

# Visuele (data-) communicatie:

*Het gaat niet om waar je naar kijkt,  
maar om wat je ziet.*

Bureau Jeugdzorg, Roermond, 14 juli 2022

Irene van den Broek, PhD

 @IrenevdBroek

 @JeBentWatJeMeet

 @IreneVDB

# Hoi, ik ben Irene!



Irene van den Broek

[irene@jebentwatjemeet.nl](mailto:irene@jebentwatjemeet.nl)

# Ik heb een achtergrond in *biomedisch* onderzoek...

Liquid chromatography coupled to tandem mass spectrometry for the quantitative bioanalysis of bioactive and potential biomarker peptides



Irene van den Broek 2010



2005-2010  
Universiteit Utrecht

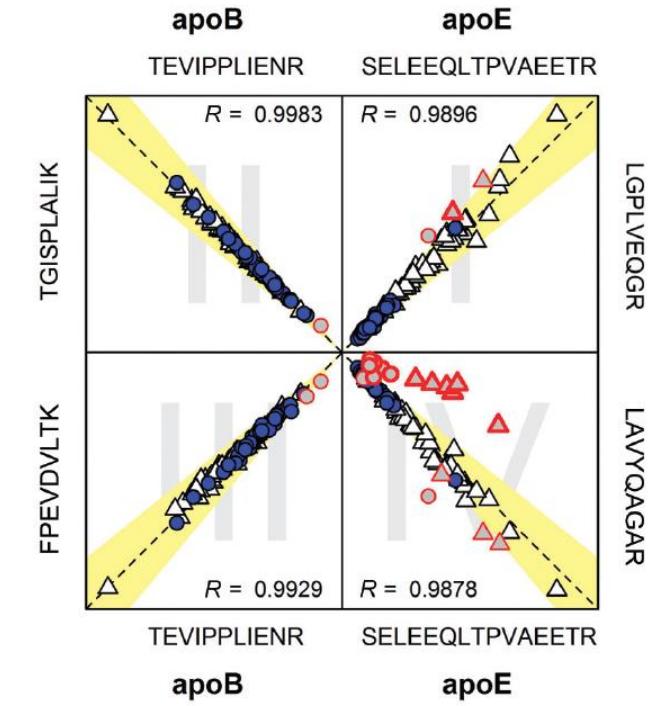
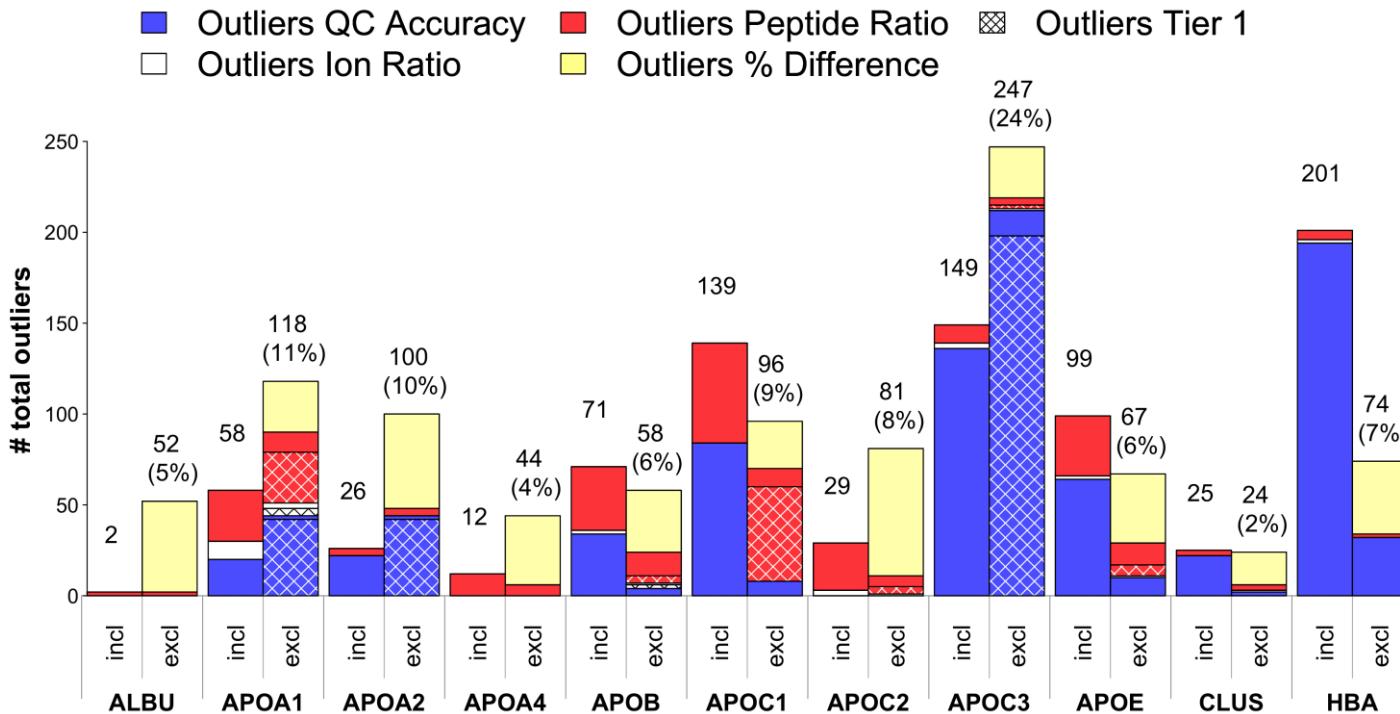


