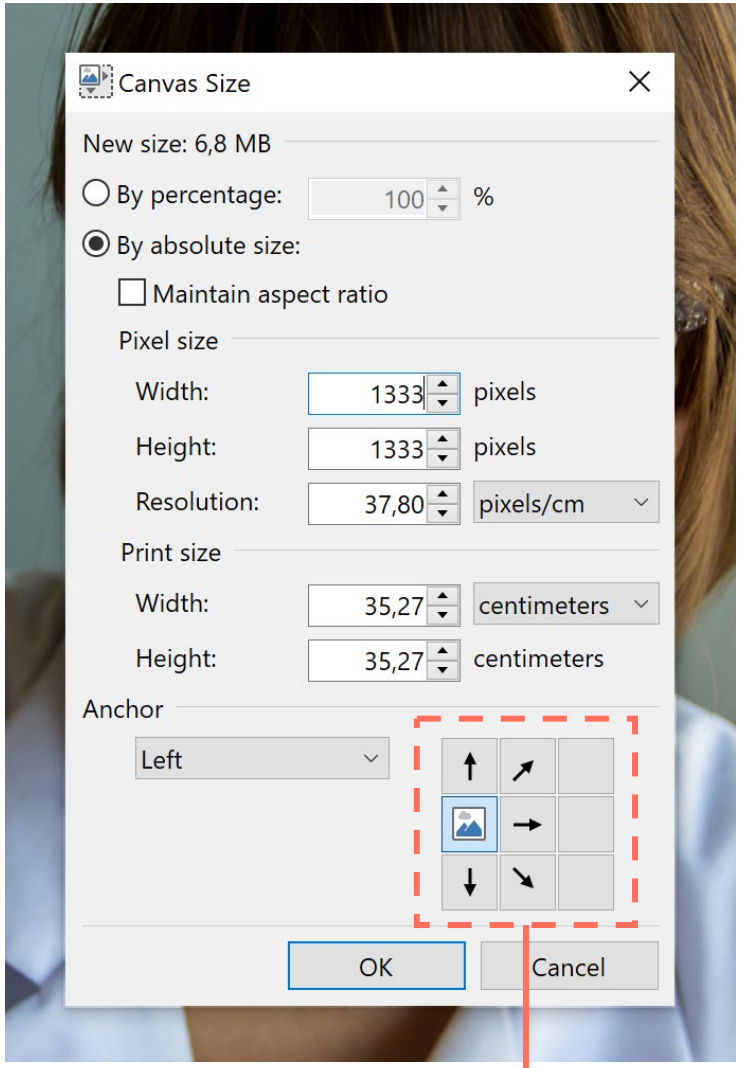
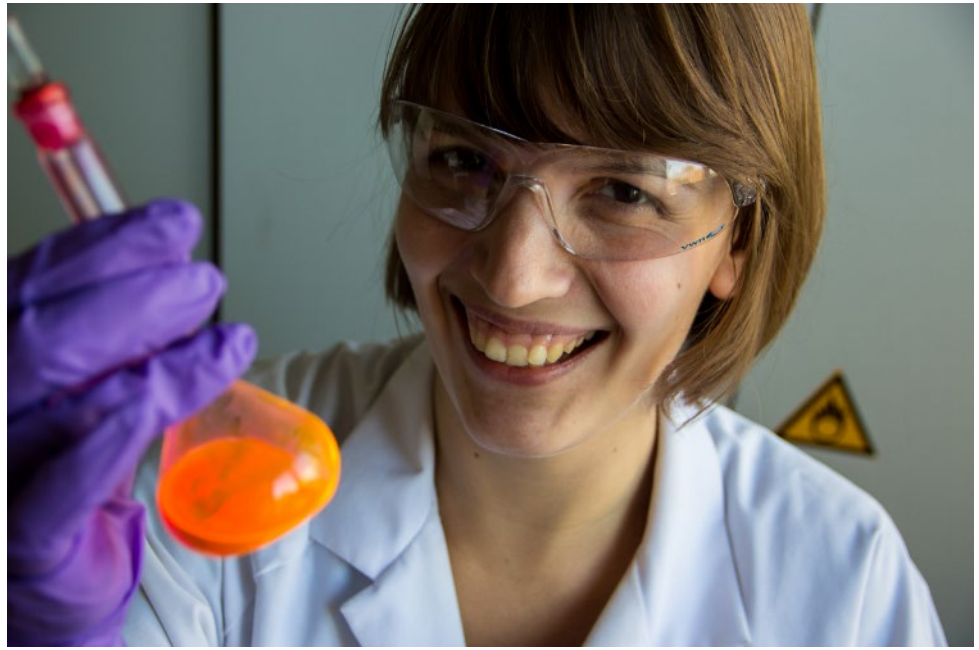
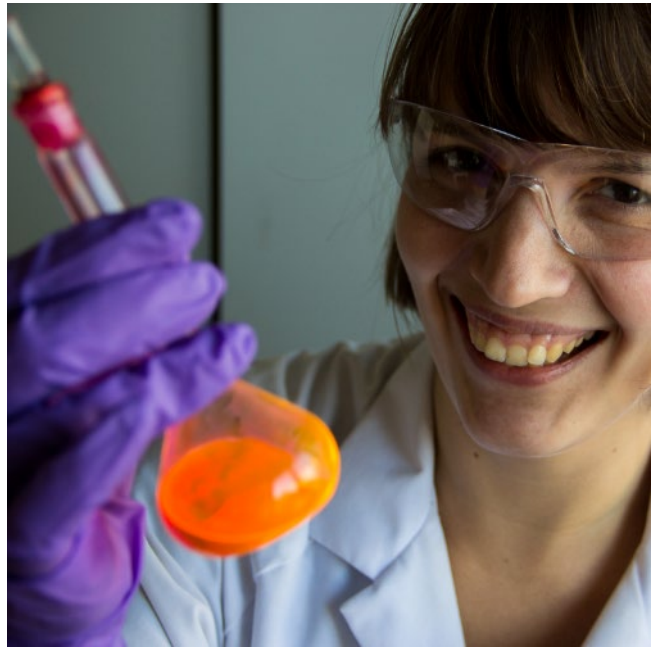


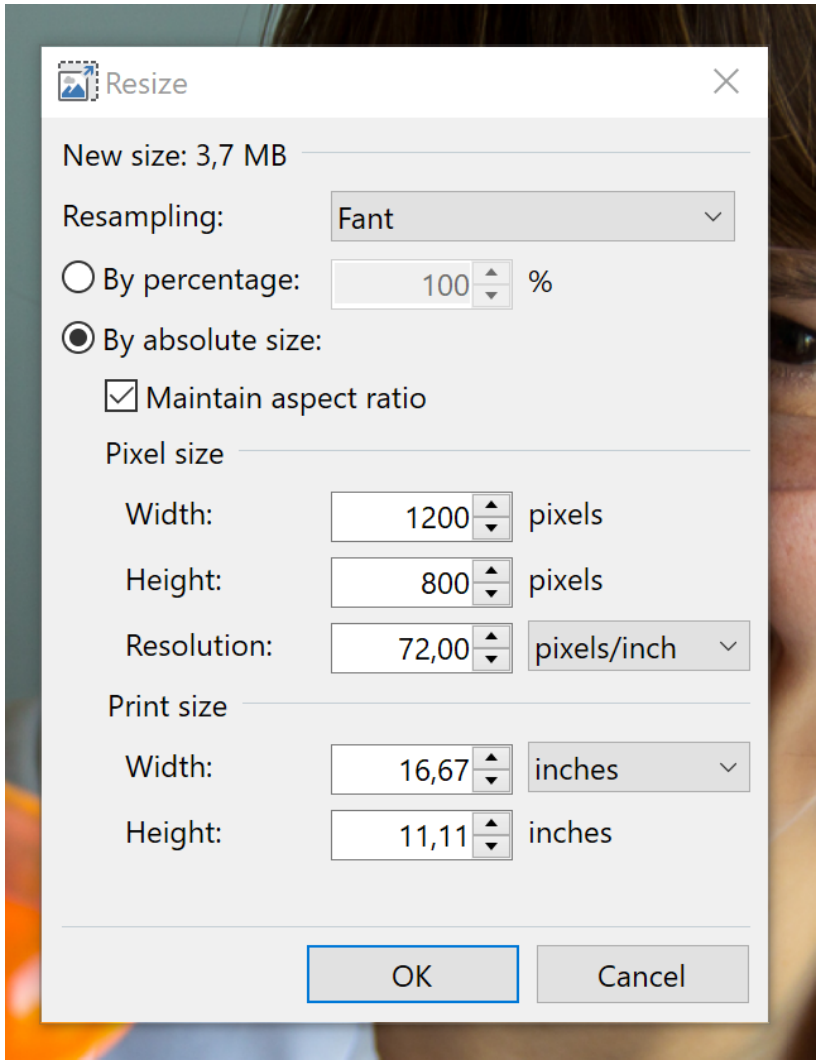
Image > Canvas Size (Ctrl + Shift + R): resize the canvas



The anchor position determines how the canvas will be cropped

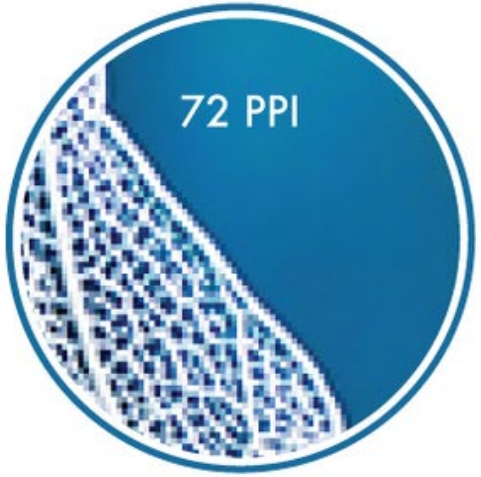




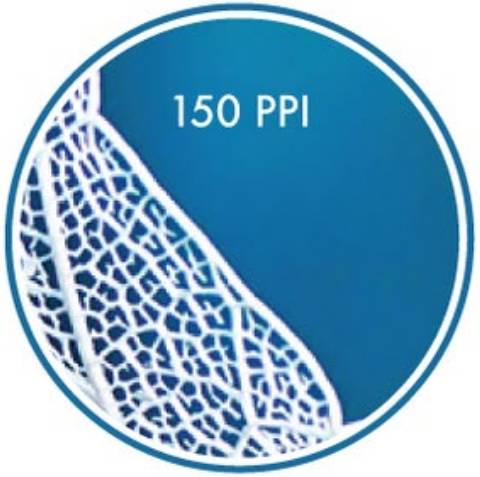


Resolution

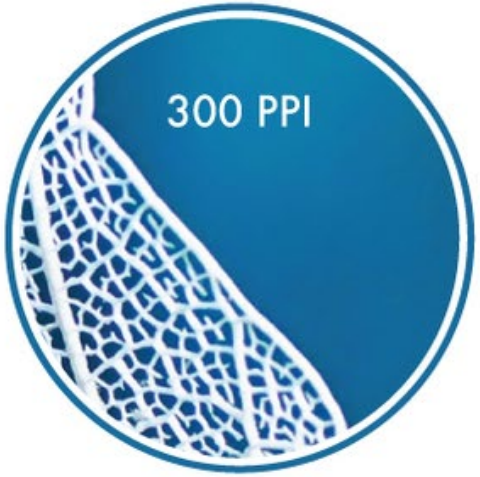
Okay for **screen** use



Okay for **presentations**



Ideal for **printing**

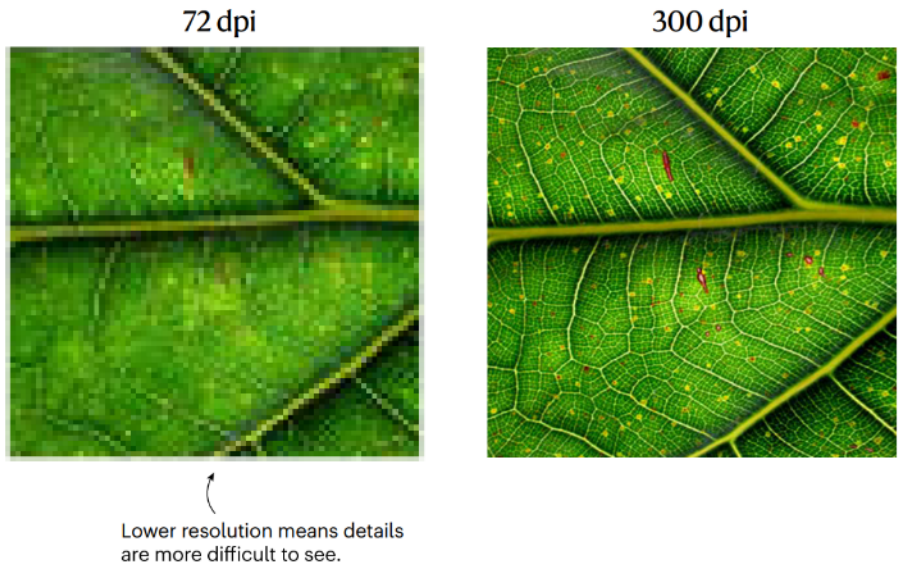


Resolution

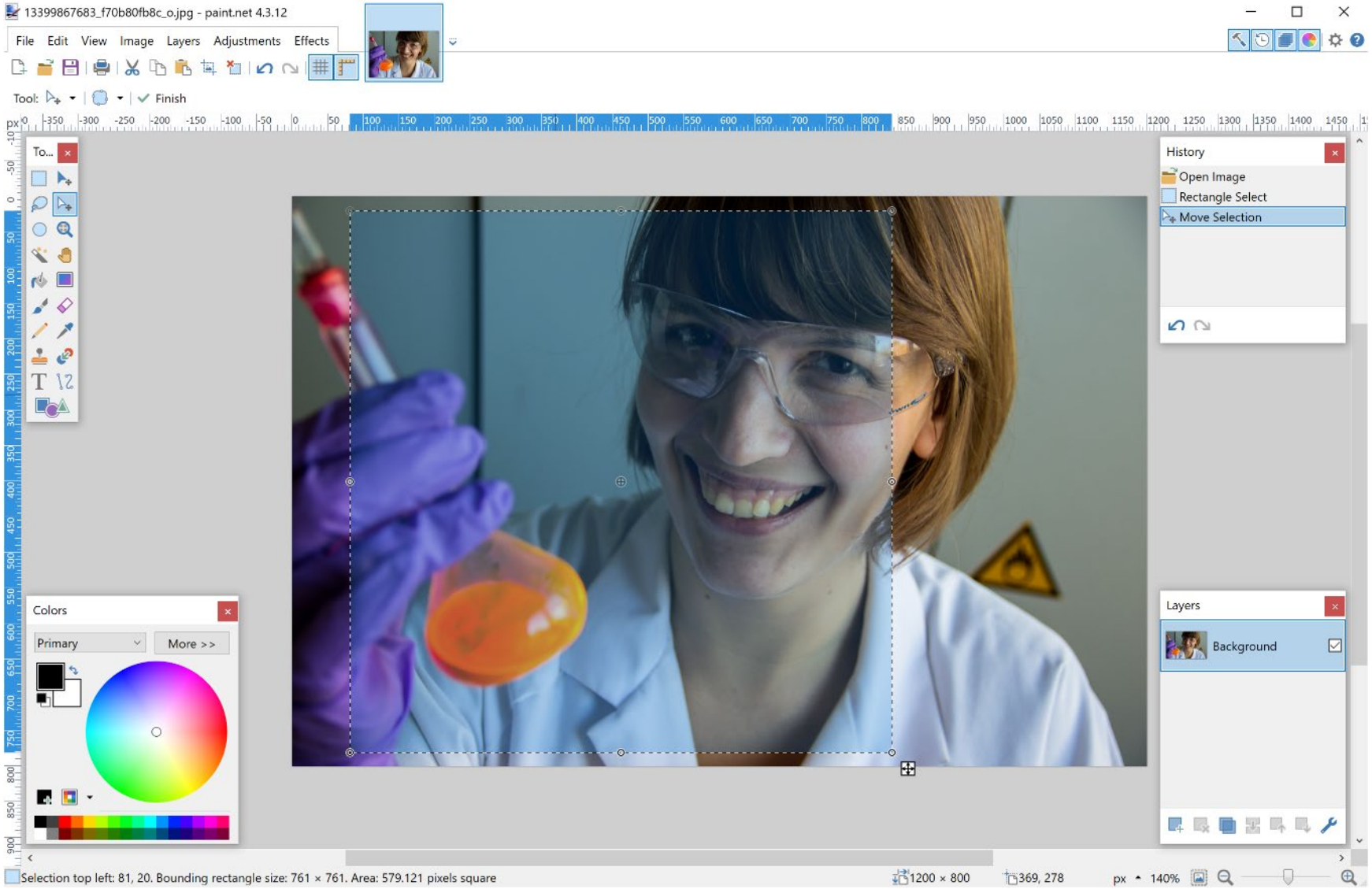
All photographic images must be supplied at a **minimum of 300 dpi** at the maximum size they can be used. The maximum we can output in online proofs is 450 dpi.

Artificially increasing an image's resolution in an artwork program will not improve its quality.

The example shows the difference between a low-resolution image and the same image at 300 dpi (the differences are more apparent the further you zoom in).

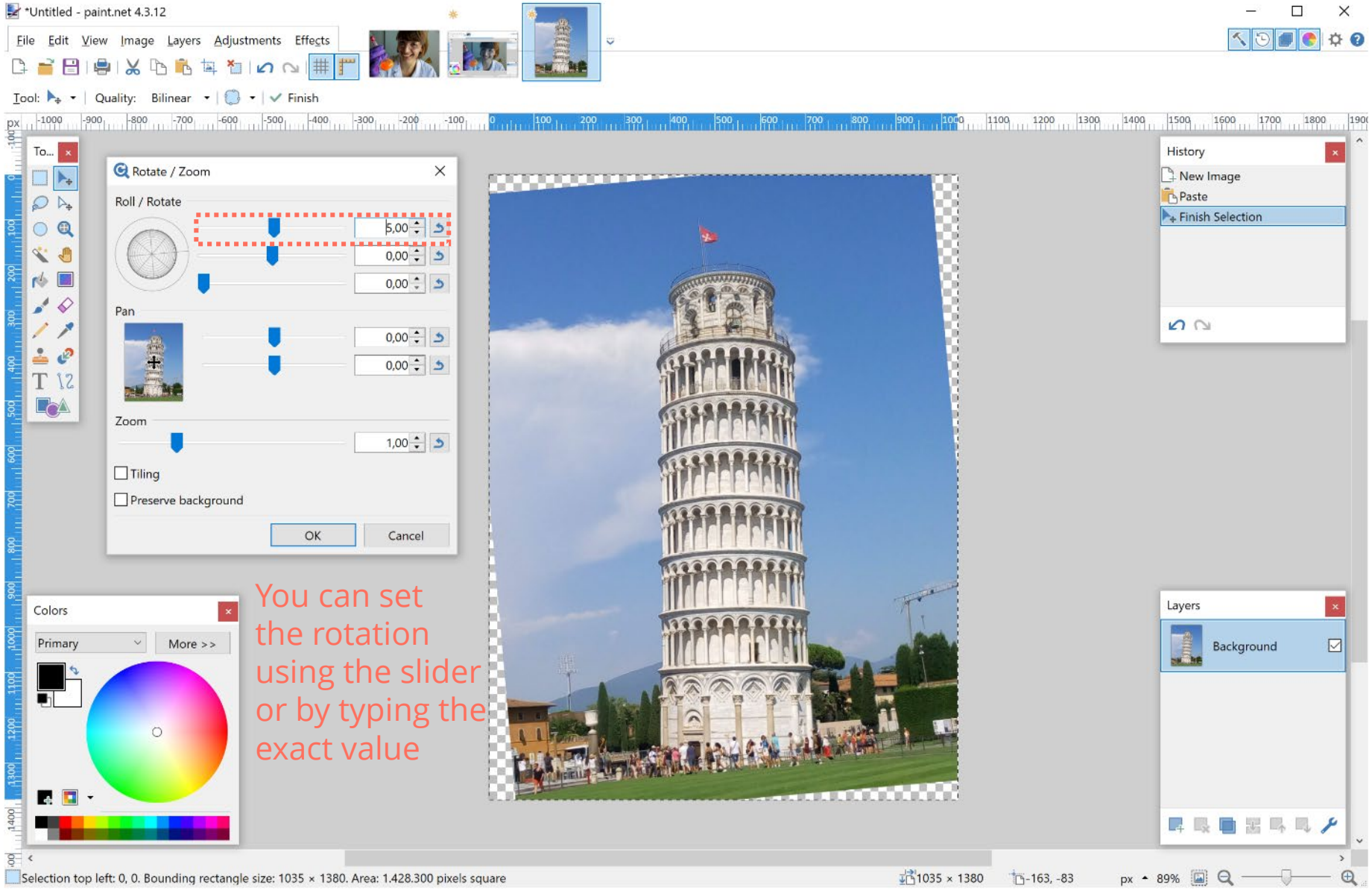


[Nature: Final guide to authors]



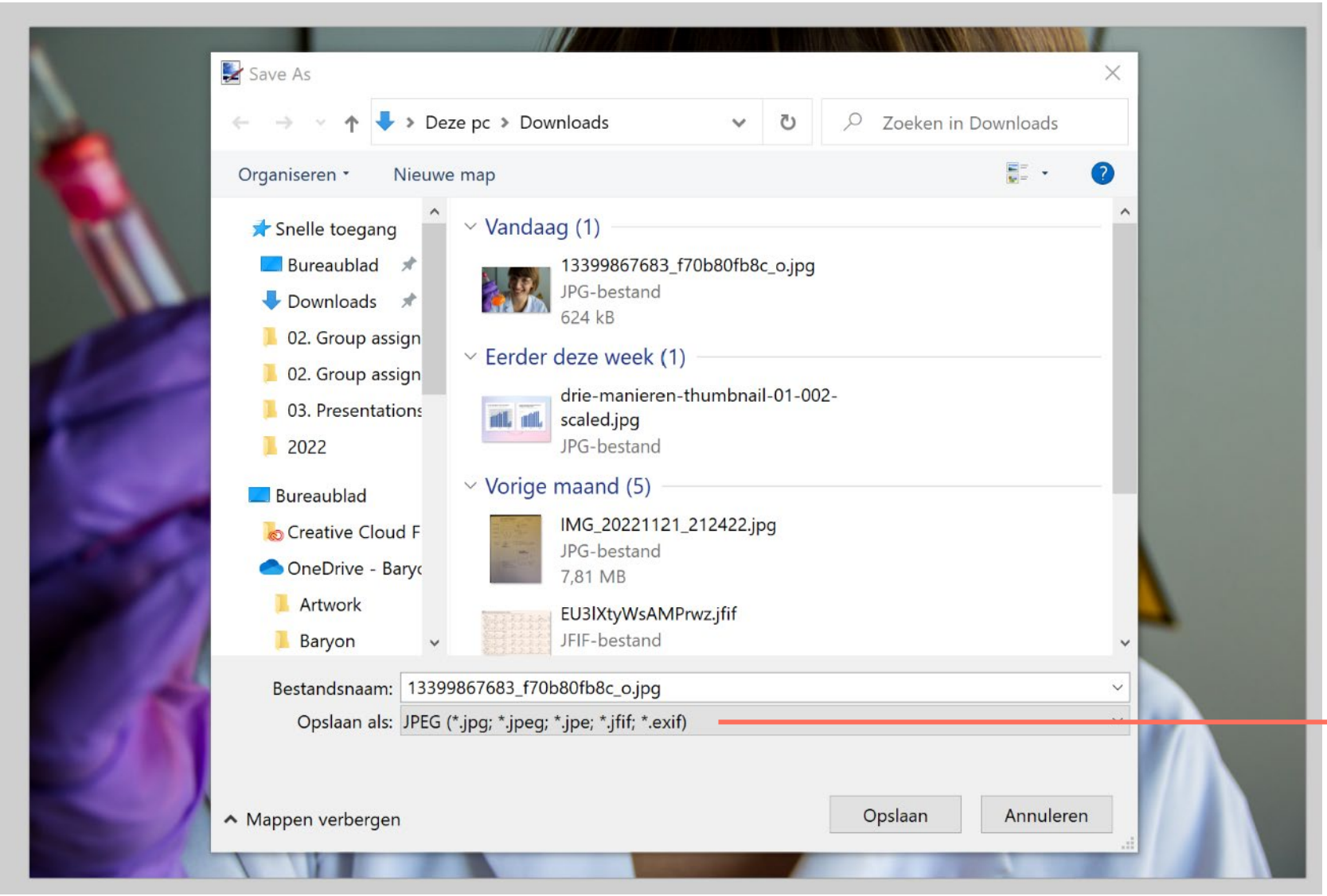
Alternative way to crop images:

- drag and drop using the **Rectangle Select** tool (hold *Shift* for a perfect square)
- move the Selection to the desired position using the **Move Selection** tool
- Image > **Crop to Selection**



Layers > Rotate / Zoom

If you **rotate** your image, be aware that part of it might fall outside of the canvas!



File > **Save As** to save your image

JPEG:
- doesn’t support transparency
- smaller file size

PNG:
- supports transparency
- larger file size
- lossless

TIFF:
- very flexible regarding properties and compression
- not always well supported

PDN:
- if you want to continue working on it later

Exercise: resize, crop and rotate

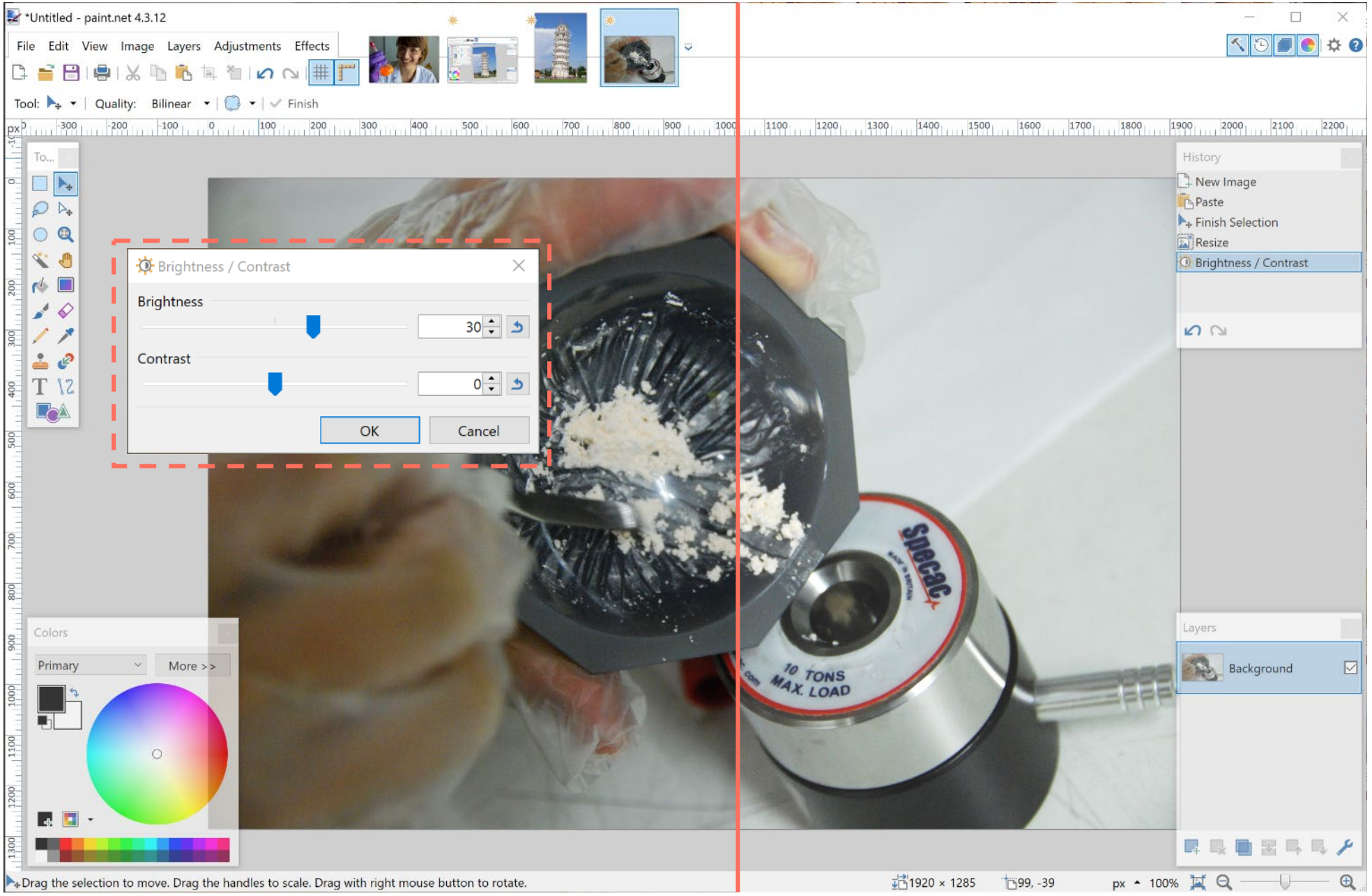
Find the following image on Unsplash (look for ‘Pisa’):

Turn it into:

- a square JPEG image
- 800 px wide
- with a straight tower

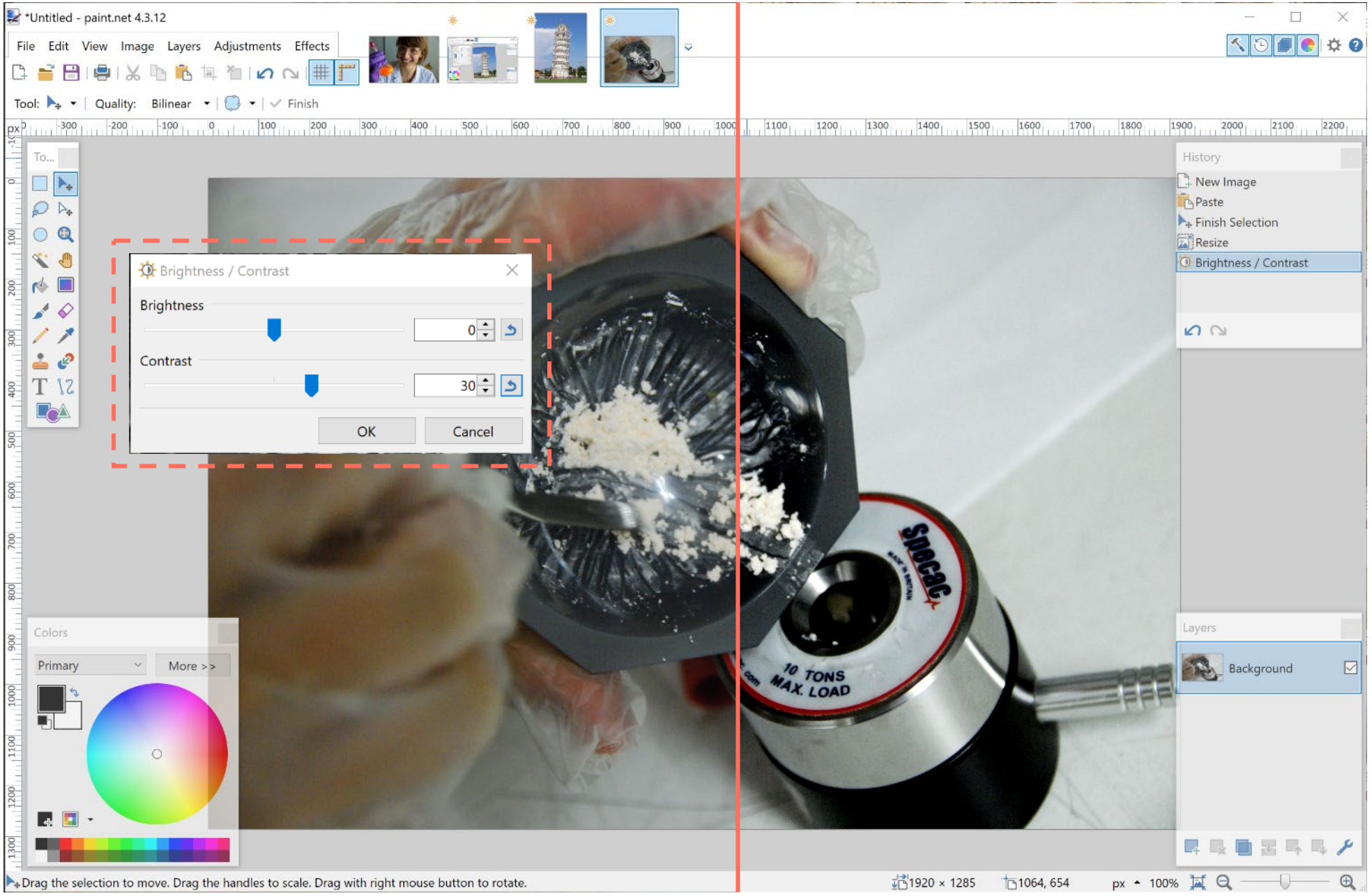
Adjustments > Brightness / Contrast

Brightness = make everything darker or brighter



Adjustments > Brightness / Contrast

Contrast =
light colors lighter,
dark colors darker

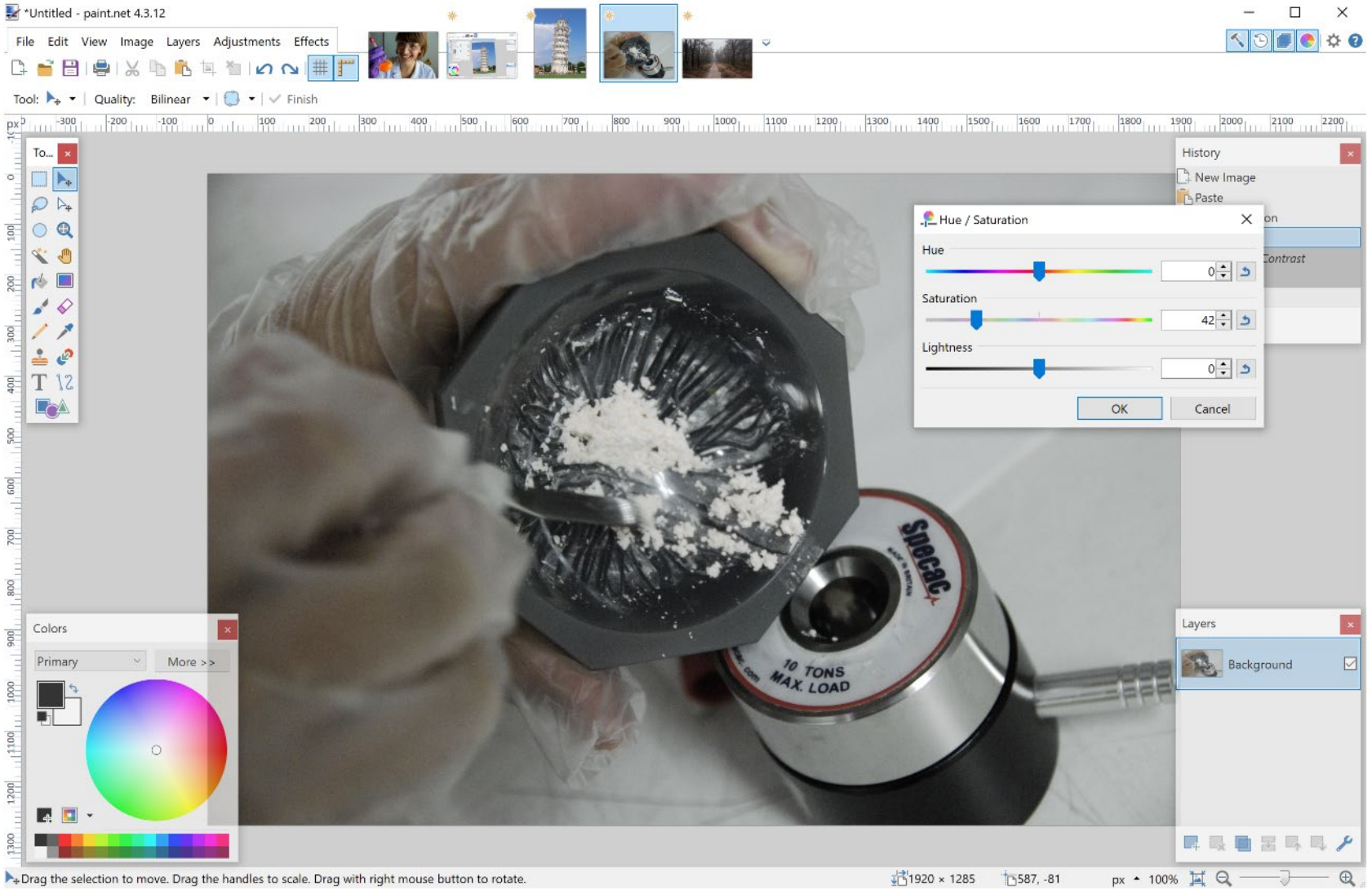


Quick tip to give your pictures more ‘punch’: increase contrast and brightness by roughly the same amount

On the other hand, lowering the contrast of a dark image can reveal a bit more detail

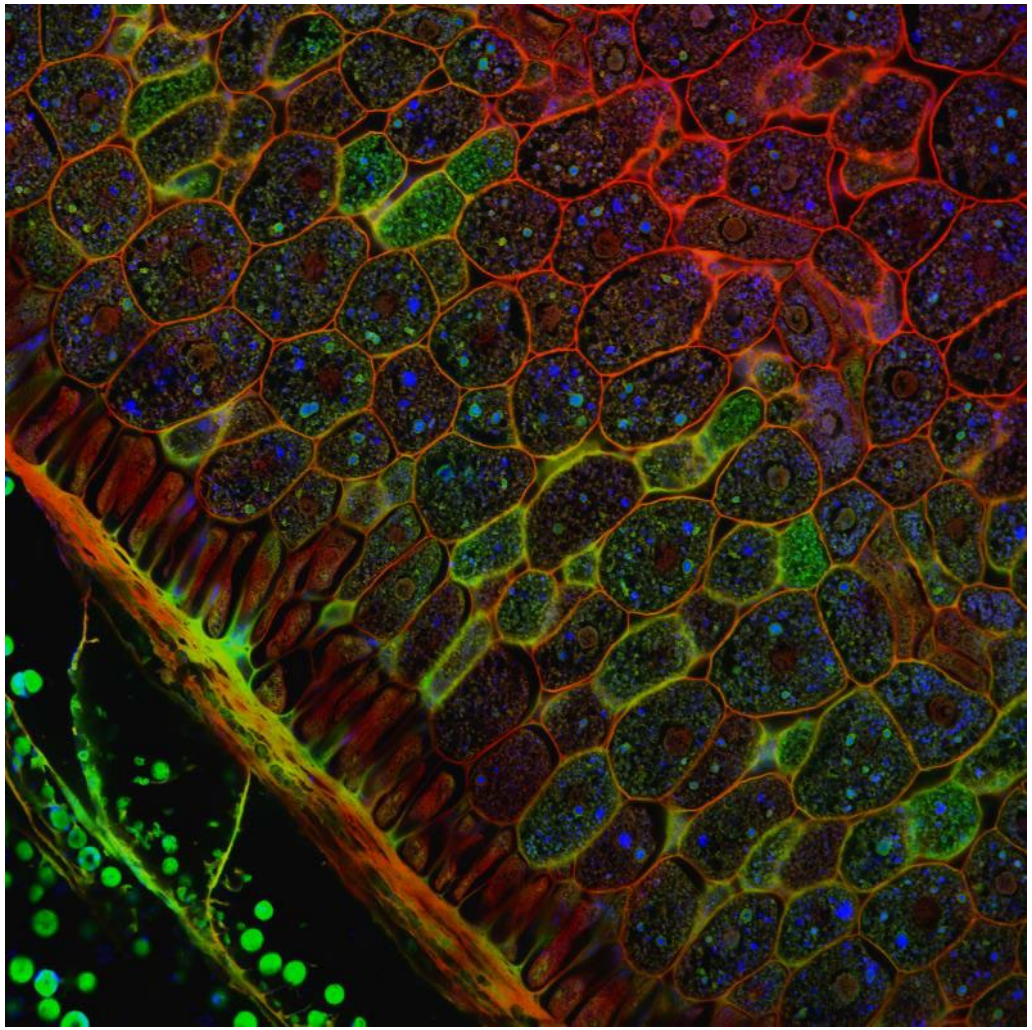
Saturation:
reduce or increase
color in your image

Careful:
Using saturation to make your images ***more*** *colorful often leads to a result that feels unrealistic*



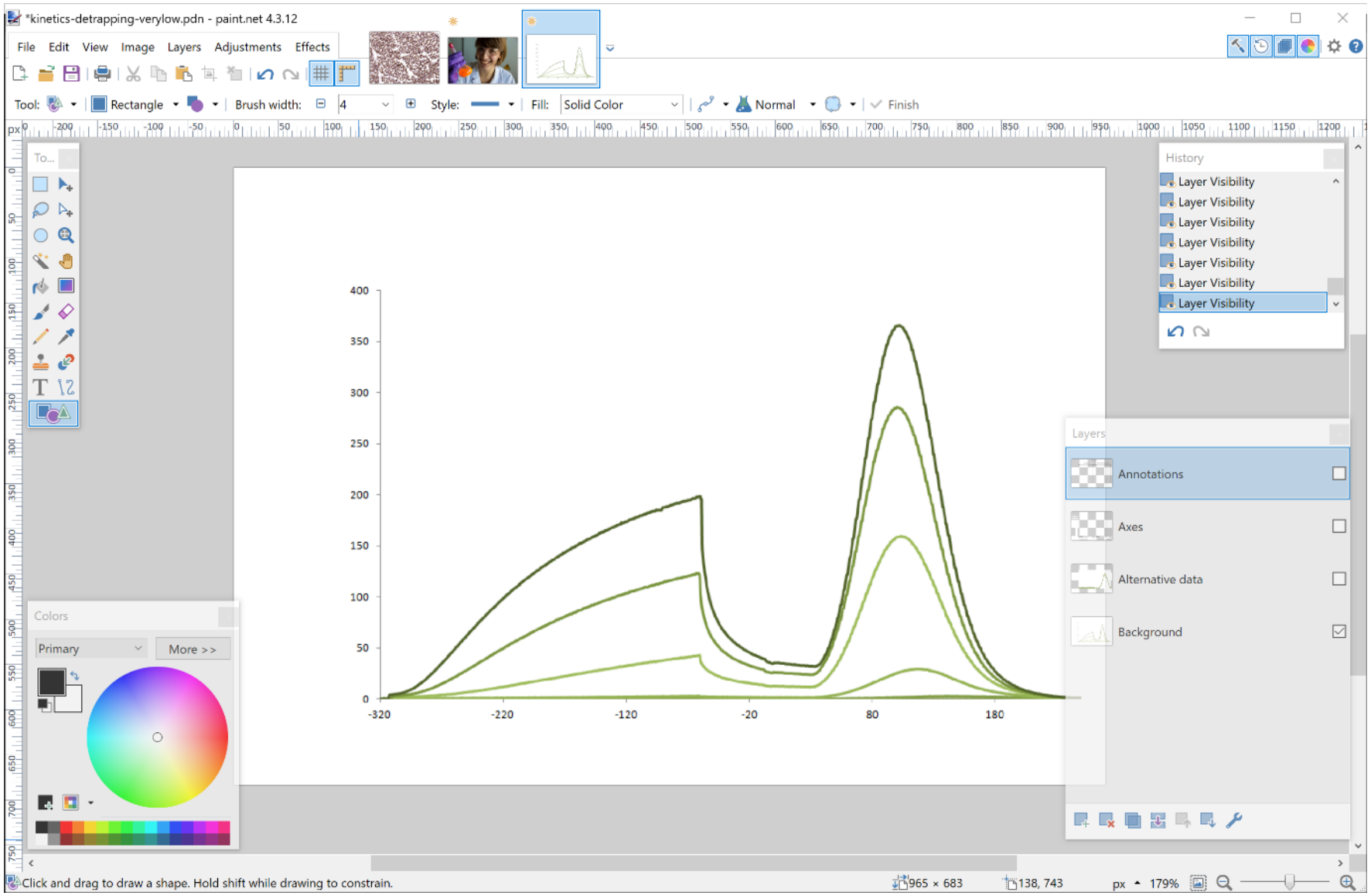
Exercise: resolution, brightness, contrast

Download the following image at baryon.be/files/workshop/visual-01.jpg

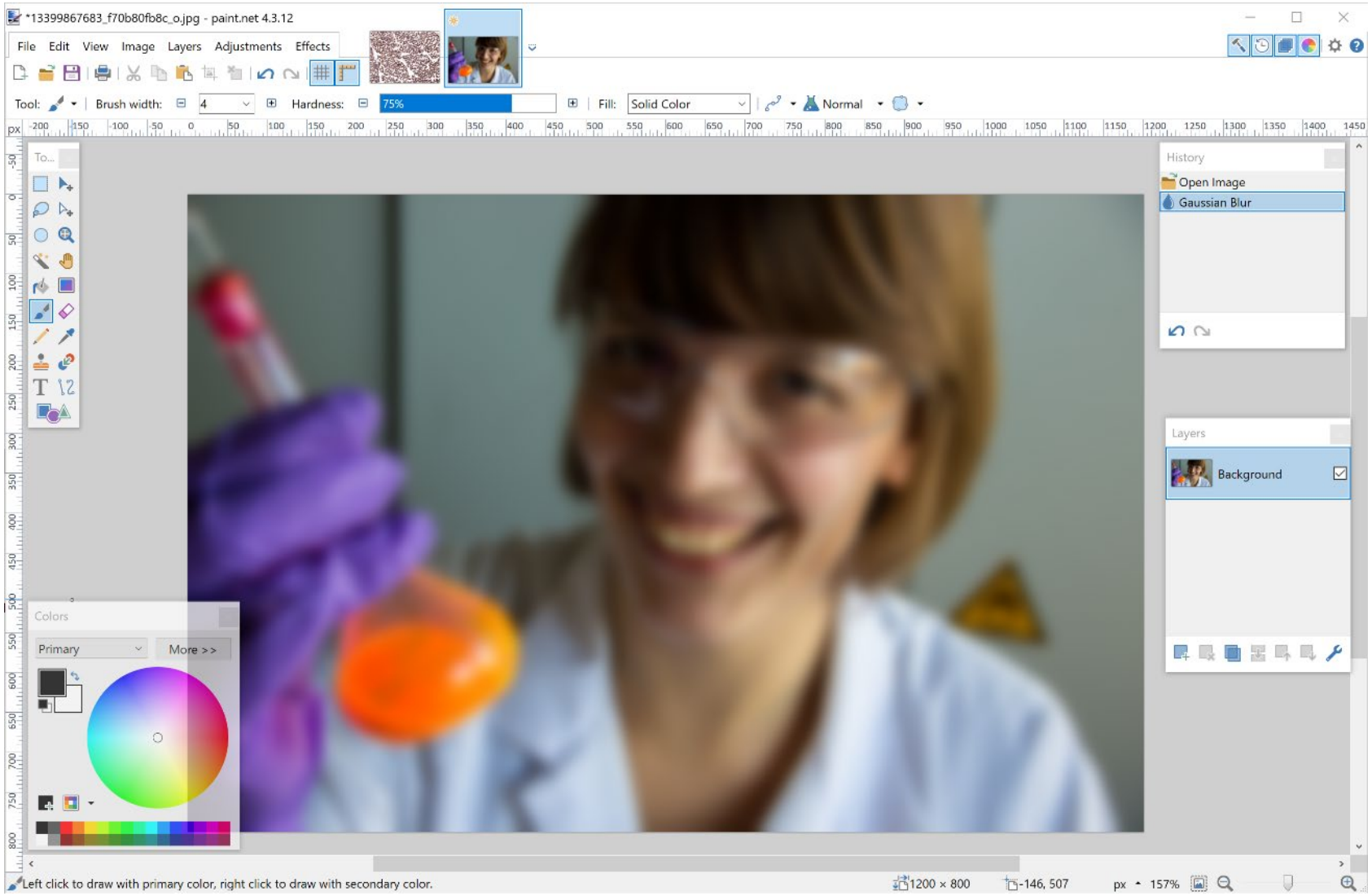


Tasks:

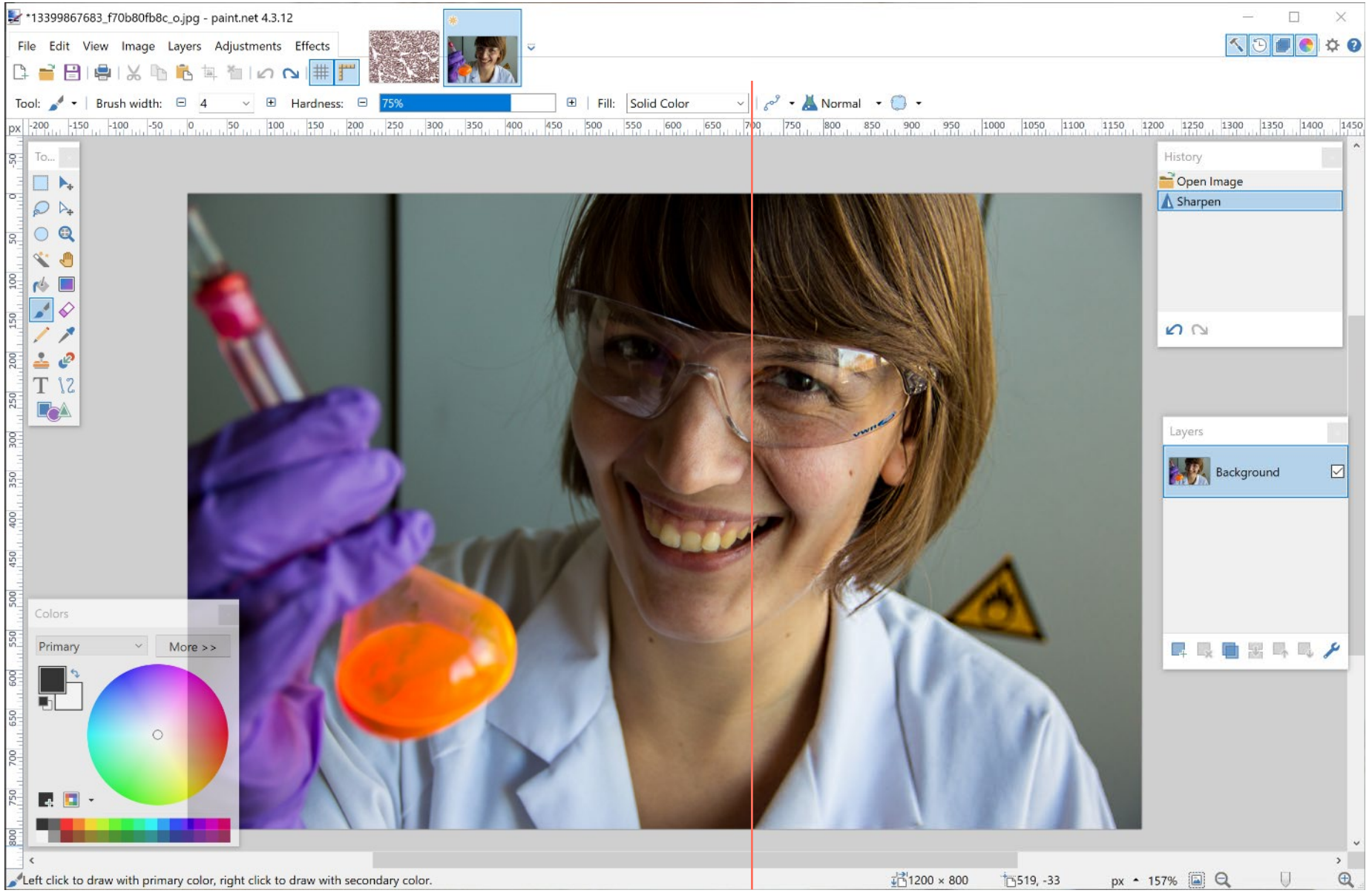
- rotate this image 45 degrees
- crop an image of 600x600 pixels out of the original
- adjust brightness and contrast
  to your own opinion
- resize the image for a 300 PPI resolution
  and a 4 cm image width
- export as a PNG file