2013-2015  
Leids Universitair  
Medisch Centrum

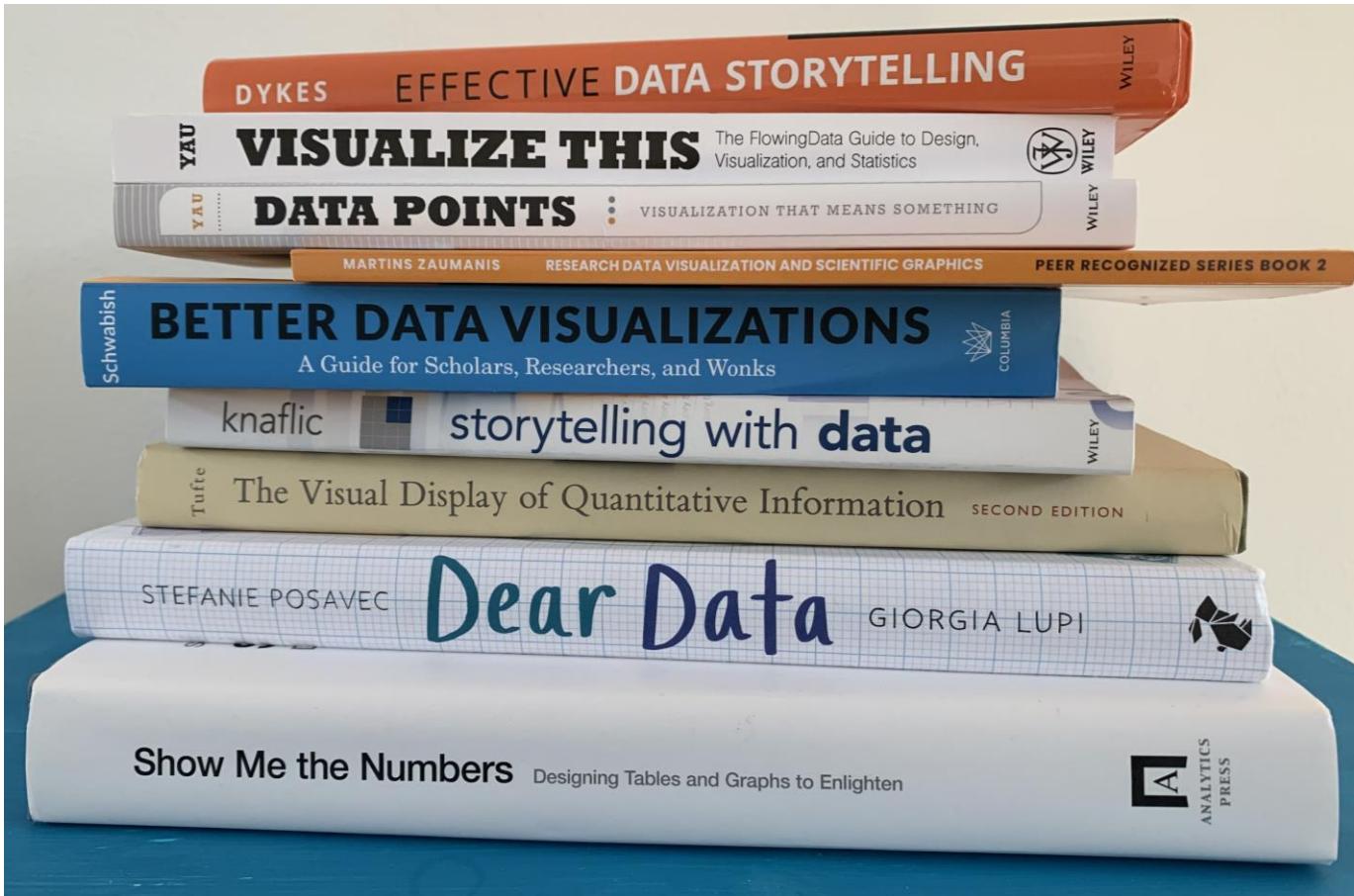


2015-2019  
Cedars-Sinai  
Medical Center

# Ik was gek op het maken van figuren, het liefst zo *complex* mogelijk!

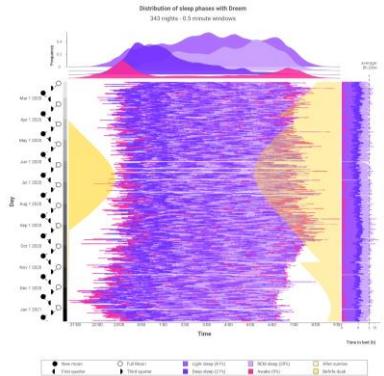


# Toen ontdekte ik dat het visualiseren van data *een vak apart* is: Ik was verkocht!

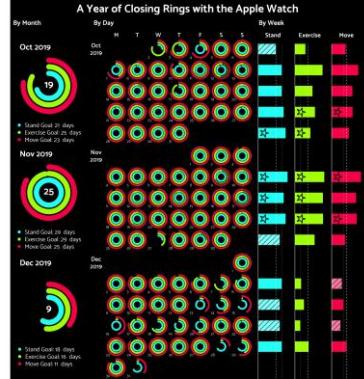


# Ik begon mijn *Lijf* en *Leven* te visualisereren...

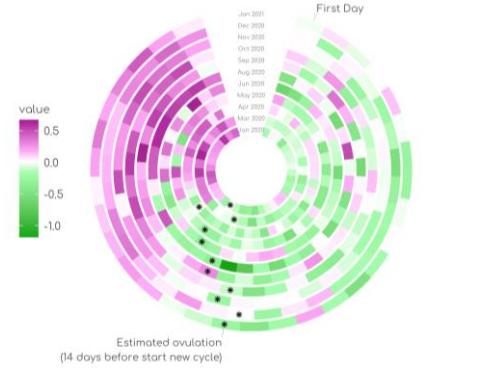
Slaap



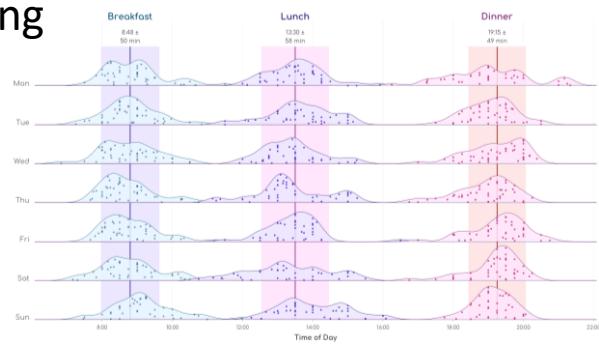
Beweging



Lichaam



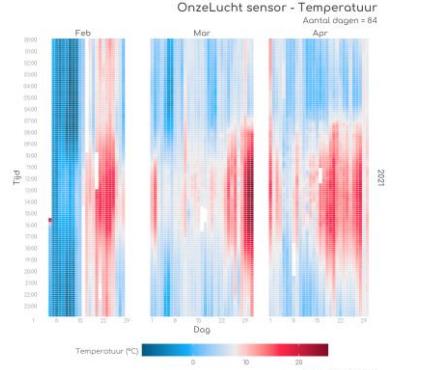
Voeding



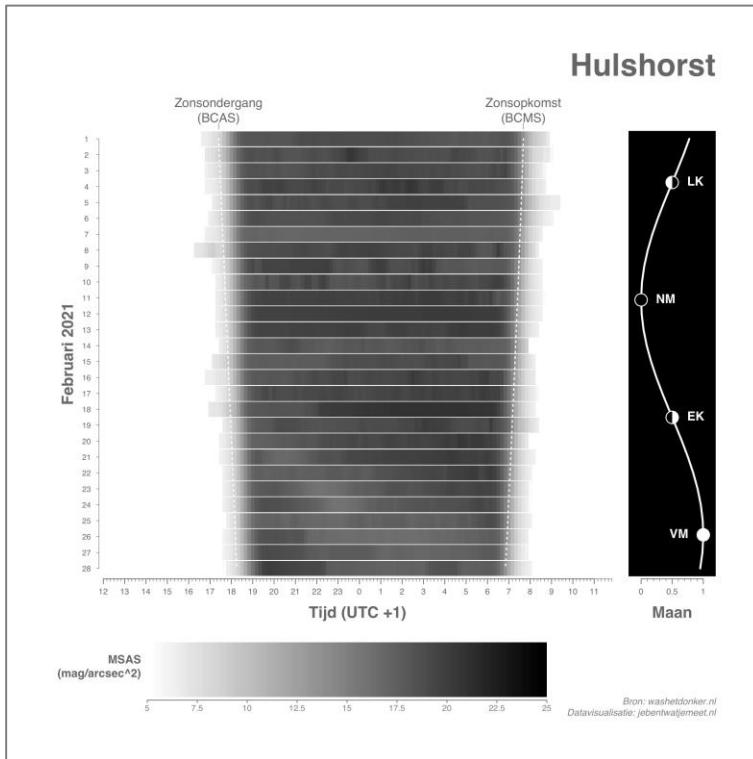
Gewoontes



Omgeving



# En maak datavisualisaties voor o.a. burgerwetenschapsprojecten...



[www.washetdonker.nl](http://www.washetdonker.nl)



[www.onzelucht.nl](http://www.onzelucht.nl)

# Het liefst combineer ik mijn beide passies...

voor onderwijs en...



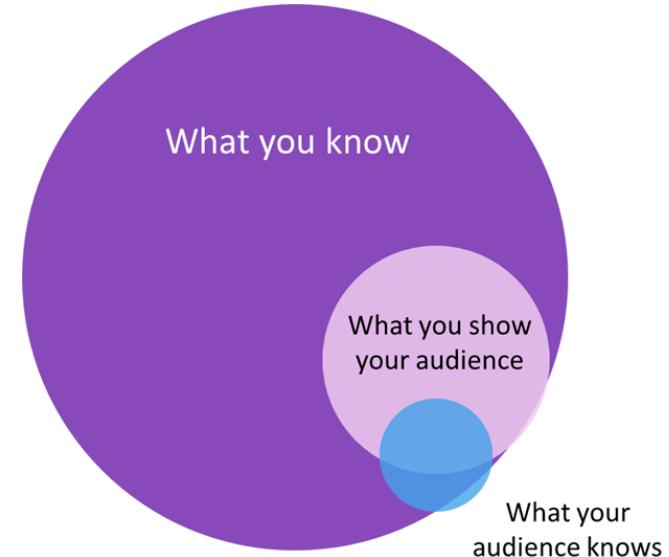
...data visualisatie!



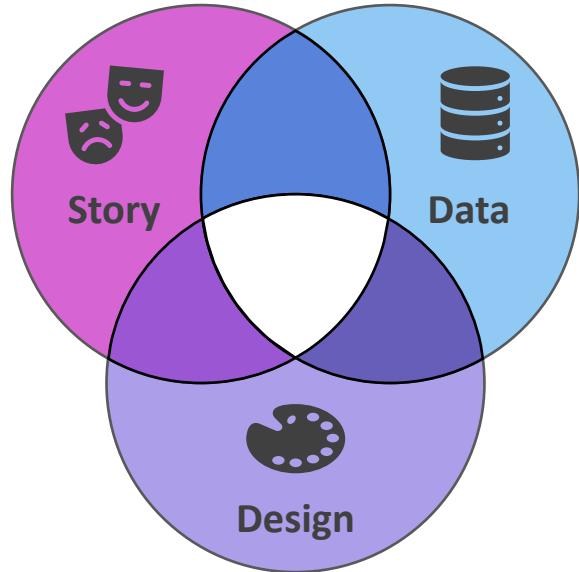
...en deel ik wat ik zelf graag eerder had willen weten!