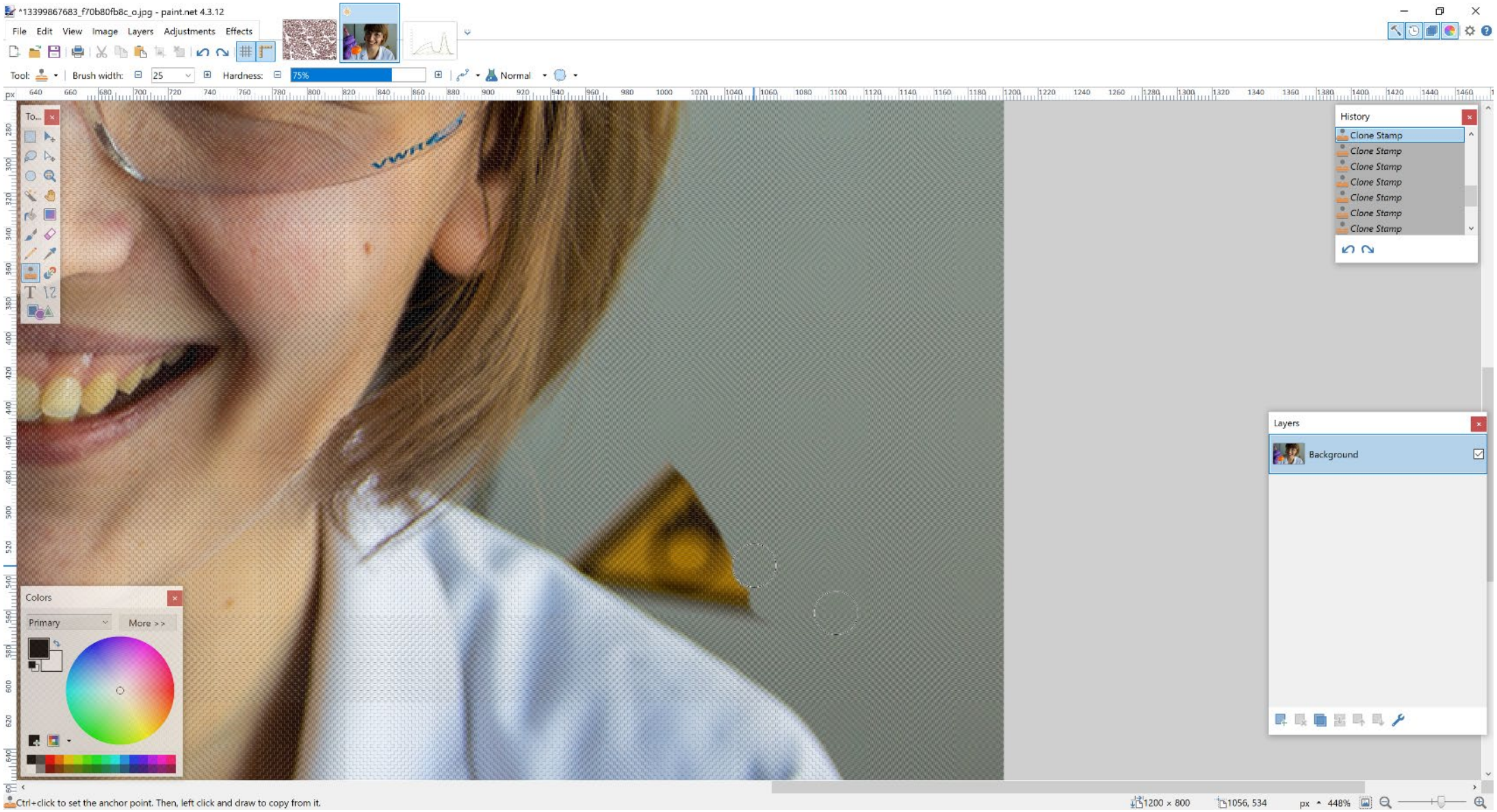
Further useful tools: **Working with layers**



Further useful tools: Effects > Blurs > **Gaussian Blur**



Further useful tools: Effects > Photo > **Sharpen**



Further useful tools: **retouching** images using **Clone Stamp**

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Graphs

Legal and ethical aspects

Recap and Q&A

Creating layouts

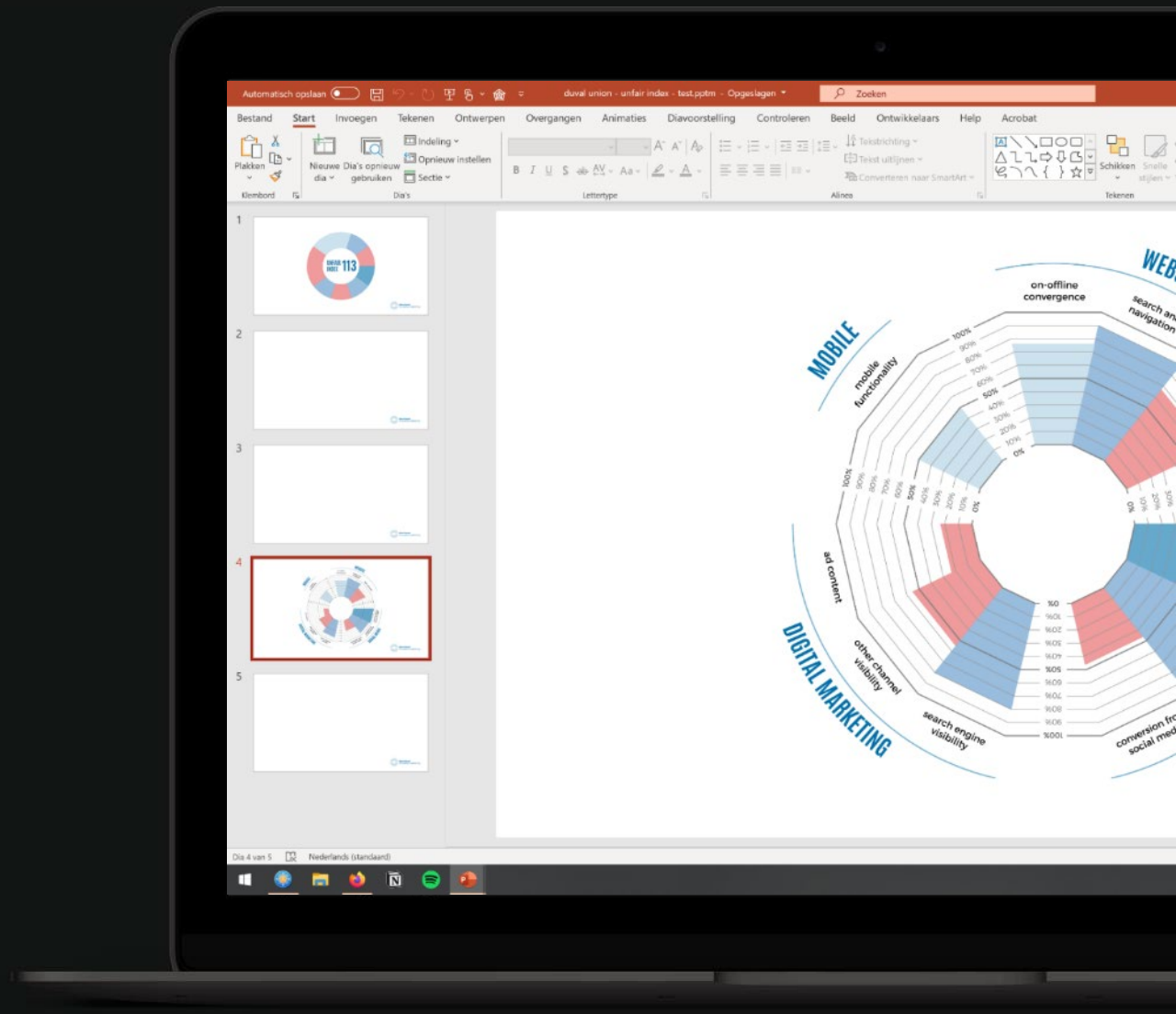
Microsoft PowerPoint

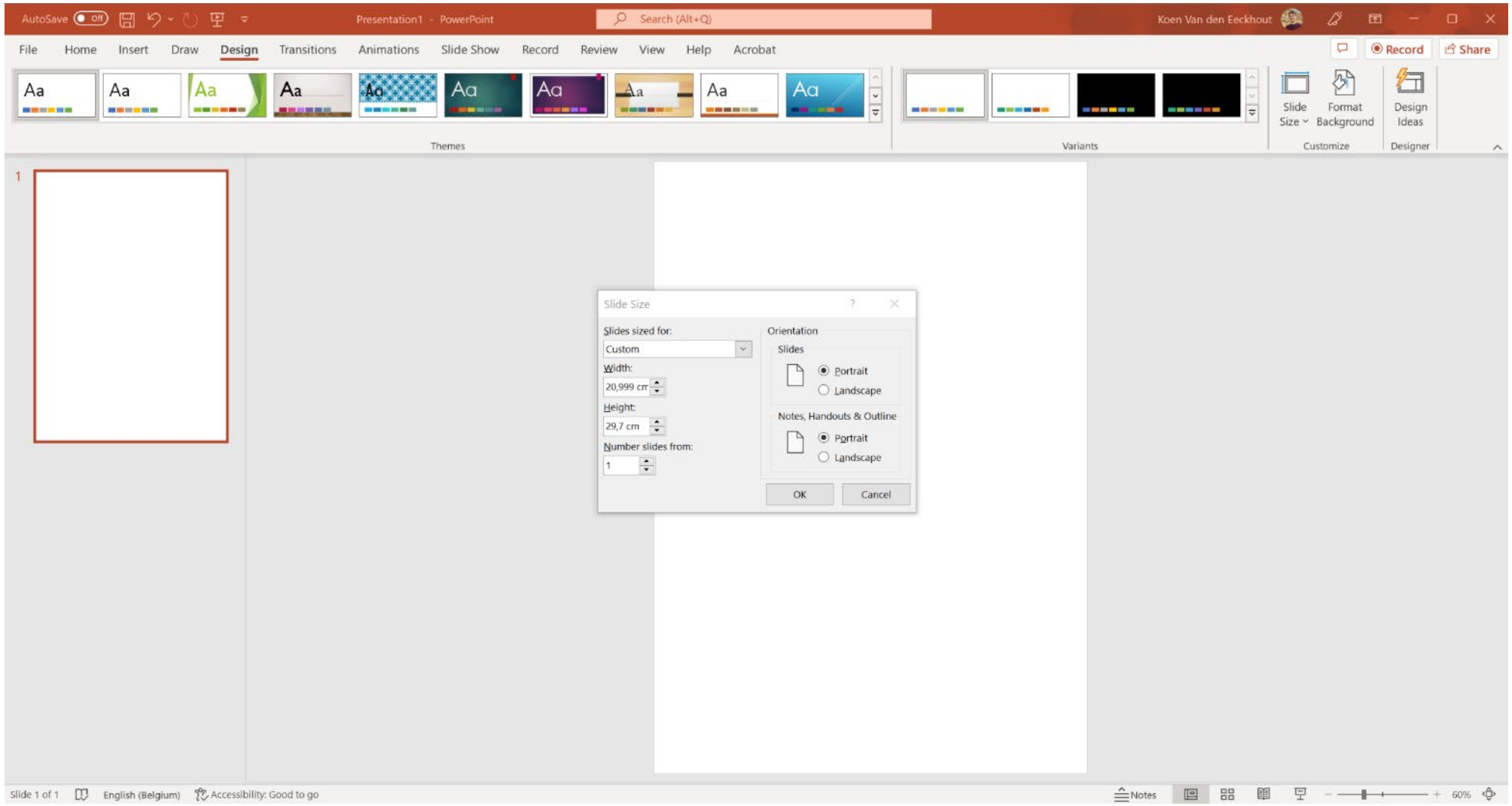
drag-and-drop, easy to use

you already have it, and know it

templates available

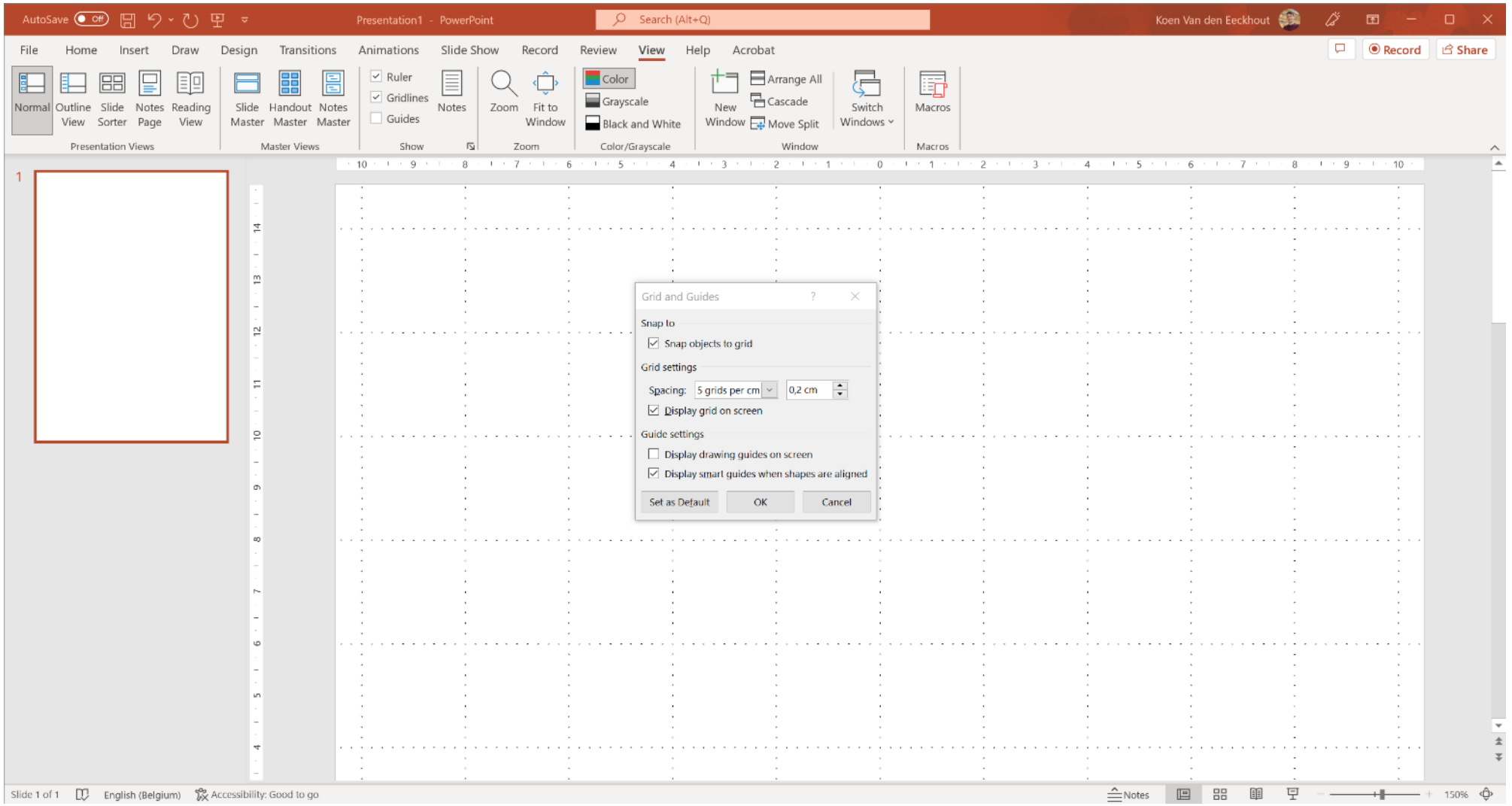
works with bitmap and vector images



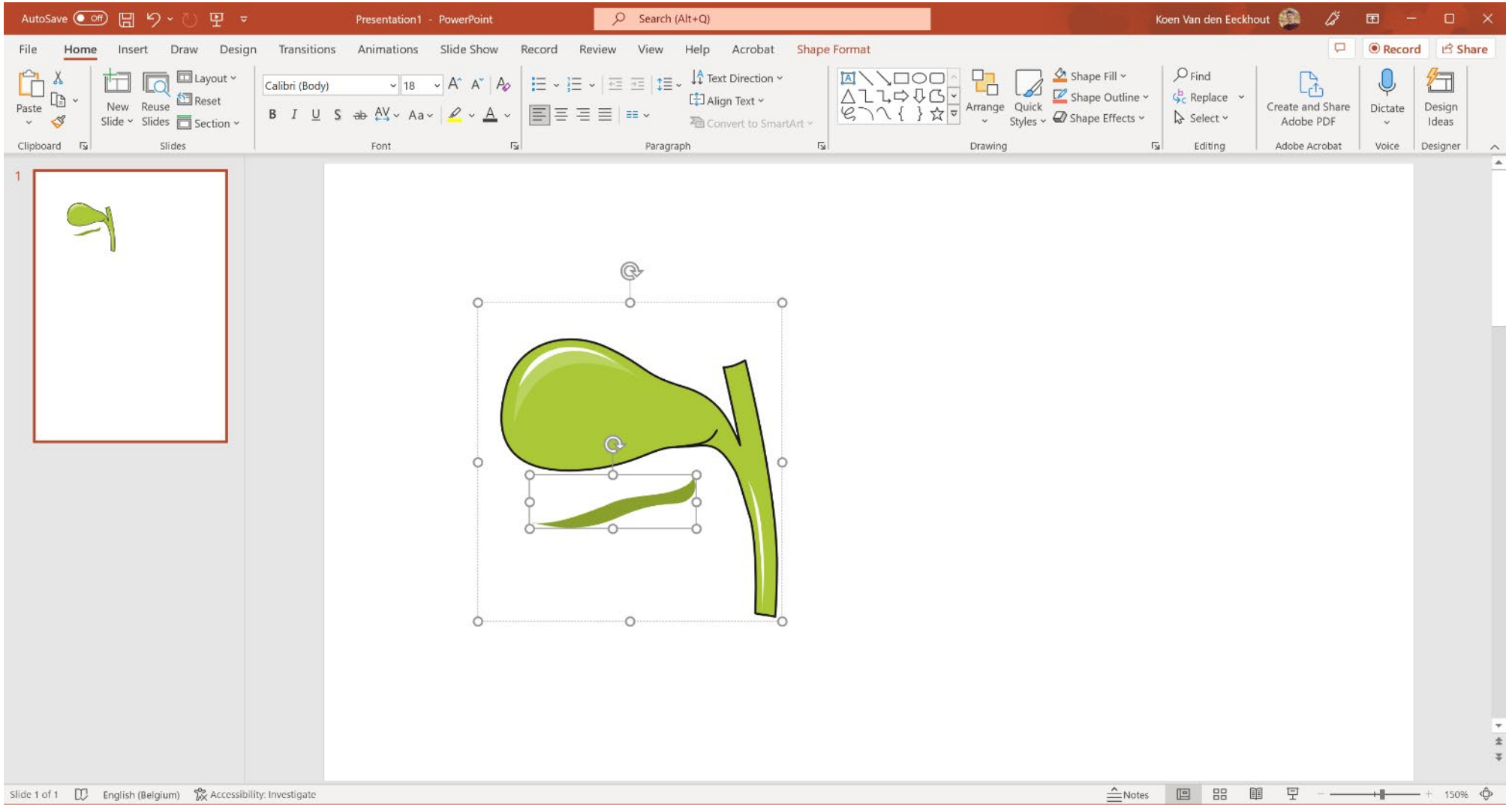


Canvas size:

use *Design > Slide Size > Custom Slide Size* to set your prefered page size

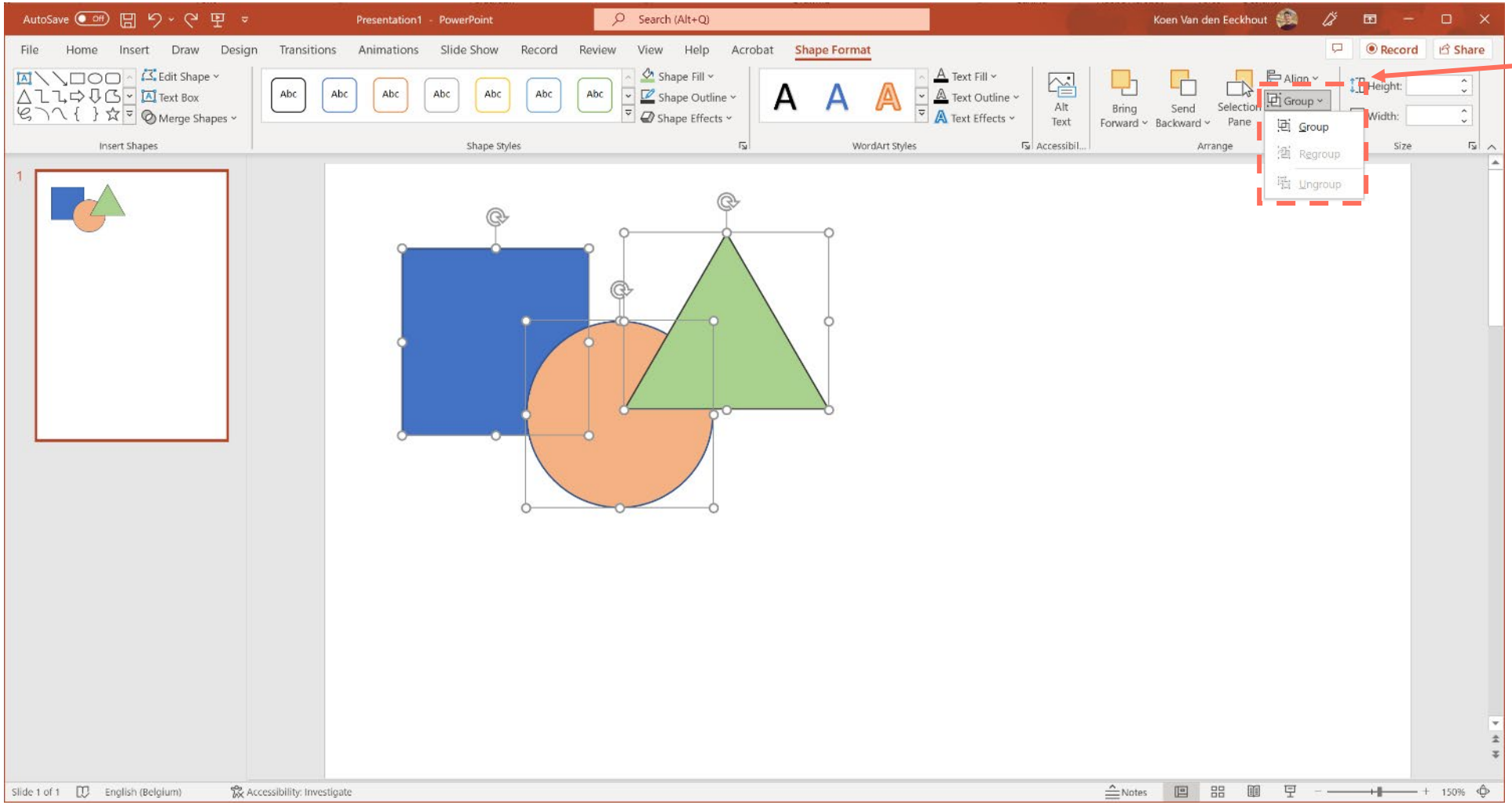


Use View > Show > Ruler and Gridlines for more precise alignment options

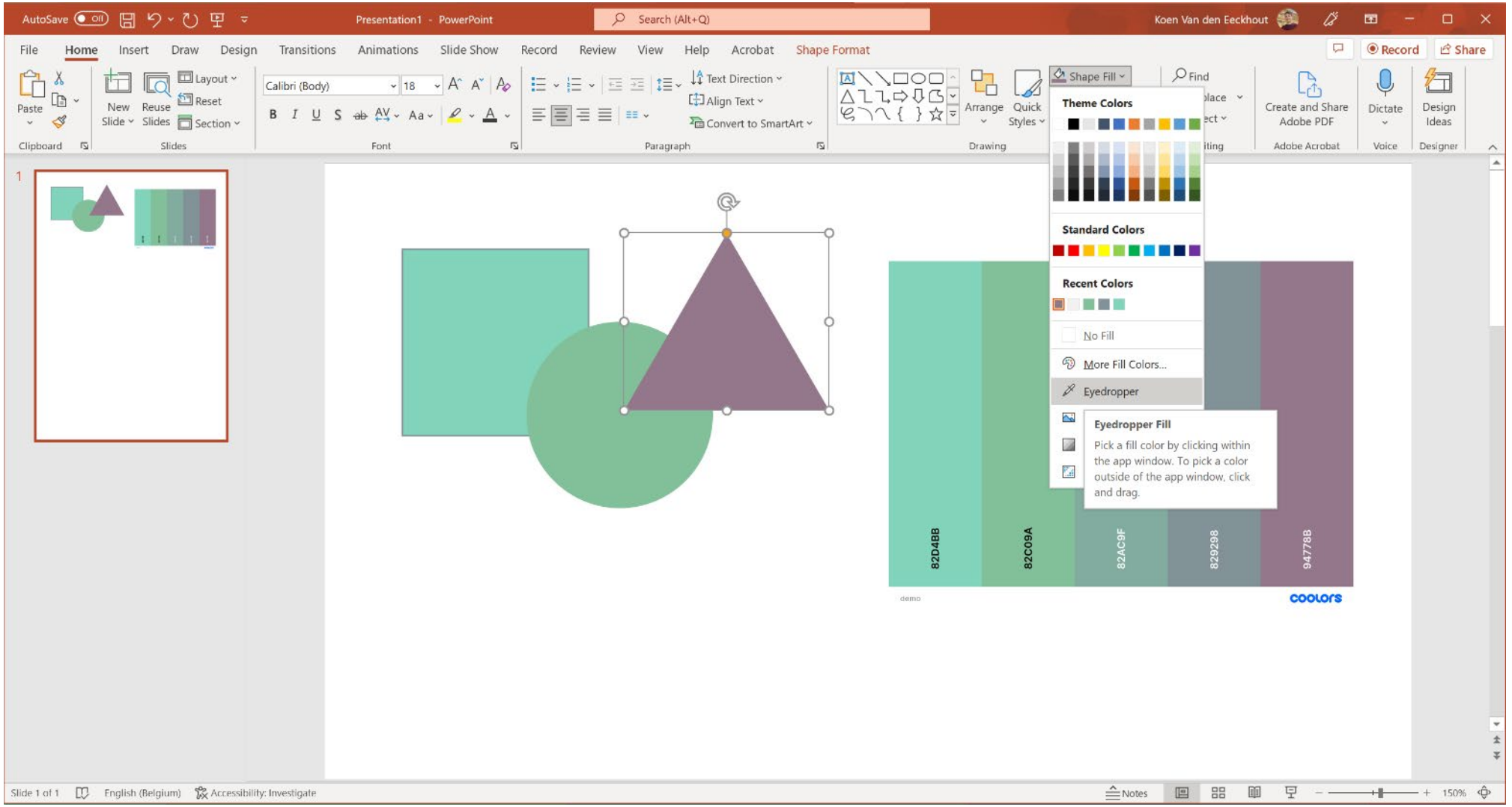


After inserting an svg image, use **Convert to Shape** to turn it into an editable group of objects

(make sure your version of PowerPoint is up to date)



Similar to Inkscape, you can group objects to keep them together



Quick tip: to use a color scheme (e.g. from Coolors):

- insert the color scheme image
- use the **Eyedropper** tool
- you can remove the image afterwards, PowerPoint will remember your recently used colors
- or use ‘More Fill Colors’ to enter the exact color values

Freemium drag-and-drop tools

Canva

canva.com

lots of templates, fonts, images,... - also in free version

limited chart options

paid version:
€ 110/year

Infogram

infogram.com

better for charts, even real-time/interactive

no downloads in free version

paid version:
$ 228/year

Piktochart

piktochart.com

pretty complete for starters, good chart options

limited number of visuals and downloads in free version

paid version:
€ 168/year

educational license: € 40/year

Visme

visme.co

pretty complete for starters, good chart options

no downloads in free version

paid version:
$ 147/year

Exercise: creating a poster

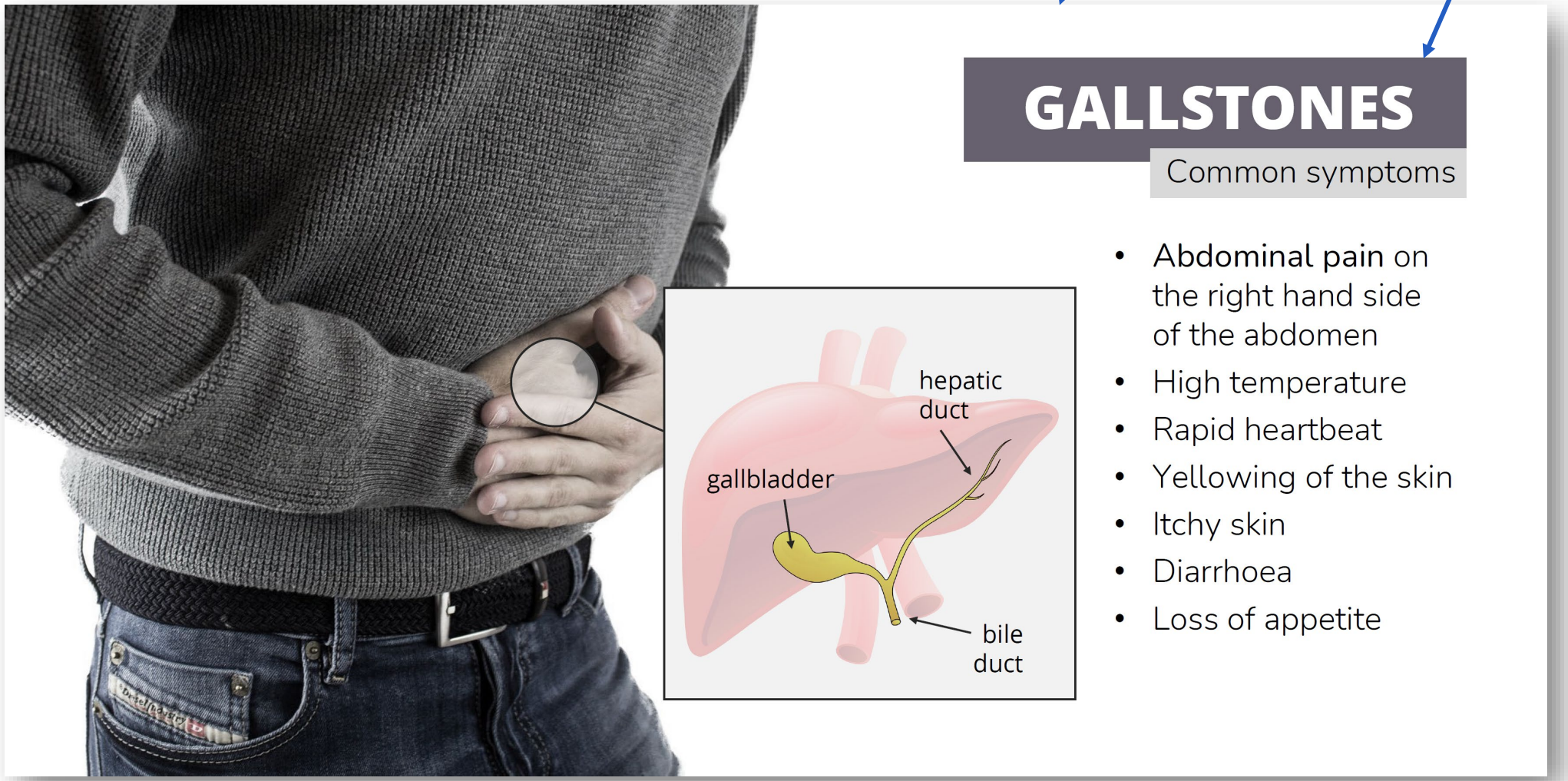
Use **Powerpoint, Inkscape** or **Paint.NET** to mimic this poster as closely as possible

Canvas size: 40 x 20 cm

Color: #1e152a, 30% transparent

Photo from Pixabay

lower the saturation!



Open Sans Extrabold

Nunito light

Save as a pdf!

Exercise: your own graphical abstract

Revisit the sketched concept you prepared for this class, and the key message you wrote down during the exercise last week.

Also think of additional visual material you could create using bitmap or vector image editing tools!

Turn your sketch into a digital version using some of the tools we discussed.

If relevant, find and use an appropriate color scheme.

Make sure to add strong labels, annotations and captions to make the graphical abstract easy to read.

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Guidelines for graphs

define your goal

What do we want to show?

comparison

part-to-whole comparison

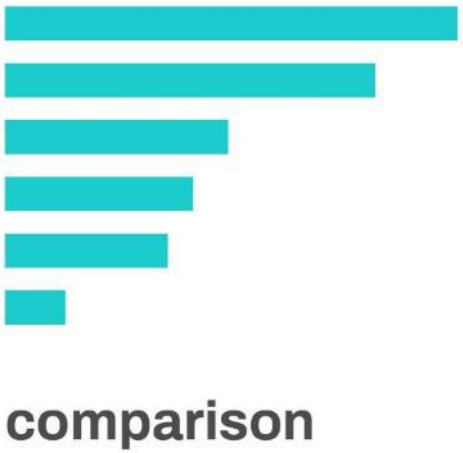
distribution

spatial distribution

correlation

evolution

hierarchy



What do we want to show?

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evolution

hierarchy

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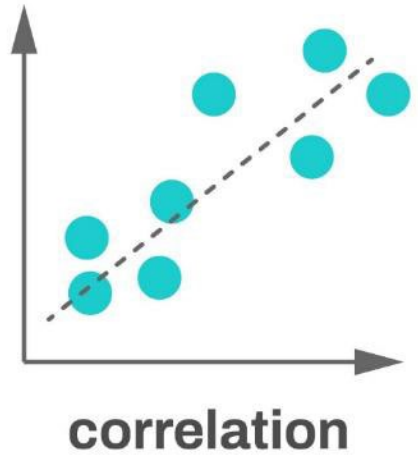
hierarchy



What do we want to show?

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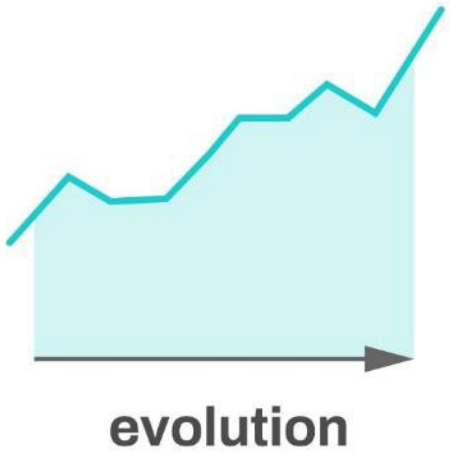
hierarchy



What do we want to show?

comparison

part-to-whole comparison

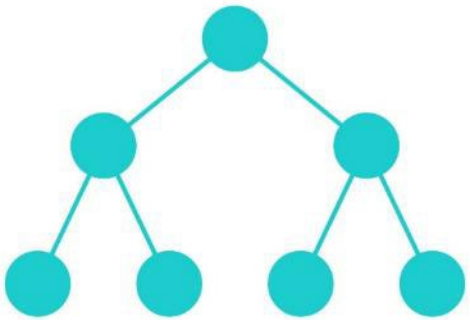
distribution

spatial distribution

correlation

evolution

hierarchy



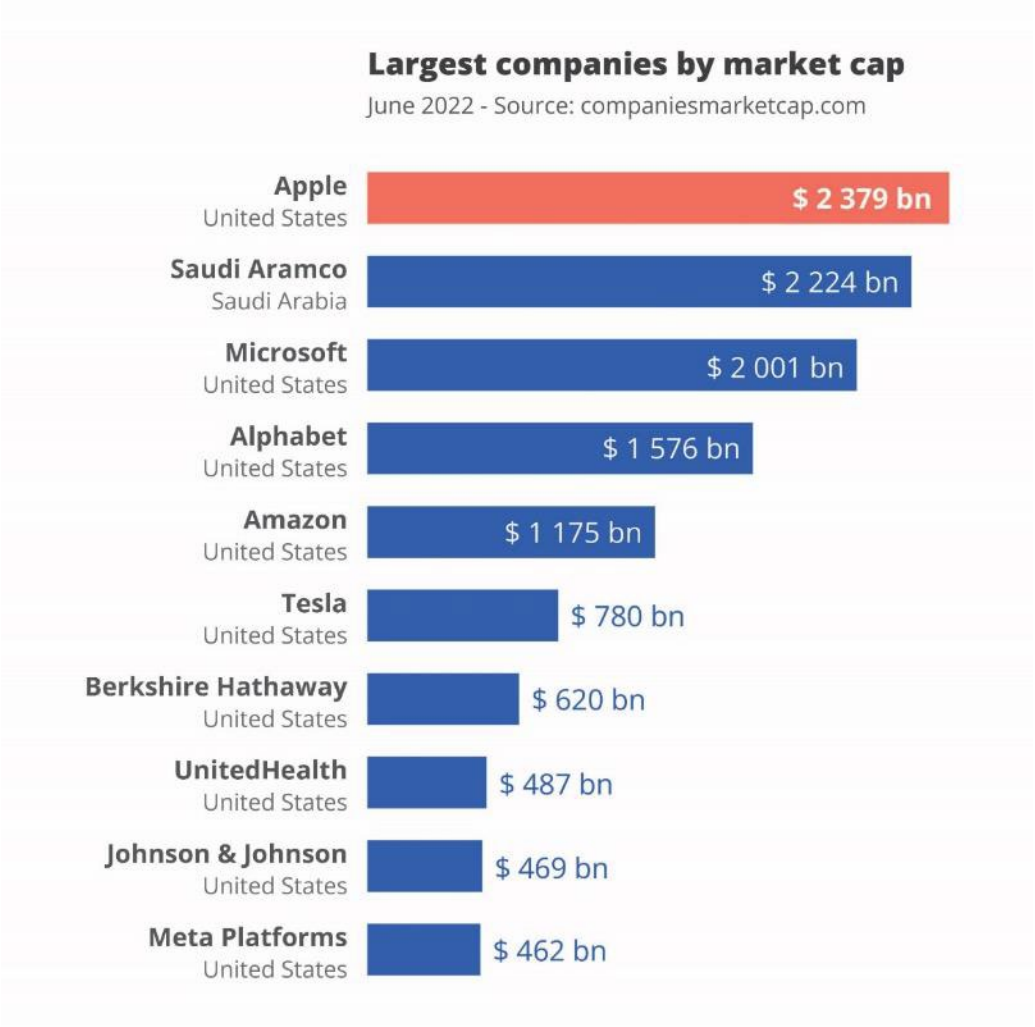
hierarchy

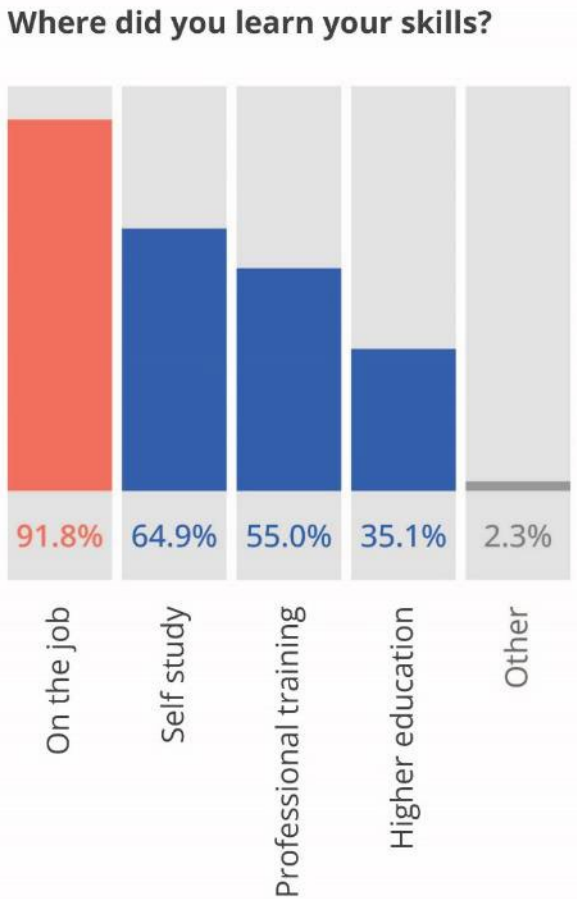

1) Choose your chart
What would you like to show?
categories
time
part to whole
distribution
geospatial
relationship
exact value
barchart
grouped bar
diverging stacked bar
deviation bar
floating bar
stacked bar
panel bar
lollipop
dumbbell
proportional
x/y coordinate plot
vertical waterfall
bullet graph
parallel coordinate
pictograph
wordcloud
radial column
radial bar
radar chart
gauge
line chart
dot-line chart
area chart
column chart
stacked column
stacked area
deviation column
deviation line
waterfall
timeline
sparklines
slopegraph
dot plot
cycle plot
horizon graph
100% stacked bar
100% stacked column
100% stacked area
100% bar chart
100% stacked bar
100% stacked column
Sankey diagram
waffle chart
tree map
100% waterfall
parallel set
Marimekko chart
nested area
Pareto chart
pie chart
donut chart
funnel chart
Venn diagram
flow chart
Gantt chart
dot matrix
age distribution
histogram
frequency polygon
error bars
box plot
violin
ridgeplot
route map
symbol map
flow map
chloropeth map
isopleth map
dot map
hexbin map
bubble map
chart on map
organization chart
arc diagram
bump chart
sorted stream graph
heatmap
network diagram
risk map
scatterplot
dendrogram
sunburst
chord diagram
bubble
number
table
deviation box
in bar labeling
Use this chart for
analysing
communicating
monitoring
confusing
2) Design your chart
Let your data speak
do's
don'ts
Show in context
relevant ranking
target or benchmark
Misleading design
cutting of Y axis
multiple Y axis
Support easy comparison
small multiple
gridlines
Beauty over accuracy
3D effect
fluid lines
Visual hierarchie
less is more
emphasize
Too much
more than 4 series
too much or meaningless color
Show and tell
descriptive title
annotation
Hard to read
too much details
align text other than horizontally
Find more tips to choose and design your Perfect Chart at:
www. Chart. Guide /poster
info@Chart Guide
/ChartGuide
@Chart_Guide
/ChartGuide

chart.guide

Common chart types

Bar charts: **comparison**

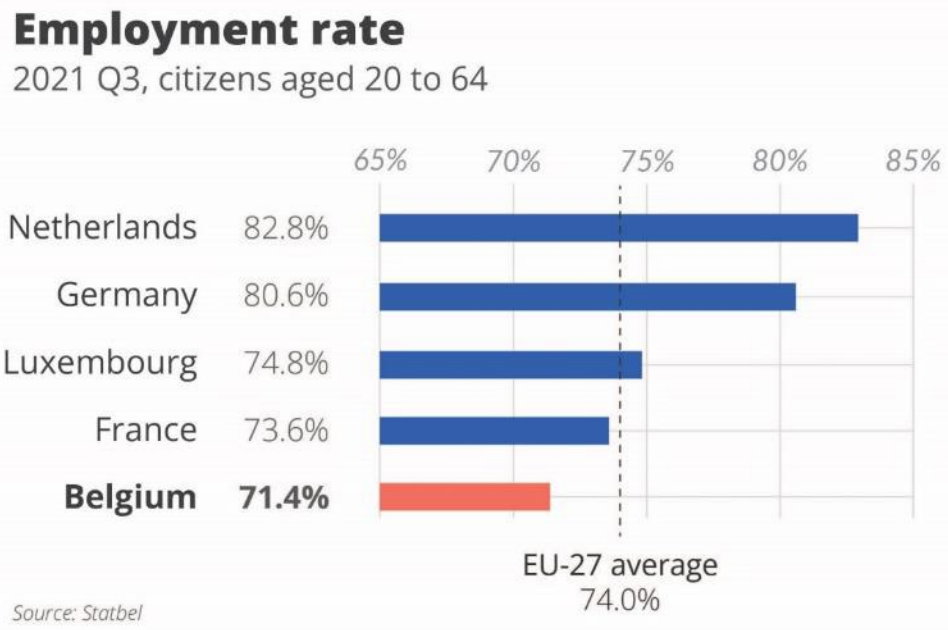


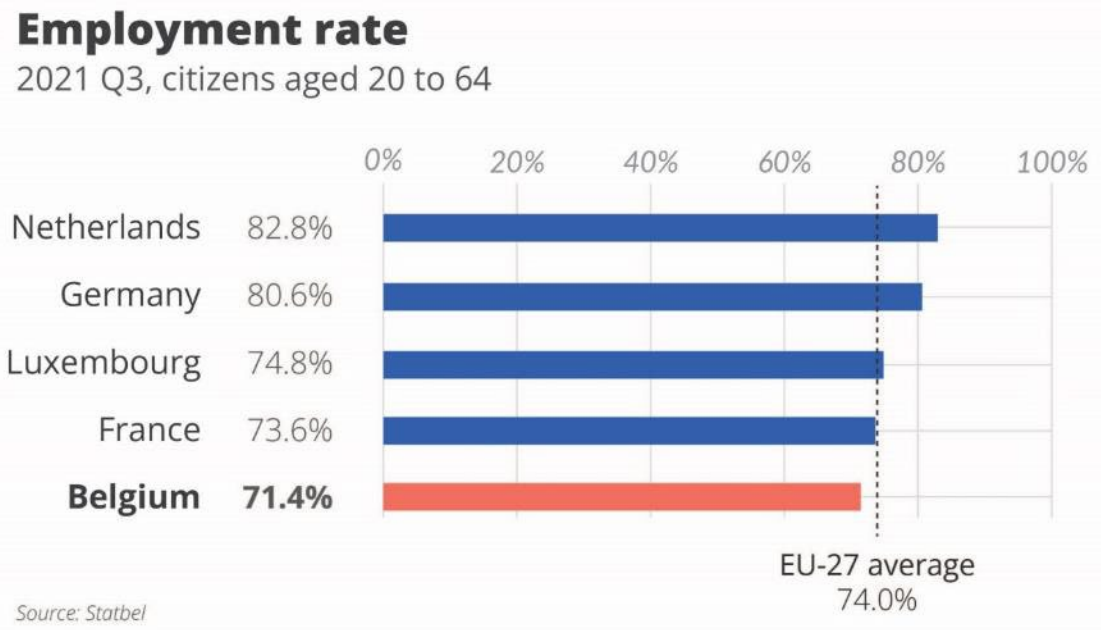

Where did you learn your skills?
91.8%
64.9%
55.0%
35.1%
2.3%
On the job
Self study
Professional training
Higher education
Other


Where did you learn your skills?
On the job
91.8%
Self study
64.9%
Professional training
55.0%
Higher education
35.1%
Other
2.3%