The curse of knowledge



# Een overzicht van vandaag:



9:30 - 10:45	<b>Warming-up</b>	Visuele communicatie: <i>Waarom, Wat &amp; Hoe?</i>
11:00 - 12:15	<b>Design</b>	<i>Hoe verwerkt ons brein visuele informatie?</i>
12:45 - 14:00	<b>Story</b>	<i>Wie, waarom, waar en wanneer?</i>
14:15 - 15:30	<b>Cooling-down</b>	Zien, verwonderen en verbeteren.

# Maar eerst over *jou*!



*Werk je met (data-) visualisaties?*

*Hoe pas je (data-)visualisaties toe of  
zou je willen toepassen?*

*Wat hoop je te leren?*

# Warming up!

En een beetje beweging ...

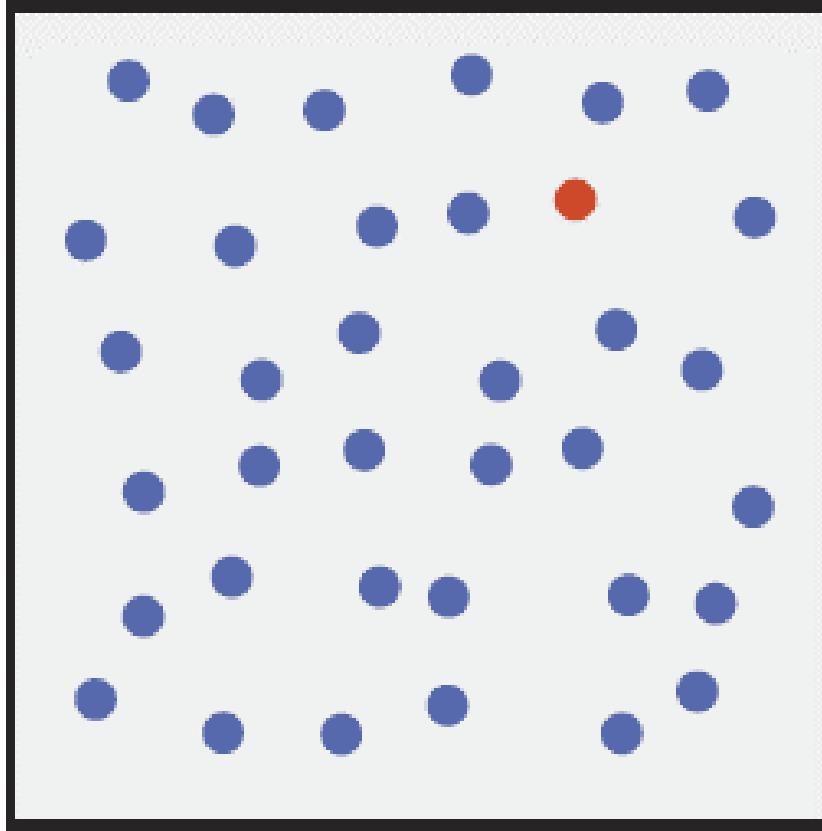
LINKS?

JA?