Pitfall

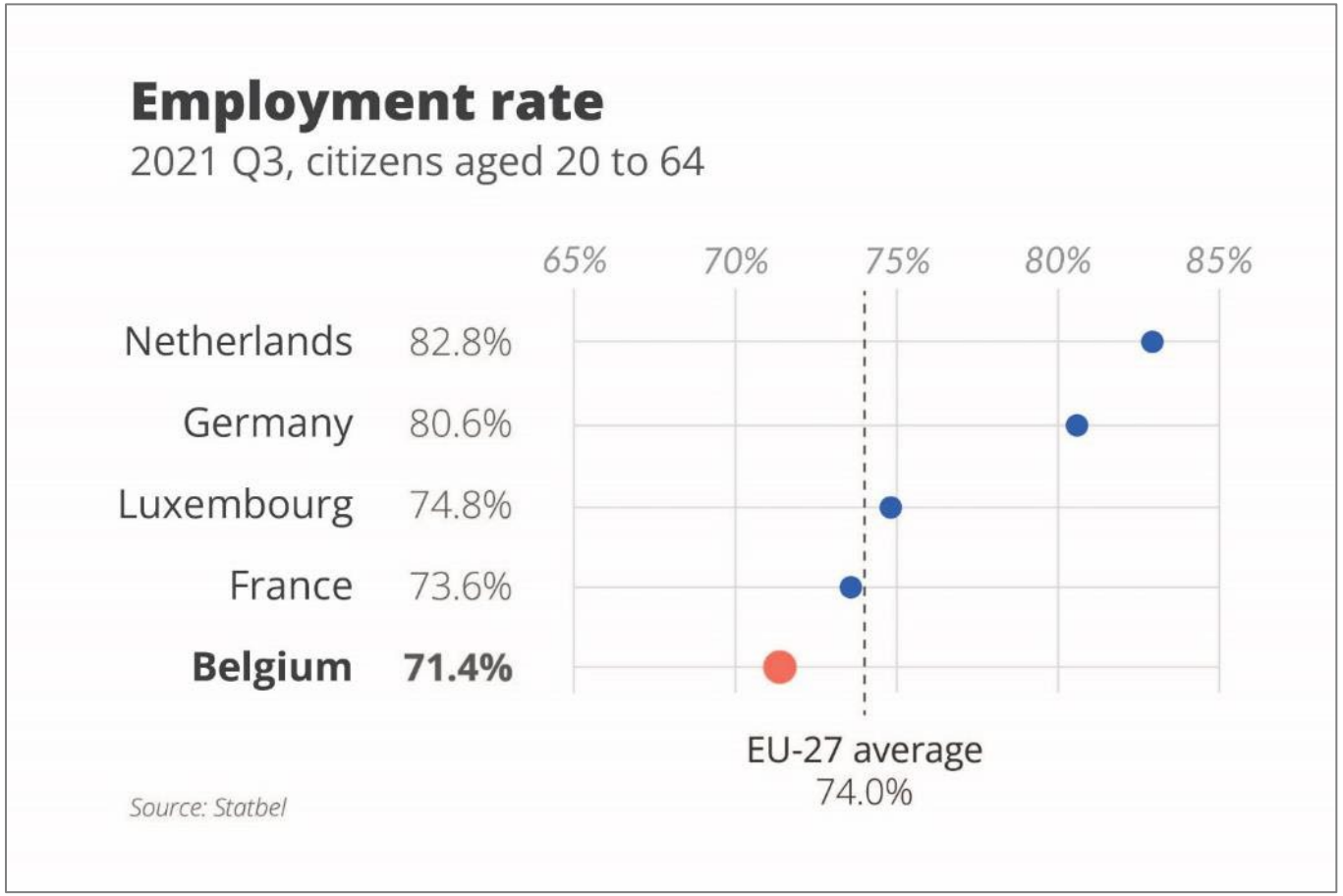
Bar charts not starting from zero





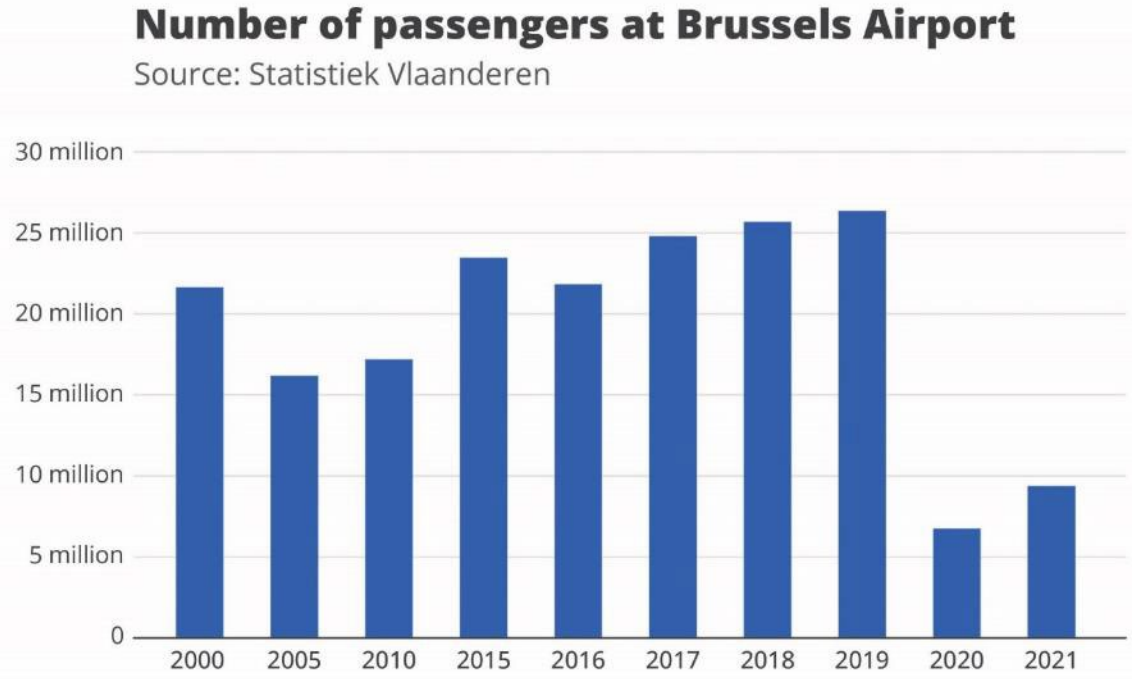
Alternative solution

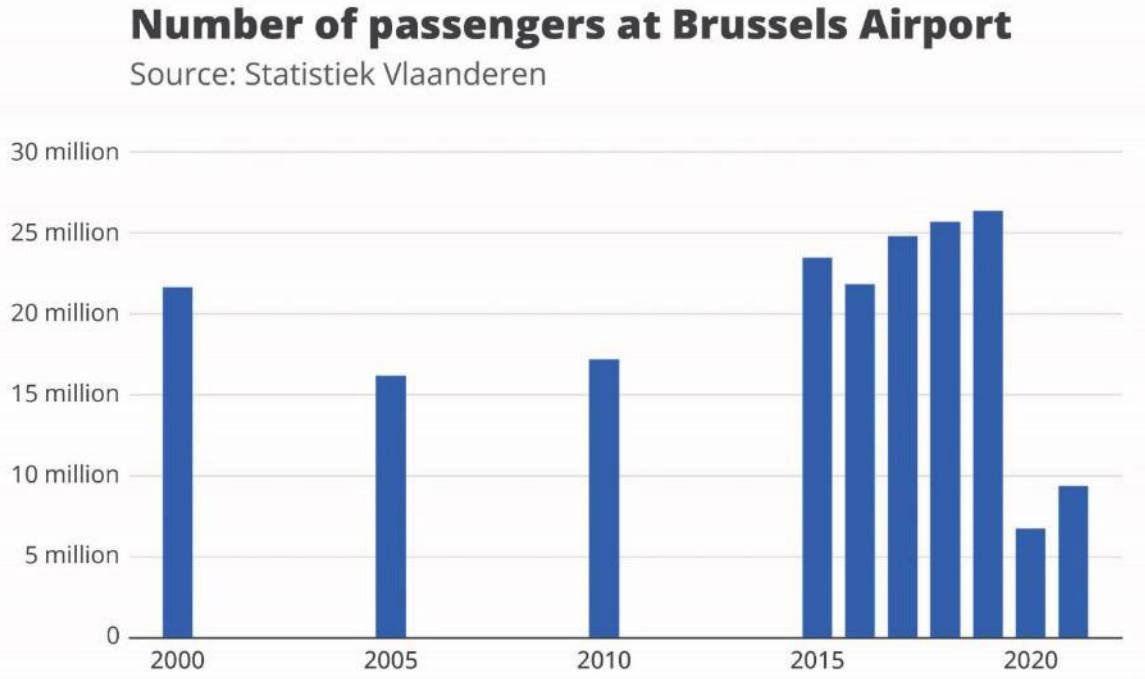
Use a dot plot



Pitfall

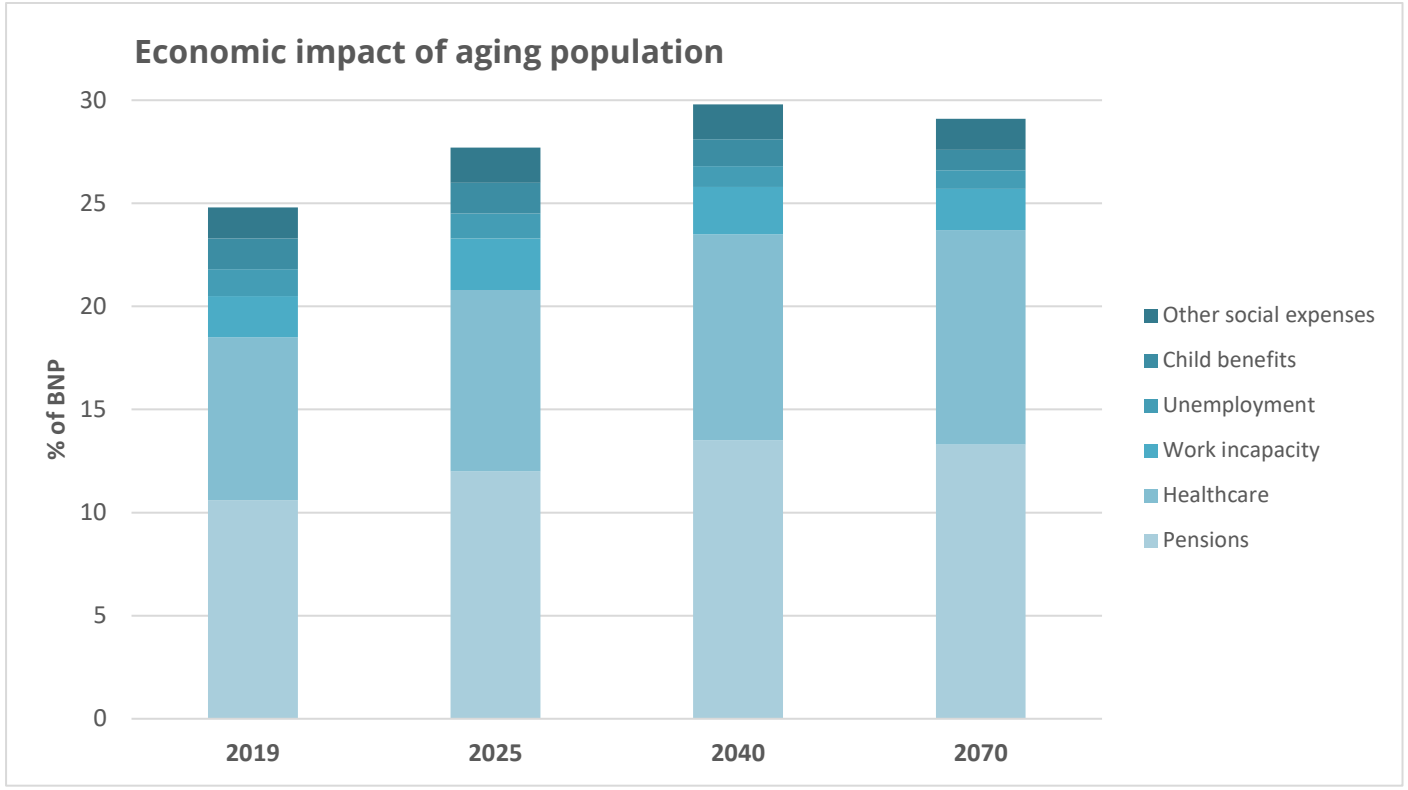
Equidistant labels for non-equidistant data





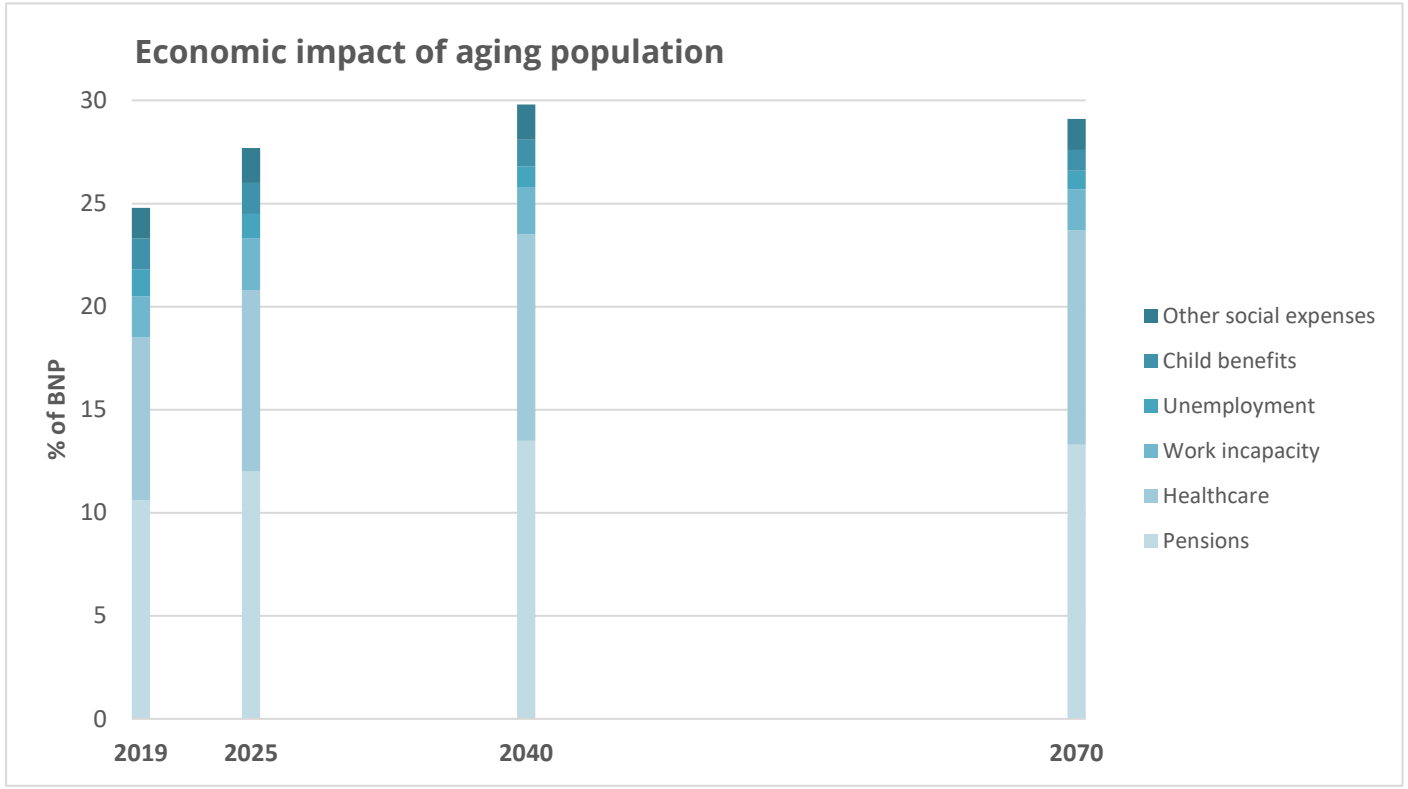
Pitfall

Equidistant labels for non-equidistant data



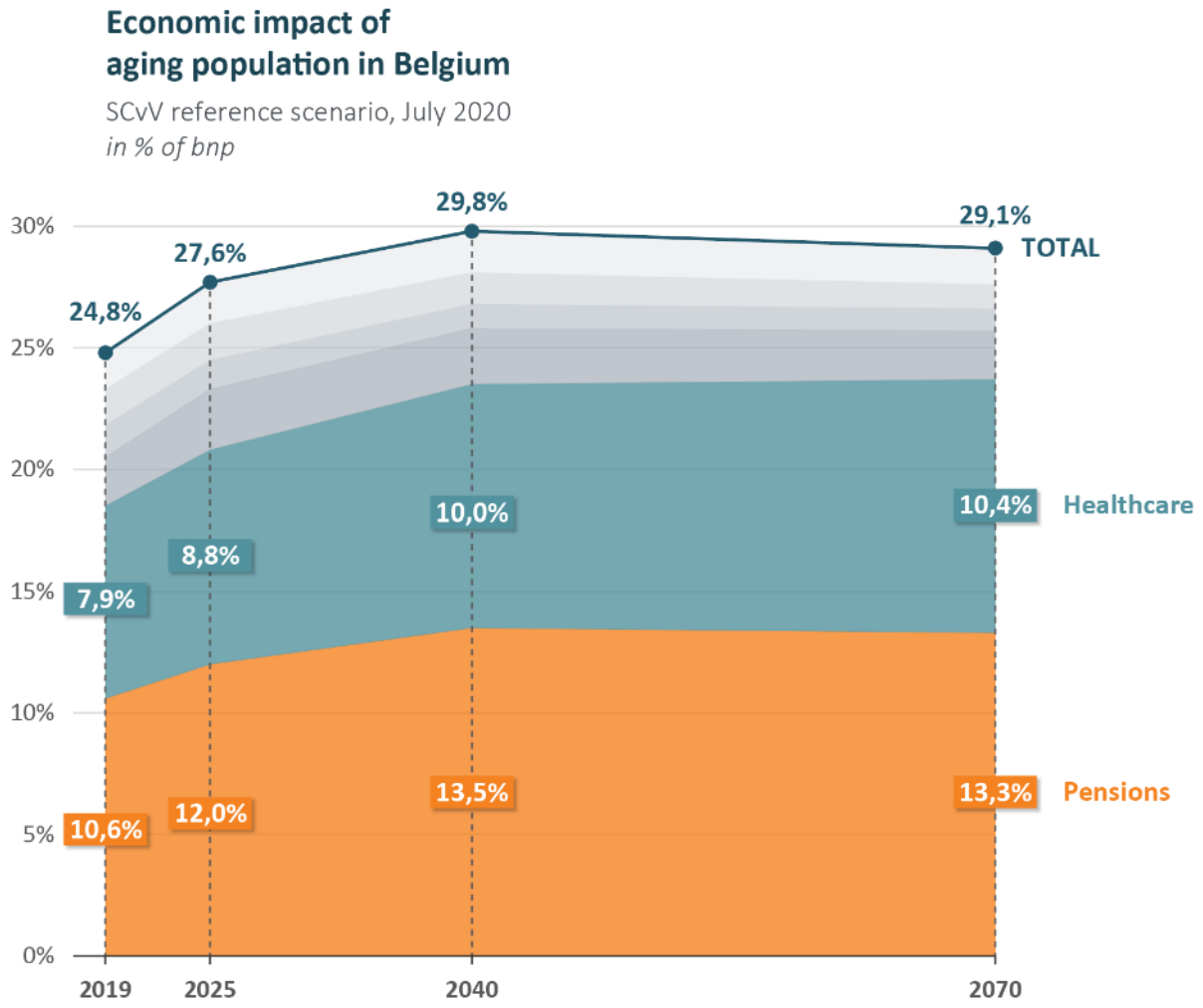
Pitfall

Equidistant labels for non-equidistant data



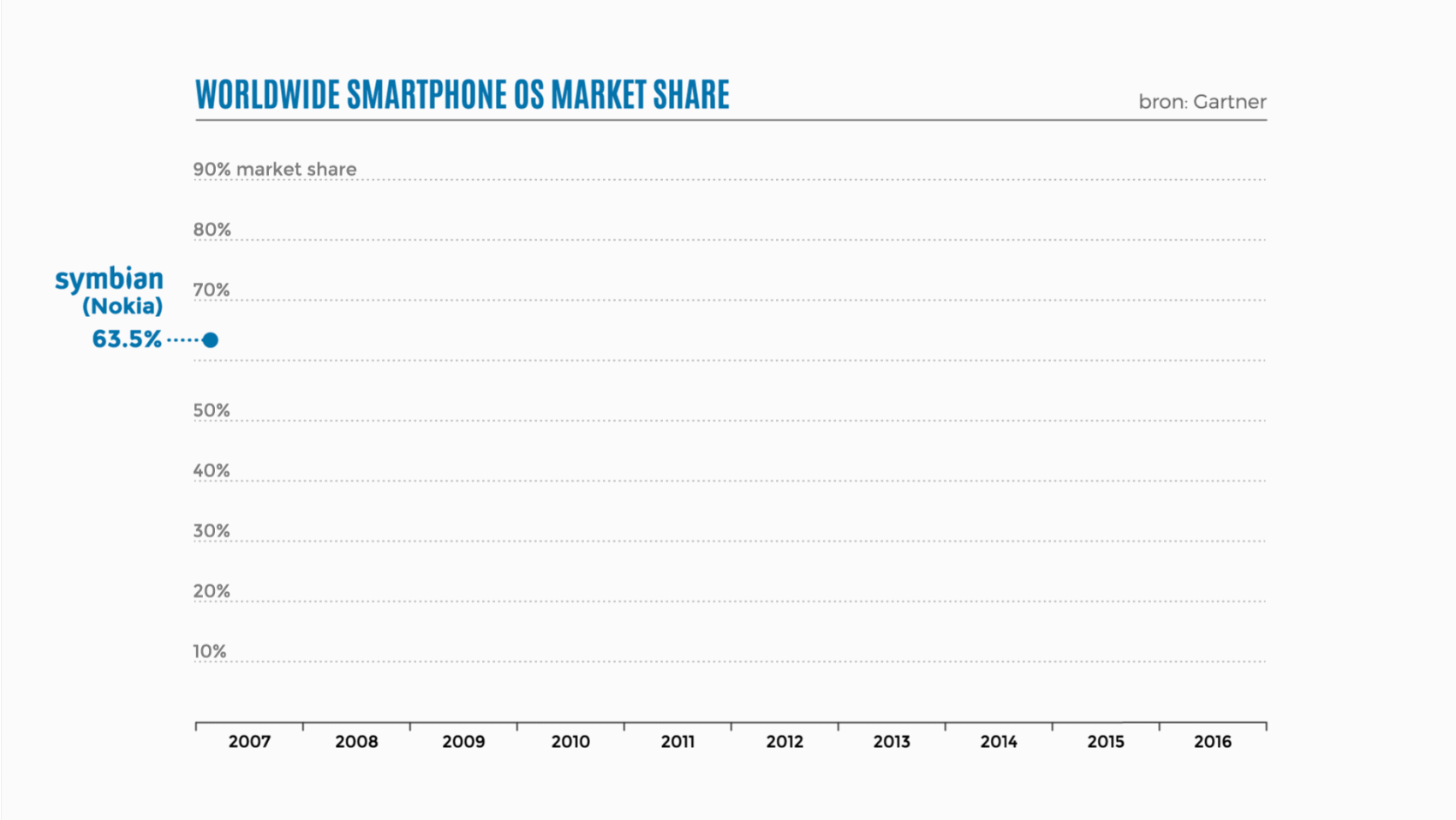
Alternative solution

Use a line or area chart



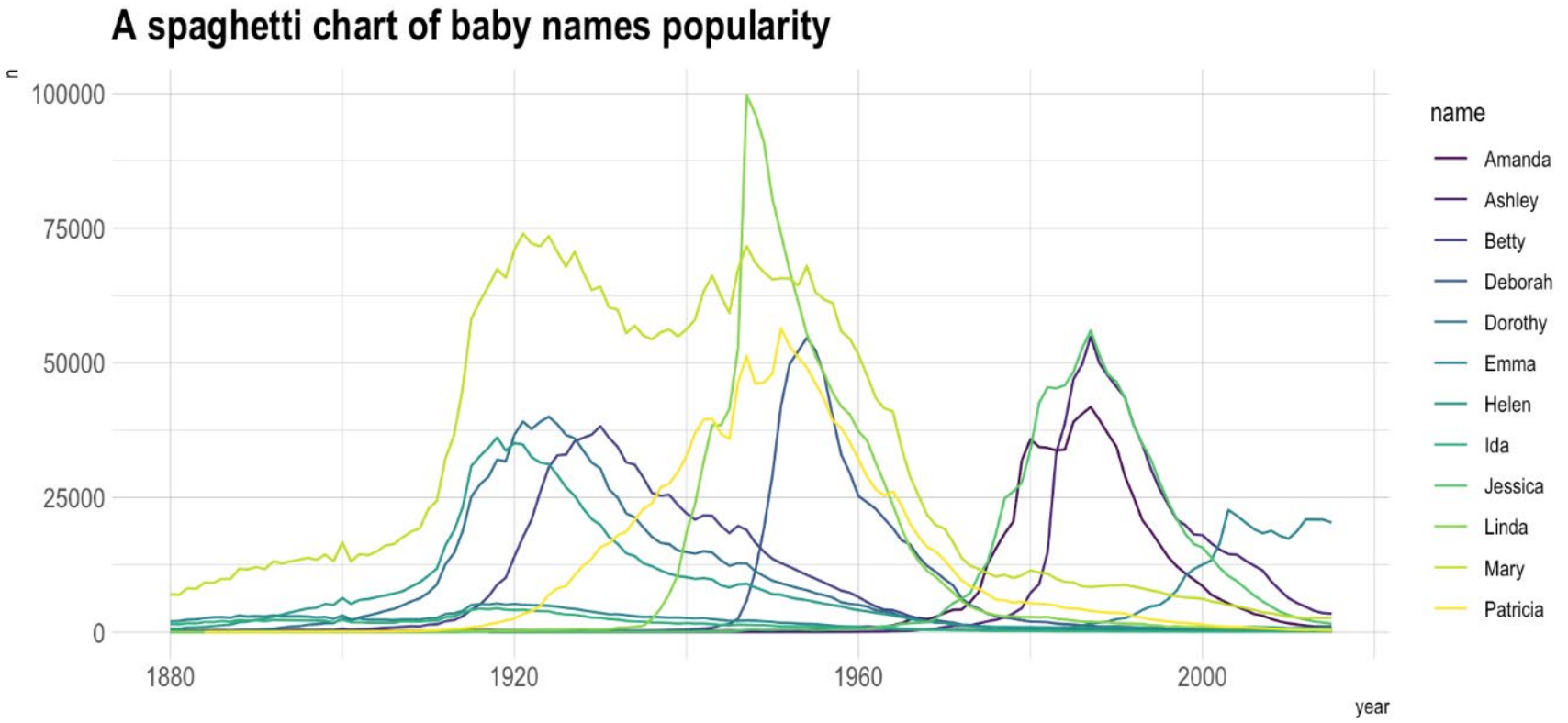
Common chart types

Line charts: **evolution**



Pitfall

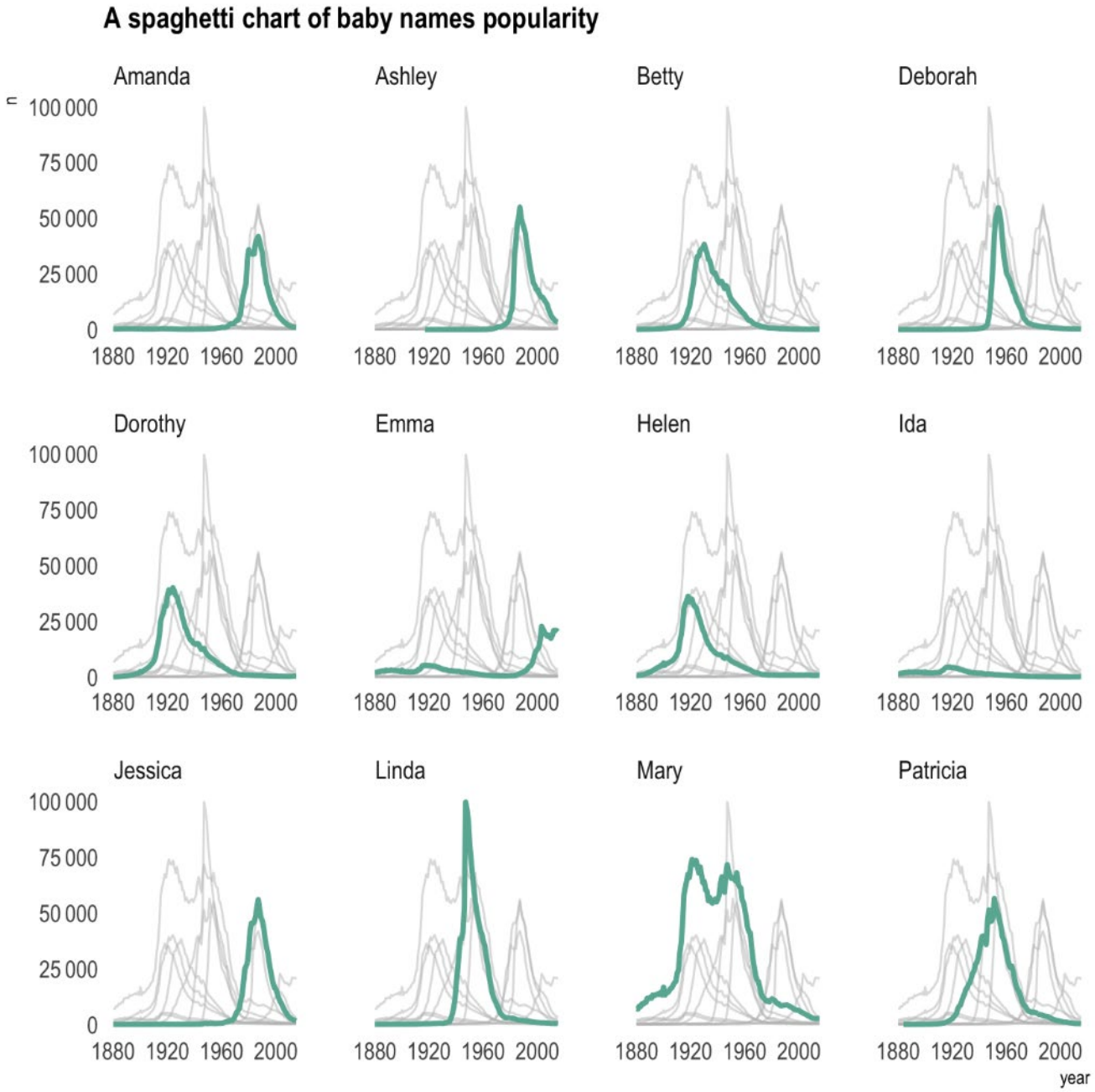
Line chart spaghetti



https://itsmecevi.github.io/dataviz/caveat/spaghetti.html

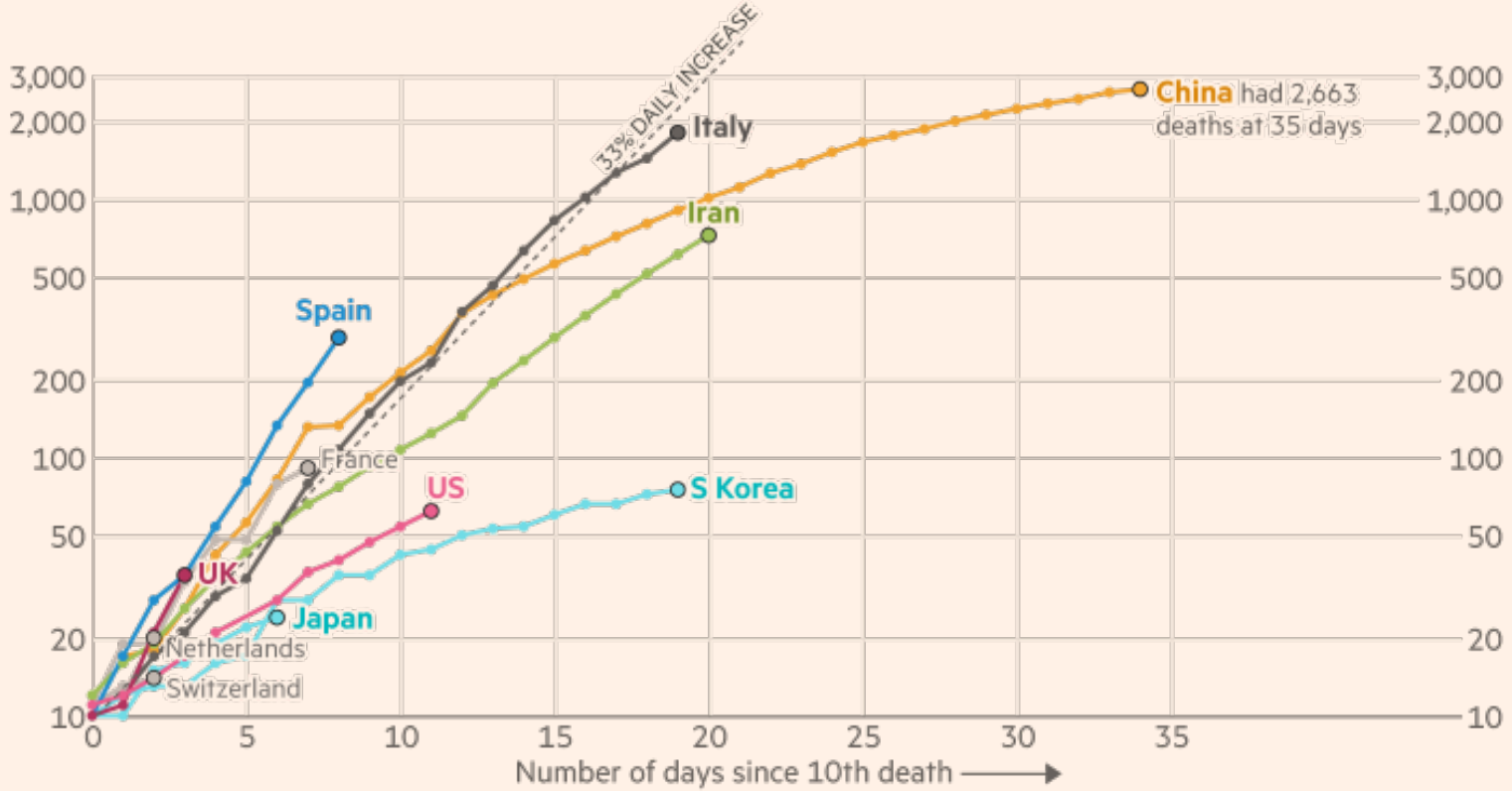
Alternative solution

Make one line stand out



Coronavirus deaths in Italy and Spain are increasing much more rapidly than they did in China

Cumulative number of deaths, by number of days since 10th death

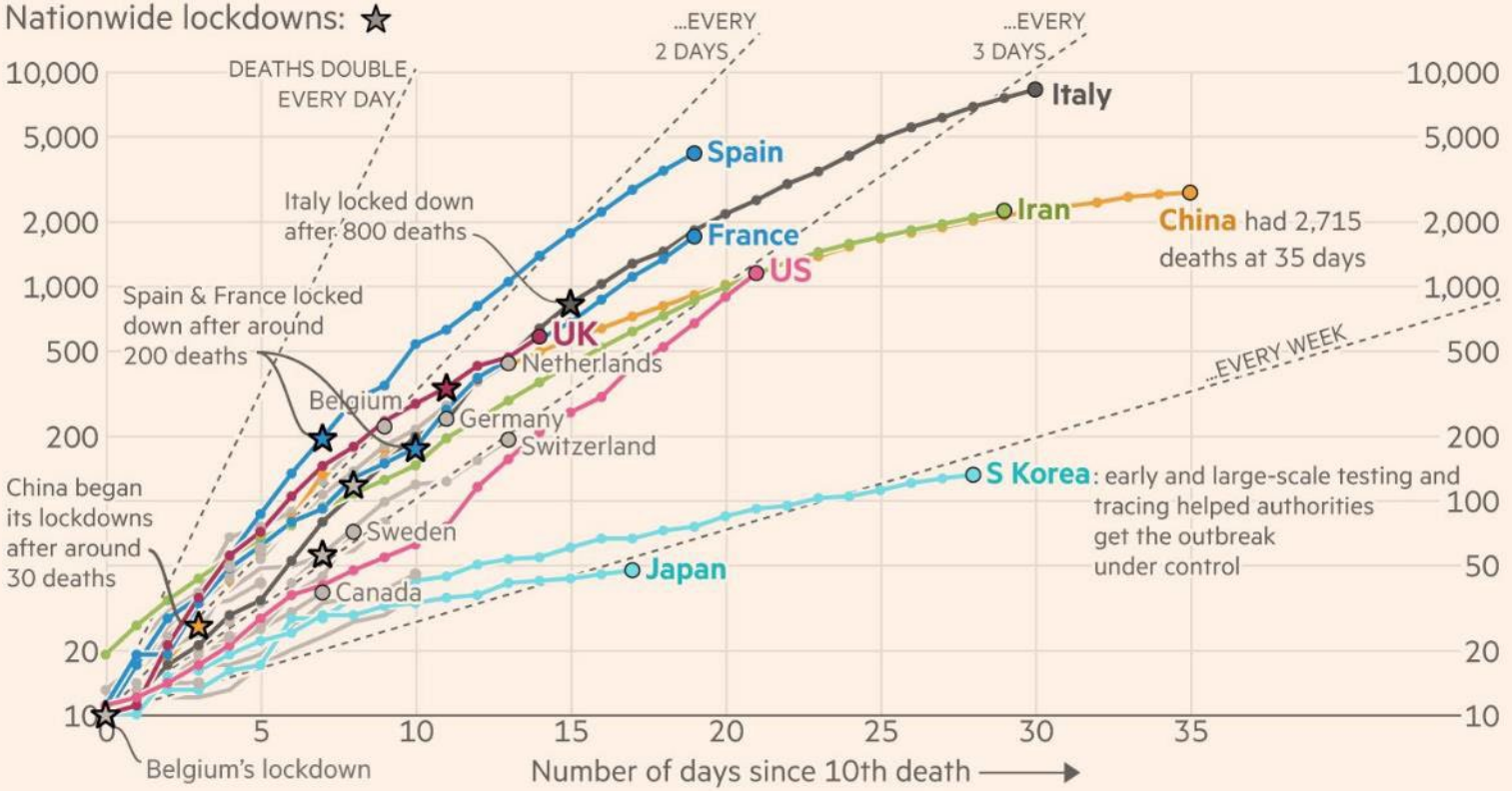


FT graphic: John Burn-Murdoch / @jburnmurdoch
Source: FT analysis of Johns Hopkins University, CSSE. Data updated March 15, 17:00 GMT

Financial Times,
March 15, 2020

Coronavirus deaths in Italy, Spain, the UK and US are increasing more rapidly than they did in China

Cumulative number of deaths, by number of days since 10th death

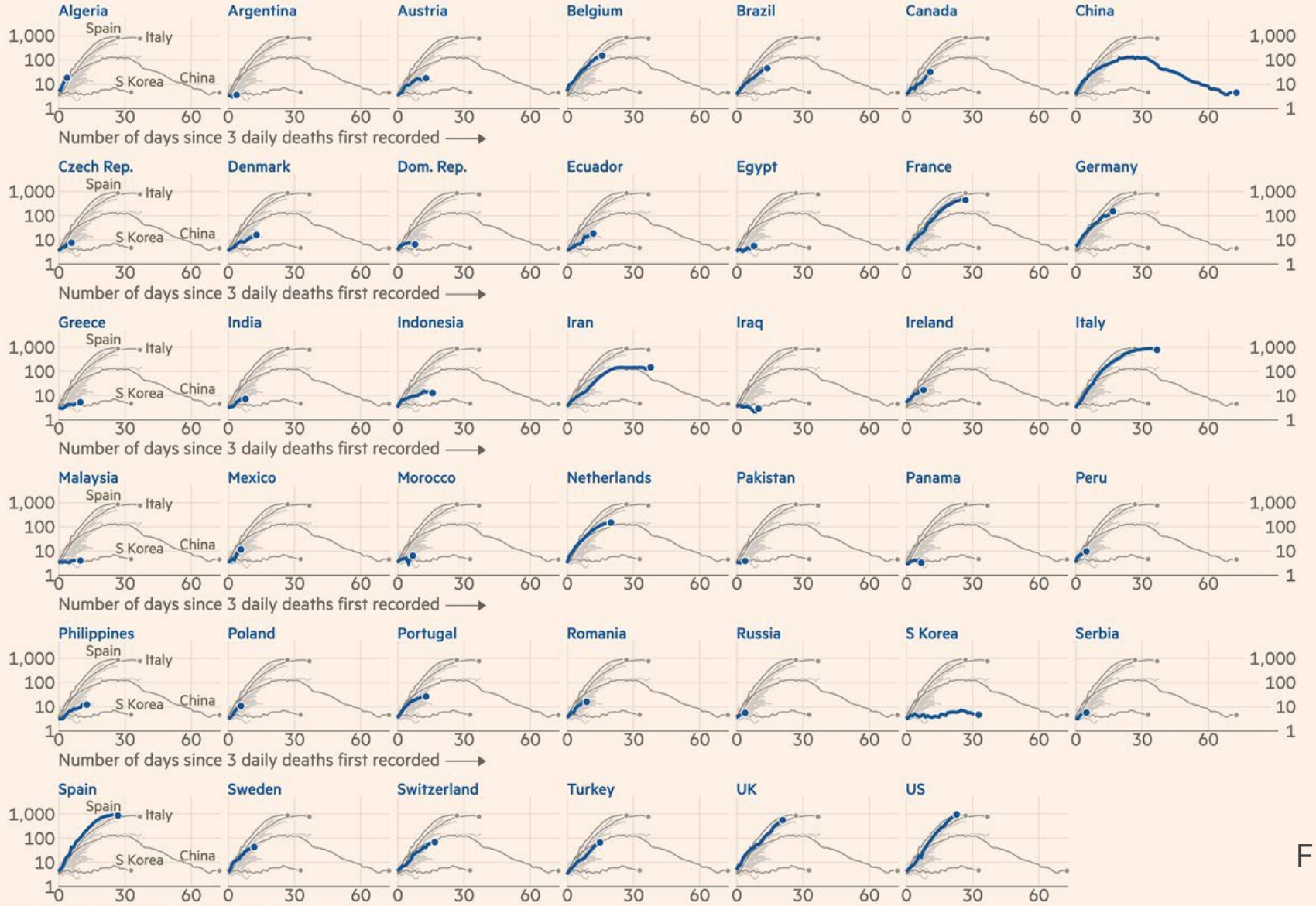


FT graphic: John Burn-Murdoch / @jburnmurdoch
Source: FT analysis of Johns Hopkins University, CSSE; Worldometers; FT research. Data updated March 26, 19:00 GMT

Financial Times,
March 26, 2020

Daily death tolls are still accelerating in most countries

Daily deaths with coronavirus (7-day rolling average), by number of days since 3 daily deaths first recorded

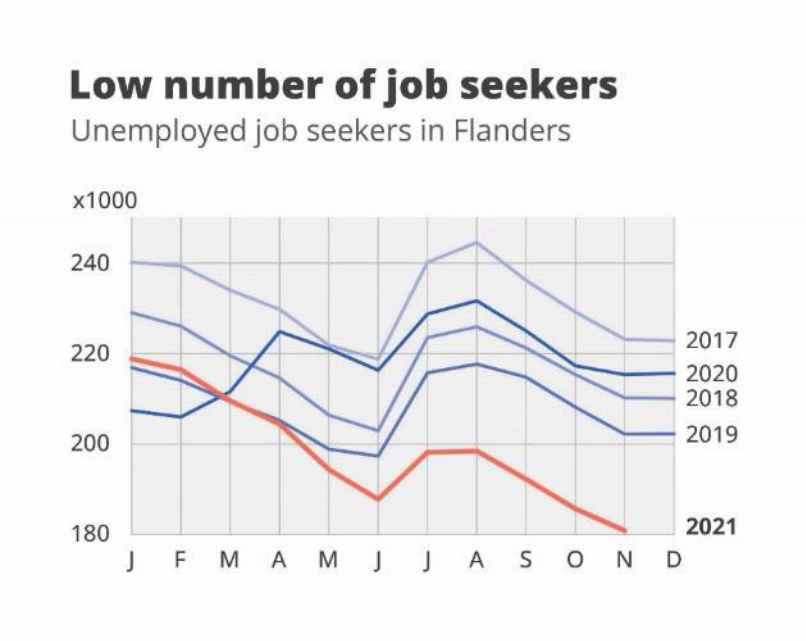


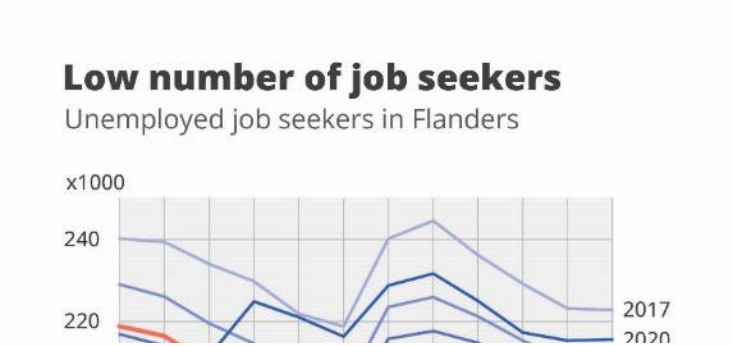
FT graphic: John Burn-Murdoch / @jburnmurdoch
Source: FT analysis of European Centre for Disease Prevention and Control; Worldometers; FT research. Data updated April 05, 19:00 GMT