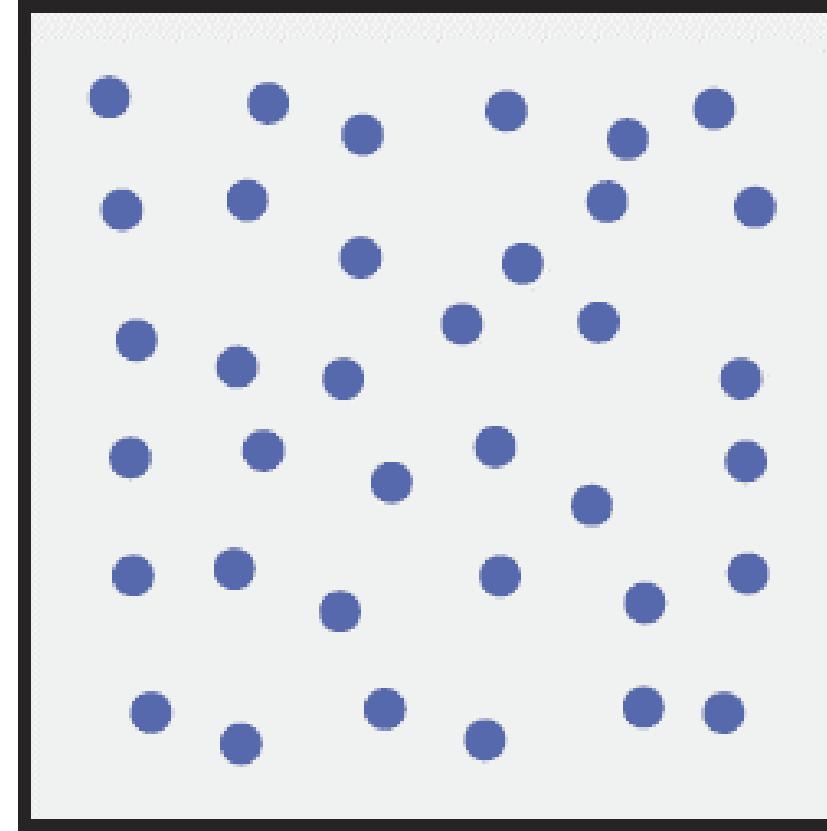


# Waar zit een rode stip?

A



B



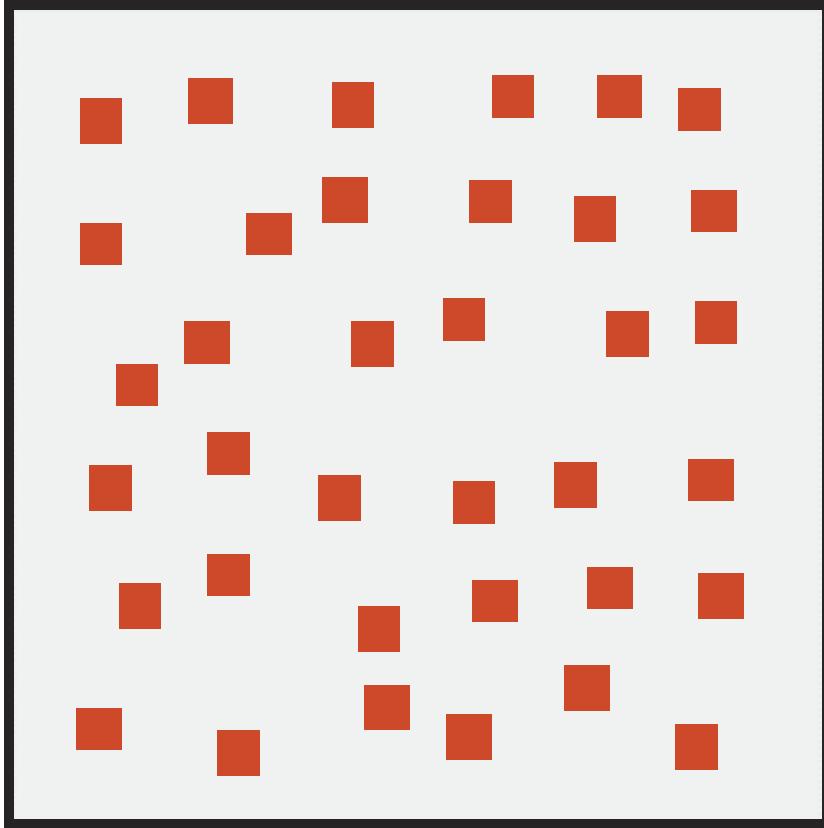
LINKS?

=

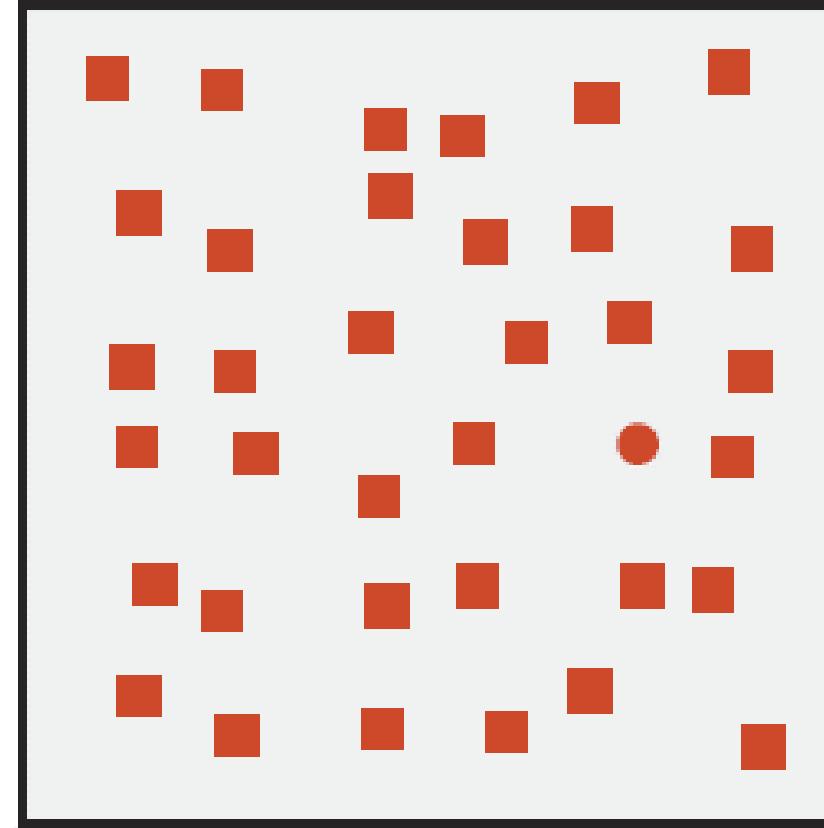
UP!

# Waar zit een rode stip?

A



B



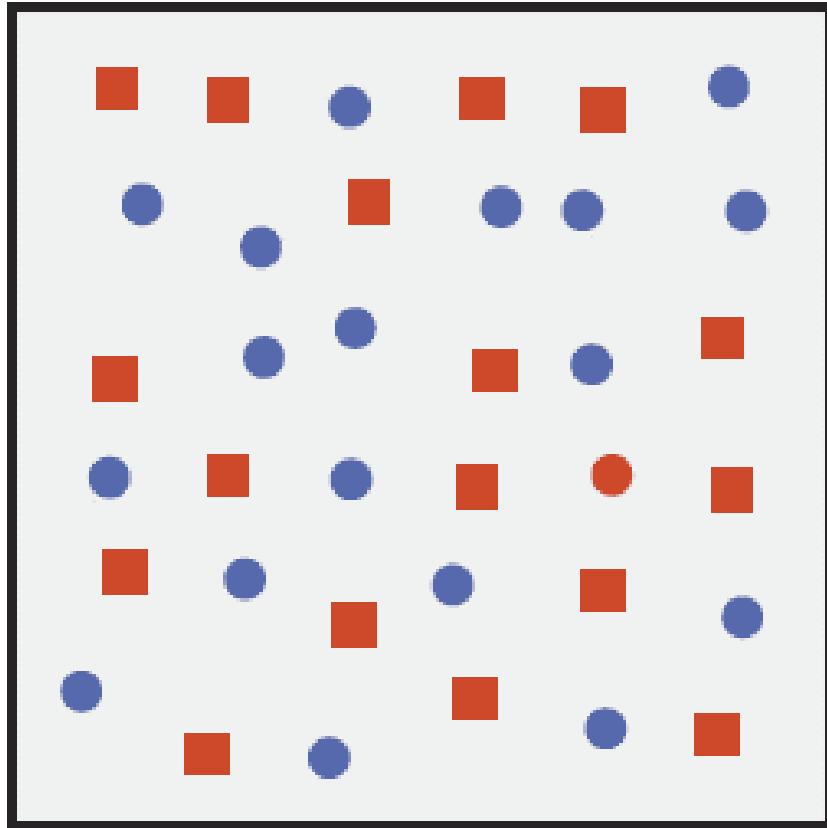
LINKS?

=

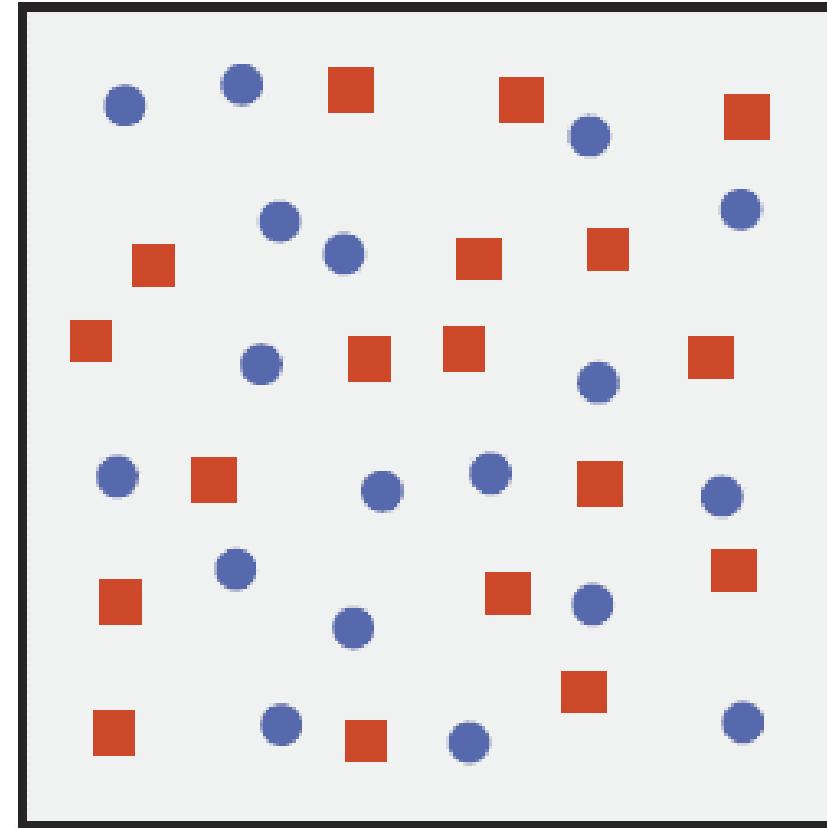
UP!