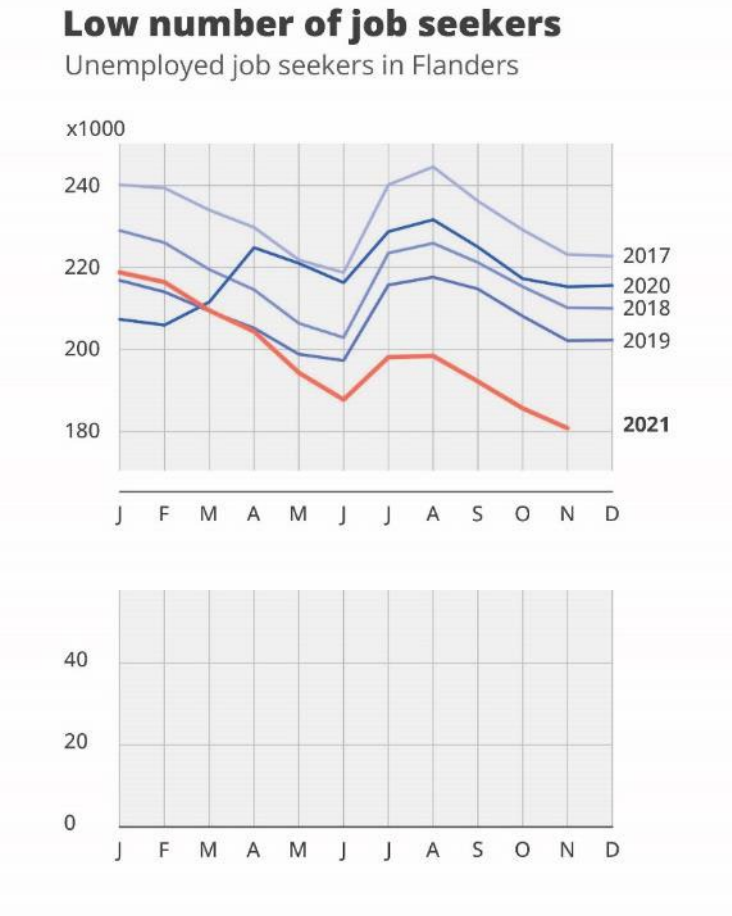
Financial Times,
April 5, 2020

Pitfall

Line charts not starting from zero

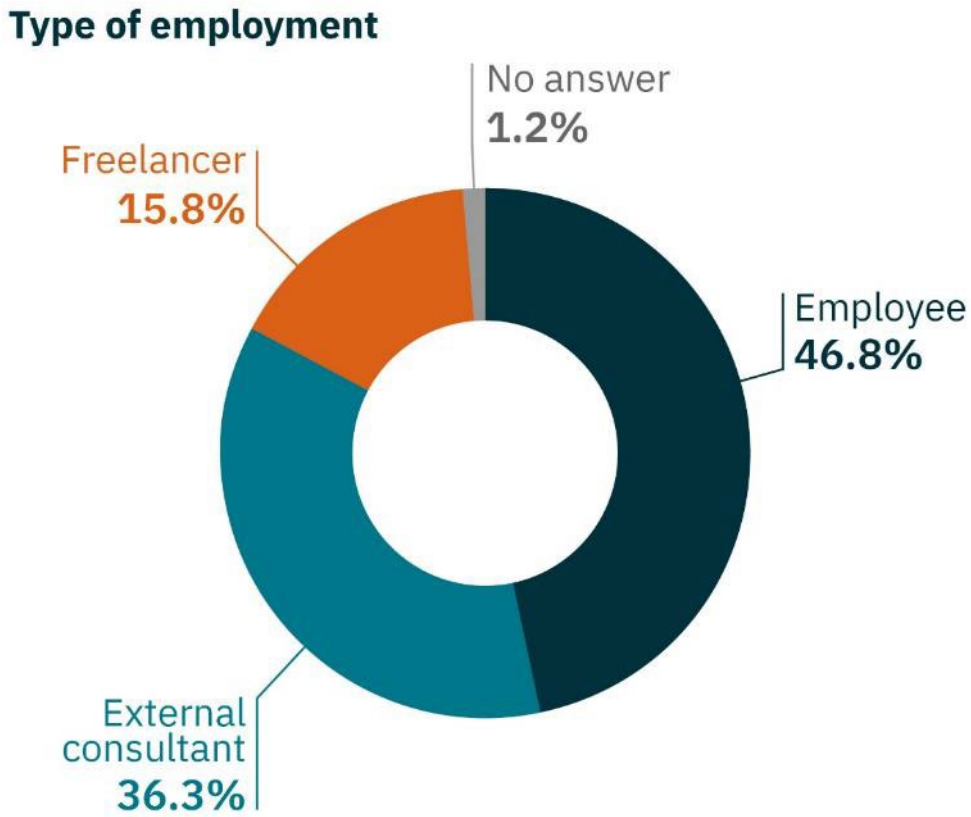






Common chart types

Pie charts: **part-to-whole comparison**

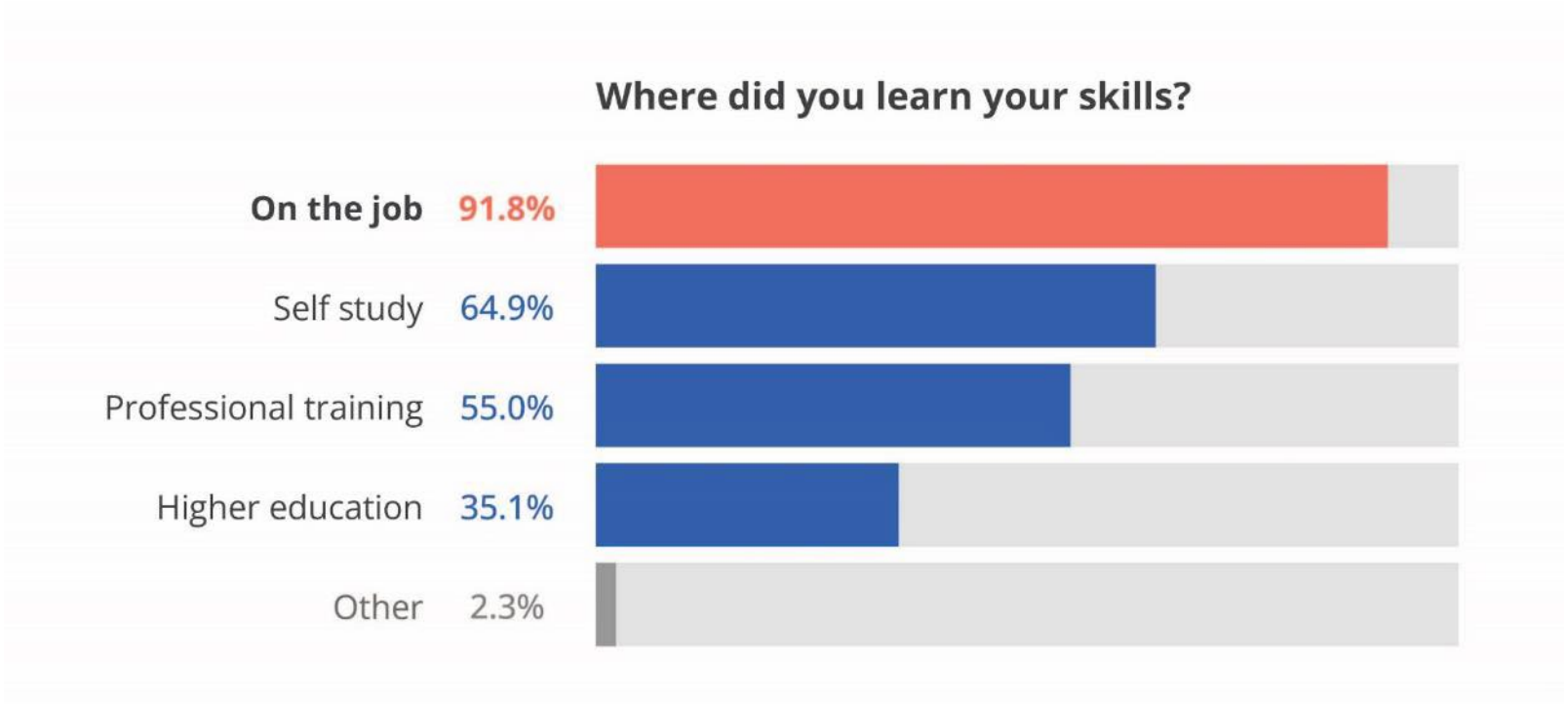


Pitfall

It doesn’t add up

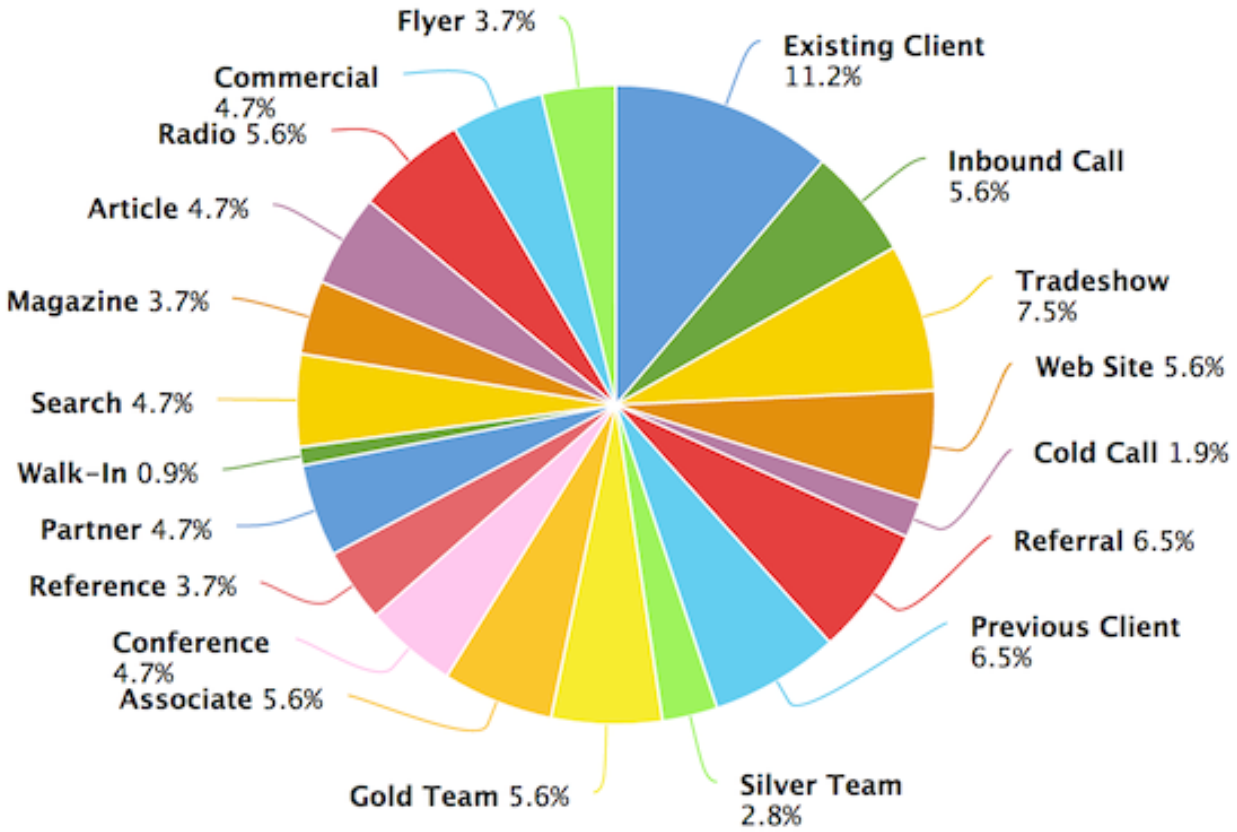
Alternative solution

Use a bar chart



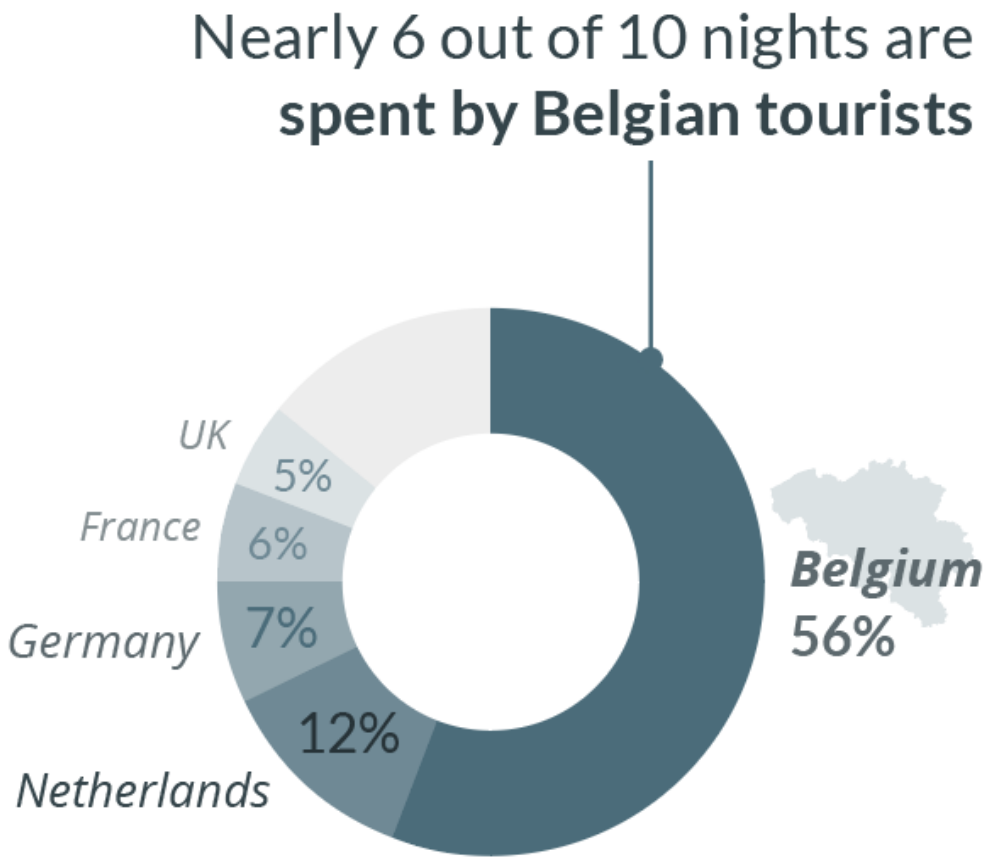
Pitfall

Too many categories



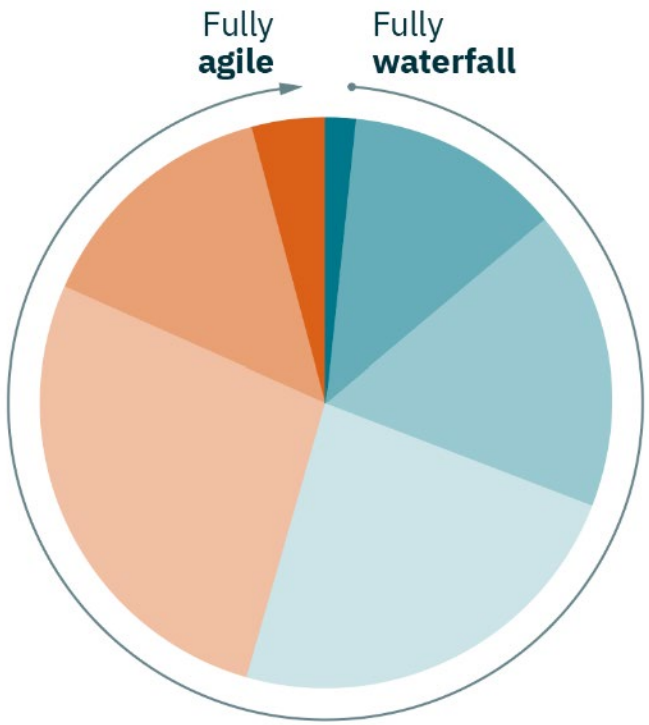
Alternative solution

Group categories together



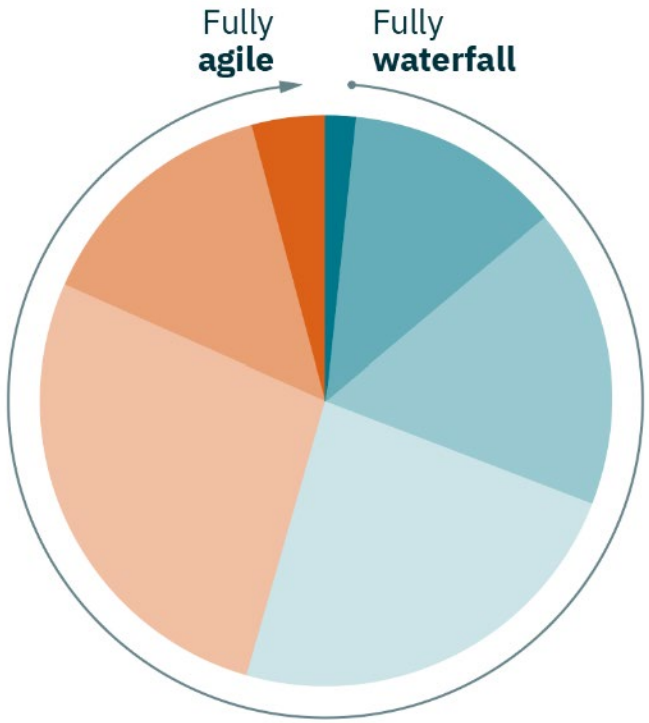
Pitfall

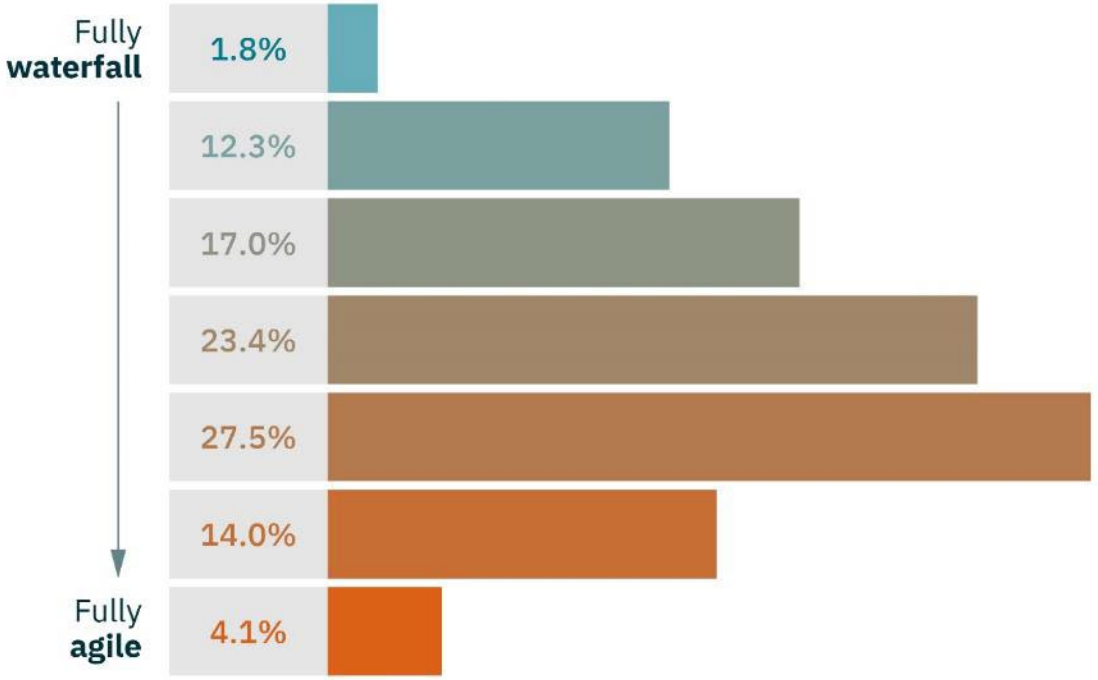
Difficult to compare



Alternative solution

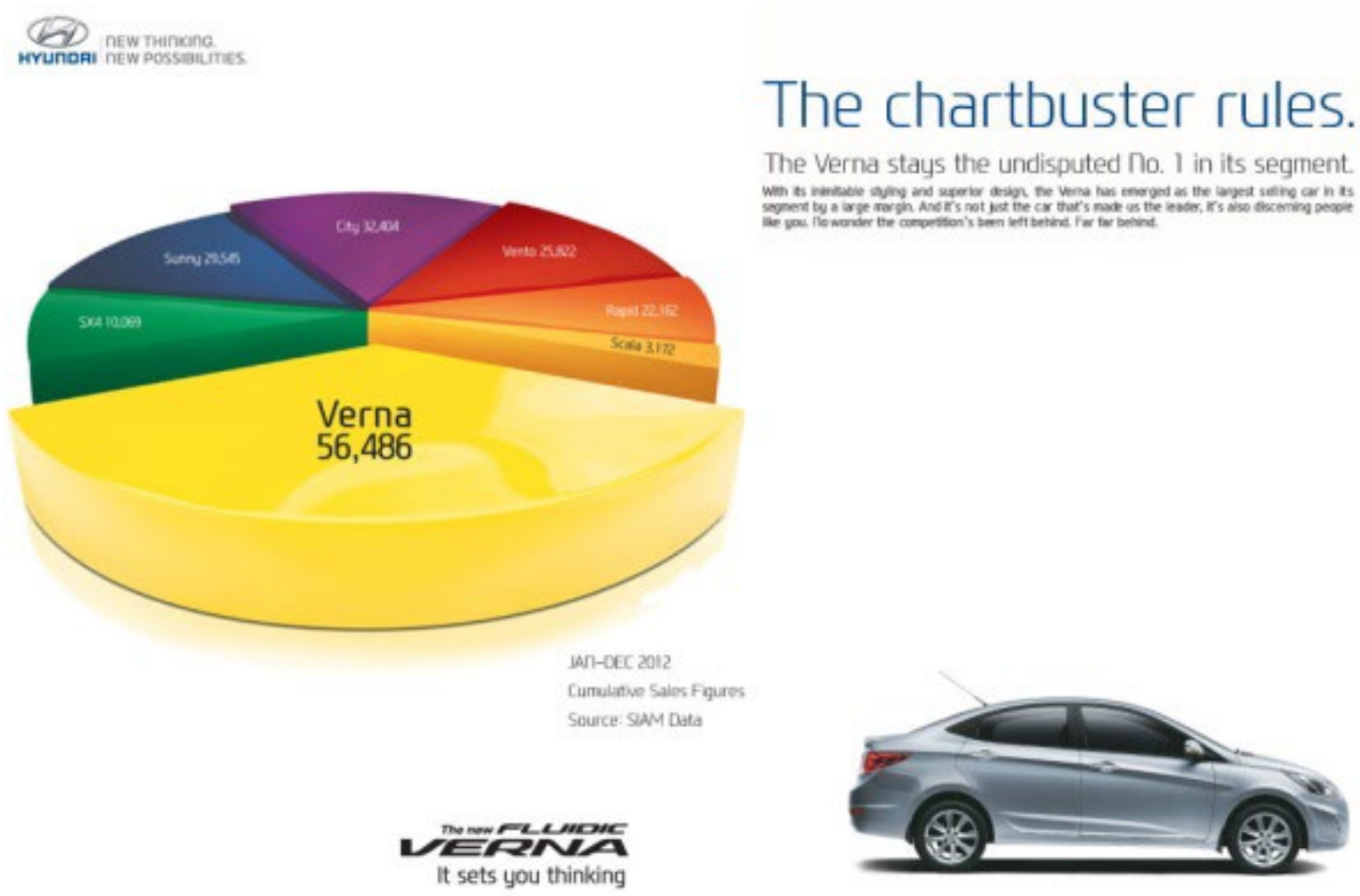
Use a bar chart





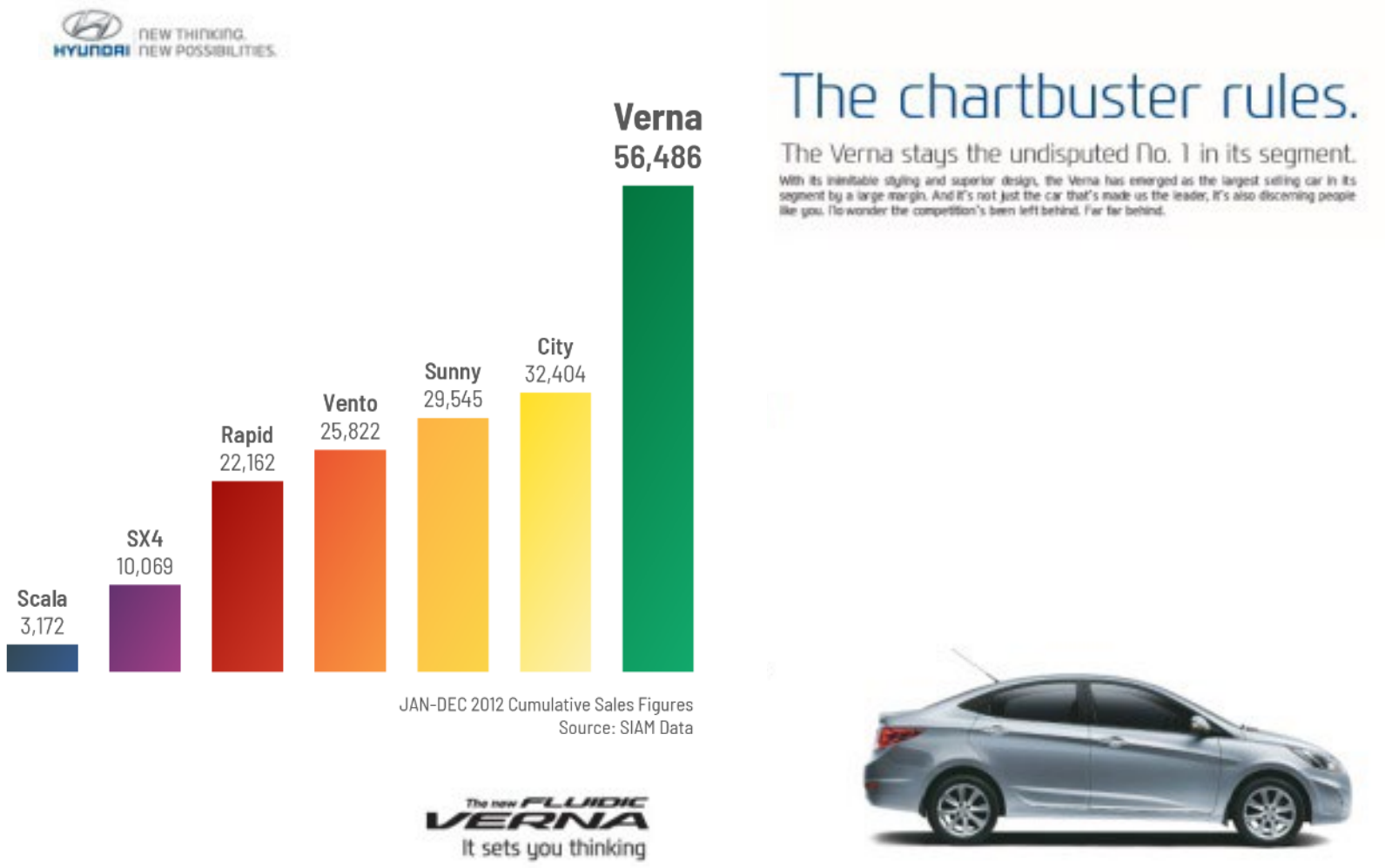
Pitfall

3D pie charts



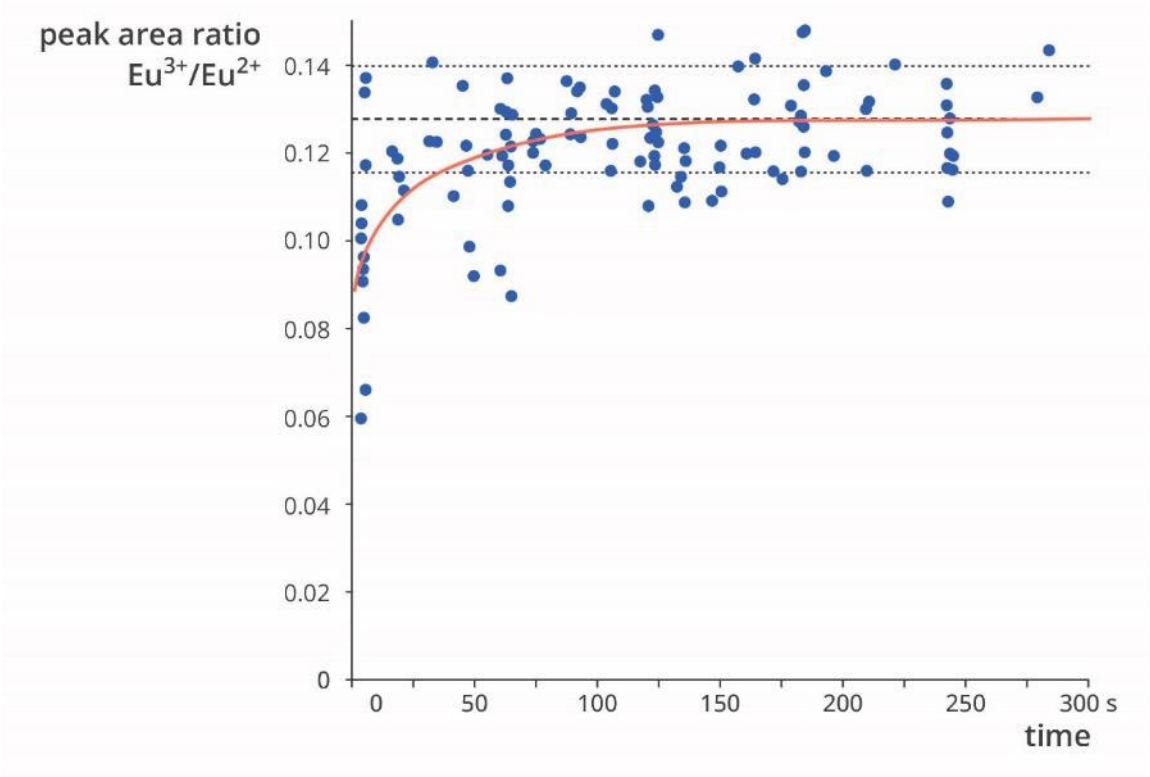
Alternative solution

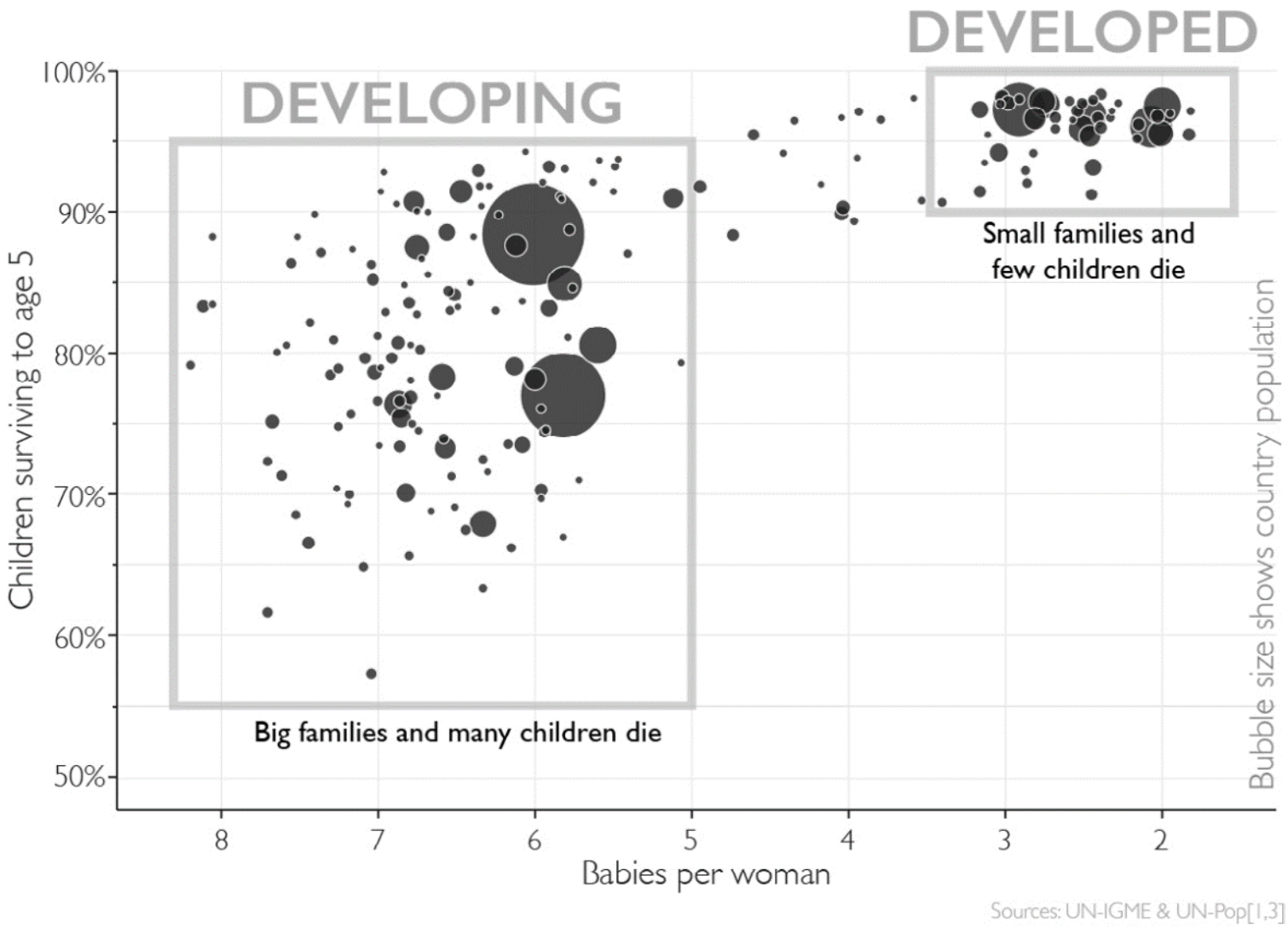
Use a bar chart



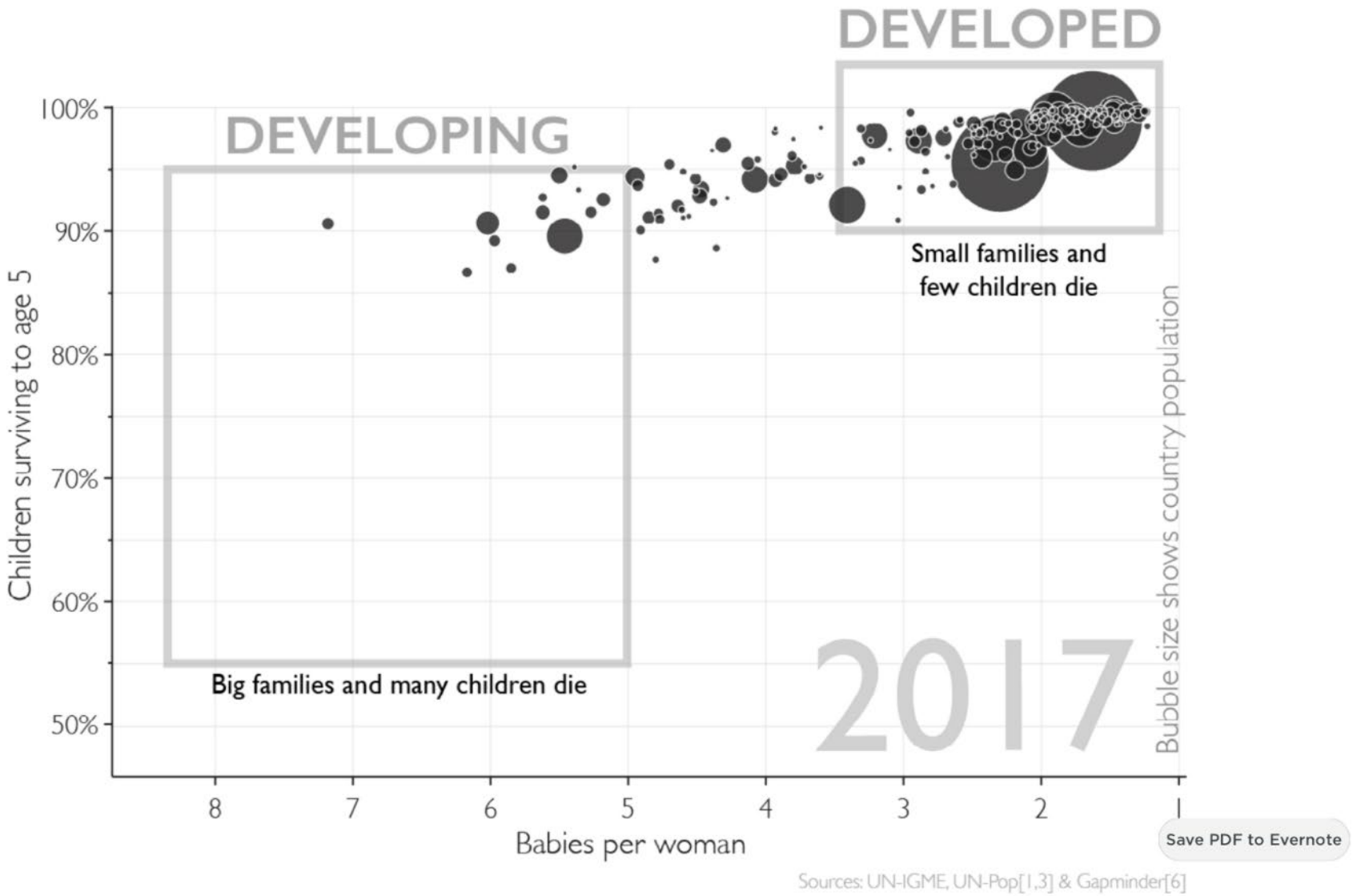
Common chart types

Scatter plots: **correlation** or **distribution**





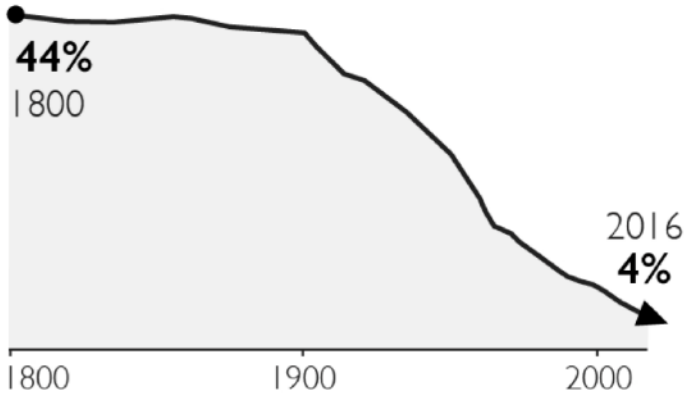
Hans Rosling, Factfulness



Hans Rosling, Factfulness

CHILDREN DYING

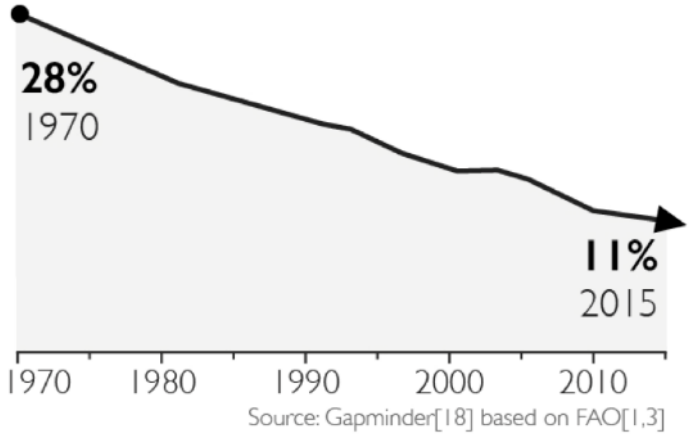
Percent dying before their fifth birthday



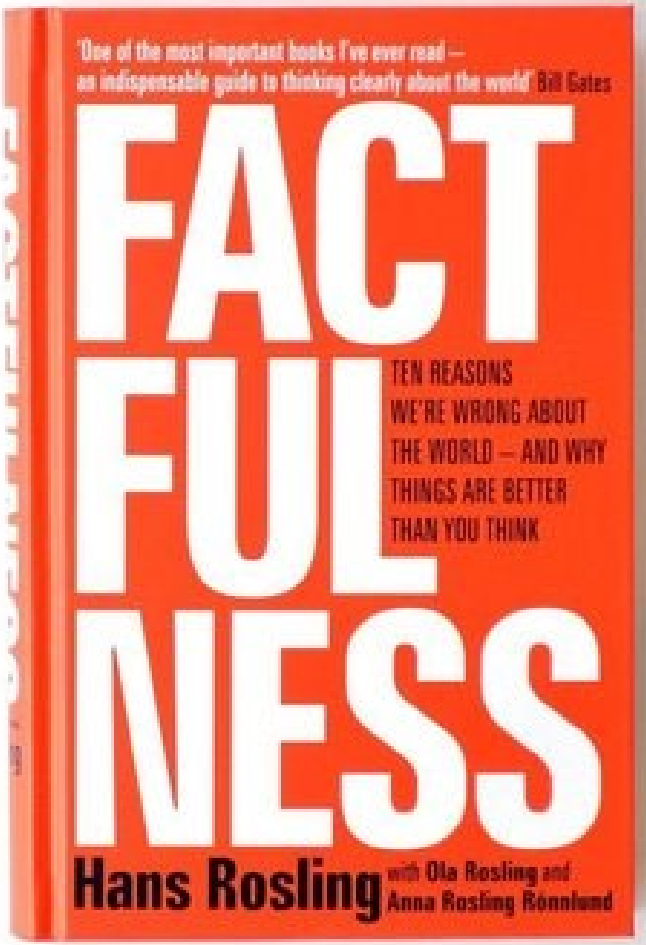
Source: Gapminder[6] based on UN-IGME & HMD

HUNGER

Share of people undernourished



Source: Gapminder[18] based on FAO[1,3]



Guidelines for graphs

define your goal

don’t settle for the default chart

www.datavizcatalogue.com

Treemap

Description

Treemaps are an alternative way of visualising the hierarchical structure of a Tree Diagram while also displaying quantities for each category via area size. Each category is assigned a rectangle area with their subcategory rectangles nested inside of it.

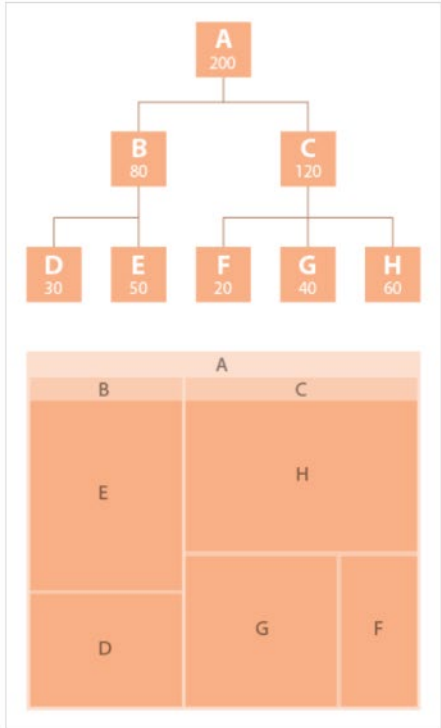
When a quantity is assigned to a category, its area size is displayed in proportion to that quantity and to the other quantities within the same parent category in a part-to-whole relationship. Also, the area size of the parent category is the total of its subcategories. If no quantity is assigned to a subcategory, then it's area is divided equally amongst the other subcategories within its parent category.

The way rectangles are divided and ordered into sub-rectangles is dependent on the tiling algorithm used. Many tiling algorithms have been developed, but the "squarified algorithm" which keeps each rectangle as square as possible is the one commonly used.

Ben Shneiderman originally developed Treemaps as a way of visualising a vast file directory on a computer, without taking up too much space on the screen. This makes Treemaps a more compact and space-efficient option for displaying hierarchies, that gives a quick overview of the structure. Treemaps are also great at comparing the proportions between categories via their area size.

The downside to a Treemap is that it doesn't show the hierarchal levels as clearly as other charts that visualise hierarchal data (such as a Tree Diagram or Sunburst Diagram).

Anatomy



Functions

Comparisons | Hierarchy | Part-to-a-whole | Proportions

Similar Charts


Circle Packing


Marimekko Chart


Sunburst Diagram

Tools to Generate Visualisation

AnyChart (code)
amCharts (code)
D3 (code)
Datamatic
Google Charts (code) or Google Docs
Infogram
jChartFX (JavaScript plugin)
JSCharting (JS Library)
RAWGraphs
Slemma
Vega (code)
Vizzlo
ZingChart (code)