# Waar zit een rode stip?

A



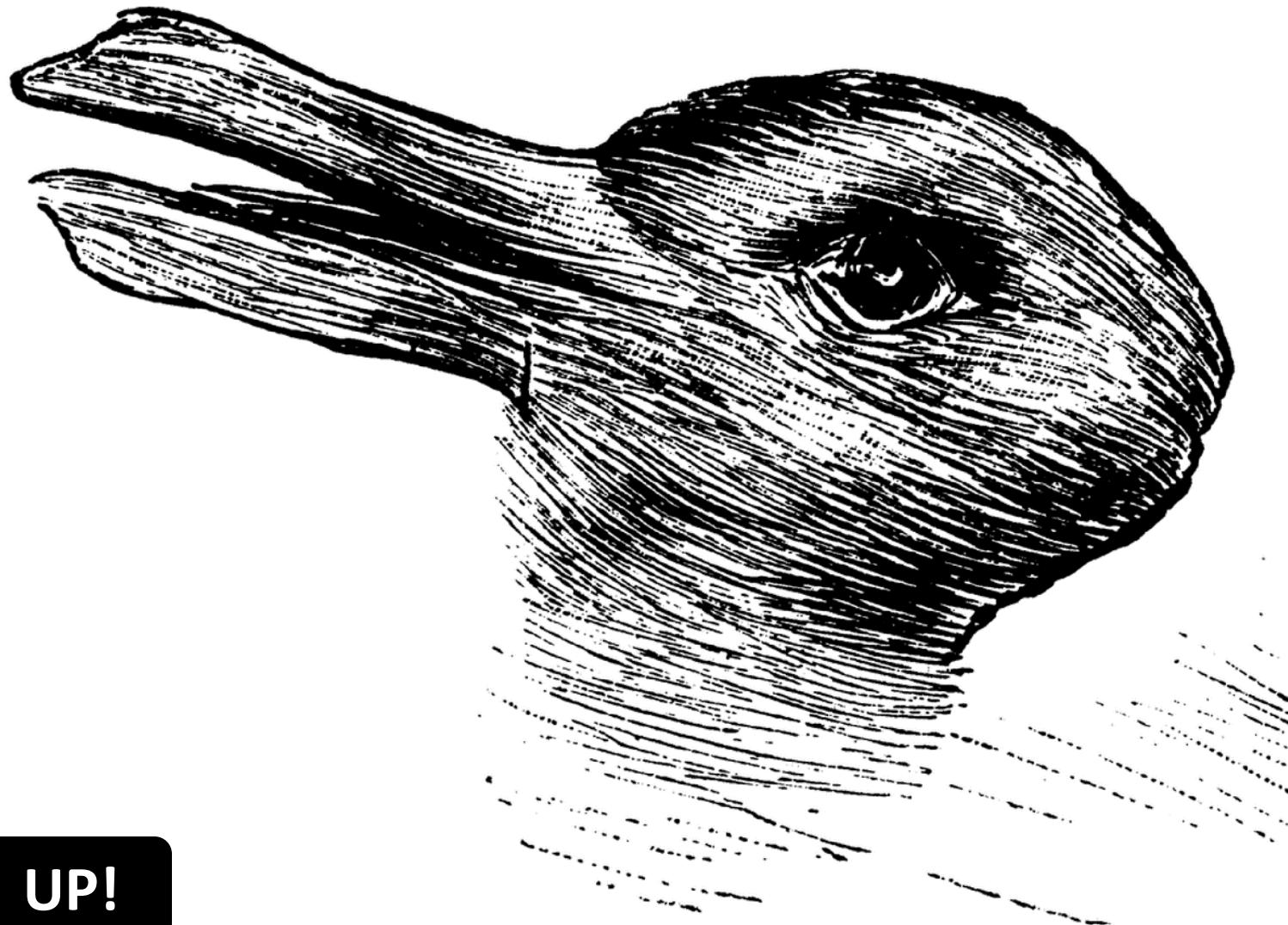
B



LINKS?

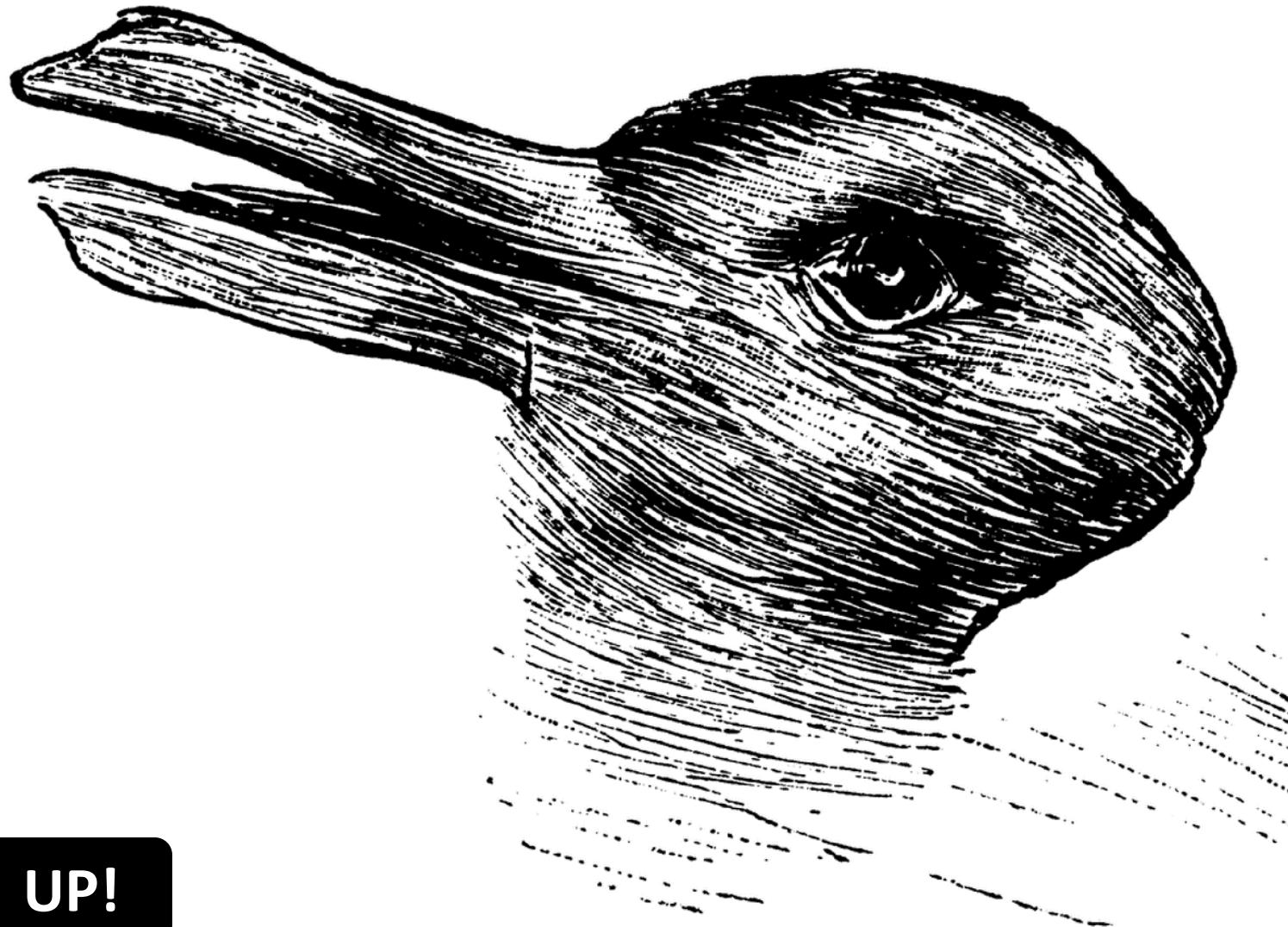
= UP!