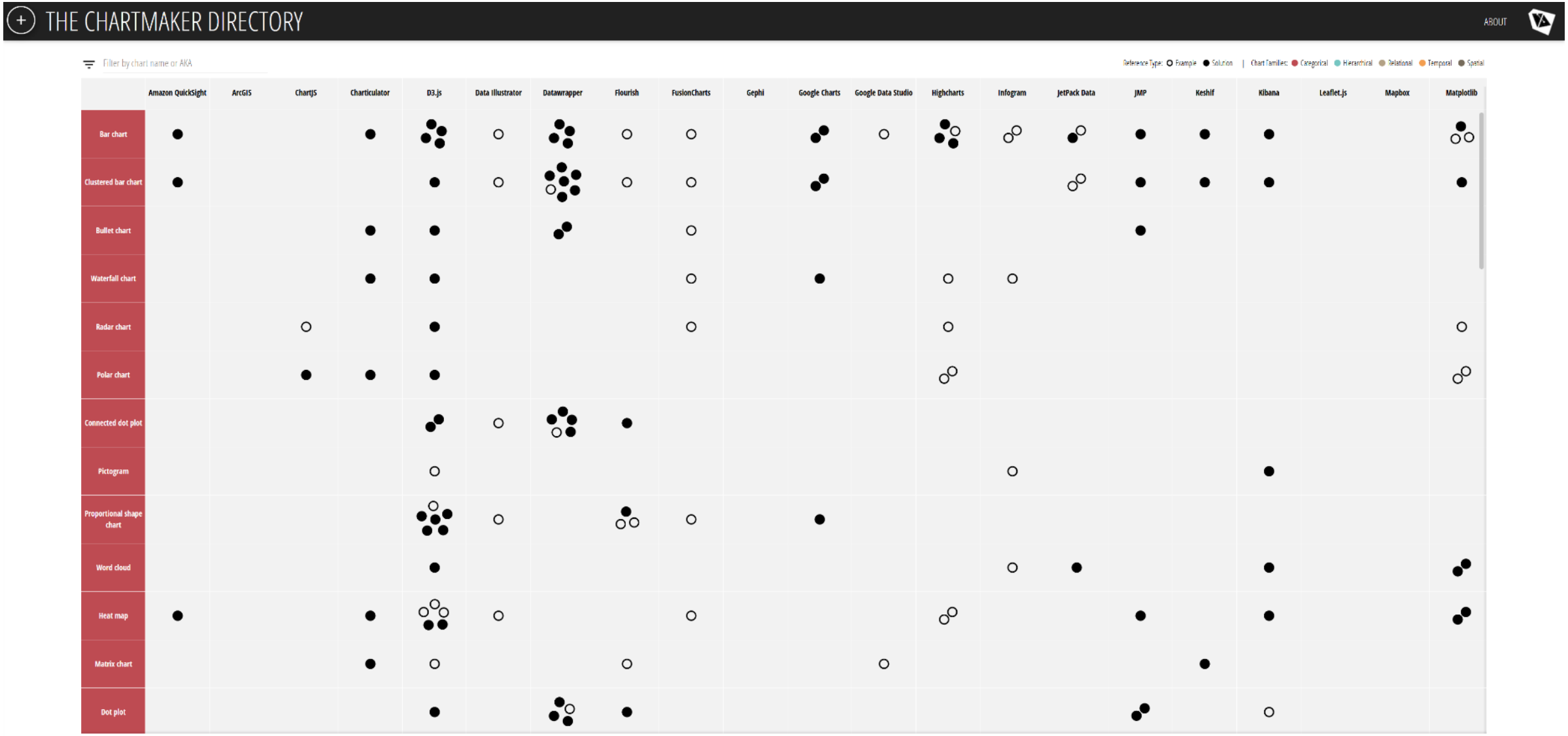
Exemples

Region-wise Literacy Rates in 2015, World Population - FusionCharts

Top 10 Chinese Exports to the World - AnyChart

Treemap - Datamatic

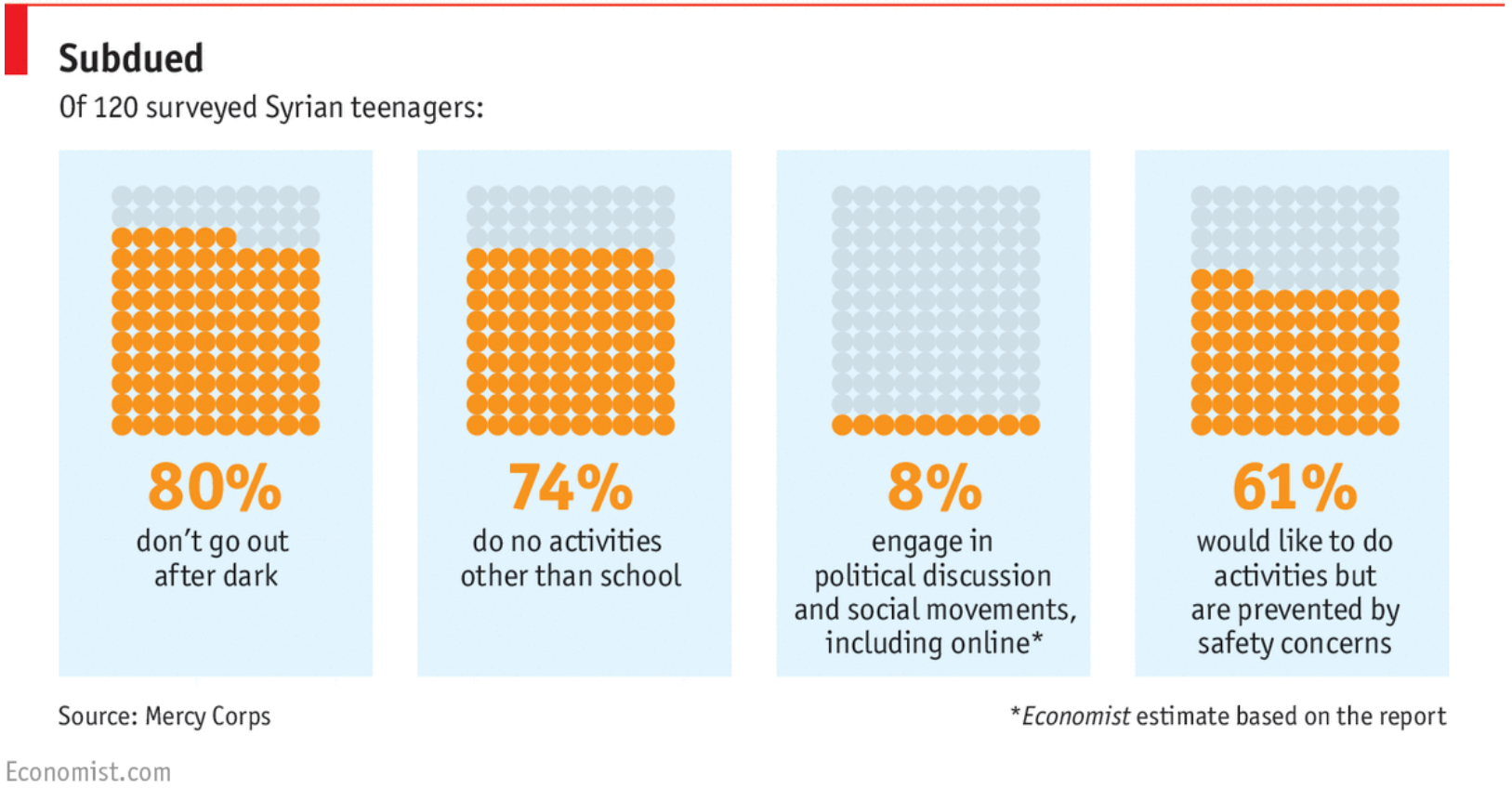
https://chart.guide/

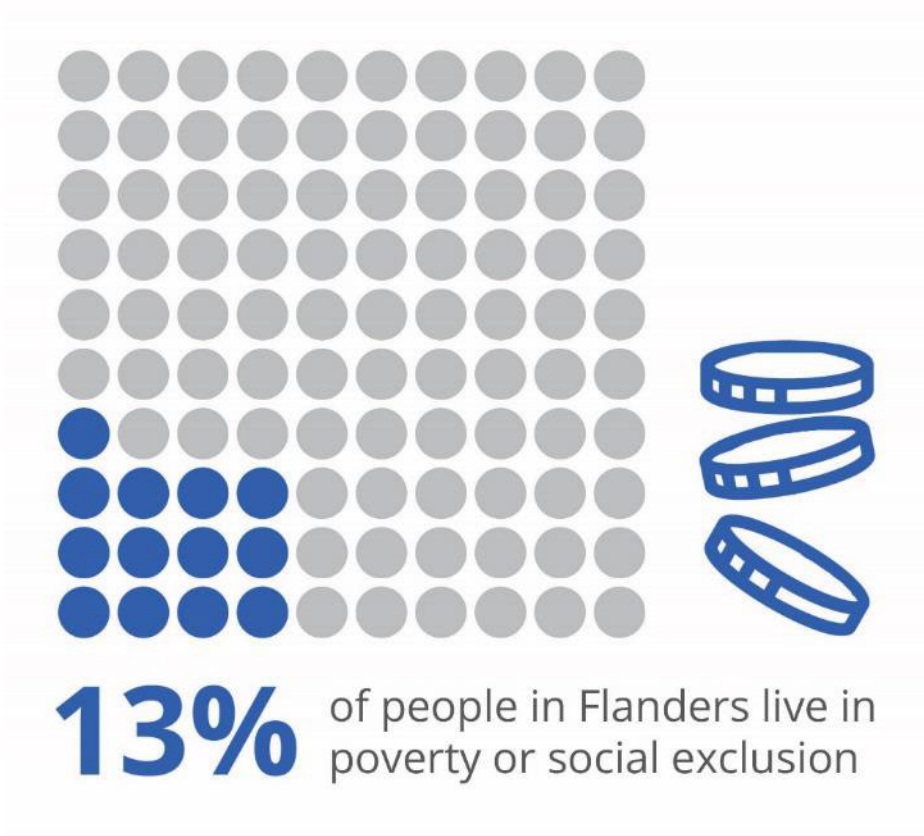


chartmaker.visualisingdata.com

Less common chart types

Waffle charts

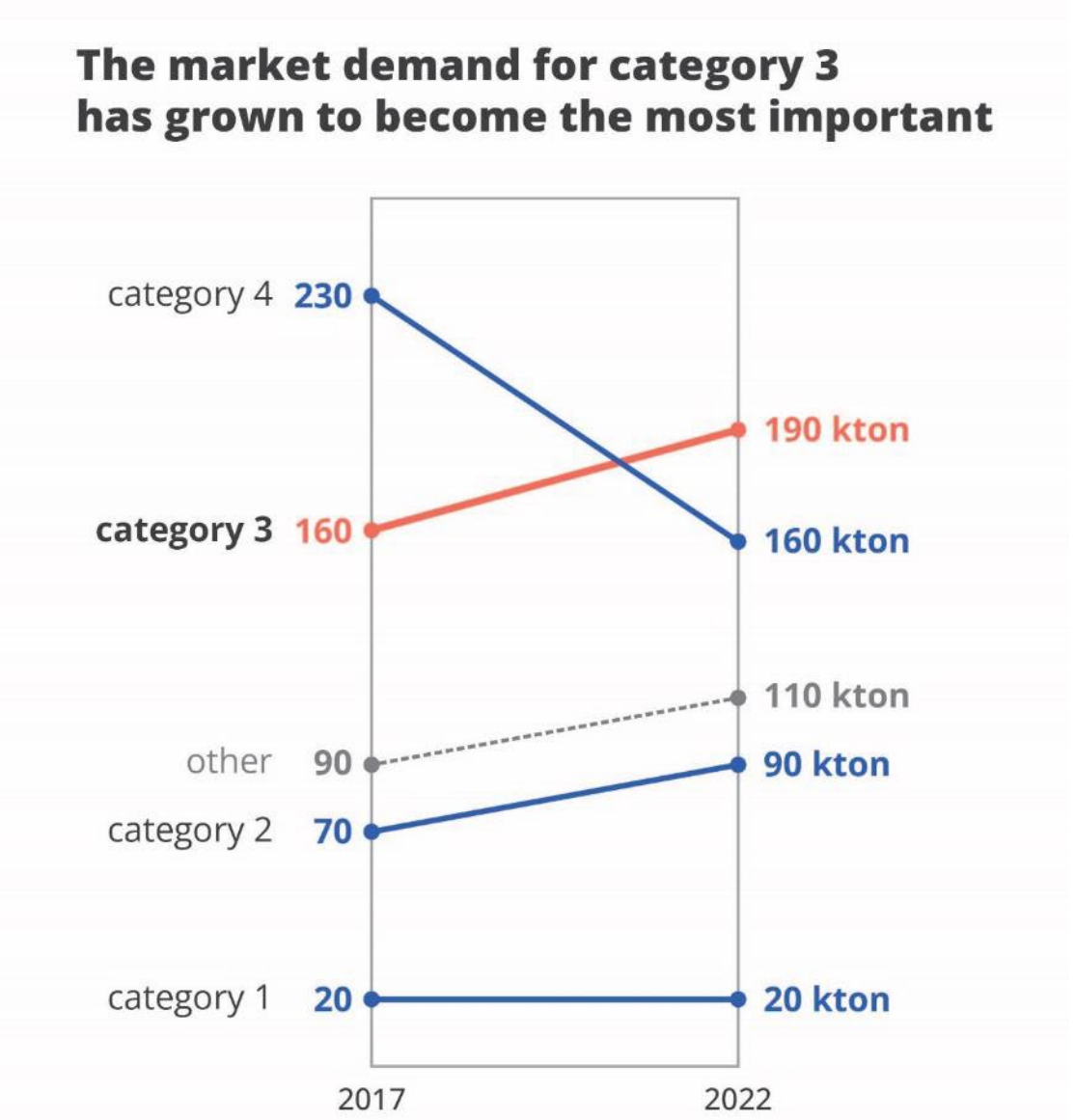




13% of people in Flanders live in poverty or social exclusion

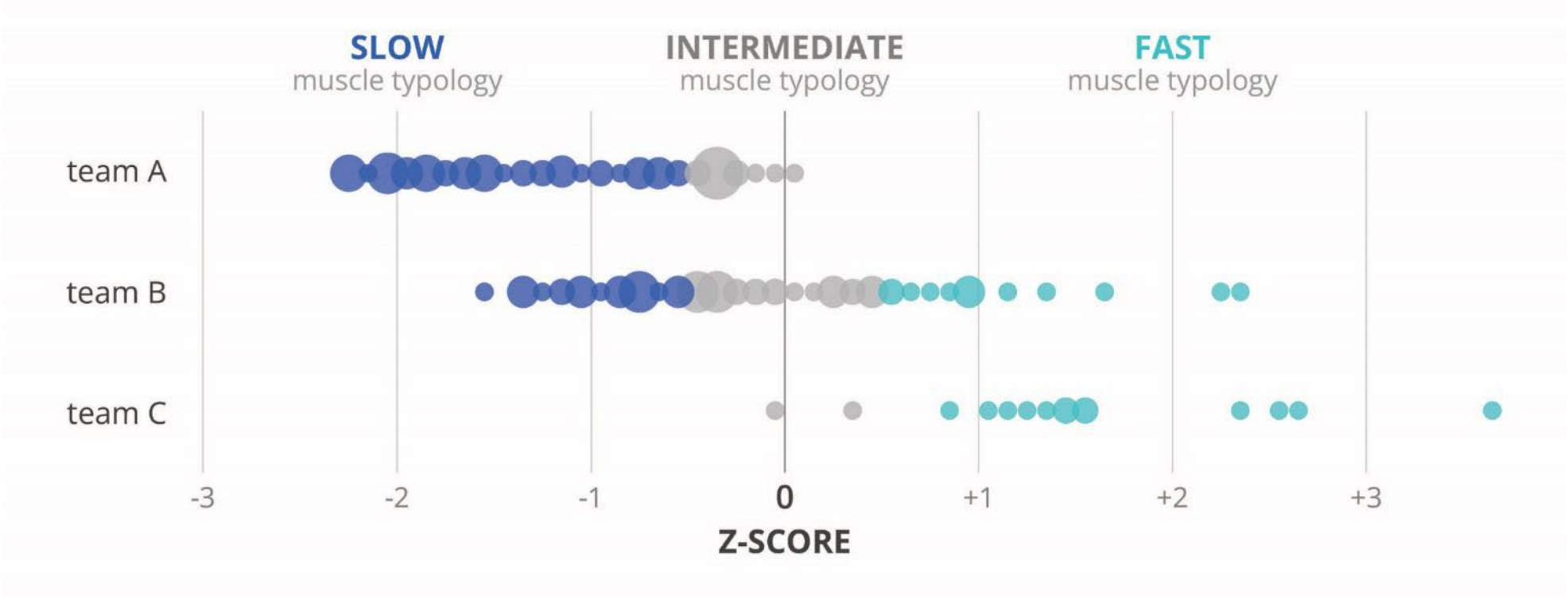
Less common chart types

Slopegraphs



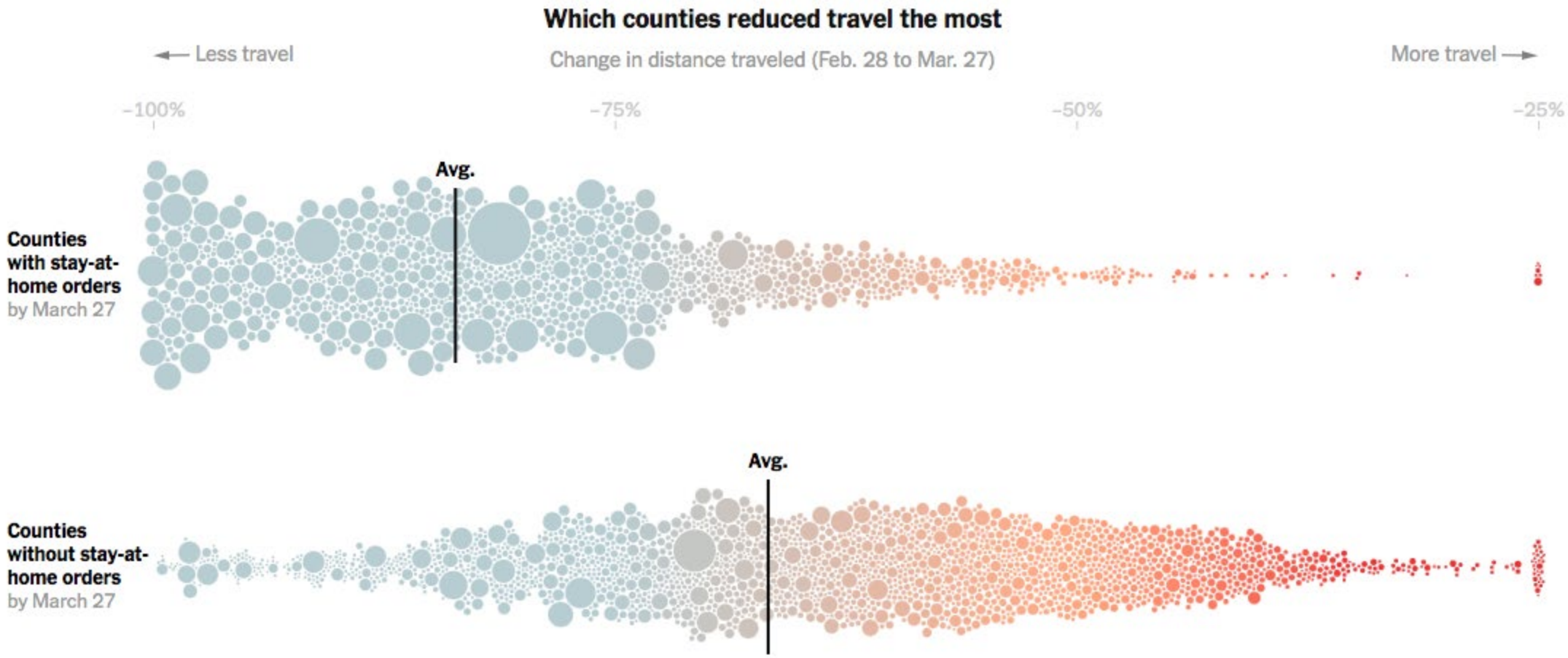
Less common chart types

Strip charts



Less common chart types

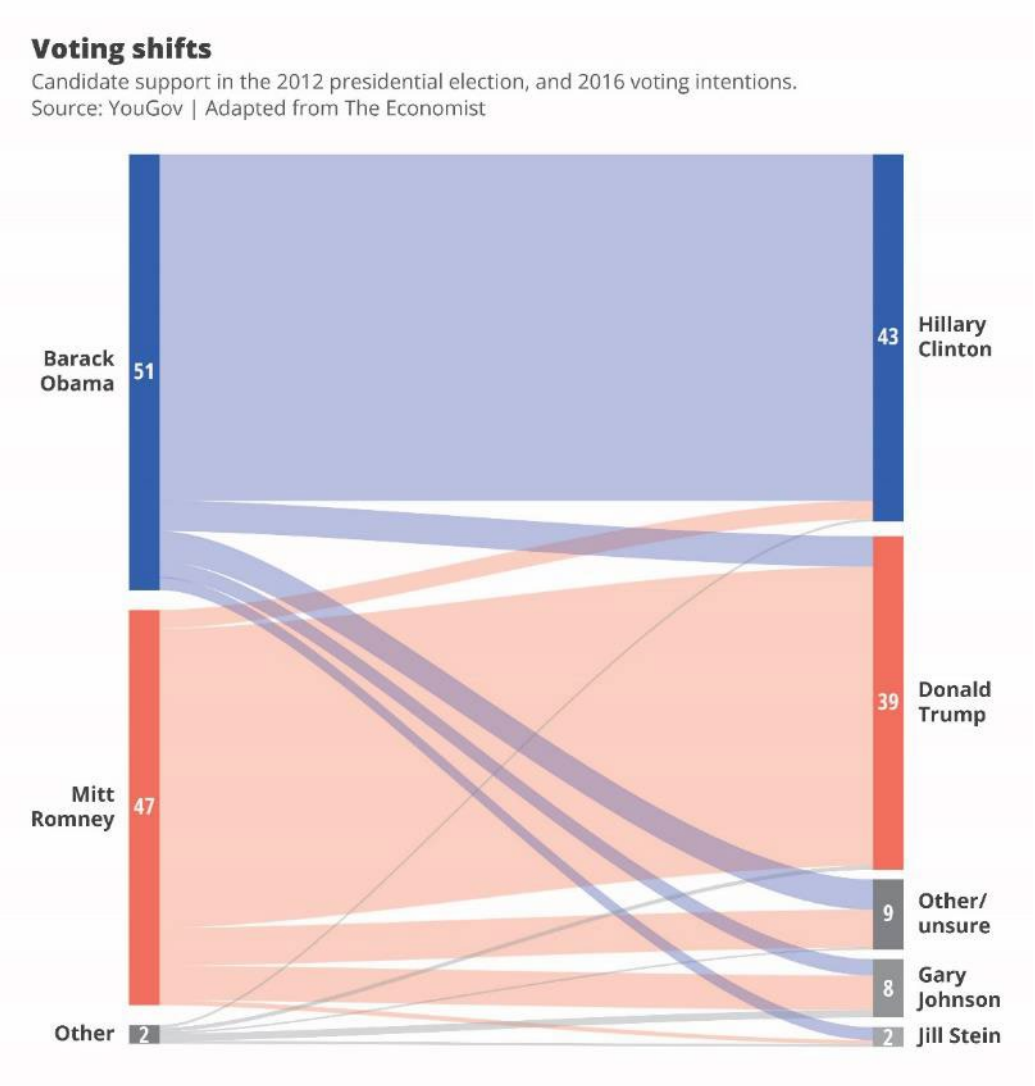
Beeswarm plots



nytimes.com/interactive/2020/04/02/us/coronavirus-social-distancing.html

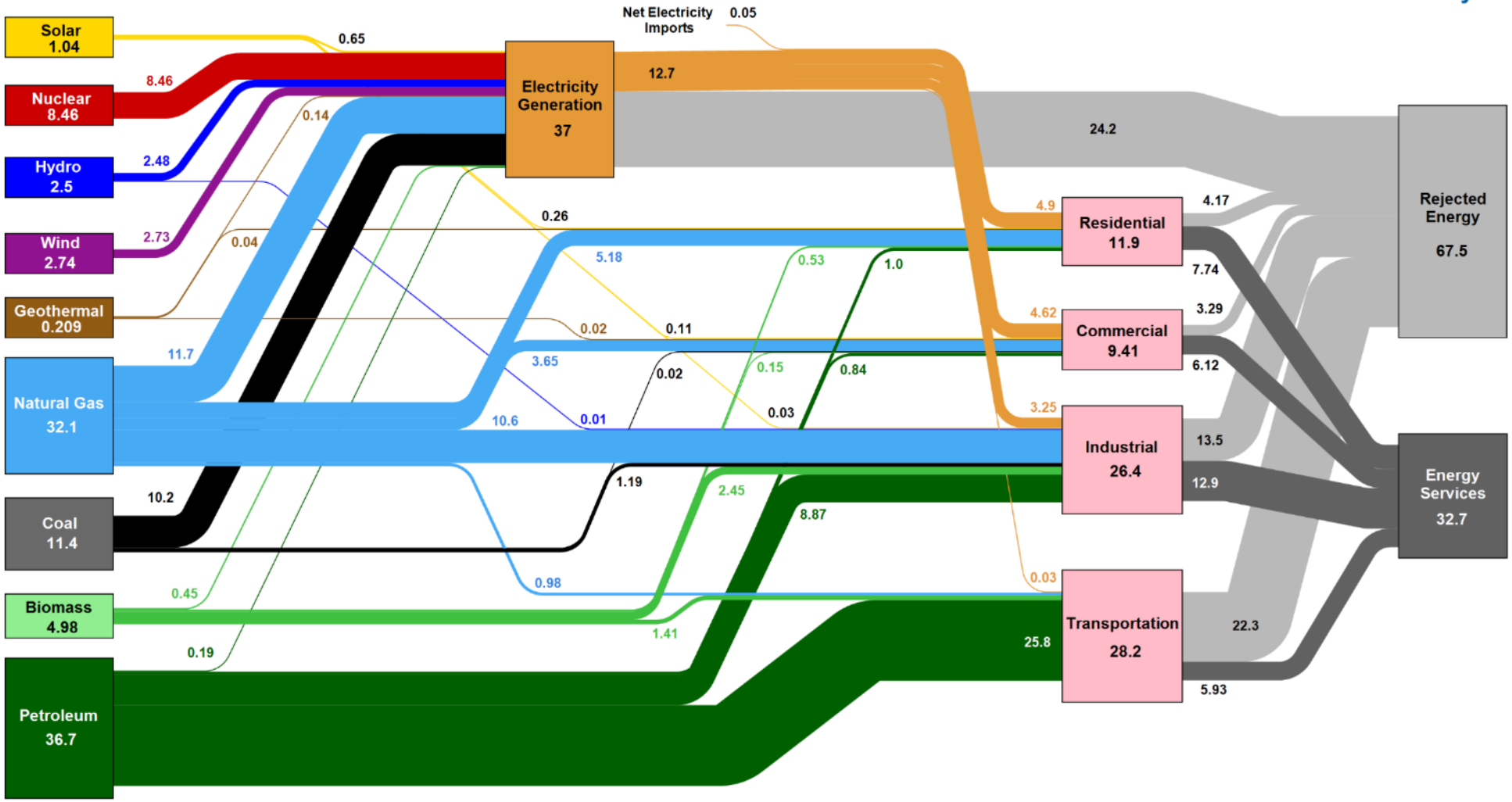
Less common chart types

Sankey diagrams



Estimated U.S. Energy Consumption in 2019: 100.2 Quads

Lawrence Livermore National Laboratory



Source: LLNL March, 2020. Data is based on DOE/EIA MER (2019). If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports consumption of renewable resources (i.e., hydro, wind, geothermal and solar) for electricity in BTU-equivalent values by assuming a typical fossil fuel plant heat rate. The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. End use efficiency is estimated as 65% for the residential sector, 65% for the commercial sector, 21% for the transportation sector and 49% for the industrial sector, which was updated in 2017 to reflect DOE's analysis of manufacturing. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527

Carte Figurative des pertes successives en hommes de l'Armée Française dans la campagne de Russie 1812-1813.

Dressée par M. Minard, Inspecteur Général des Ponts et Chaussées en retraite.

Paris, le 20 Novembre 1869.

Les nombres d'hommes présents sont représentés par les largeurs des zônes colorées à raison d'un millimètre pour dix mille hommes; ils sont de plus écrits en travers des zônes. Le rouge désigne les hommes qui entrent en Russie, le noir ceux qui en sortent. — Les renseignements qui ont servi à dresser la carte ont été puisés dans les ouvrages de MM. Thiers, de Ségur, de Fezensac, de Chambray et le journal inédit de Jacob, pharmacien de l'Armée depuis le 28 Octobre.

Pour mieux faire juger à l'œil la diminution de l'armée, j'ai supposé que les corps du Prince Jérome et du Maréchal Davoust qui avaient été détachés sur Minsk et Mobilow et ont rejoint vers Orscha et Witebsk, avaient toujours marché avec l'armée.

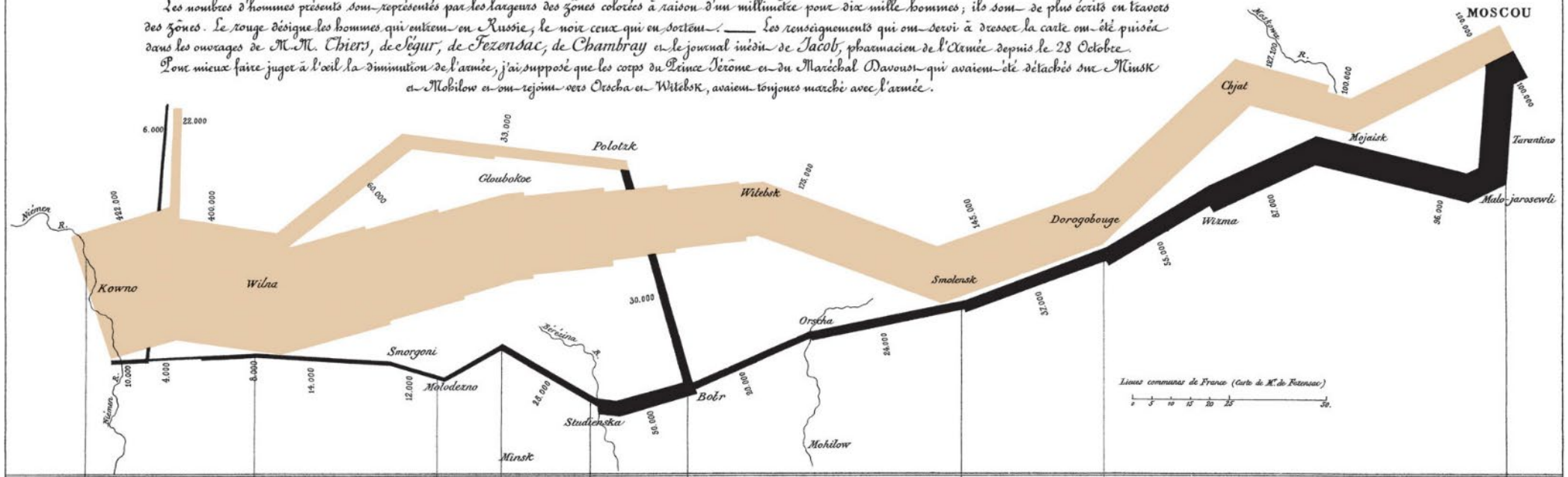
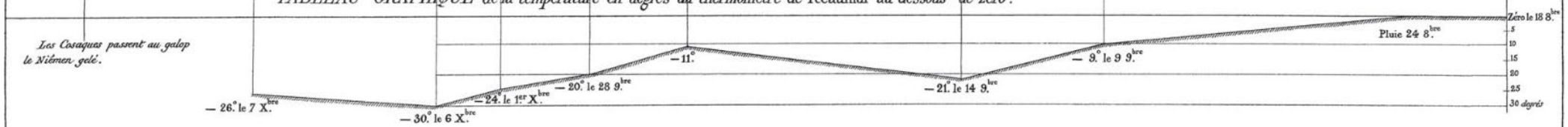


TABLEAU GRAPHIQUE de la température en degrés du thermomètre de Réaumur au dessous de zéro.



Autog. par Regnier, 8. Pas. Ste Marie St Gain à Paris.

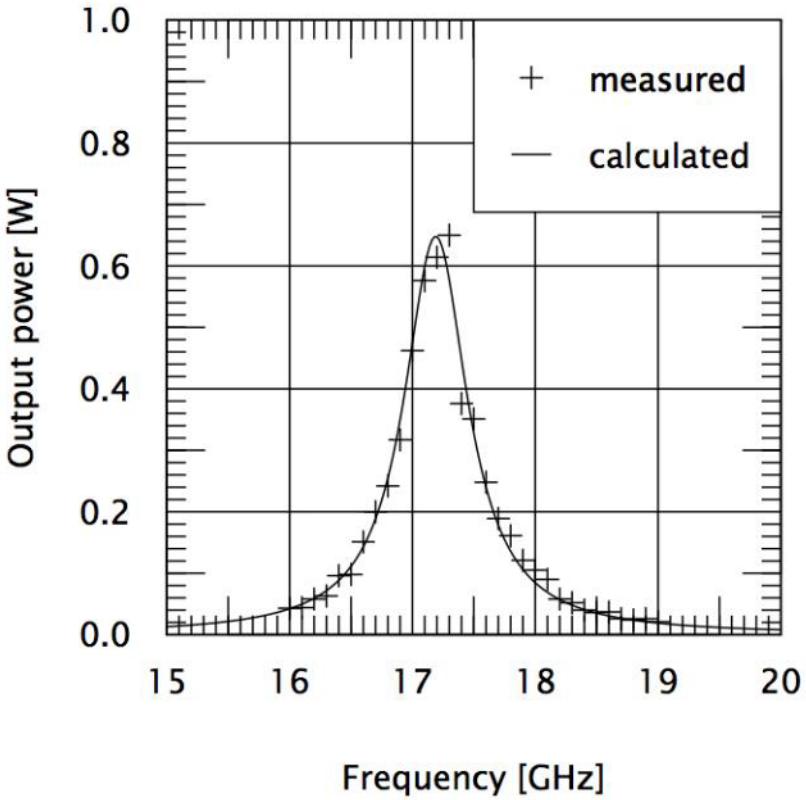
Imp. Lith. Regnier et Dourdet.

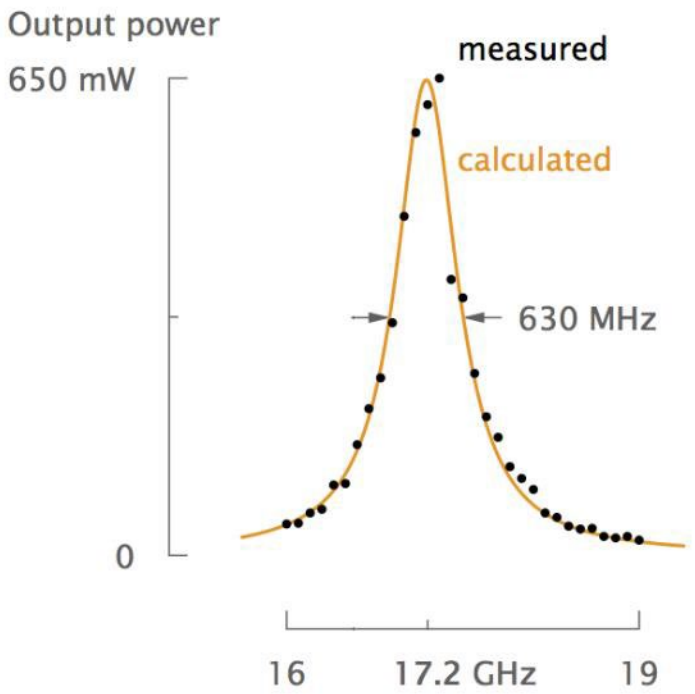
Guidelines for graphs

define your goal

don’t settle for the default chart

maximize the signal-to-noise ratio





Jean-Luc Doumont, Optics & Photonics Focus 2010

Noise = physical noise

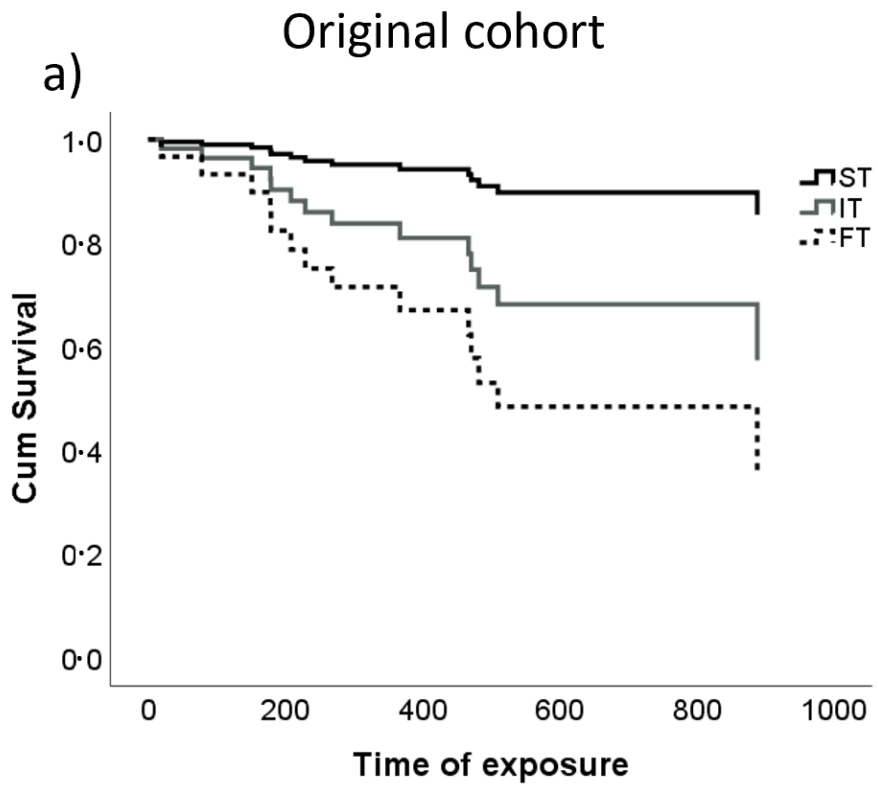
elements which are on the visual
but are not helpful

+ mental noise

thinking work required
from your audience

How would you do it?

Write down at least 5 things you would change to improve this visual



ORIGINAL

Increased injury
fast-twitch mus

80% of athletes inj

talking about injuries, not 'survival'

60%

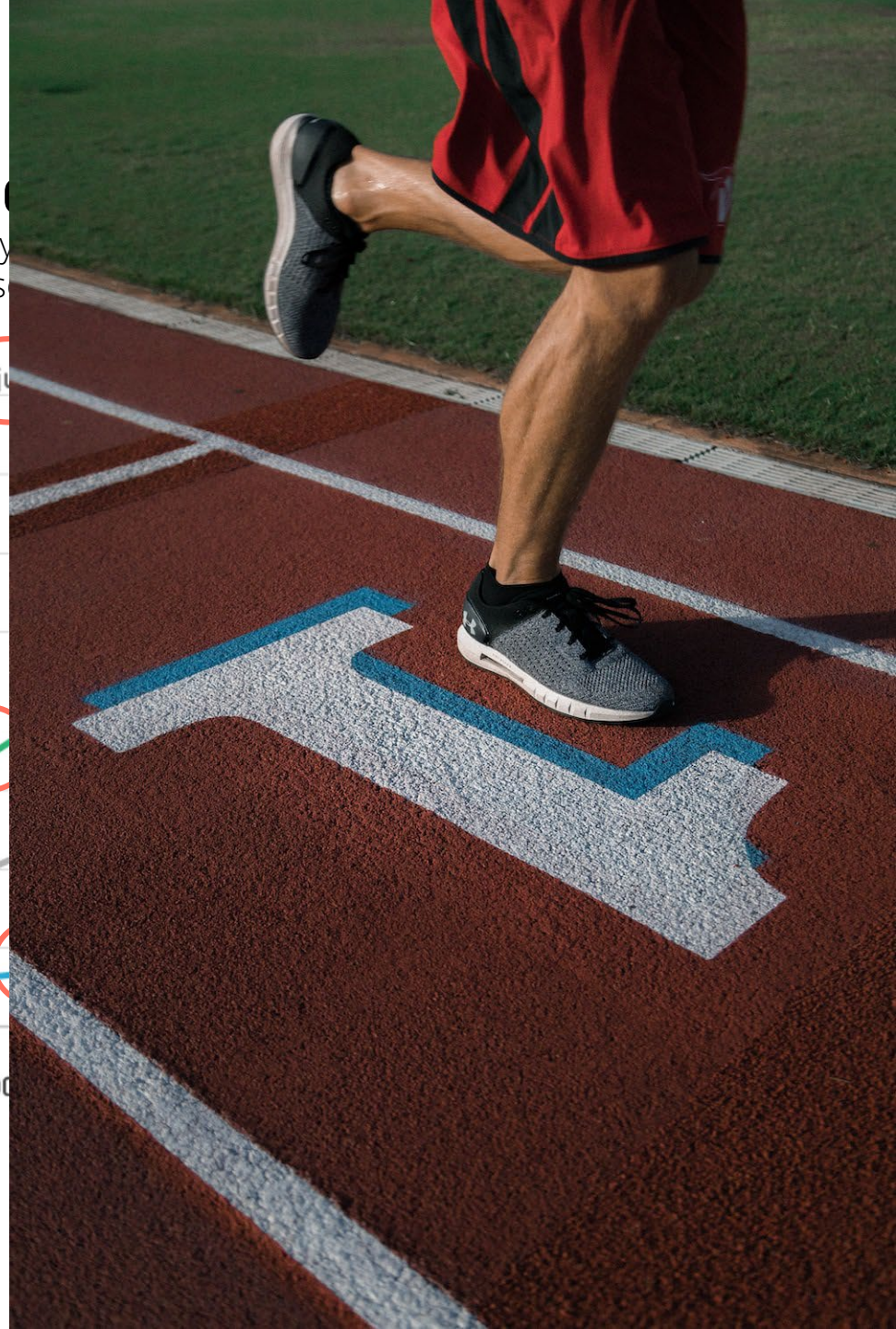
linear interpolation gives a better idea than stepwise

20%

0

400

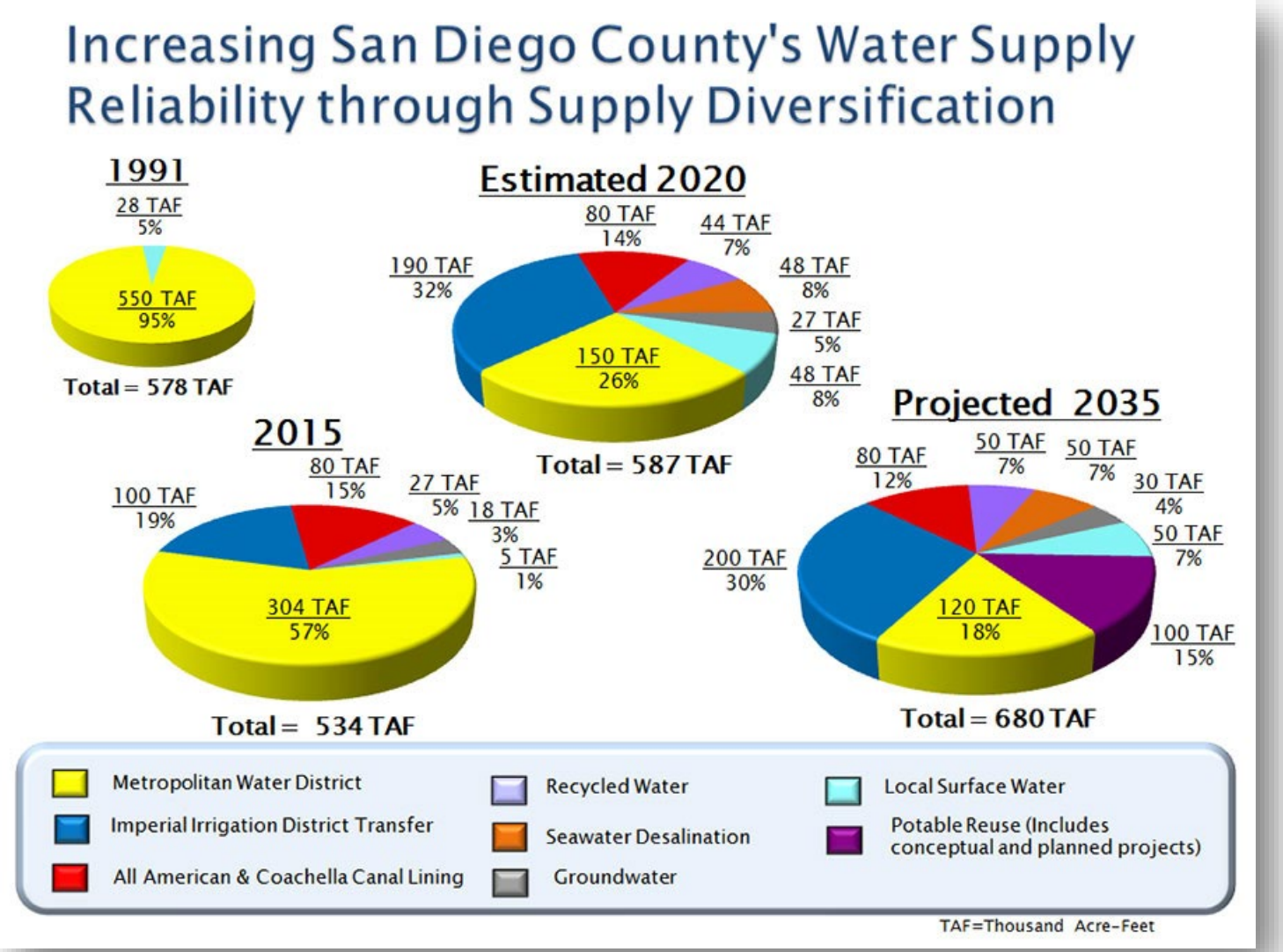
add color to better differentiate lines



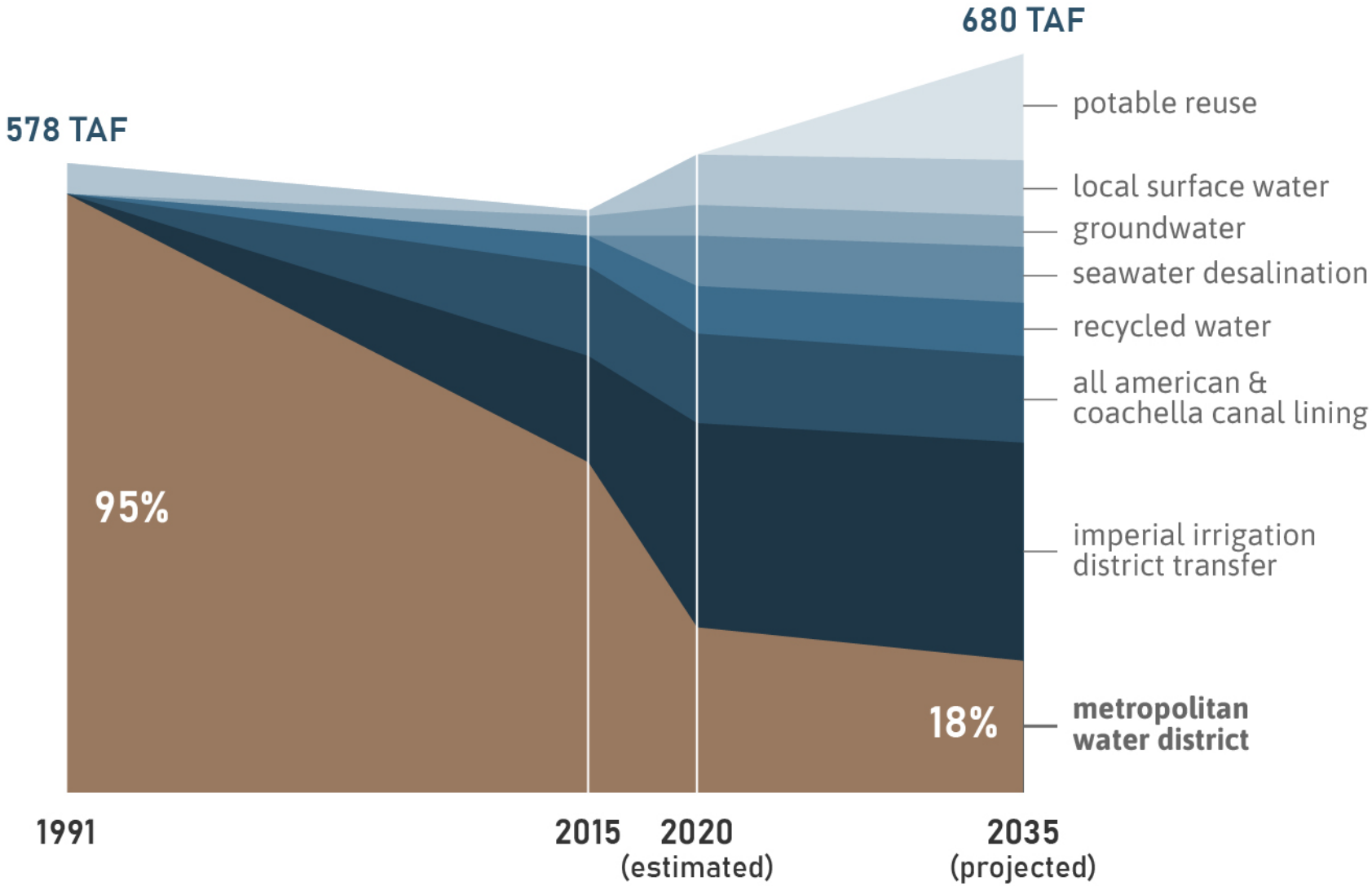
How would you do it?

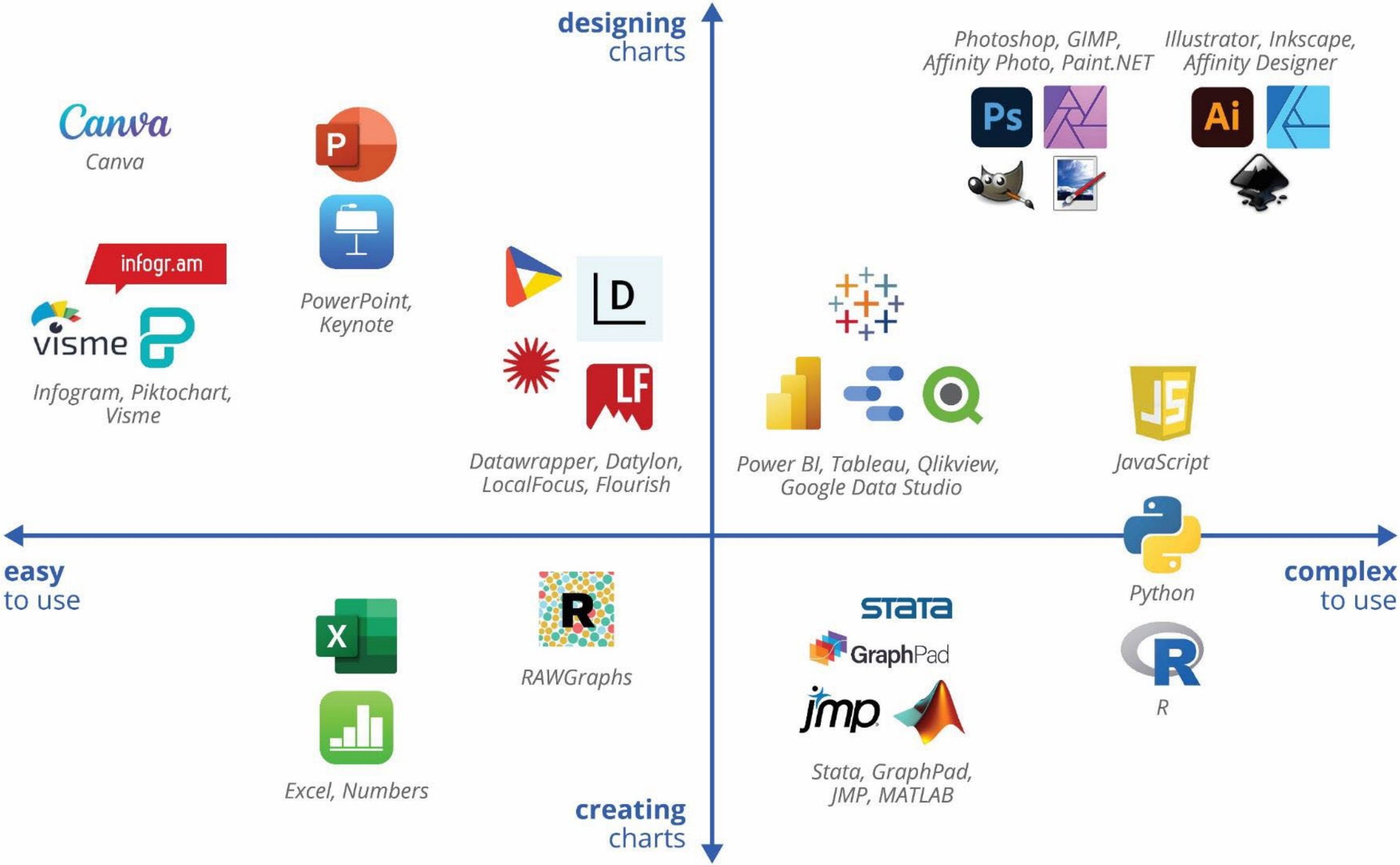
Share what you **don't like** about this visual

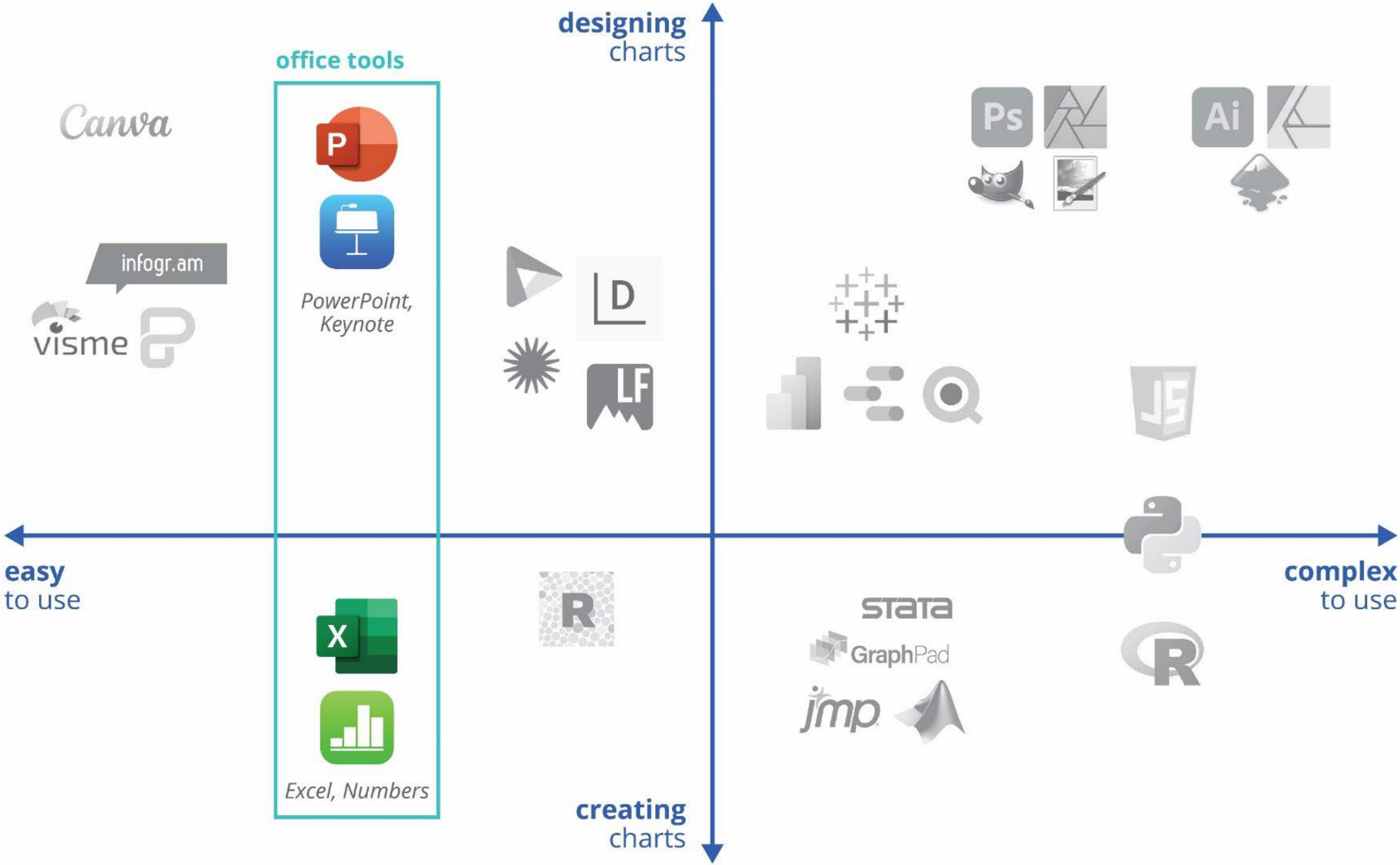
What would you change to **improve it**?



Supply diversification will increase
San Diego County's water supply reliability




designing
charts
Photoshop, GIMP,
Affinity Photo, Paint.NET
Illustrator, Inkscape,
Affinity Designer
Canva
Canva
infogr.am
visme
Infogram, Piktochart,
Visme
PowerPoint,
Keynote
LD
LF
Datawrapper, Datylon,
LocalFocus, Flourish
Power BI, Tableau, Qlikview,
Google Data Studio
JavaScript
easy
to use
complex
to use
Python
R
RAWGraphs
STATA
GraphPad
jmp
Stata, GraphPad,
JMP, MATLAB
Excel, Numbers
creating
charts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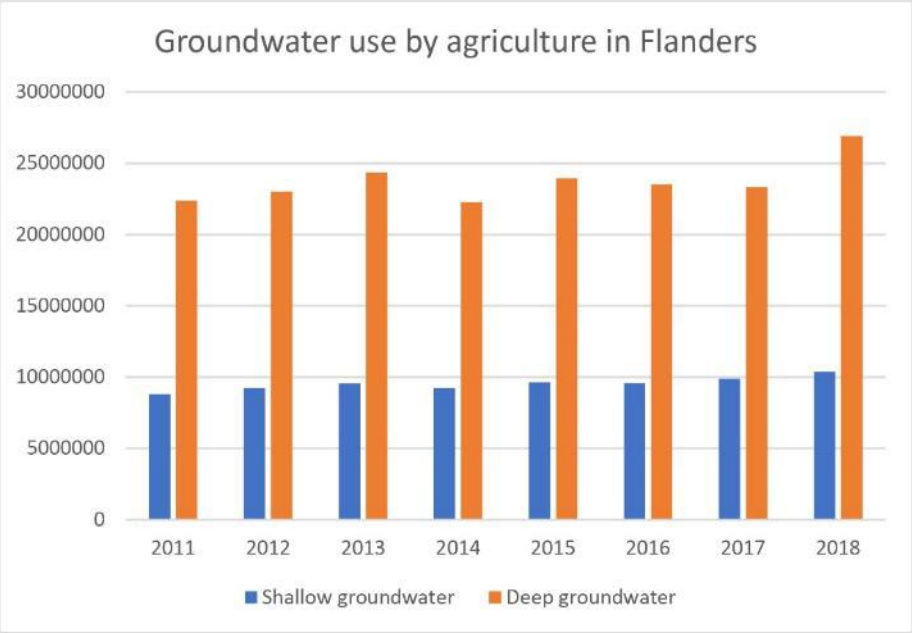
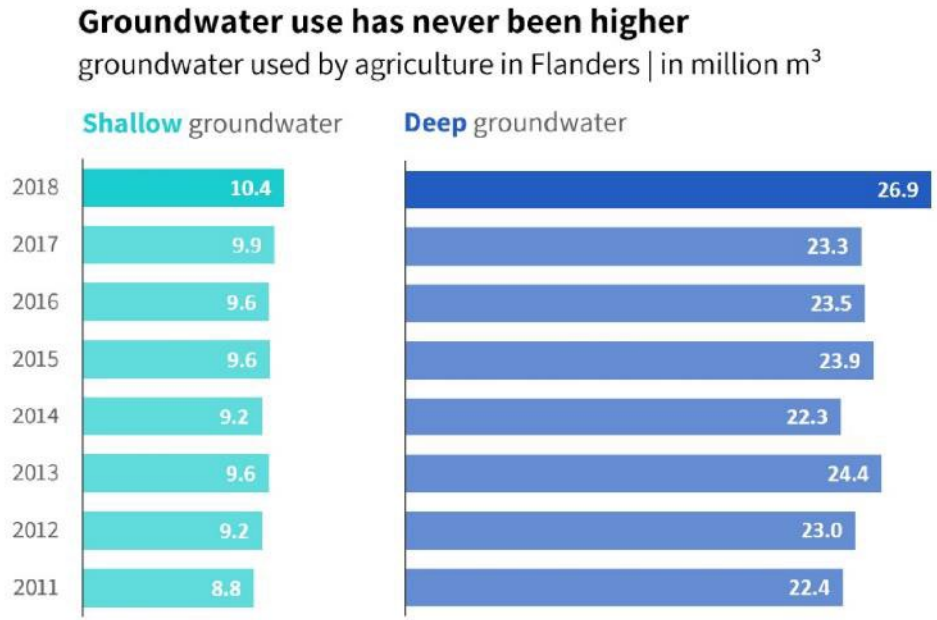
Available tools

Spreadsheet tools

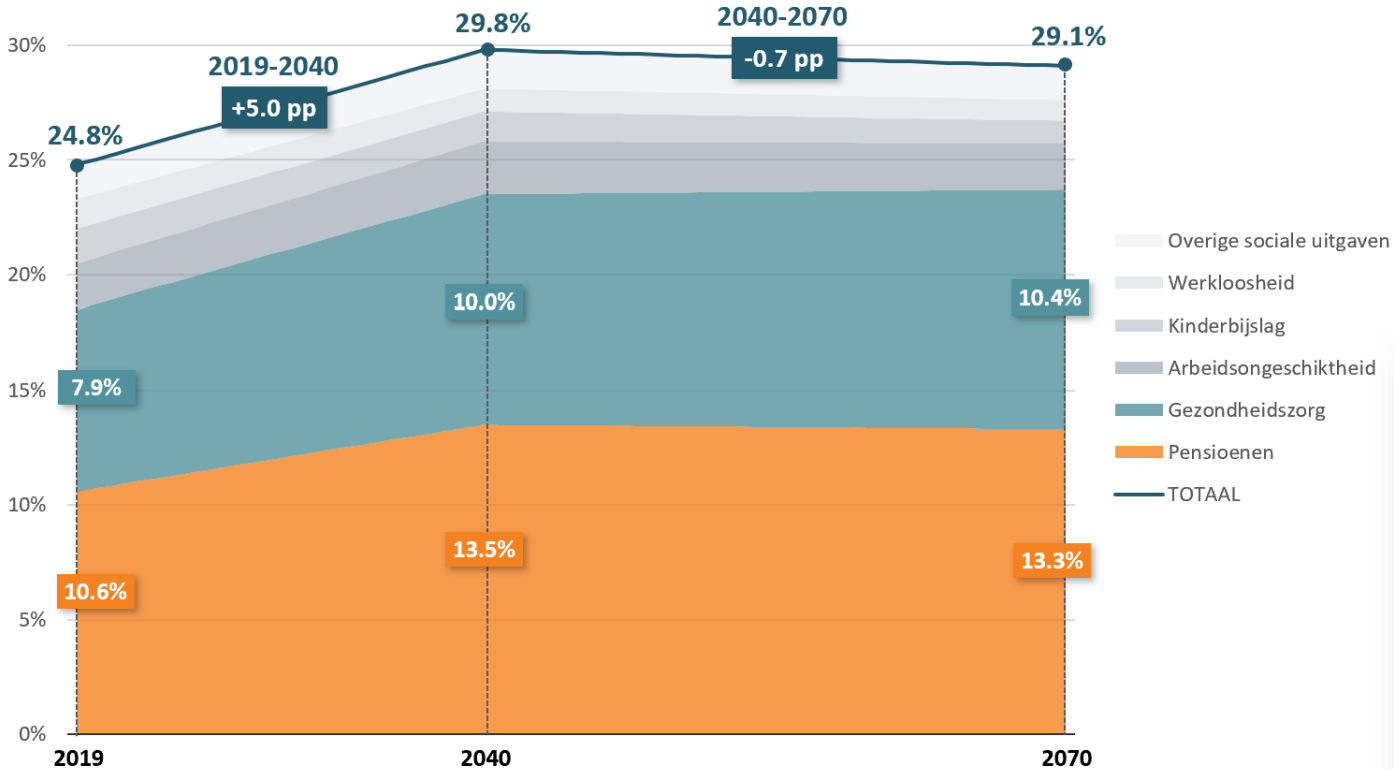




Evolutie van de budgettaire kosten van de vergrijzing op lange termijn

Volgens het SCvV-referentiescenario van juli 2020

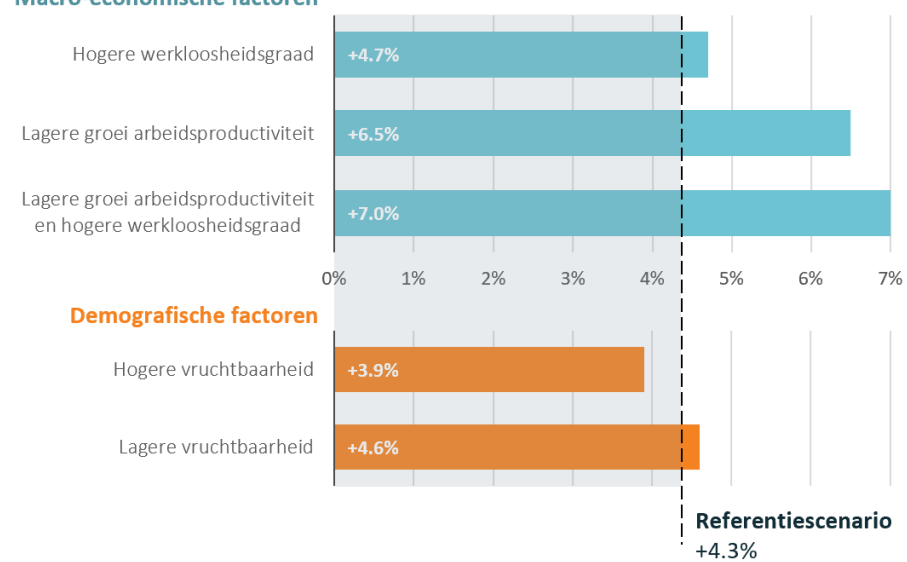
in procent van het bbp

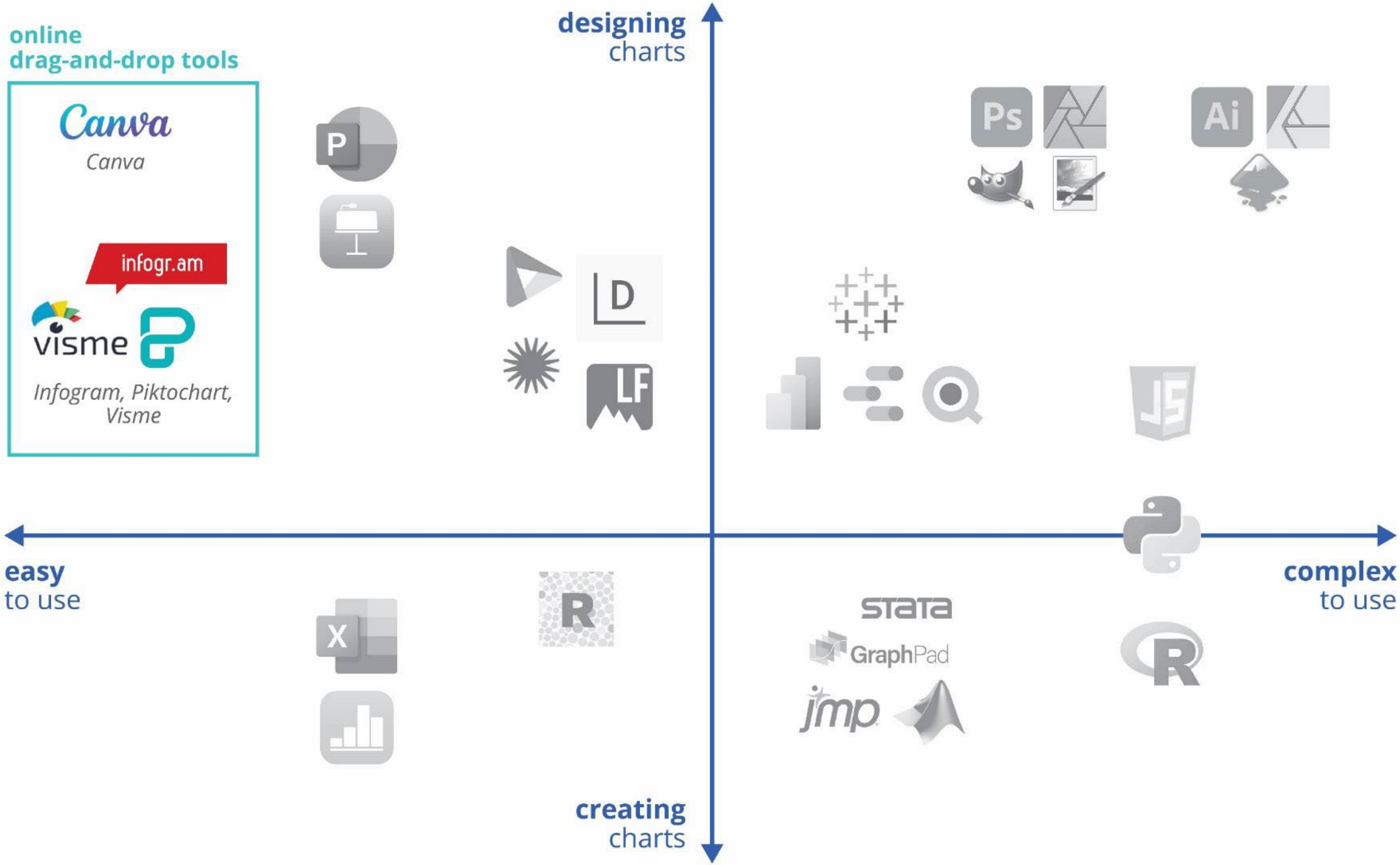


Evolutie van de budgettaire kosten van de vergrijzing tussen 2019 en 2070

Volgens het referentie- en alternatieve scenario's

in procentpunt van het bbp

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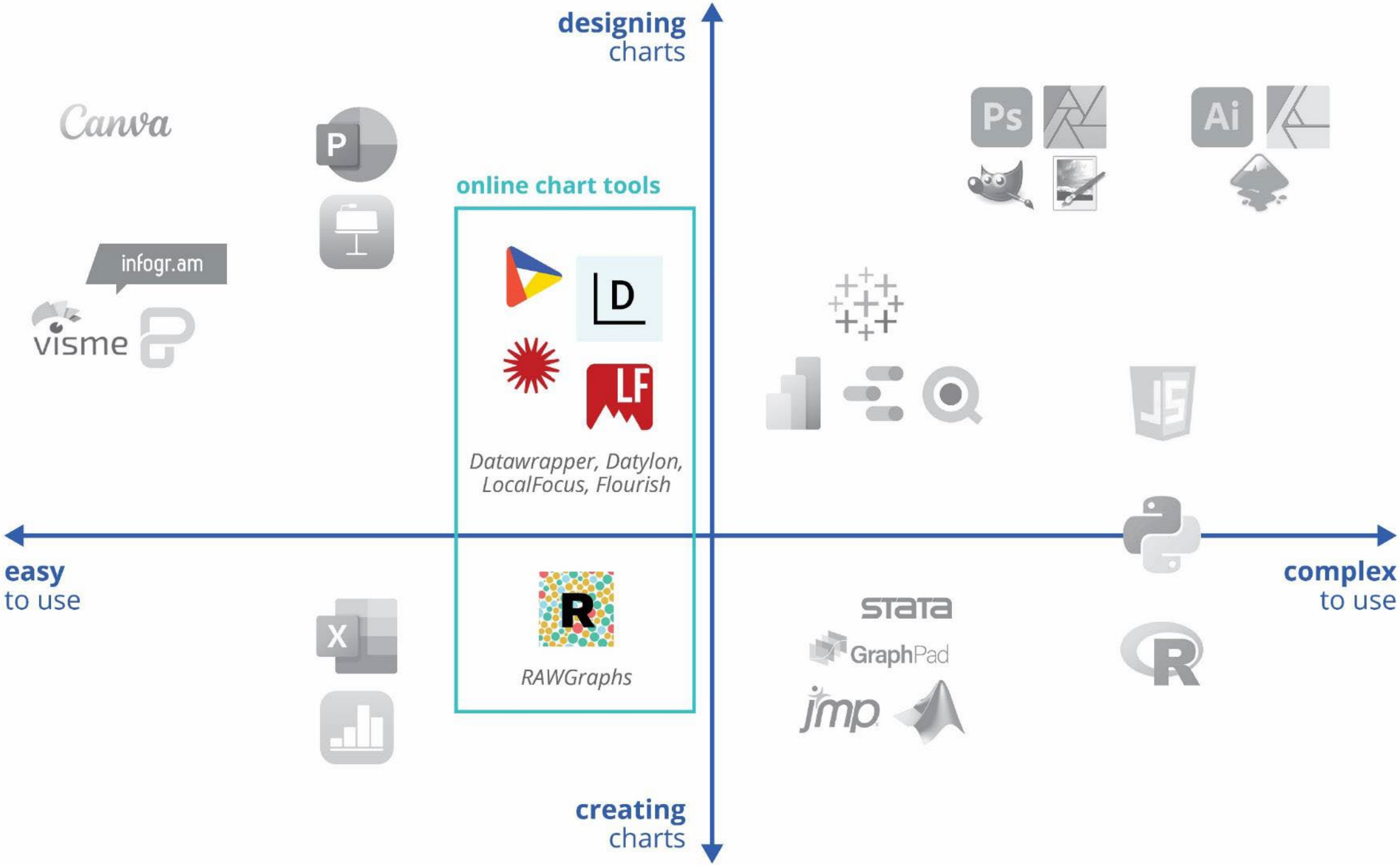
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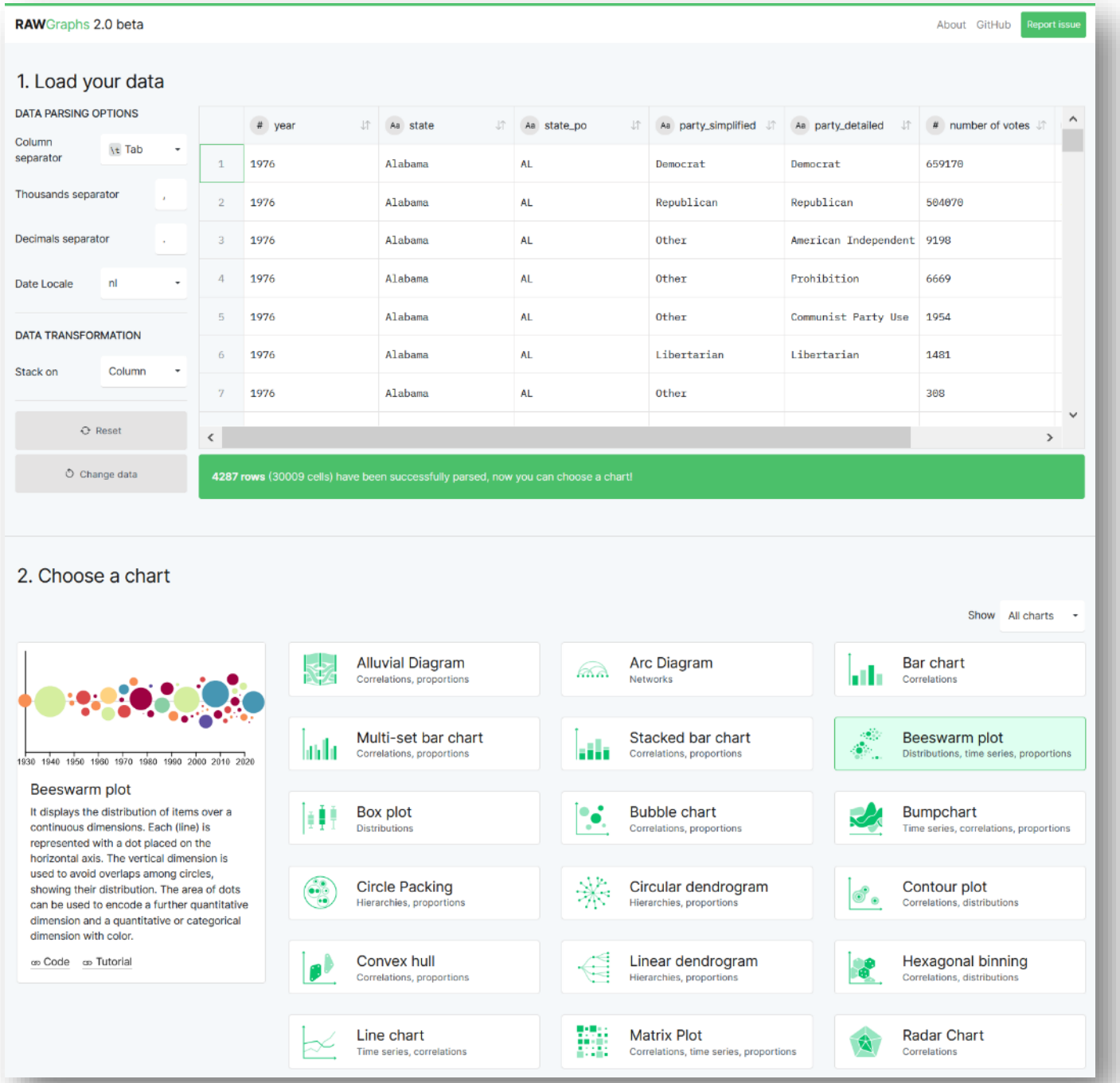
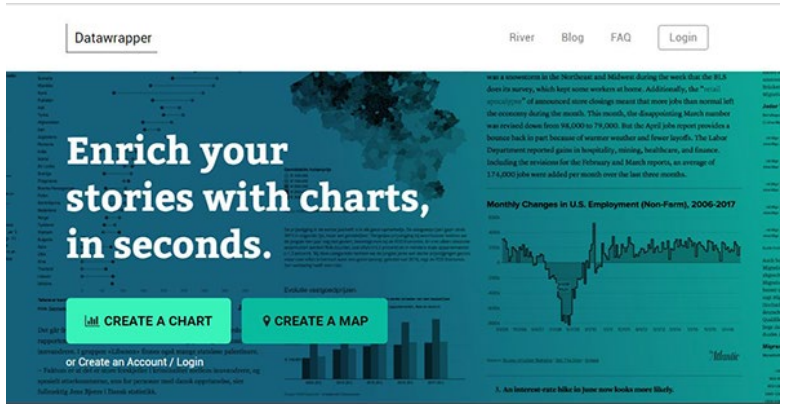


app.rawgraphs.io

Available tools

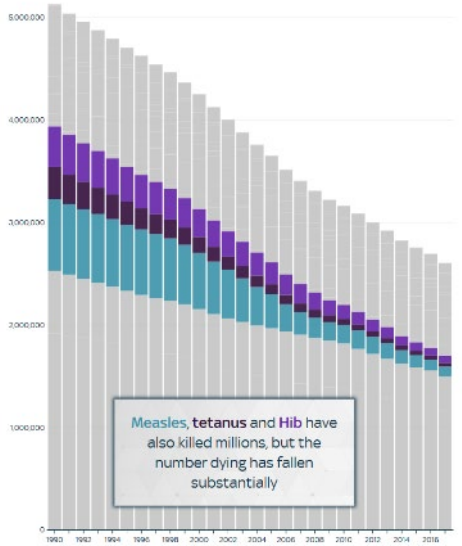
Interactive chart tools



Datawrapper

datawrapper.de

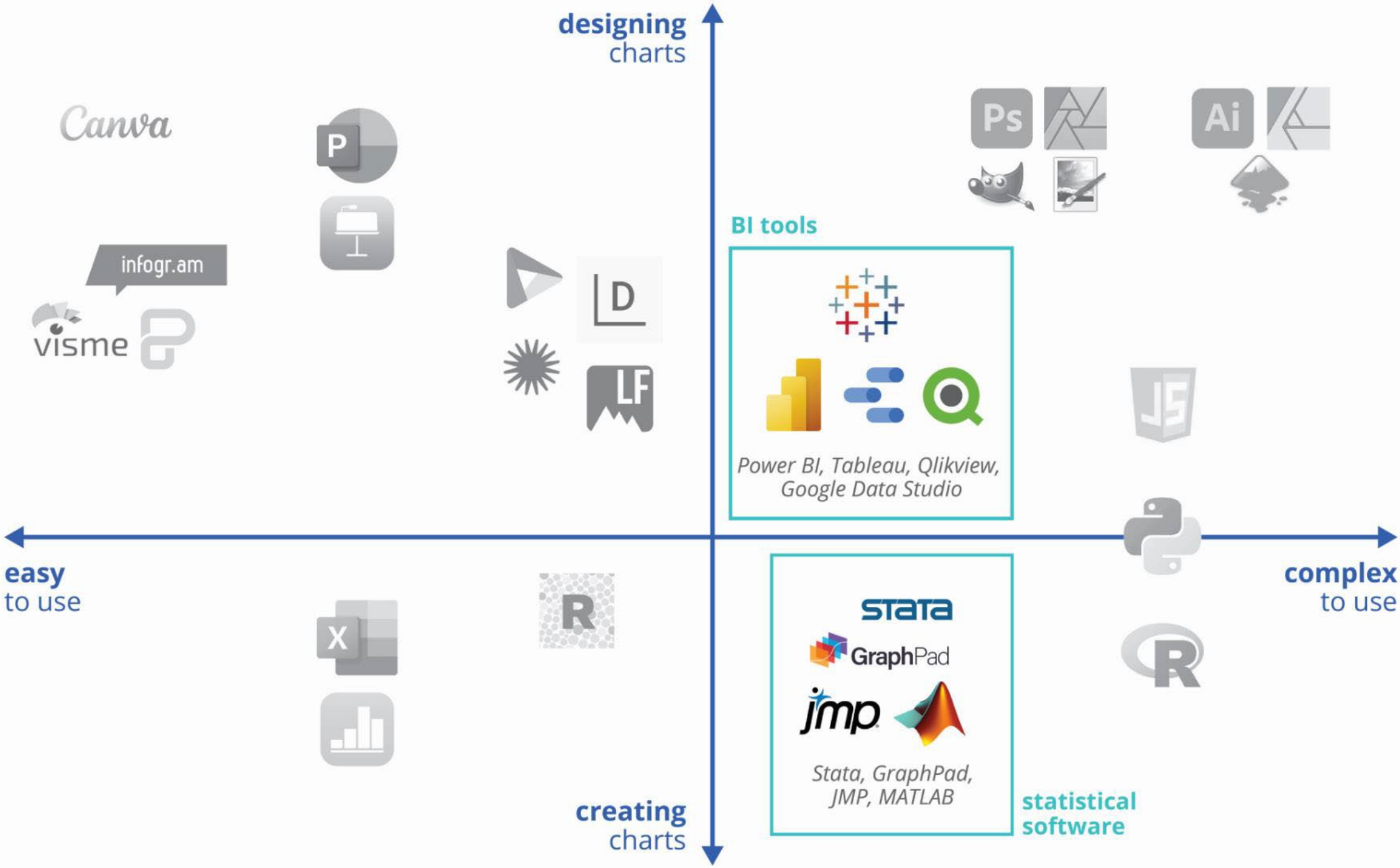
charts to embed in a website,
charts with tooltips



Flourish

flourish.studio

storytelling
with charts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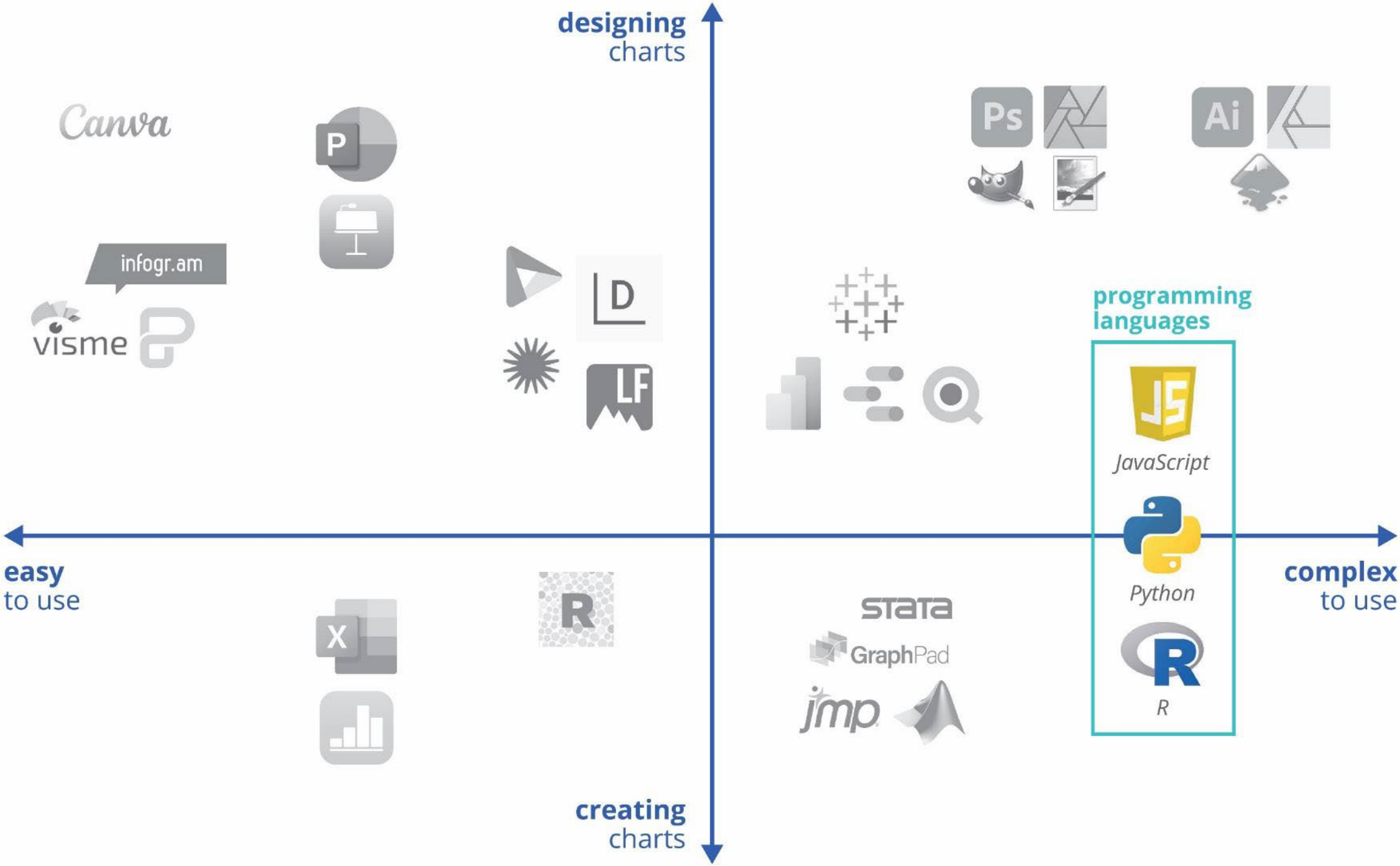
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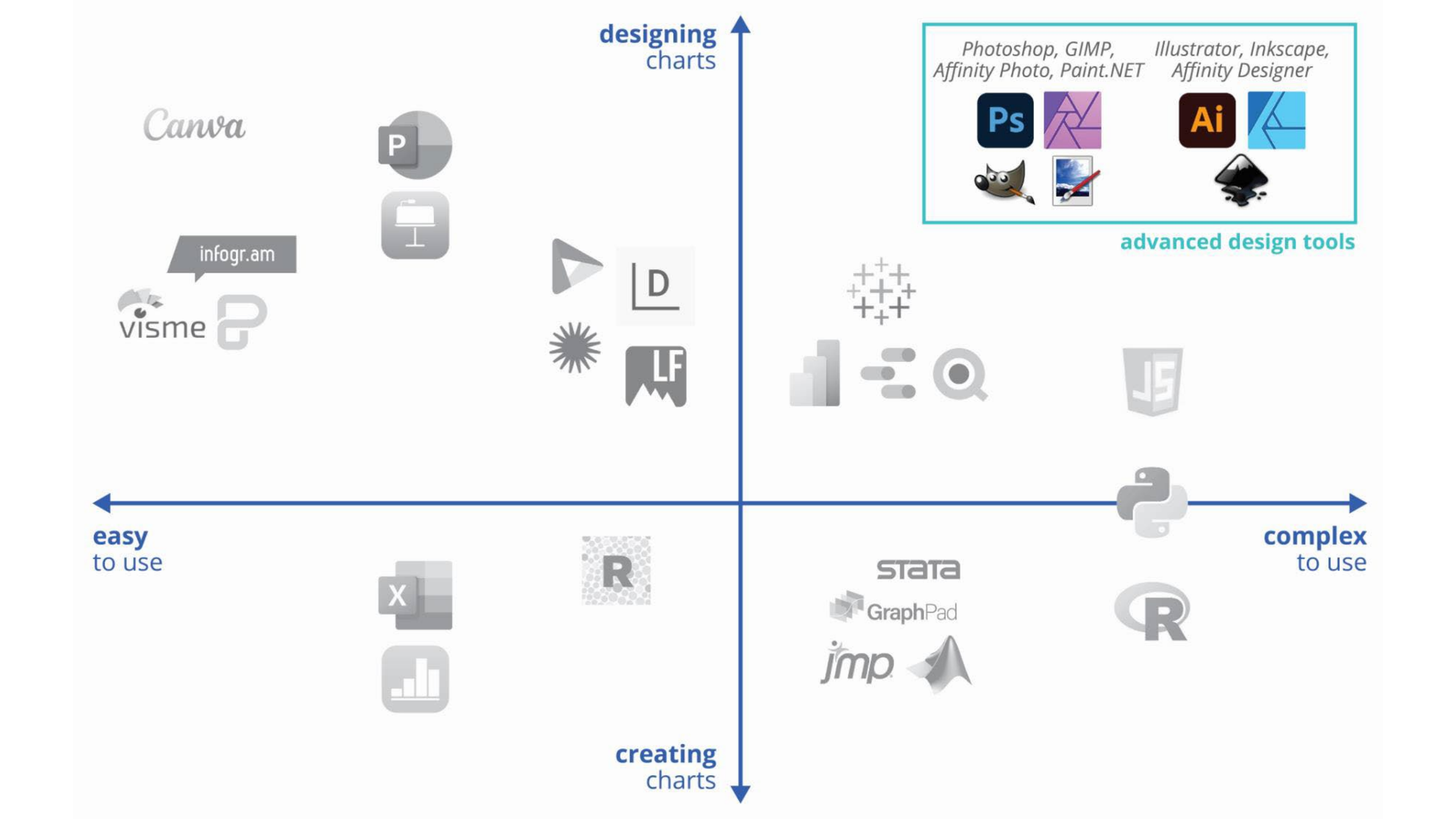
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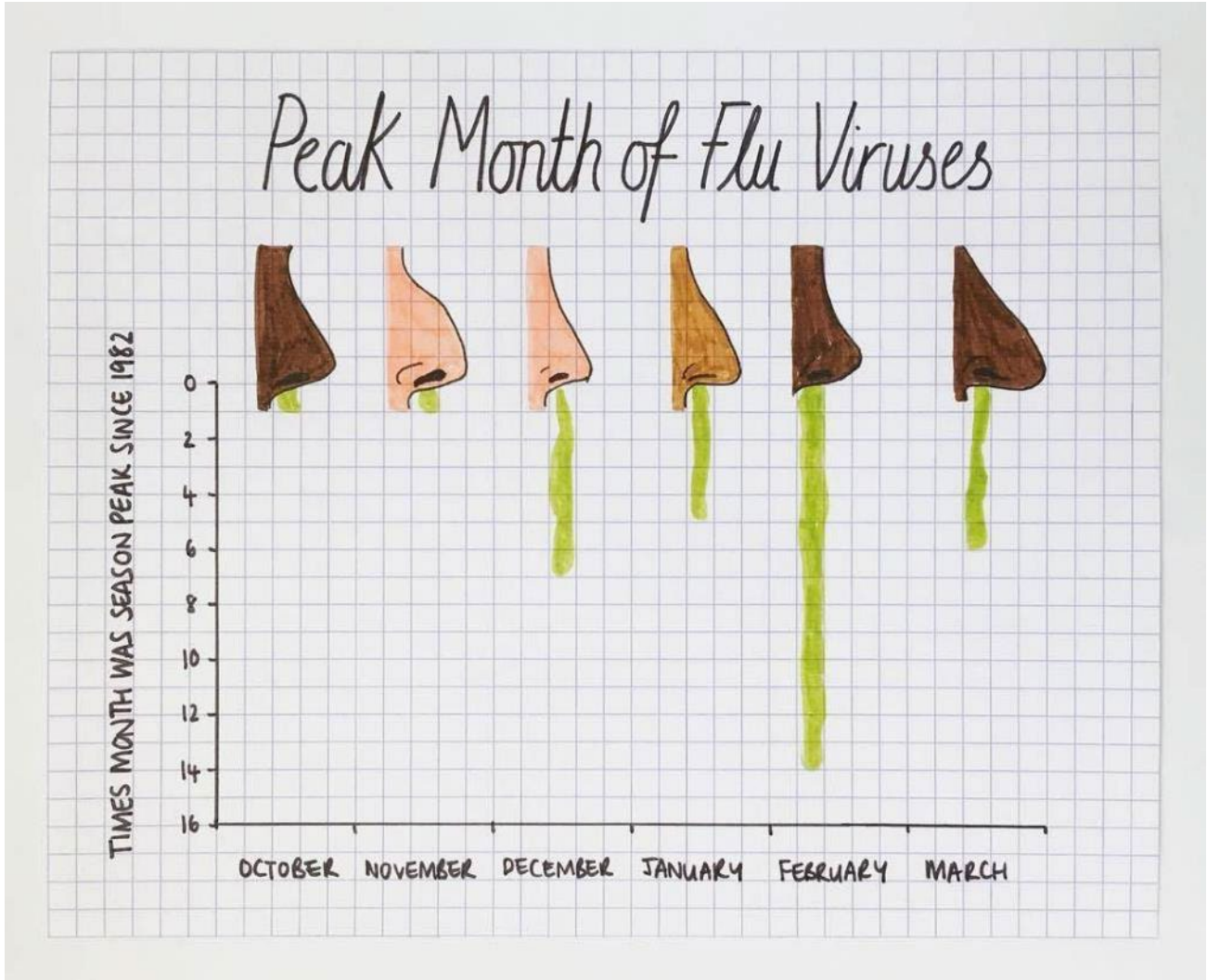
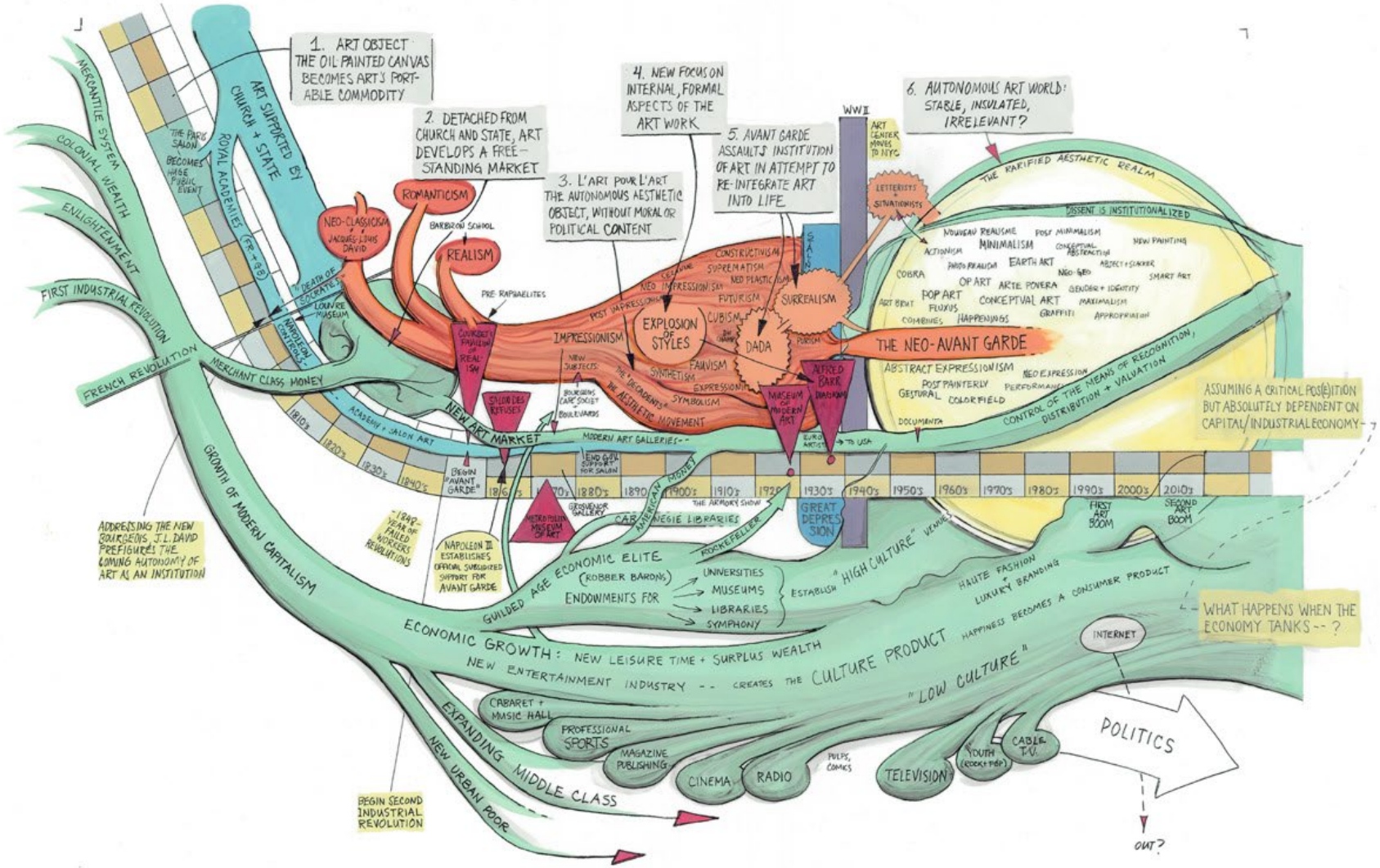
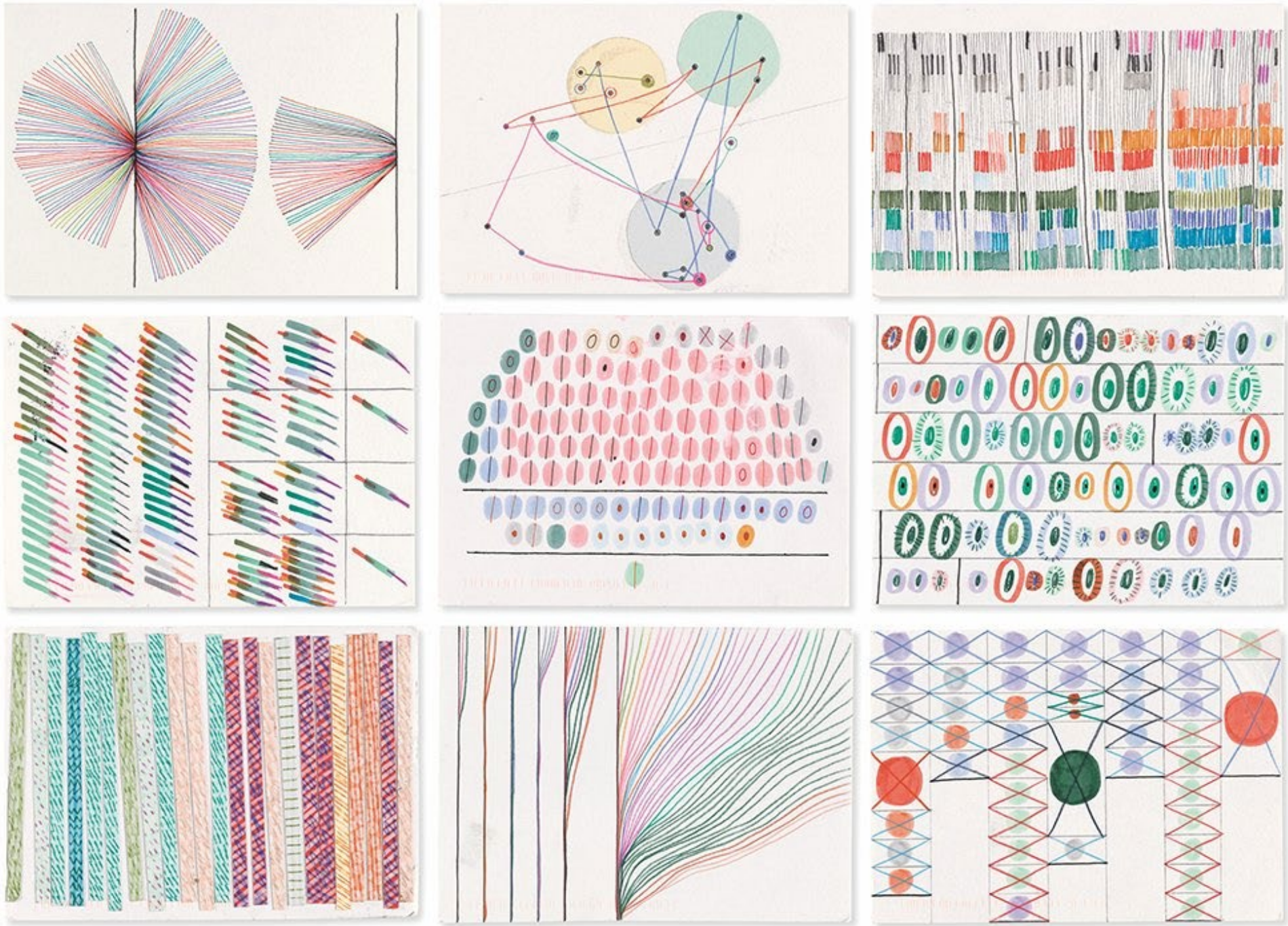


Mona Chalabi



Ward Shelley

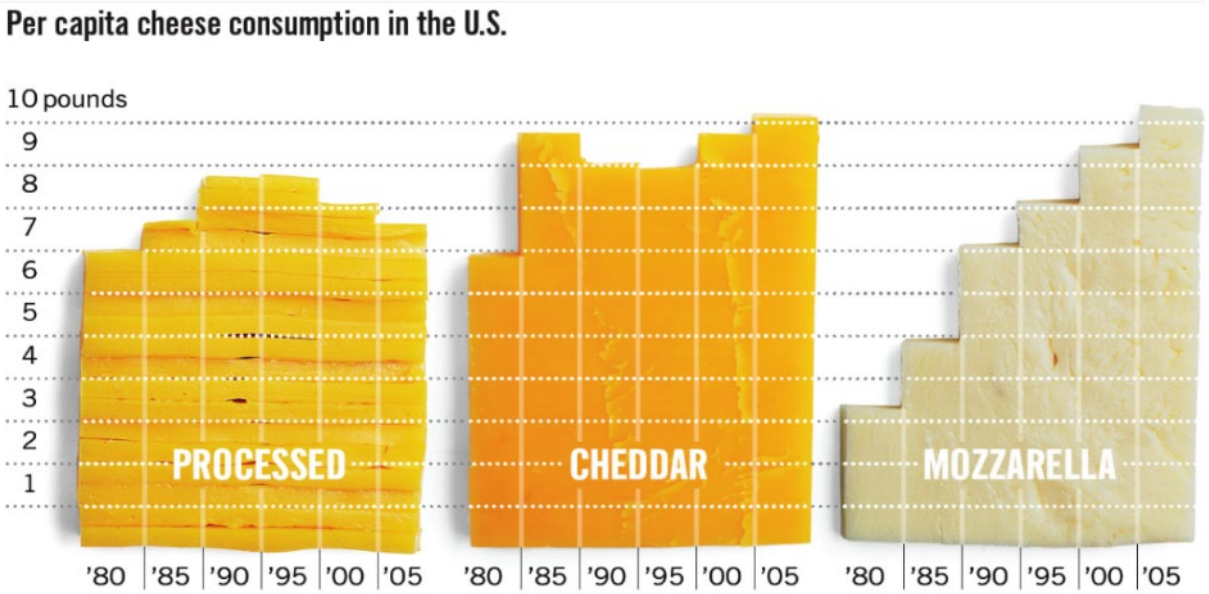


dear-data.com

Fish Pharm
These pills represent the relative amounts of four pharmaceutical drugs found in fish pulled from Chicago's North Shore Channel and tested by Baylor scientists.

The traditional foe of water quality is waste from factories and farms, but now environmental regulators are eyeing a new pollution source: our medicine chests. Fish caught downstream from sewage treatment plants in five U.S. cities contained traces of pharmaceuticals and toiletries, Baylor University researchers found in a recent study. You'd have to eat tons of fish for such small concentrations to affect human health, but the products could pose a threat to marine life. To assess the risk, the EPA has expanded monitoring to 150 sites, with results due in 2011.

National Geographic Magazine


Per capita cheese consumption in the U.S.
10 pounds
9
8
7
6
5
4
3
2
1
PROCESSED
CHEDDAR
MOZZARELLA
'80 '85 '90 '95 '00 '05
'80 '85 '90 '95 '00 '05
'80 '85 '90 '95 '00 '05

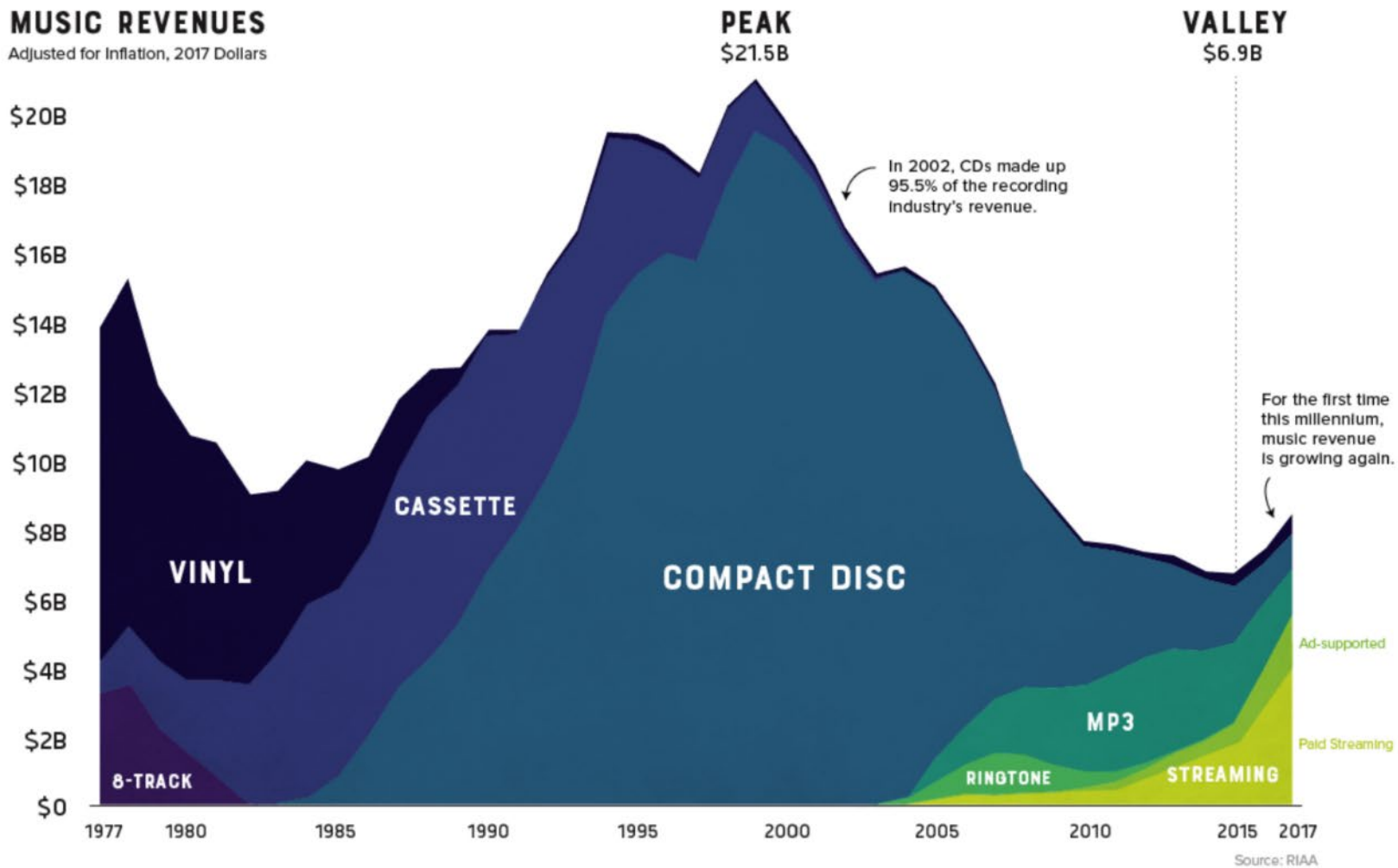

Pie I have eaten
Pie I have not yet eaten


REASONS I LOVE CHEESE BURGERS
BREAD
MEAT
KETCHUP
CHEESE

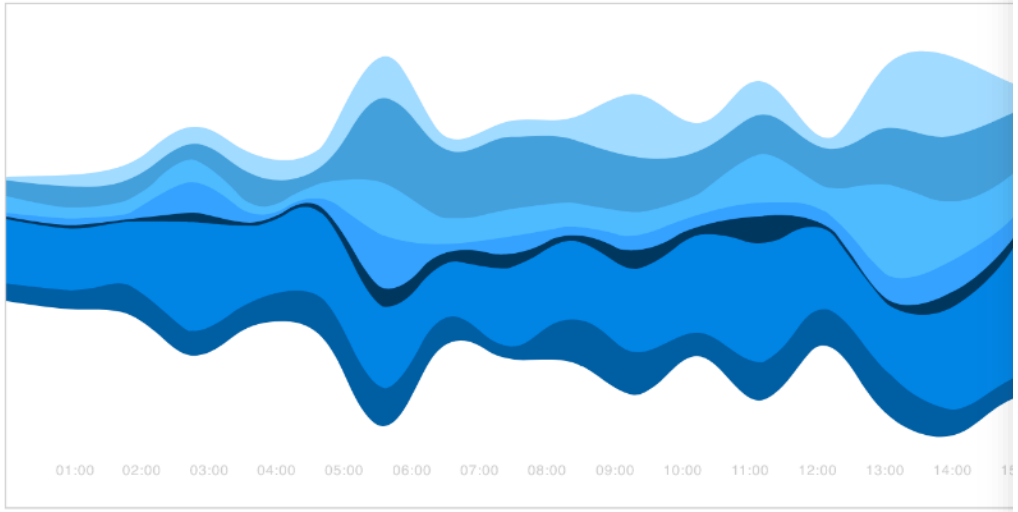
Visualizing 40 Years of Music Industry Sales

Published 3 years ago on October 6, 2018

By **Nick Routley**



Stream Graph



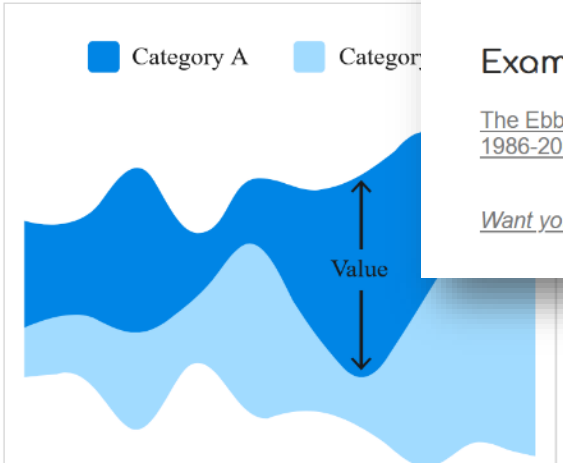
Description

Also known as a *ThemeRiver*.

This type of visualisation is a variation of a Stacked Area Graph, but instead of plotting values against a fixed, straight axis, a Stream Graph has values displaced around a varying central baseline. Stream Graphs display the changes in data over time of different categories through the use of flowing, organic shapes that somewhat resemble a river-like stream. This makes Stream Graphs aesthetically pleasing and more engaging to look at.

In a Stream Graph, the size of each individual stream shape is proportional to the values in each category. The axis that a Stream Graph flows parallel to, is used for the timescale. Colour can be used to either distinguish each

Anatomy



Functions

Data over time | Patterns

Similar Charts

Stacked Area Graph

Tools to Generate Visualisation

Bob Rudis' GitHub (code)
D3 (code)
Infogram
JSFiddle (code)
Lee Byron's GitHub (code)
NVD3.js (code)
plotDB
RAWGraphs
Stream graph generator (code)

Examples

The Ebb and Flow of Movies: Box Office Receipts 1986-2008, The New York Times

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Need to access this page offline? Download the eBook from here.

Merchandise & other related dataviz products can be found at the store

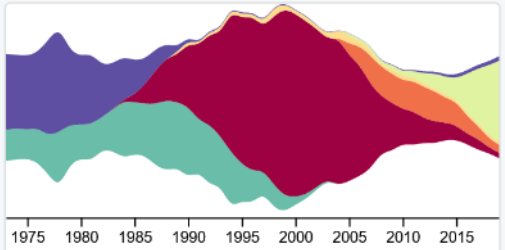
RAWGraphs

RAWGraphs 2.0 beta

Ab

2. Choose a chart

Show All charts



Streamgraph (area chart)

It allows the comparison of multiple categories over a continuous dimension.

Code Tutorial

- **Alluvial Diagram** — Correlations, proportions
- **Arc Diagram** — Networks
- **Bar chart** — Correlations
- **Multi-set bar chart** — Correlations, proportions
- **Stacked bar chart** — Correlations, proportions
- **Beeswarm plot** — Distributions, time series, proportions
- **Box plot** — Distributions
- **Bubble chart** — Correlations, proportions
- **Bumpchart** — Time series, correlations, proportions
- **Circle Packing** — Hierarchies, proportions
- **Circular dendrogram** — Hierarchies, proportions
- **Contour plot** — Correlations, distributions
- **Convex hull** — Correlations, proportions
- **Linear dendrogram** — Hierarchies, proportions
- **Gantt chart** — Time series, correlations
- **Hexagonal binning** — Correlations, distributions
- **Horizon graph** — Time series, correlations
- **Line chart** — Time series, correlations

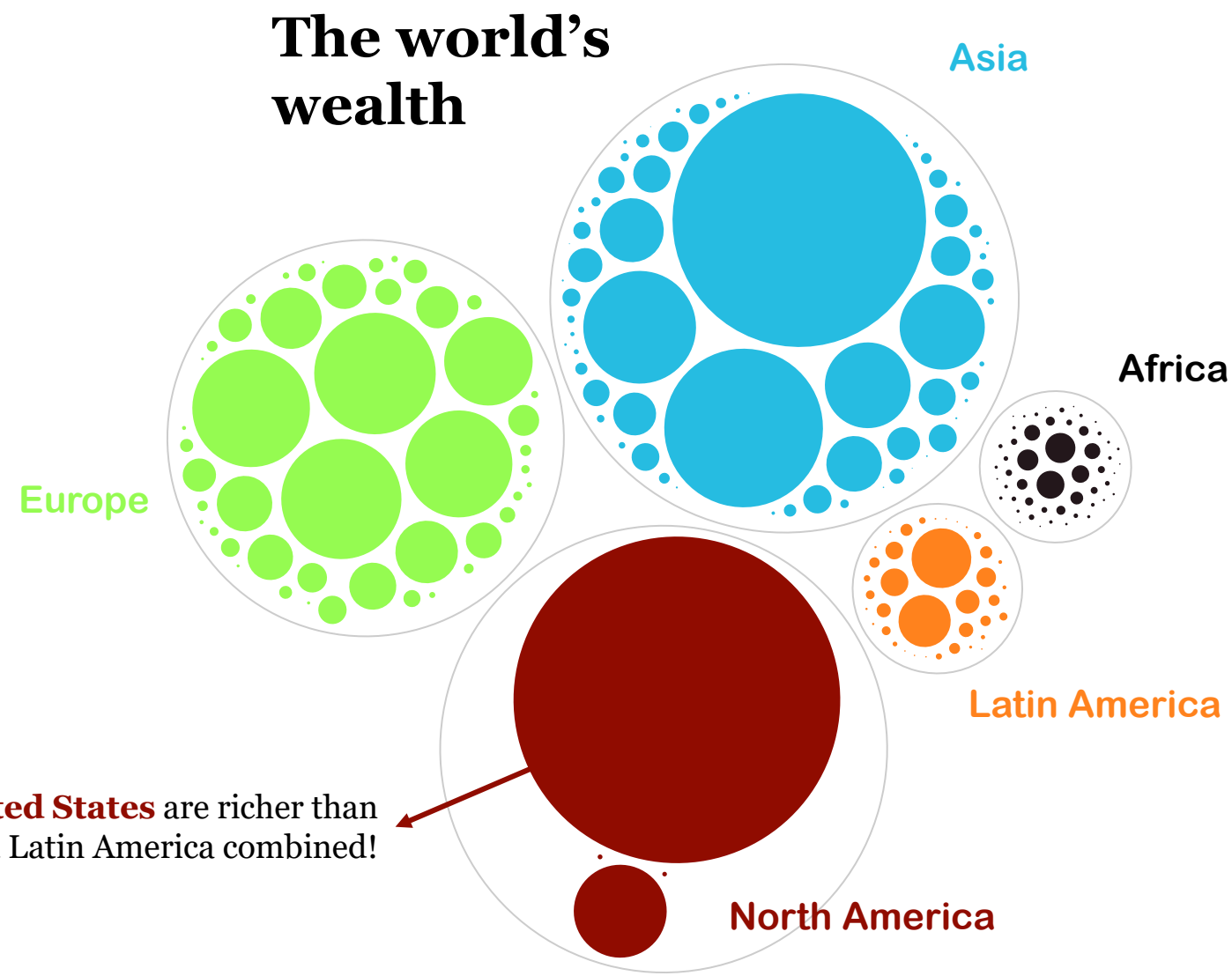
Time to play

Individual exercise

Download the data file
baryon.be/files/workshop/wealth.xlsx

Use **RAWGraphs** and **PowerPoint**
to mimic the chart on the right

Or feel free to play around and
explore a tool of your choice



Session 1

Introduction

Elements of powerful visuals

Visual communication principles

lunch break

Graphical abstracts/posters

Design principles

Icons and illustrations

Editing vector images

HOMEWORK
Create a graphical abstract

Session 2

Homework feedback

Colours and text in your visuals

Editing bitmap images

Creating layouts

Graphs

Legal and ethical aspects

Recap and Q&A

Legal and ethical aspects

Licenses and **rights**

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Fleur Reijngoudt 20-07-20, 09:00 Laatste update: 20-07-20, 17:21

Doe mee aan de Handbal NL Verenigingsloterij en steun ABS-handbal!
Het bericht met deze titel verscheen op 3 januari op de website van de

NET BINNEN

16:02 Treinverkeer tussen Deventer en Almelo plat door aanrijding: extra drukte op...

15:01 PREMIUM Dromen komen uit voor Deventer Nachtparlement: 'We kunnen nu...

12:21 Tientallen tips na delen heftige dashcambeelden van over de kop geslagen...

11:30 PREMIUM Deventer schaatsen in het vet, maar nog niet gedaan met de pret: 'Tijd voor...

11:29 PREMIUM Verloren zoon Duteweert helpt ABS langs Colmschate

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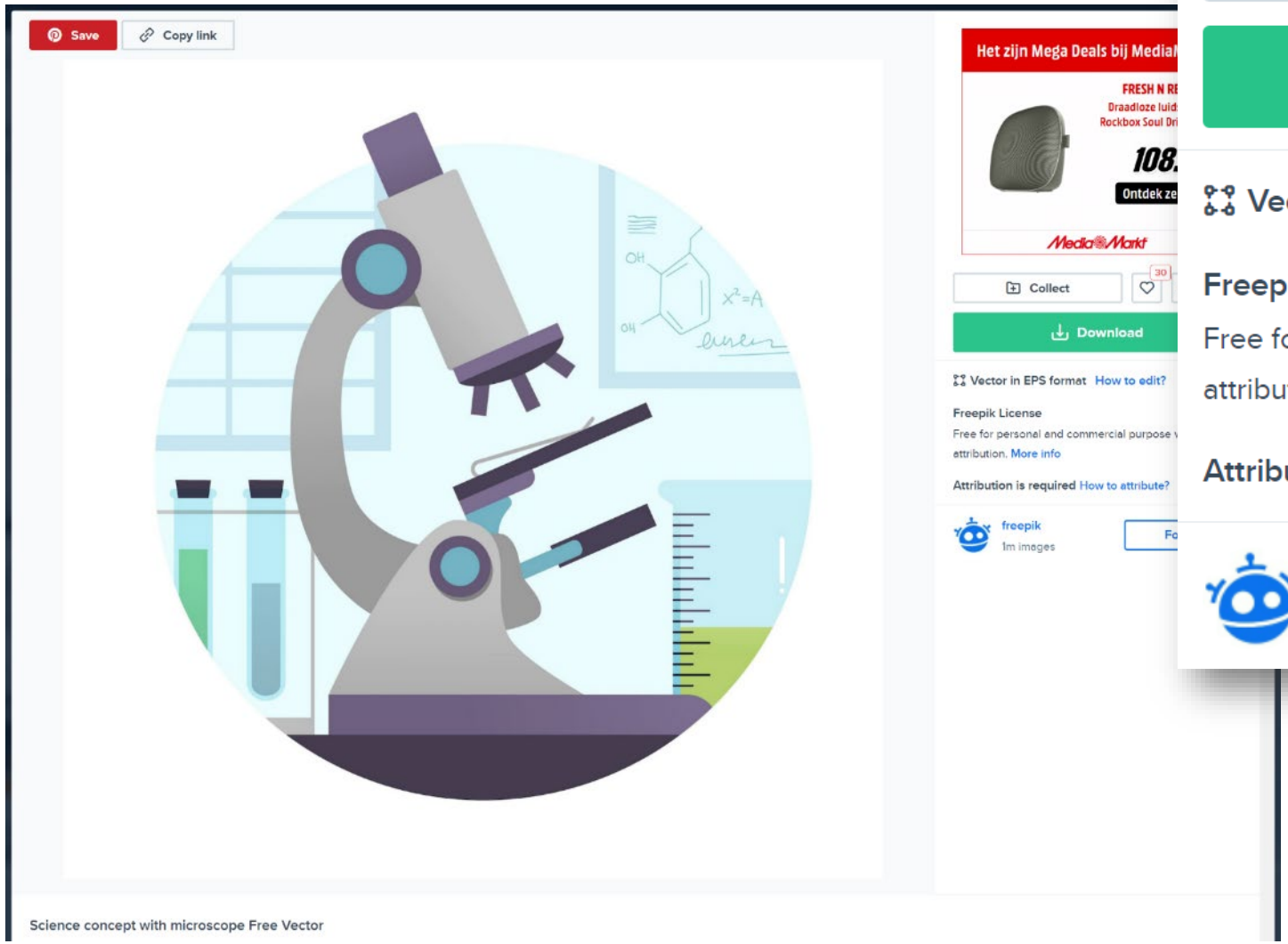
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- using visuals in a logo
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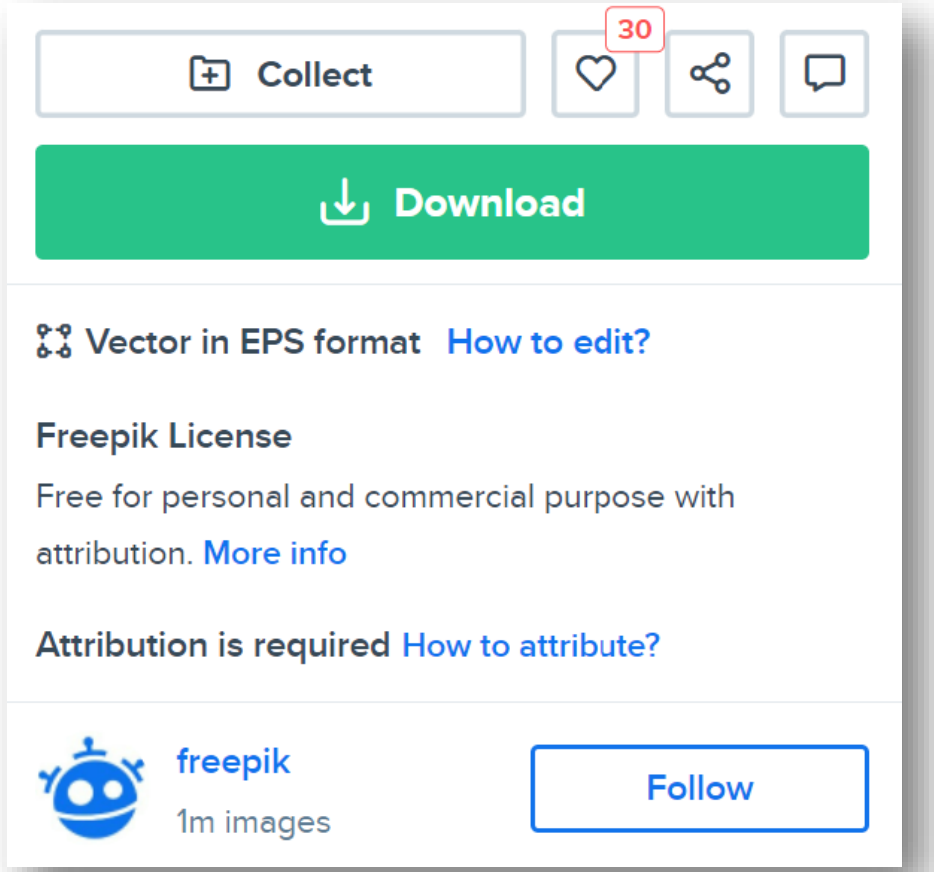

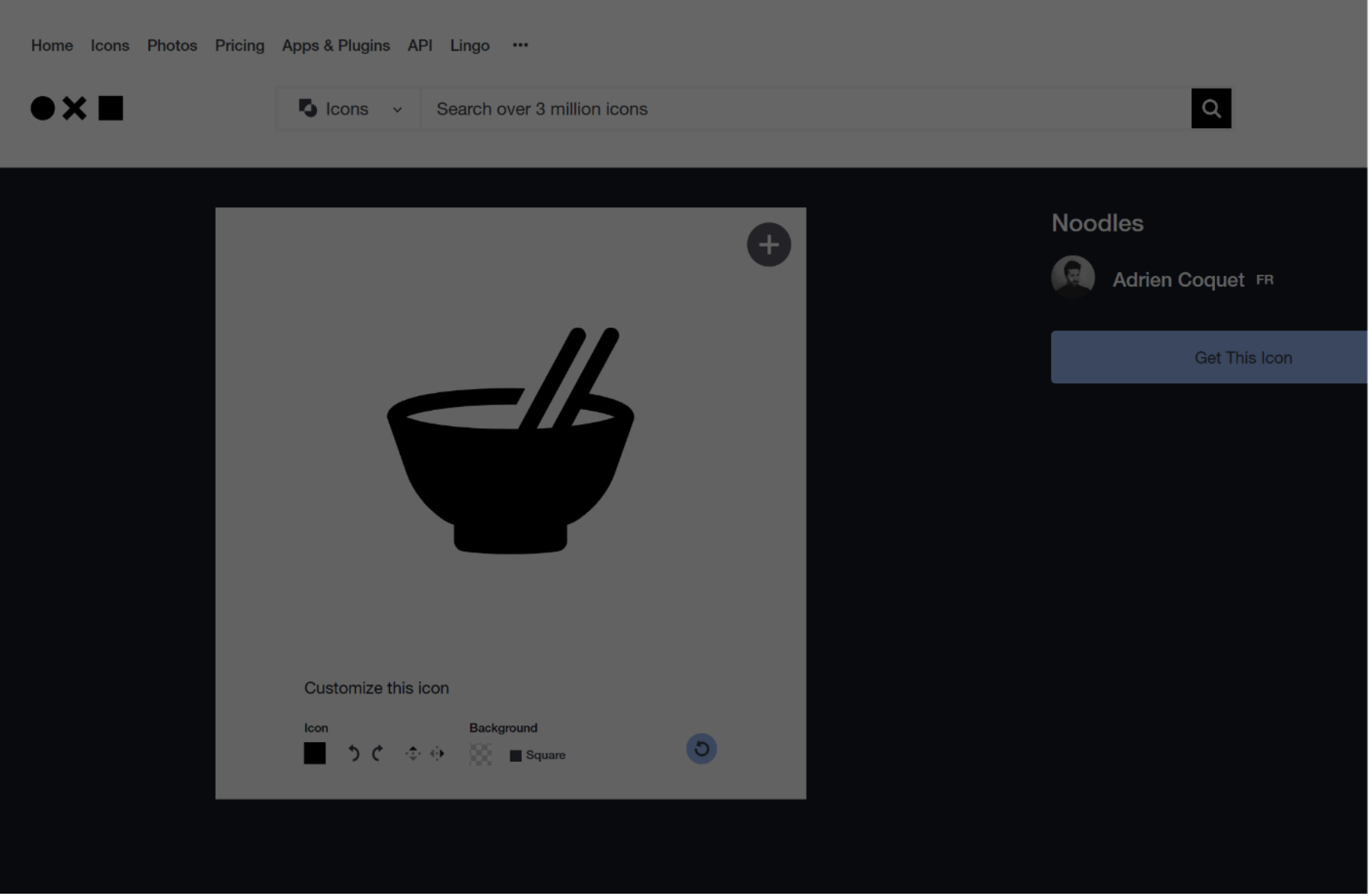

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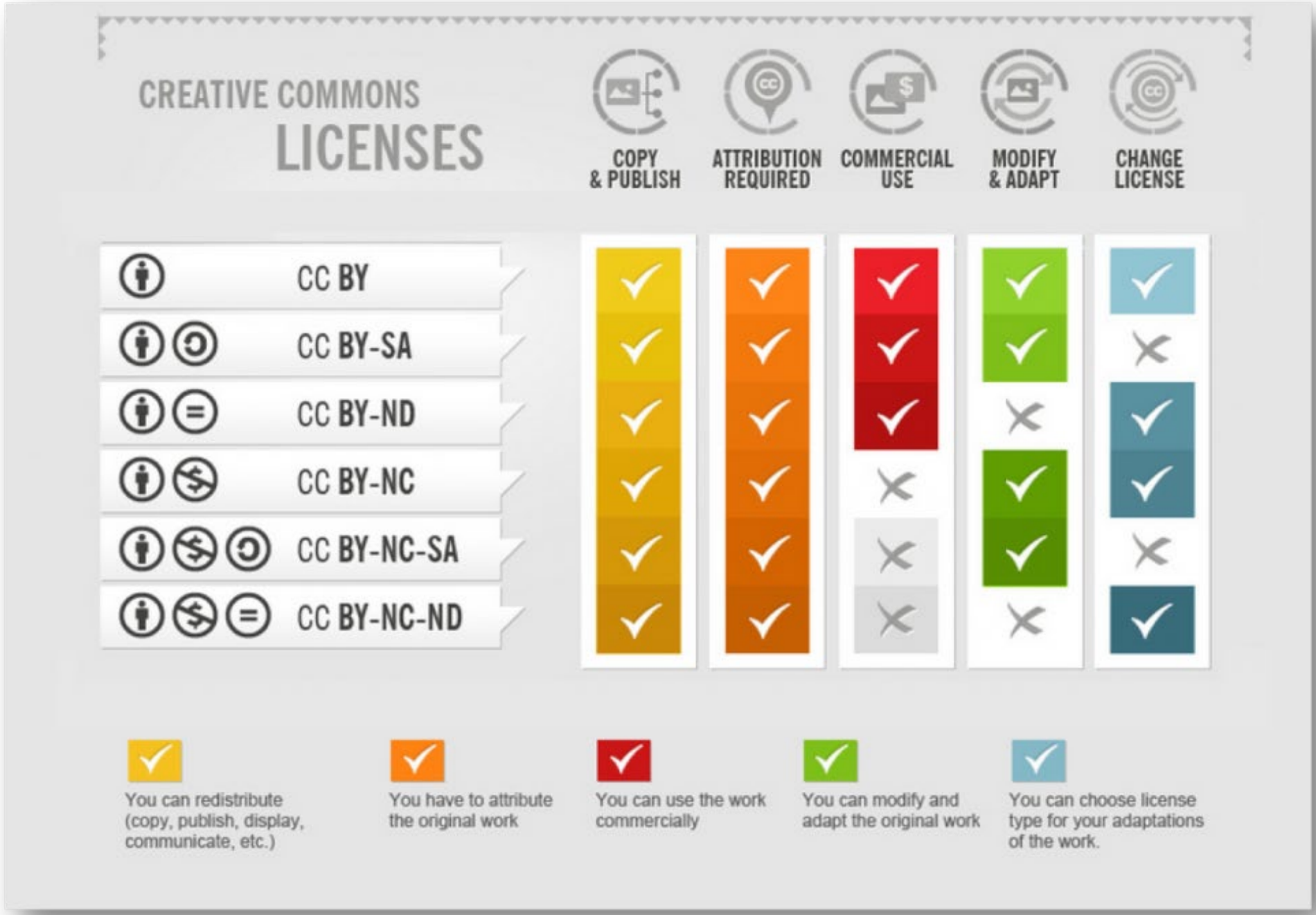
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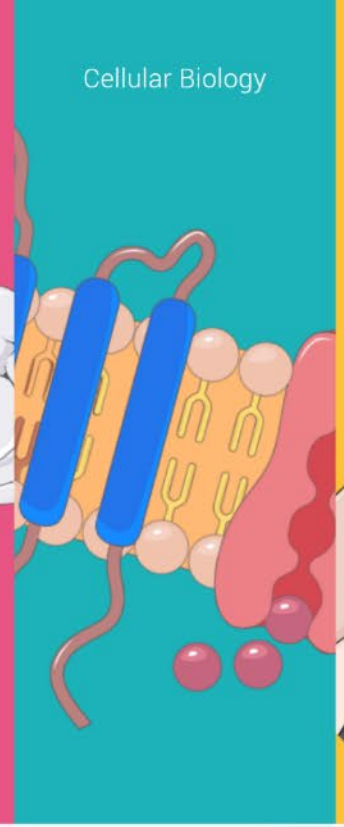

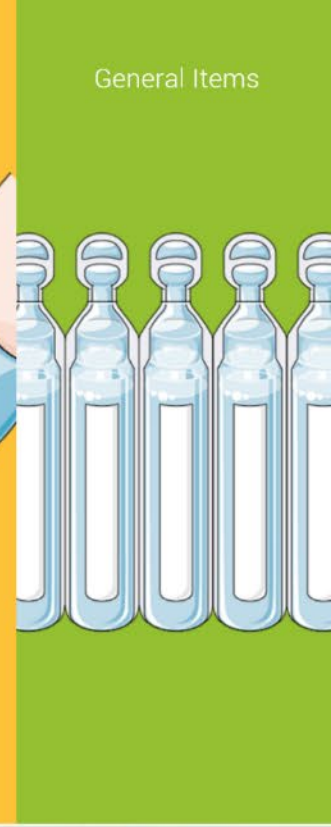

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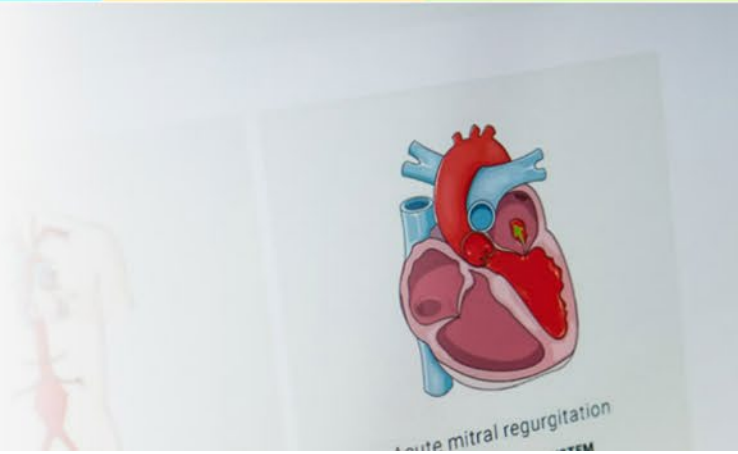

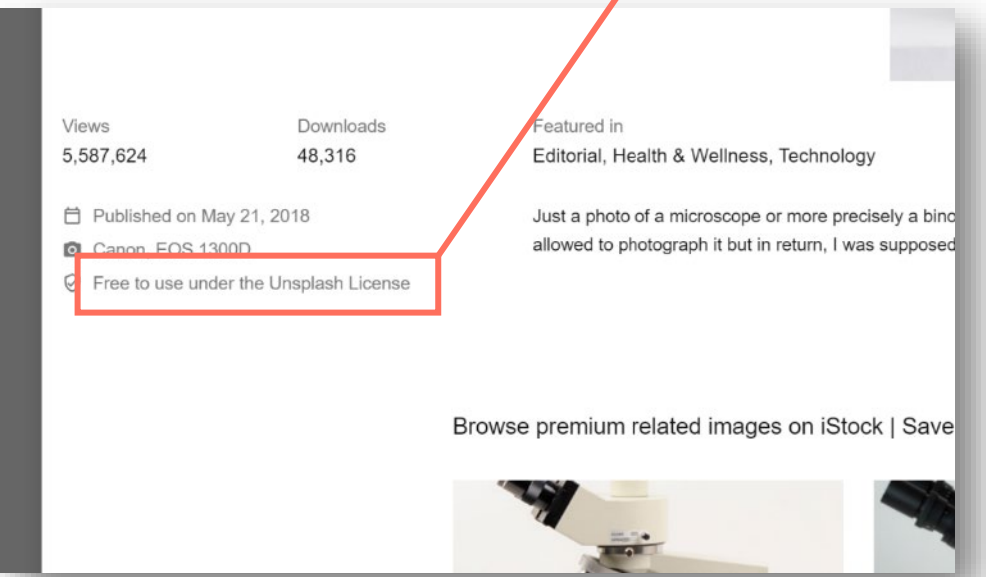

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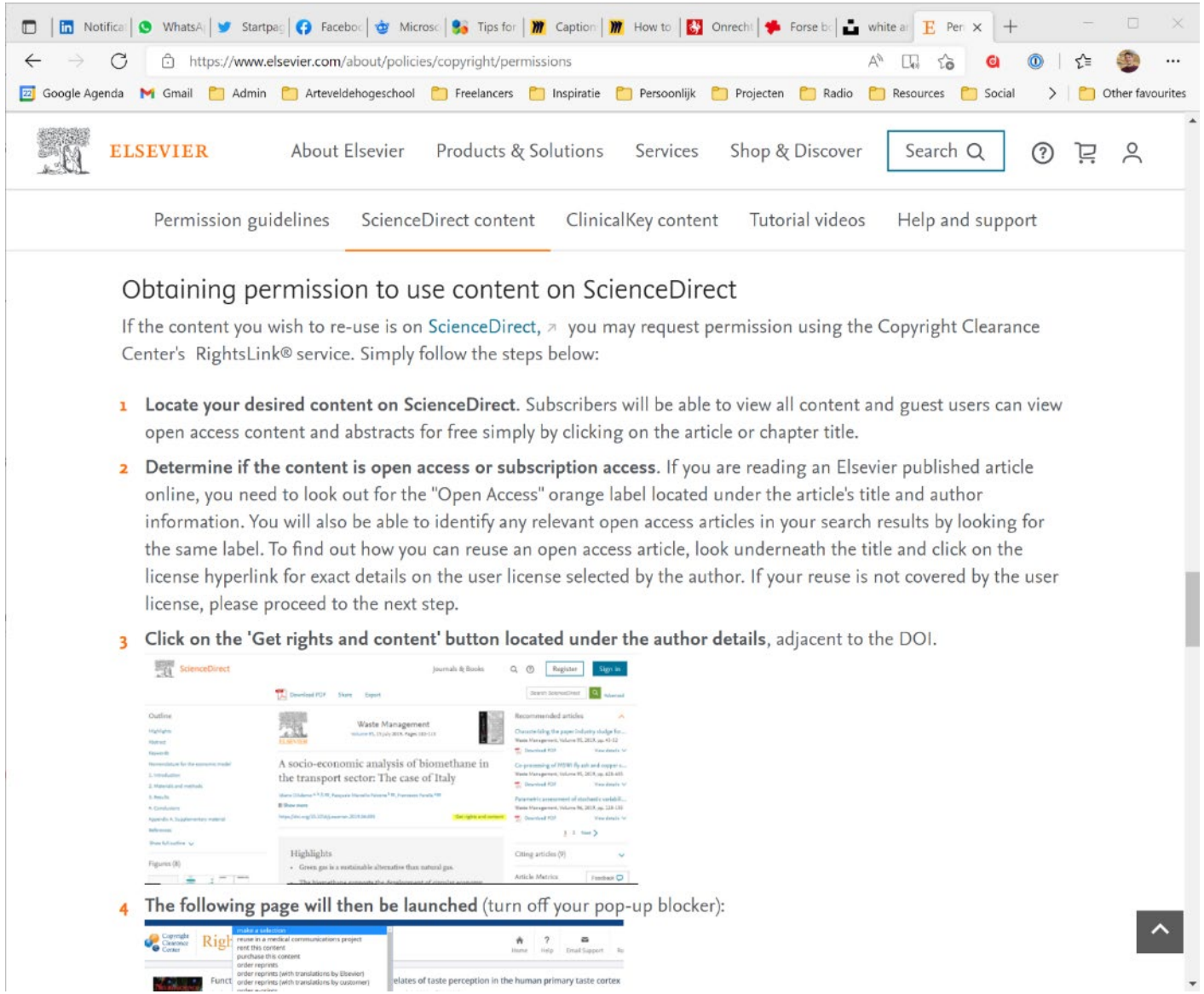

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-> ask permission to the owner/copyright holder

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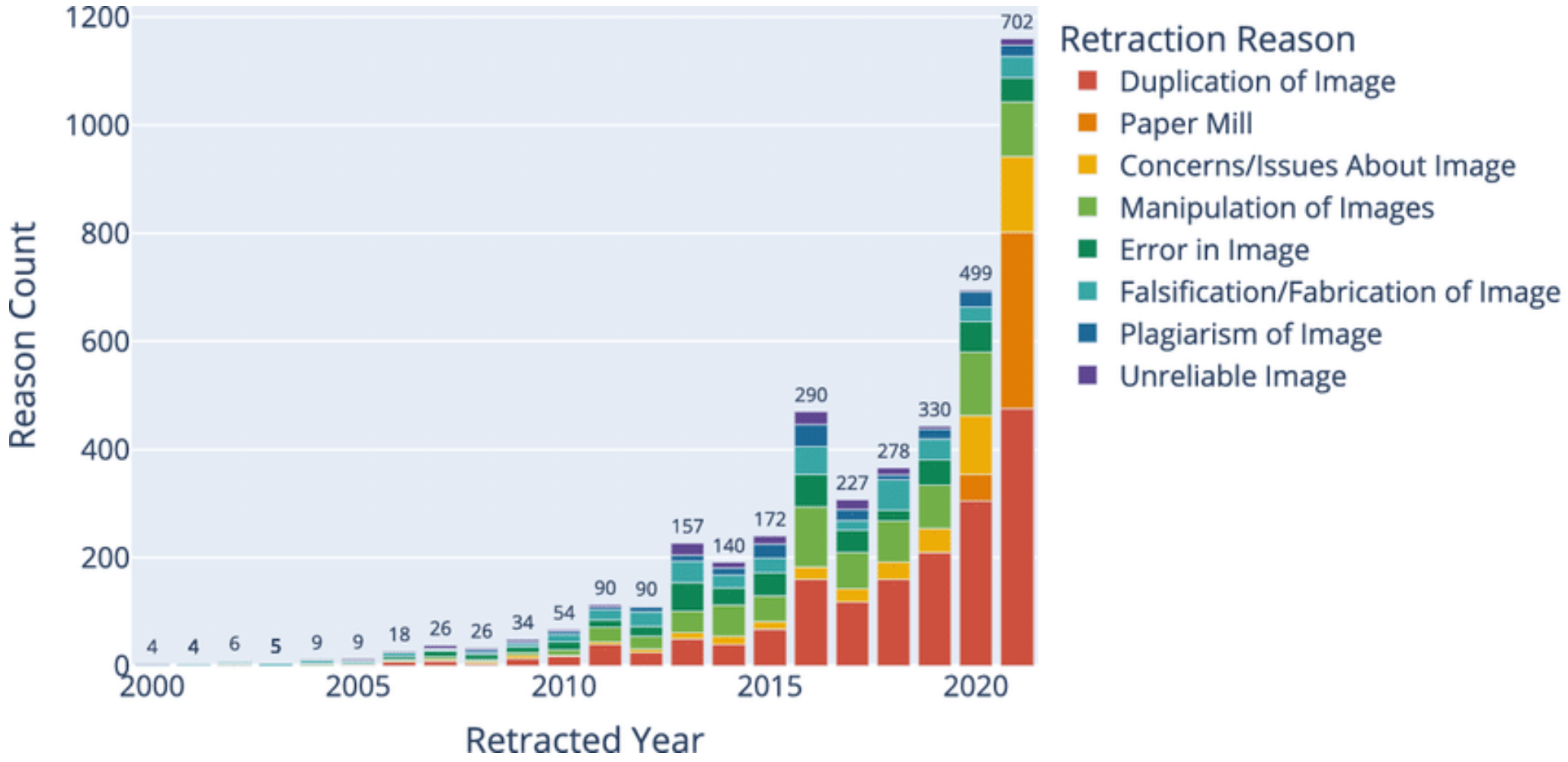
Image **manipulation**



Benchmarking Scientific Image Forgery Detectors, Science and Engineering Ethics 28 (2022) 35

General Sherman (1865)

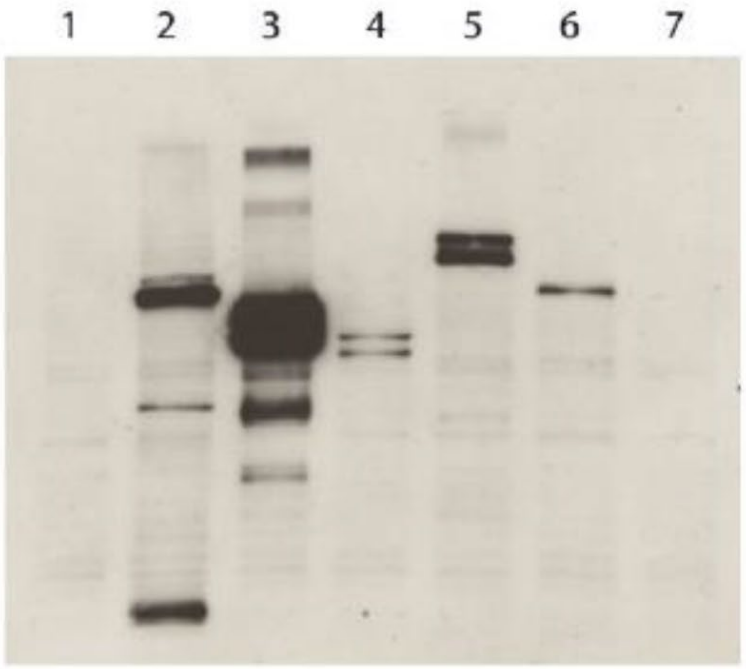
Why do people manipulate images?

- perceived acceptability?
- lack of education or monitoring?
- more focus on the essence?
- need for nice looking data?
- ease of manipulation?
- neglecting negative outcomes?
- removing outliers?
- honest error?
- …

Why is image manipulation wrong?

- deceiving the audience
- damaging your (group) reputation
- limiting progress in the field
- endangering patients
- missing funds
- …

“Ethical” manipulation



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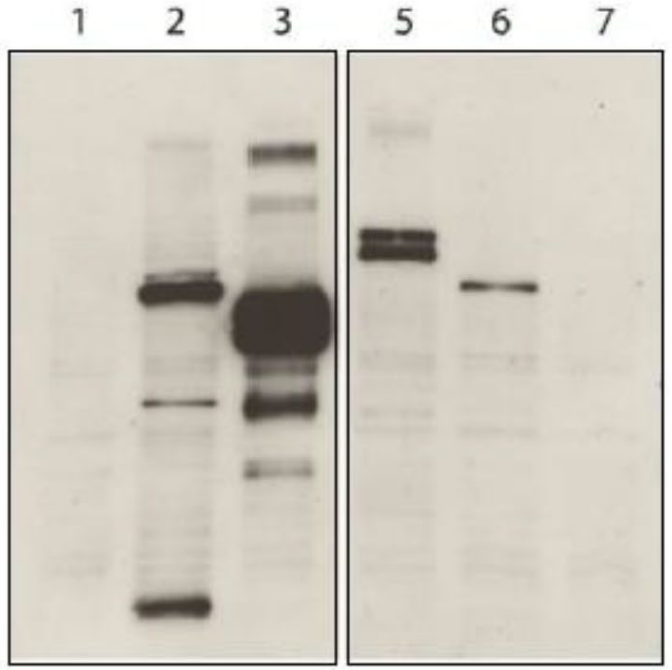
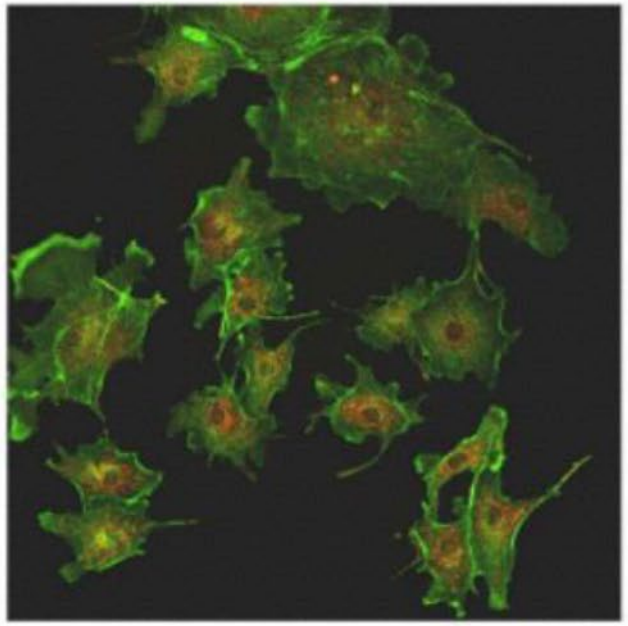
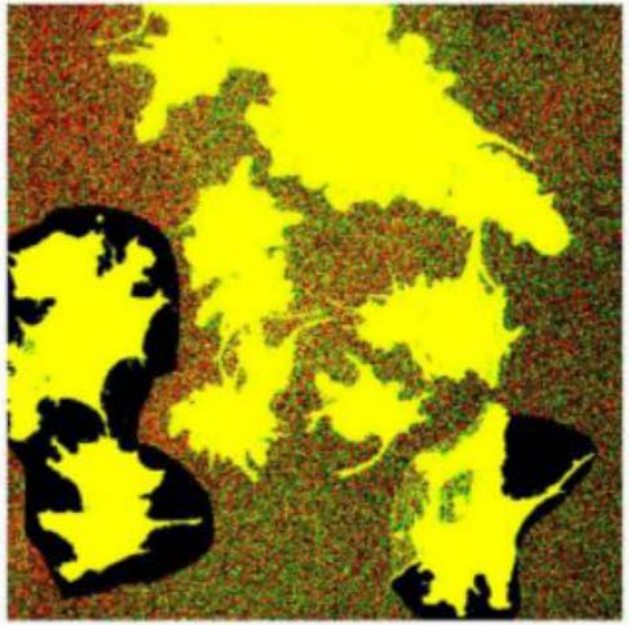


Manipulated image: a lane was removed because it was not relevant. A white dividing line clearly indicates that something was removed.

Unethical manipulation

Original submitted





Manipulation revealed
by contrast adjustment

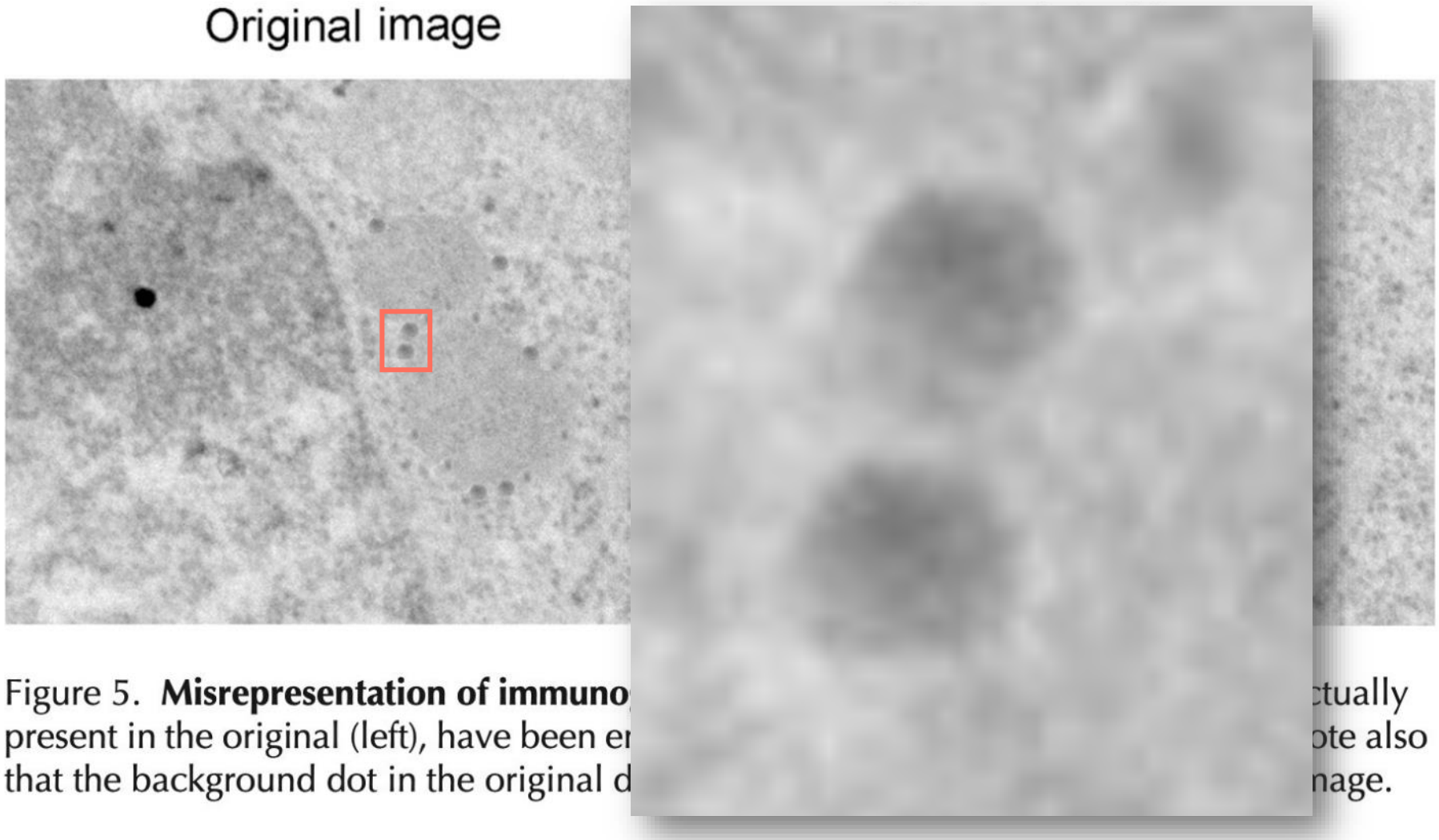


Figure 5. **Misrepresentation of immuno** ctually present in the original (left), have been er ote also that the background dot in the original d nage.

[What's in a picture? The tempatation of image manipulation, The Journal of Cell Biology 166 (2004) 11-15]

Elisabeth Bik
66,2K Tweets

Volgend

Elisabeth Bik
@MicrobiomDigest Volgt jou

Science consultant, PhD. Microbiome, science integrity, #ImageForensics.
@ElisabethBik@med-mastodon.com
Patreon.com/elisabethbik. She/her 🐢🔬🇳🇱🇺🇸

San Francisco, CA scienceintegritydigest.com/about/
Lid sinds oktober 2013

44,2K Volgend **135,2K** Volgers

Gevolgd door Dr Yiğit Oezcelik, Sarah Ahannach en 65 anderen die jij volgt

Tweets | Tweets en antwoorden | Media | Vind-ik-leuks

Vastgemaakte Tweet

Elisabeth Bik @MicrobiomDigest · 9 dec.
New Microbiome Digest, December 9, by @svetlana_up

> **Svetlana U. Perović** @svetlana_up · 9 dec.
> NEW @MicrobiomDigest 👉 microbiomedigest.com/2022/12/09/dec...
>
> · global sewage #AMR /@pat_munk
>
> · wastewater /@KatieCommits @irmarie_25
>
> · mOTUs3 /@hjruscheweyh @alessio_mila
>
> · postdoc days /@Prokaryota @chris_zie

[12 Guidelines for best practices in image processing]

Treating Images as Data: Digital scientific images should be treated as data

Saving the Original: Manipulations of digital images should always be done on a copy of the raw image data. The original must be retained.

Making Simple Adjustments: Simple adjustments to the entire image are usually acceptable.

Cropping is usually OK: Cropping an image is usually acceptable.

Comparing Images: Digital images that will be compared to one another should be acquired under identical conditions.

Manipulating the Entire Image: Manipulations that are specific to one area of an image and are not performed on other areas are questionable.

Filters Degrade Data: Use of software filters to improve image quality is usually not recommended for biological images.

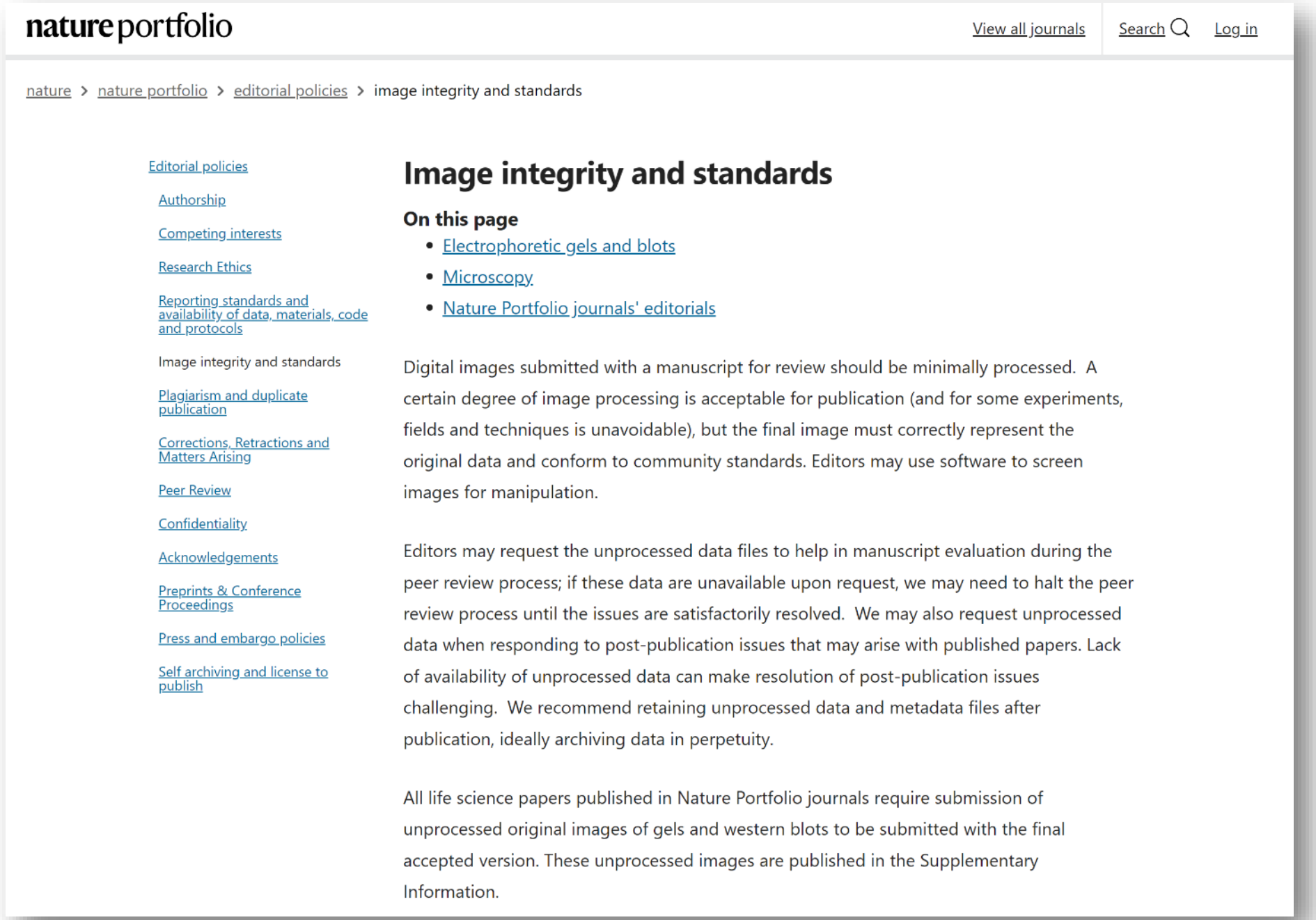
Cloning Degrades Data: Cloning objects into an image or from other parts of the image is very questionable.

Making Intensity Measurements: Intensity measurements of digital images should be performed on raw data and the data should be calibrated to a known standard.

Lossy Compression Degrades Data: Avoid the use of lossy compression.

Issues With Magnification: Magnification and resolution issues are important.

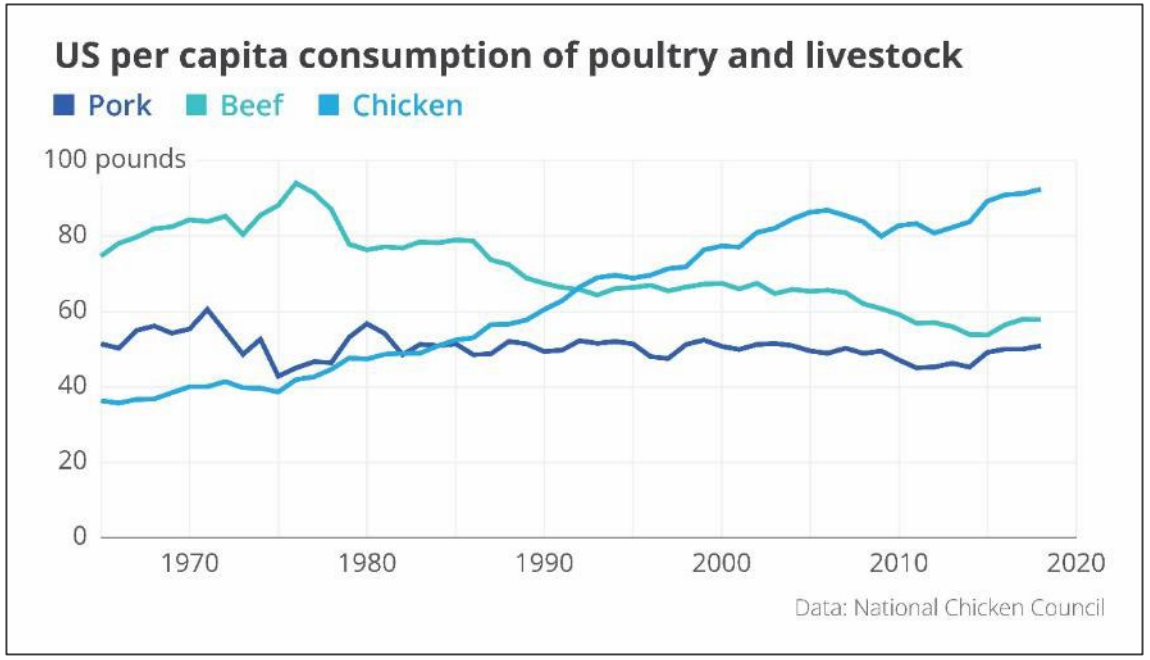
Issues With Pixels: Be careful when changing the size (in pixels) of a digital image.

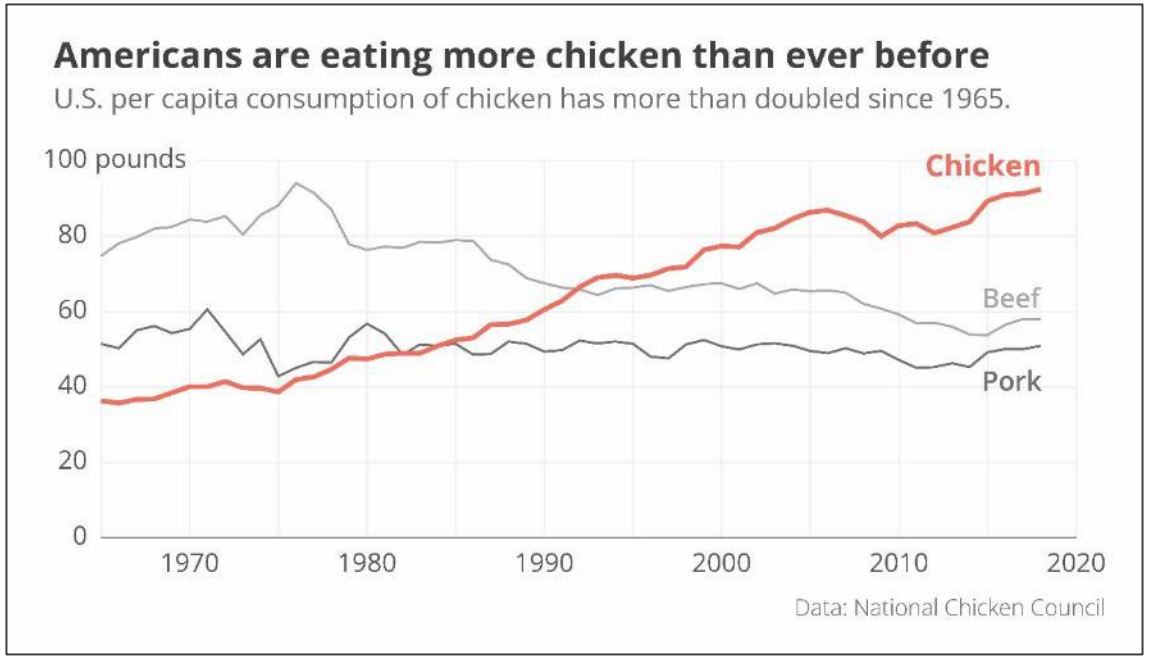


Nature Portfolio: Image integrity and standards

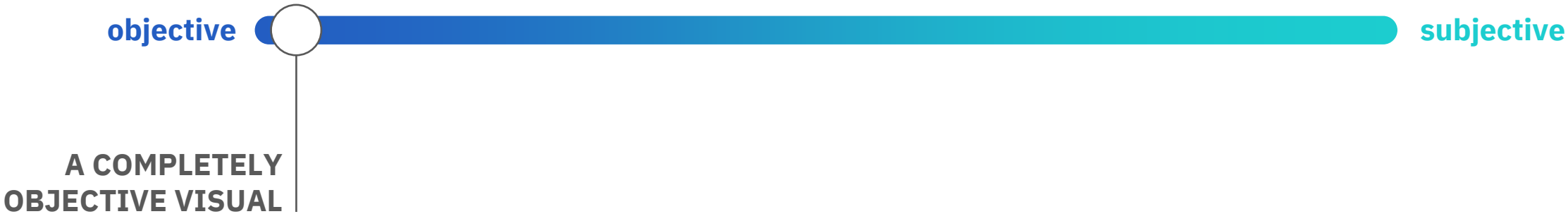
Objective versus **subjective** data visuals

~~data~~ → story


US per capita consumption of poultry and livestock
Pork
Beef
Chicken
100 pounds
80
60
40
20
0
1970
1980
1990
2000
2010
2020
Data: National Chicken Council


Americans are eating more chicken than ever before
U.S. per capita consumption of chicken has more than doubled since 1965.
100 pounds
80
60
40
20
0
Chicken
Beef
Pork
1970
1980
1990
2000
2010
2020
Data: National Chicken Council

Which chart do you want?

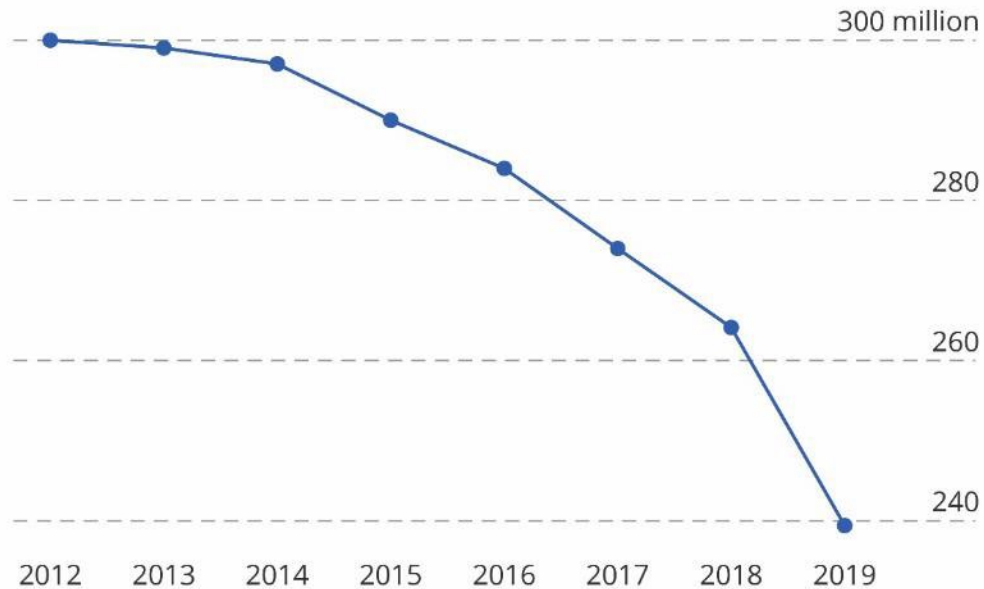


(number of cash withdrawals from ATMs)

Source: [De Standaard](), 22 December 2020

Number of cash withdrawals at Belgian ATMs

Source: Febelfin

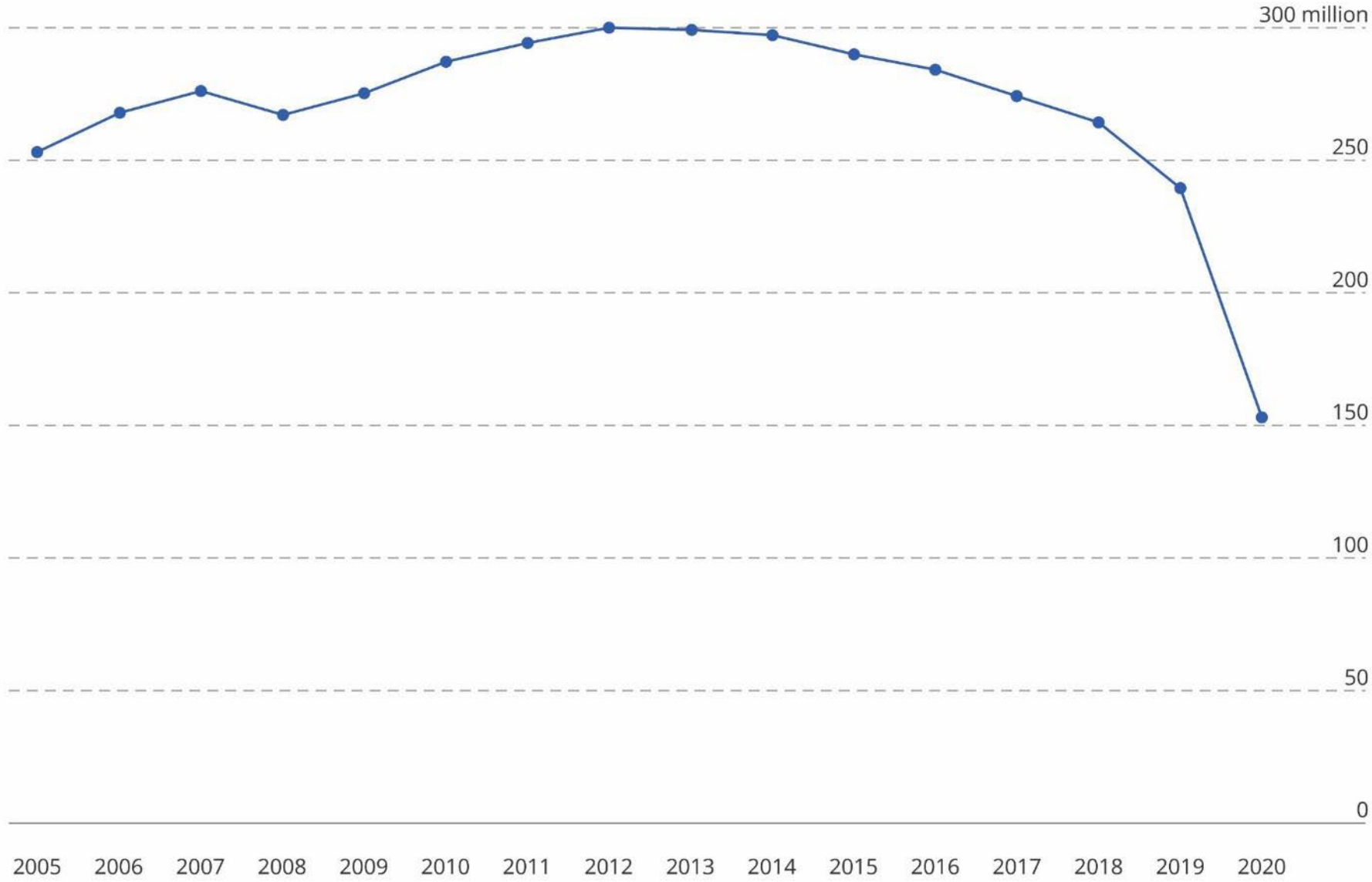


Number of cash withdrawals at Belgian ATMs

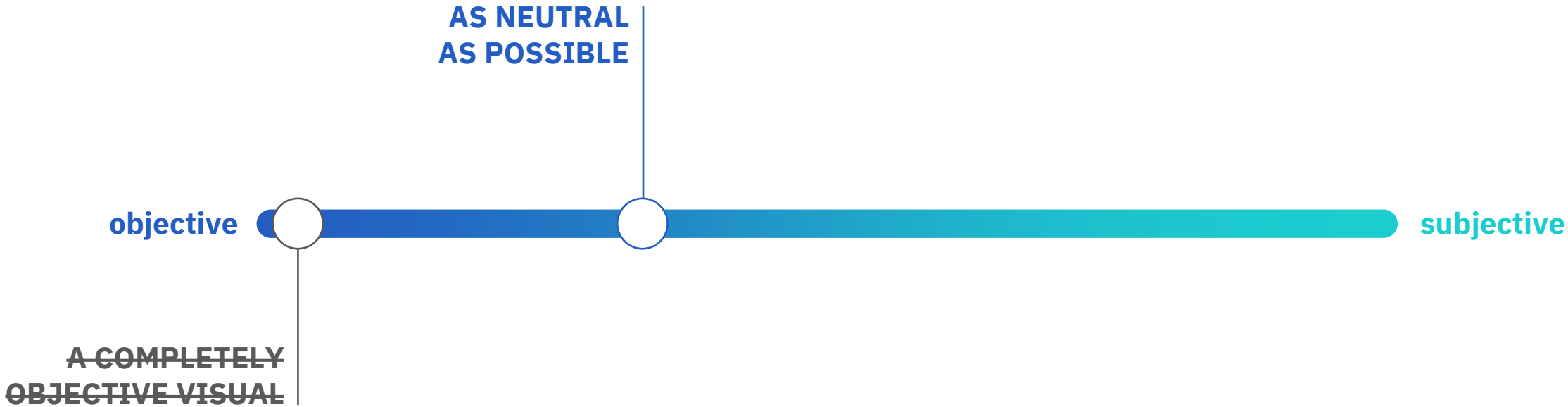
Source: Febelfin

Number of cash withdrawals at Belgian ATMs

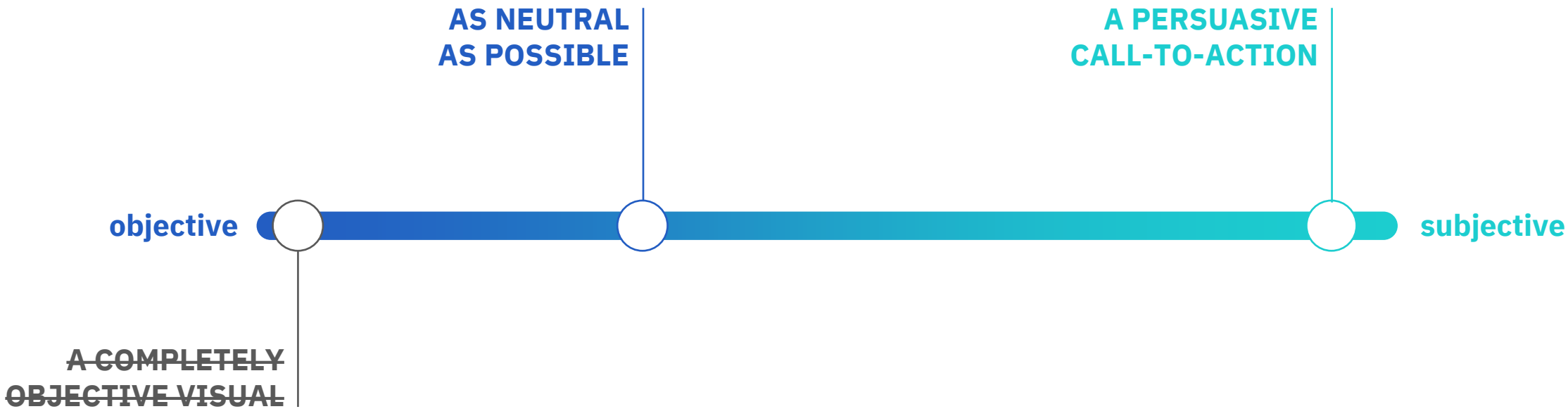
Source: Febelfin



Which chart do you want?



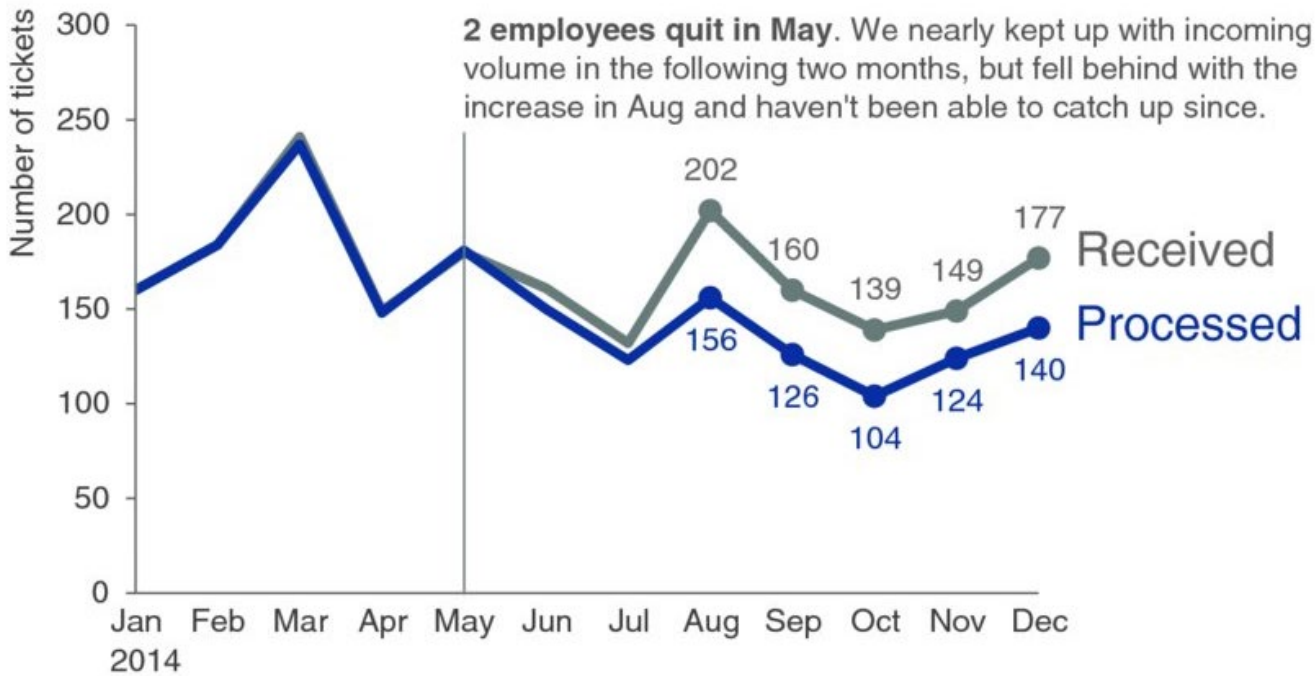
Which chart do you want?



Please approve the hire of 2 FTEs

to backfill those who quit in the past year

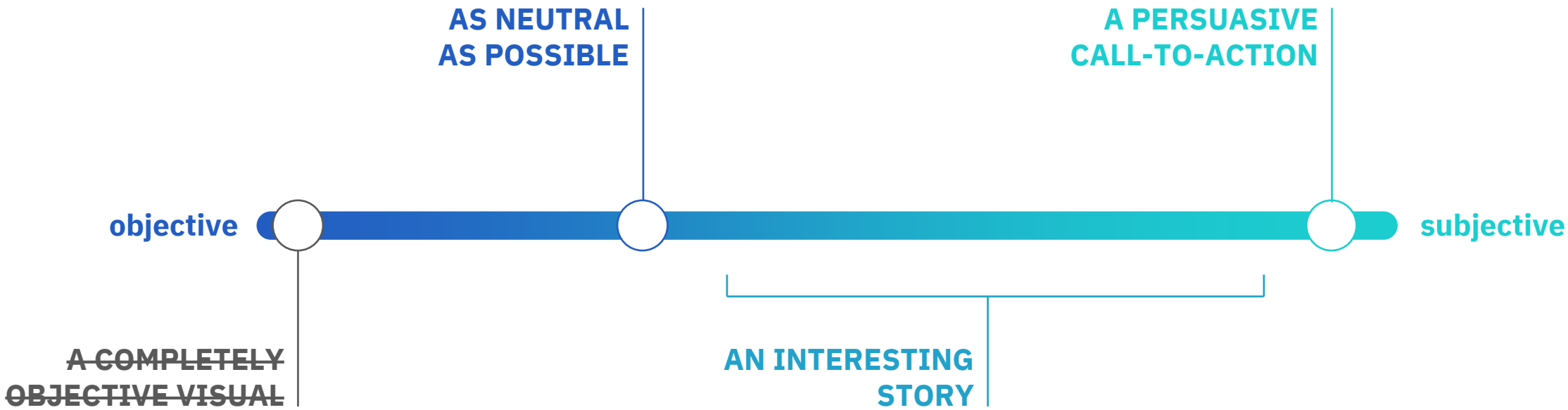
Ticket volume over time



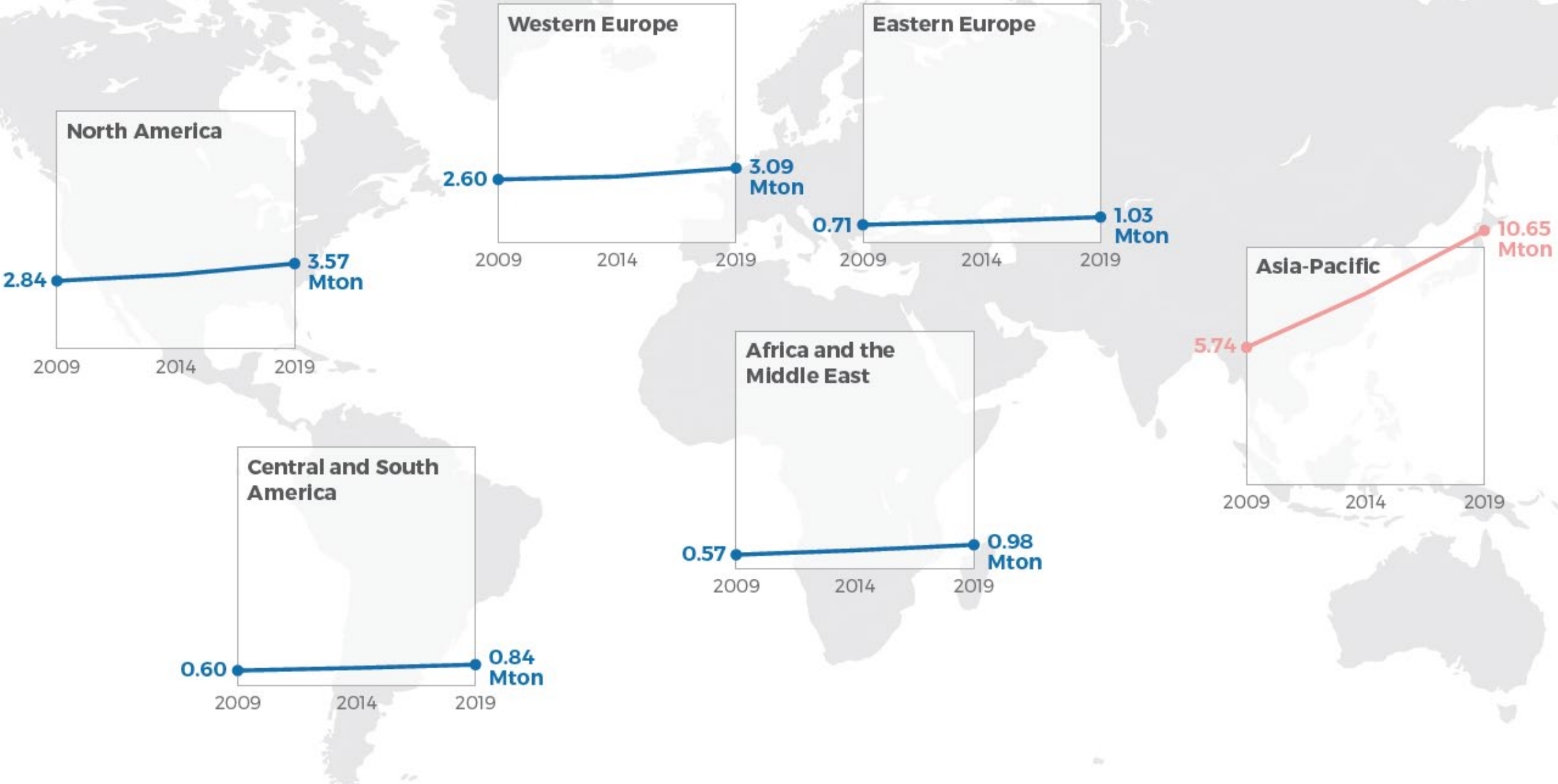
2 employees quit in May. We nearly kept up with incoming volume in the following two months, but fell behind with the increase in Aug and haven't been able to catch up since.

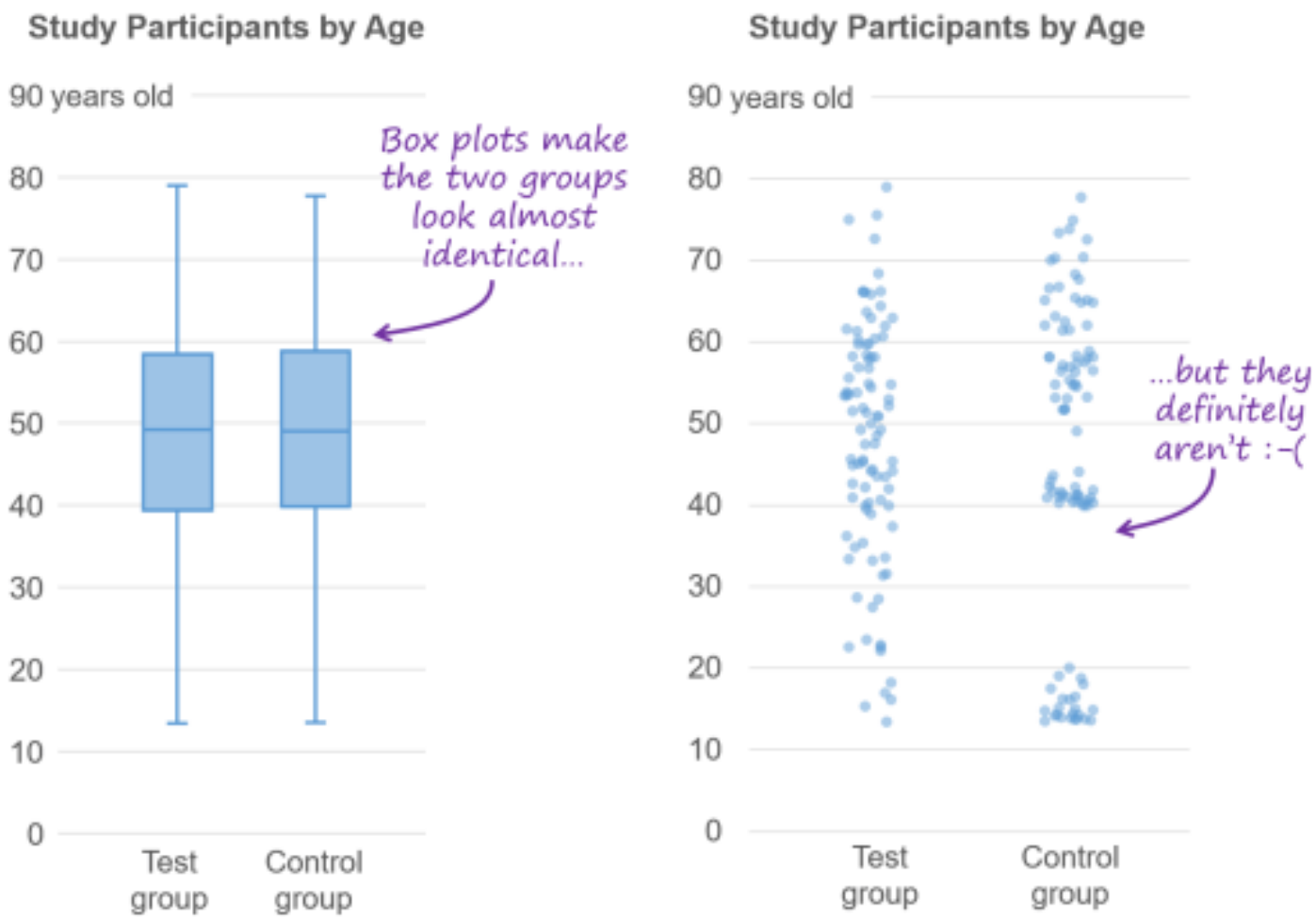
Data source: XYZ Dashboard, as of 12/31/2014 I A detailed analysis on tickets processed per person and time to resolve issues was undertaken to inform this request and can be provided if needed.

Which chart do you want?



Asia-Pacific will continue to be the biggest demand region



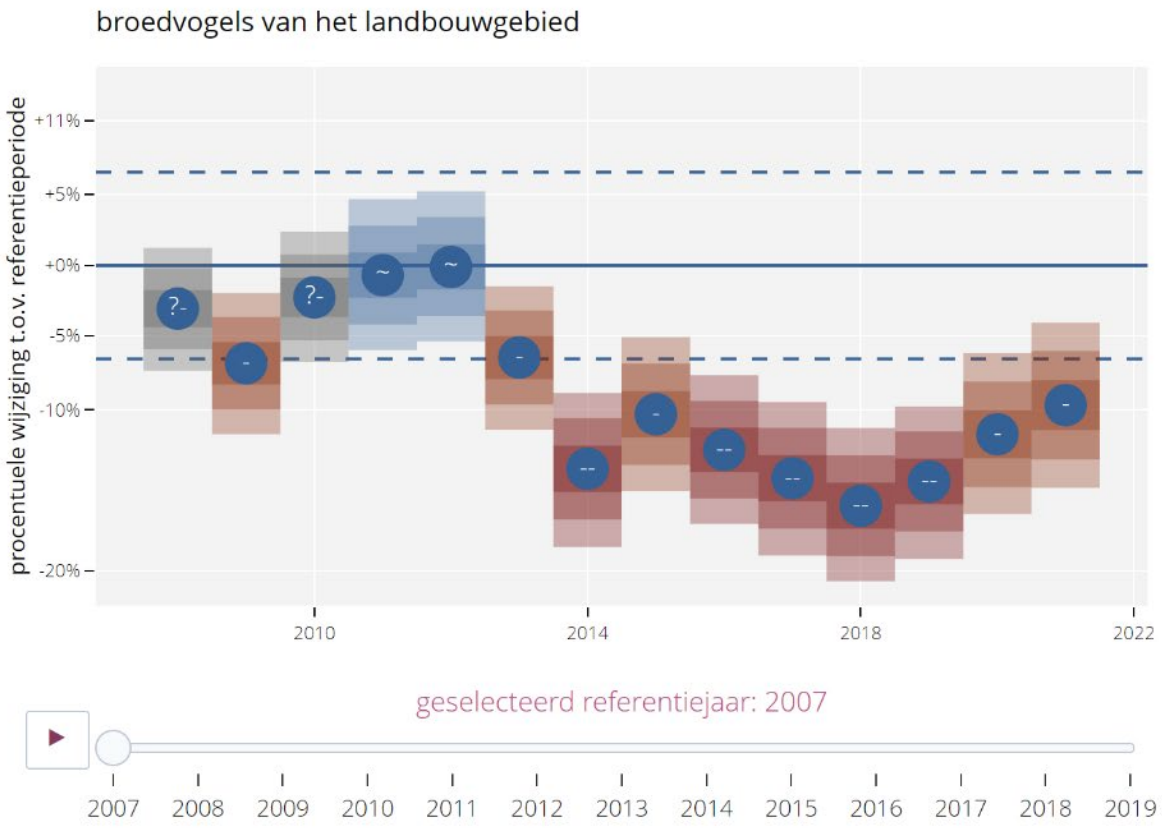


nightingaledvs.com/ive-stopped-using-box-plots-should-you

Akkervogels volgens de Algemene Broedvogelmonitoring Vlaanderen

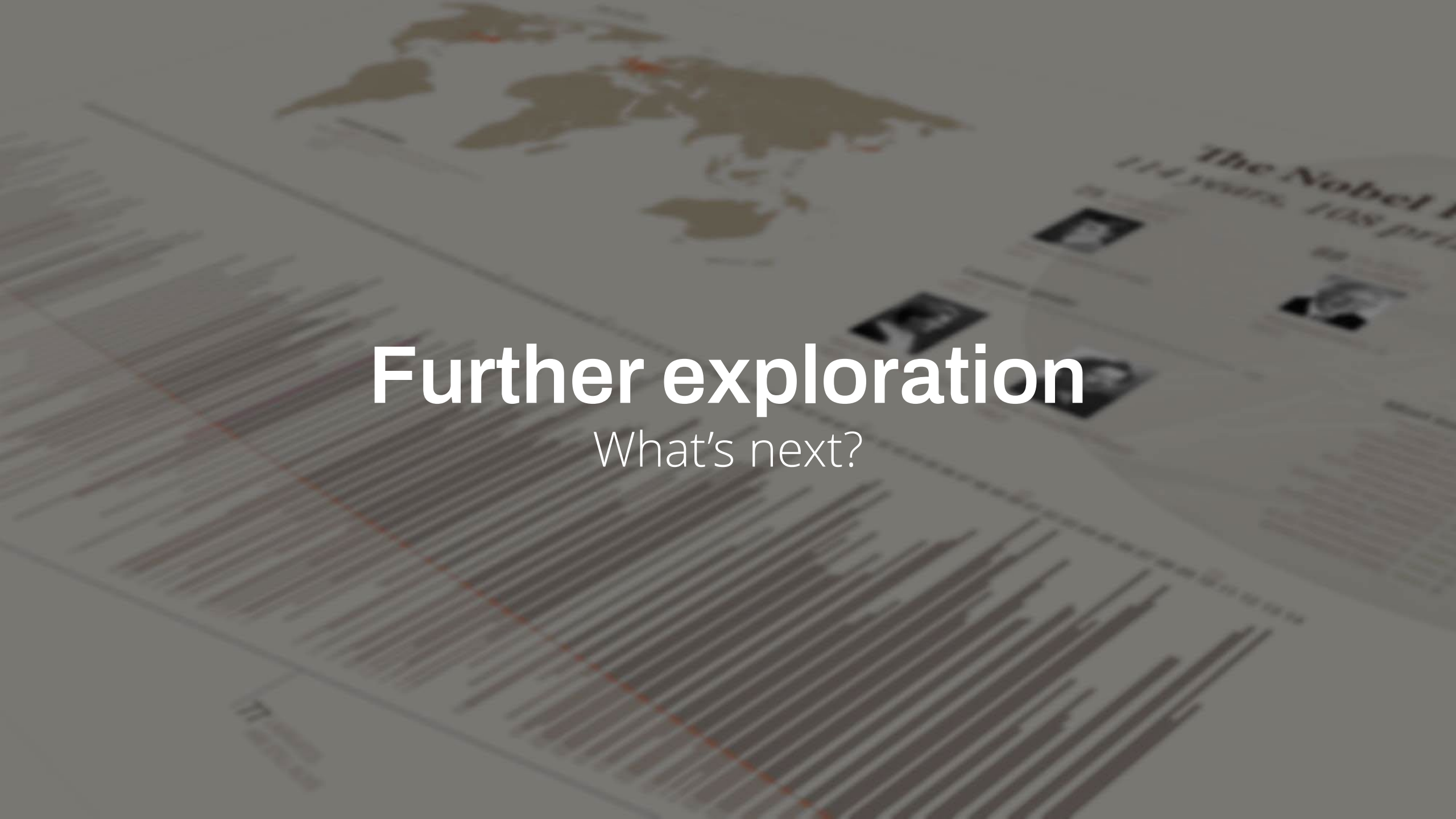
Publicatiedatum: 2022-03-24T10:00:00+01:00

De soorten van het landbouwgebied schommelden in de periode 2007-2012. Na een sterke daling in de periode 2013-2018, lijken de aantallen sinds 2019 heel langzaam wat te herstellen, maar ze bevinden zich nog ruim onder die van de start van het ABV-project in 2007.



Gebruikte drempelwaarden classificatie: referentie = 0%, ondergrens = -6.6% en bovengrens = +7.0%.

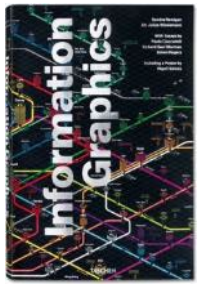
vlaanderen.be/inbo/indicatoren/akkervogels-volgens-de-algemene-broedvogelmonitoring-vlaanderen



Further exploration

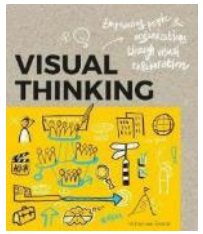
What's next?

Books



Information graphics

Taschen



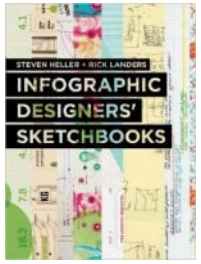
Visual thinking

Willemien Brand

RECOMMENDED

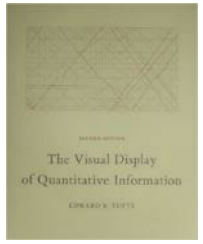
Visual journalism

Gestalten



Infographic designers' sketchbooks

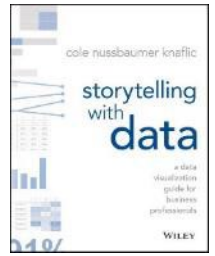
Steven Heller, Rick Landers



The visual display of quantitative information

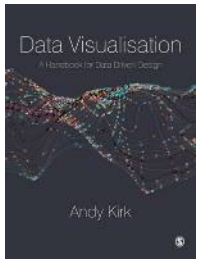
Edward R. Tufte

RECOMMENDED



Storytelling with data

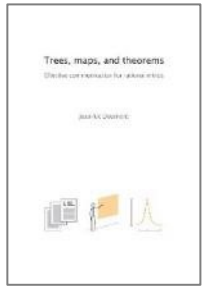
Cole Nussbaumer Knaflic



Data visualisation

Andy Kirk

RECOMMENDED

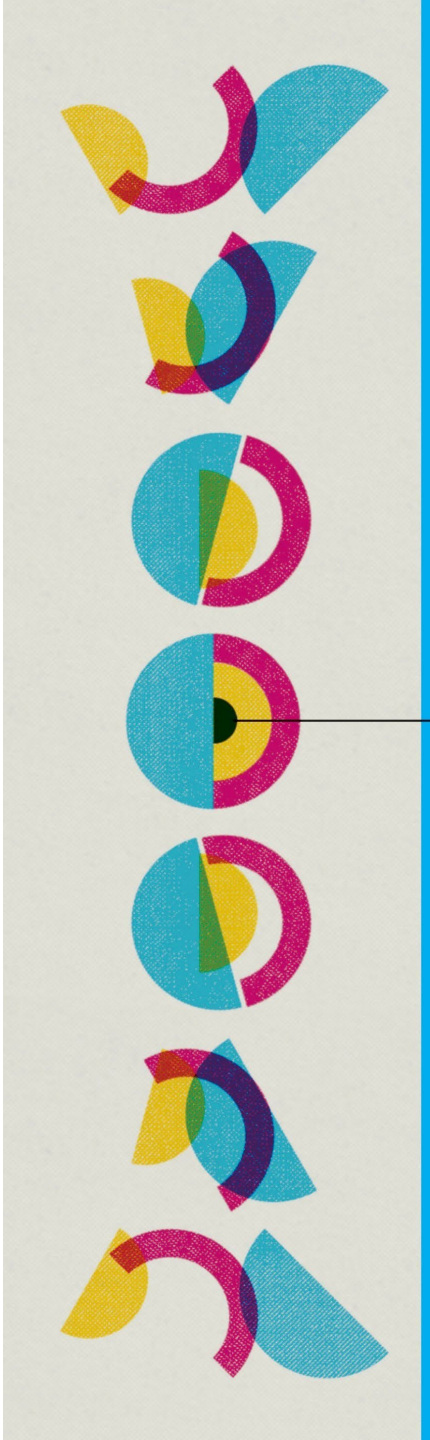


Trees, maps and theorems

Jean-Luc Doumont

Dear data

Stefanie Posavec, Giorgia Lupi



Building Science Graphics

An illustrated guide to communicating science through diagrams and visualizations

JEN CHRISTIANSEN

CRC Press
Taylor & Francis Group
AN A K PETERS BOOK

STEP-BY-STEP GUIDE: BUILDING A SCIENCE GRAPHIC

1 Confirm the Need

Take a moment to think through if it makes sense to build a science graphic.

Thinking of building a science graphic right now?

NO → Consider scanning through this flowchart now, so you'll be ahead of the game when you are ready to start.

YES → Is a graphic required (i.e., graphical abstract request from a journal publisher)?

YES → Do you think a graphic would be useful in communicating the information at hand? (Can you tick one or more of these options?)

- ☐ An image could potentially tell the story—or a piece of the story—more efficiently, effectively, or completely than words.
- ☐ The narrative involves complex and intertwining relationships, and an image map may be able to help the reader track connections.
- ☐ A direct and immediate visual comparison may be useful in highlighting change, or differences between states, such as competing hypotheses, or before-and-after views.
- ☐ Custom entry: Why do you think a graphic would be useful in this case?

NOT SURE → Engage with your collaborators to help answer the question. This is a great time to initiate field research, and to formally fold audience members into your official collaborator list. (See pages 231–233.)

NO → Perhaps a graphic isn't the best use of your time and resources. If engagement is your primary goal, have you considered if another type of image might be a better match for the project? (See page 212.)

YES → **2 Describe the Context**

Before diving into content details, think about where your graphic will live, and who it will be for. Use the sample entries in the columns below as a prompt to help you clearly state your outlet, focus on your audience, and to prime thoughts on scope and vibe.

TIP In tandem with describing your outlet, I recommend looking into the specifications of the publication, organization, website, or application that you're developing the graphic for. See pages 157–162 for more information about scale, resolution, color mode, and file type. Some outlets are quite specific about what they need. This is a good time to collect that information.

OUTLET

Where will your image live? The answer to this question will inform decisions related to both content and style, as well as the dimensions of your graphic (and therefore the composition).

- ☐ Journal article
- ☐ Print news or magazine article
- ☐ Digital news or magazine article
- ☐ Print version of thesis
- ☐ Academic poster
- ☐ Presentation slide
- ☐ Press release
- ☐ Blog post
- ☐ Social media
- ☐ Interpretive display
- ☐ Instruction manual
- ☐ Textbook
- ☐ Custom entry: _____

AUDIENCE

Who is your audience? Check all that apply and add more details in the open field, if known.

- ☐ People very familiar with the topic
- ☐ People somewhat familiar with the topic
- ☐ People new to the topic
- ☐ General public
- ☐ Policy makers
- ☐ Funders
- ☐ Adults
- ☐ Kids
- ☐ Custom entry: _____

TONE

Given the outlet and audience, what tone or vibe feels like a good match? The answer to this question—along with the subject matter—will inform decisions related to rendering style and illustrative details. Check all that apply.

- ☐ Playful
- ☐ Authoritative
- ☐ Energizing
- ☐ Serious
- ☐ Elegant
- ☐ Spare and to-the-point
- ☐ Lush
- ☐ Concise
- ☐ Entertaining
- ☐ Instructive
- ☐ Custom entry: _____

CONTINUED ON THE NEXT PAGE

20 Seek Tight Sketch Feedback from Collaborators

Return to your project team, potential audience members, and/or content experts for feedback. Be specific about what sorts of critiques would be most helpful at this stage, and what your reviewers can expect as the project moves forward. State the goal of the graphic and indicate that you're looking for confirmation that concerns from the last round have been addressed, and that no new errors have been introduced. Indicate that only newly introduced errors will be corrected in the next round. Propose a deadline for feedback and indicate the expected date for the next—and hopefully final—review.

21 Digest Tight Sketch Feedback

Review the notes provided by your collaborators.

19 Develop a Tight Sketch

If the notes are relatively minor—and pertain to details within the larger plan—it's time to develop a tight sketch. Correct errors and sharpen the details. It may be useful to introduce color at this stage, if you haven't already done so. If you're responsible for writing the captions, refine them now, too. If someone else will be writing them, this is a good time to check in and ask for updated text. Pay special attention to color, text and label position, and the developing rendering style at this stage.

Here's an example

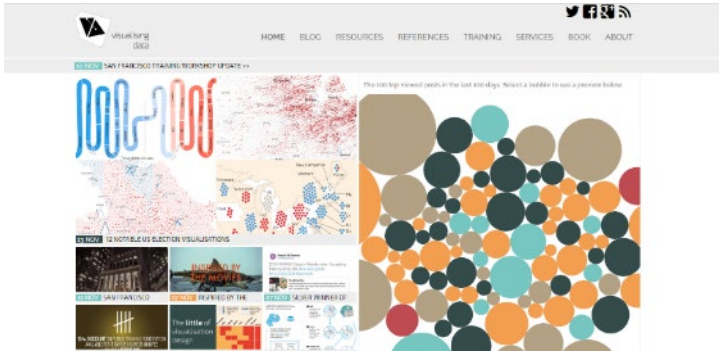
Ask your expert consultant for guidance and/or return to step 7 on page 258.

Is the path through your graphic self-evident? Are folks able to read it?

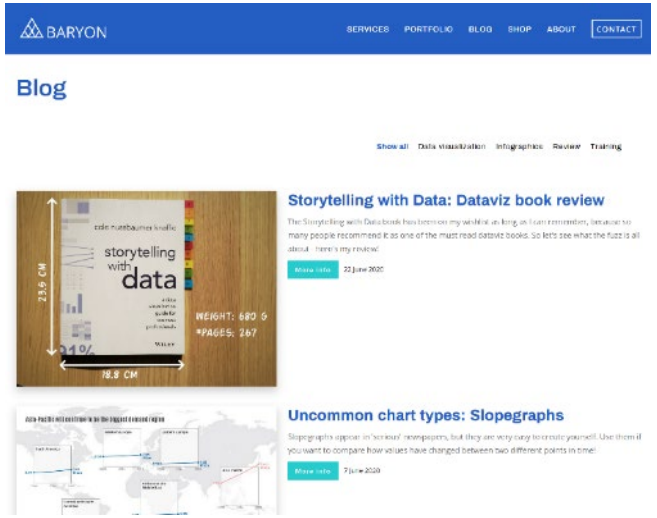
Return to step 12 on page 262.

Image Credit: Sketch by Jen Christiansen for "Building Tastier Fruits & Veggies (No GMOs Required)," by Ferris Jabr, Scientific American (July 2014)

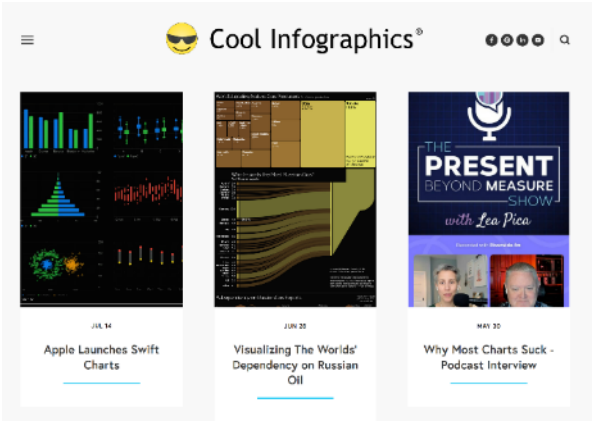
Blogs



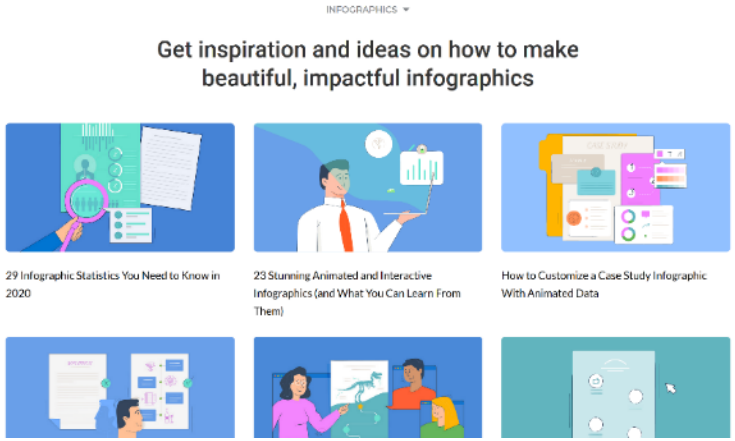
[Visualising data]



[Baryon blog]



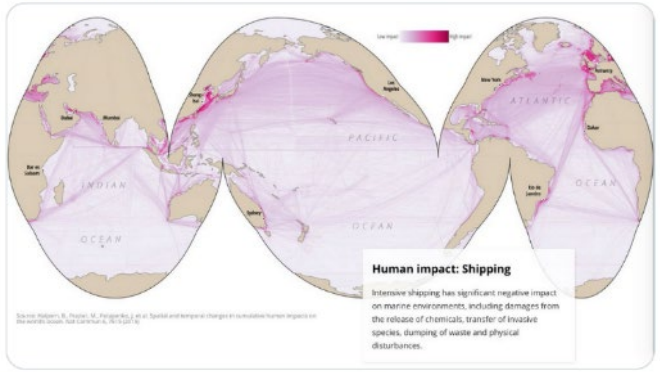
[Cool infographics]



[Visme blog]

Twitter

Maarten Lambrechts @maartenzam · 23 mei
Als antwoord op @pickover
From a work in progress



5

Nadieh Bremer @NadiehBremer · 15 u
New!! I've created a streamgraph-meets-bump-chart #dataviz to show the rise & sudden surge in the no. of satellites orbiting Earth for @sciam

Huge thanks to @ChristiansenJen for the feedback + layout + sending me 2 issues when my store in NL didn't get them due to covid-19

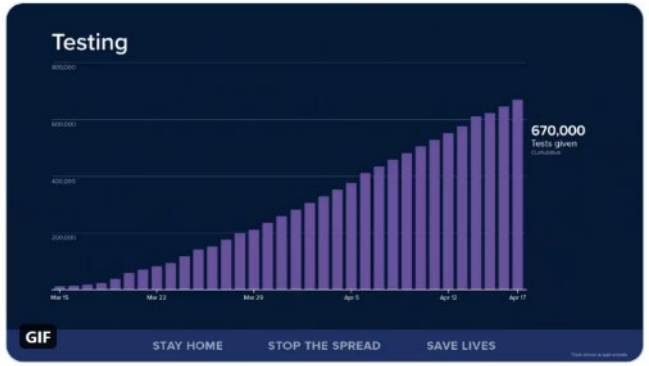
7 40 368

Vastgemaakte Tweet

Giorgia Lupi @giorgialupi · 30 apr.
We ❤️@NYGovCuomo 's daily briefings. That's why at @pentagram we humbly tried to make his charts even more effective and human.

We talked to @FastCompany about it: fastcompany.com/90498405/andre...

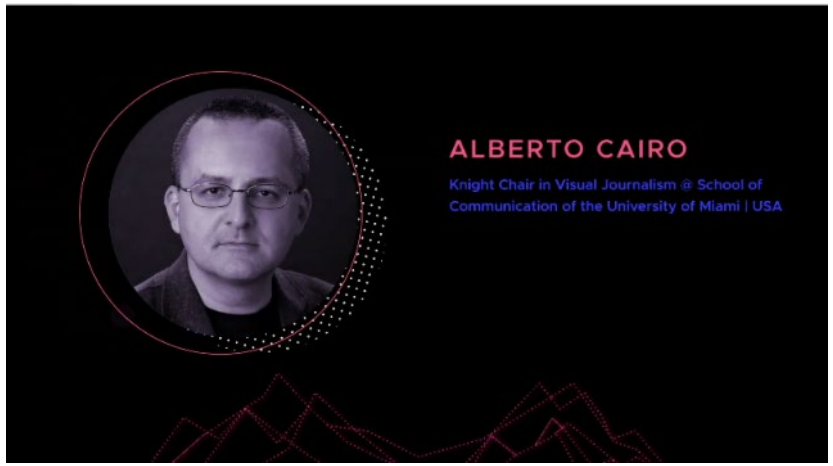
But also check out the full project here: drive.google.com/file/d/1tS-BDR...



13 160 441

Full **Dataviz World Leaders** list at: twitter.com/Koen_VdE/lists

Videos



Datafest online 2020
23 different talks

Youtube playlist

Outlier Conference 2022
71 different talks

Youtube playlist

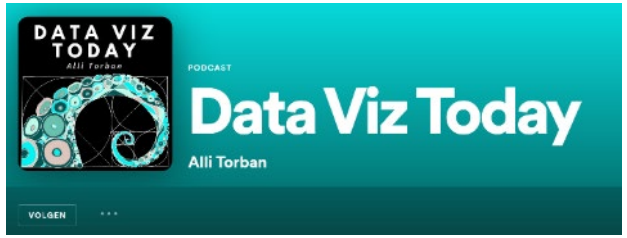
Podcasts

[Data Journalism Conversations]

[The Data Journalism Podcast]

[Explore Explain]

[Storytelling with data]



[Data Viz Today]

[Data Stories]

Thank you!

All the slides and all the links:

baryon.be/visuals-resources

Koen Van den Eeckhout – koen@baryon.be - @koen_vde