# Zie jij een konijn?



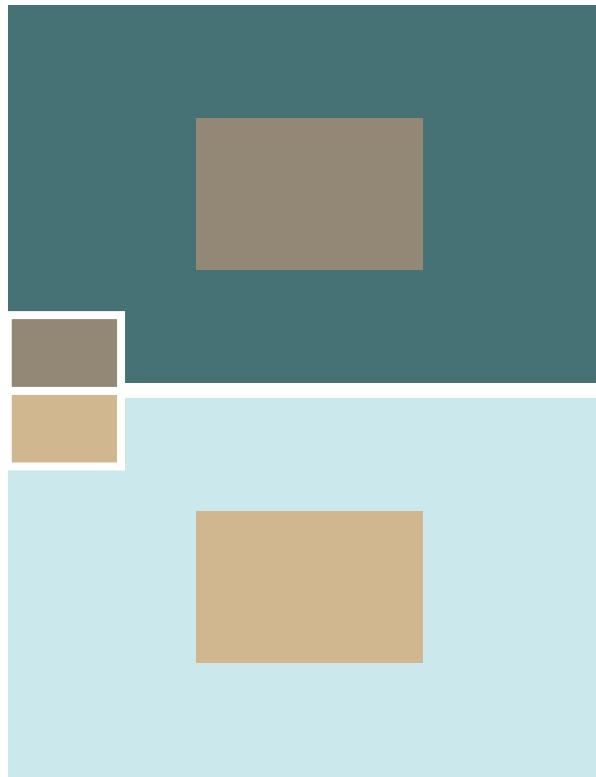
JA? = UP!

Zie jij een eend?



JA? = UP!

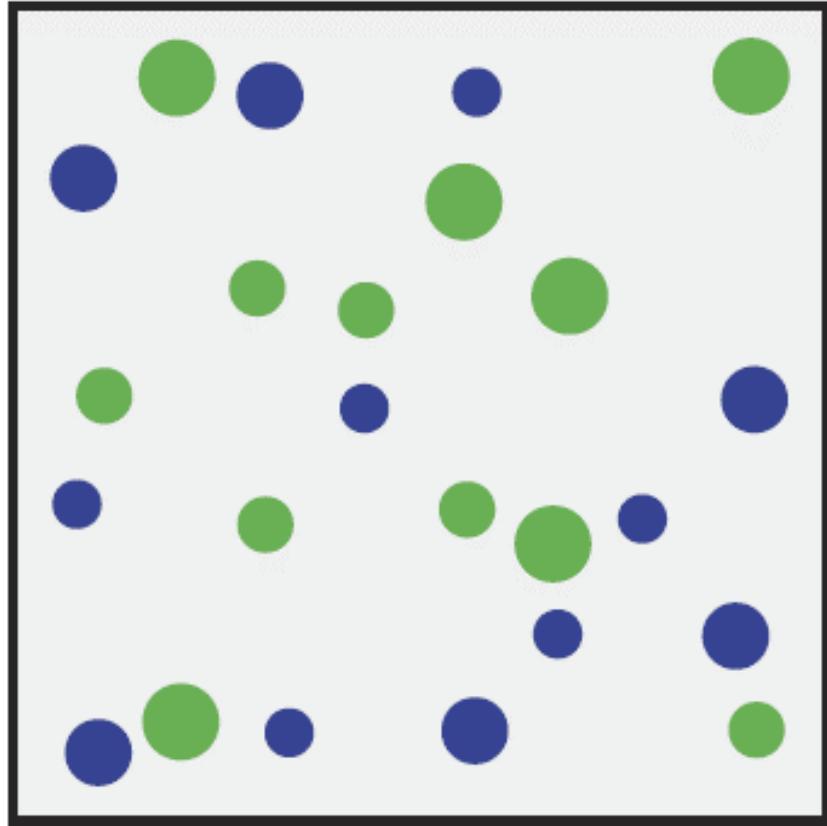
# De bruine rechthoeken zijn dezelfde kleur



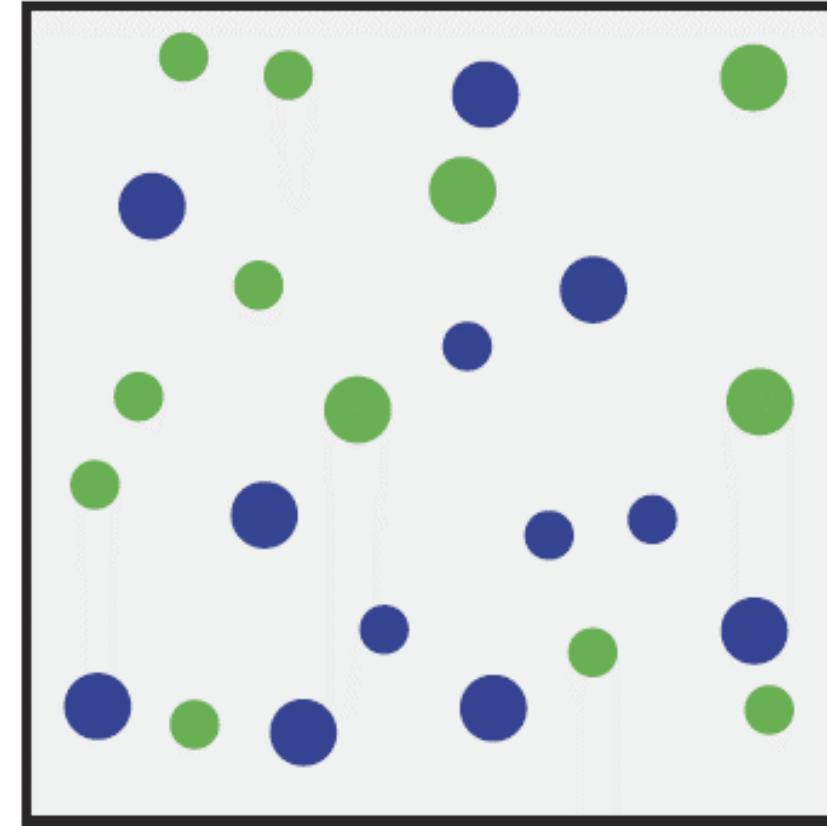
JA? = UP!

# Waar zijn de **groene** stippen het grootst?

A



B

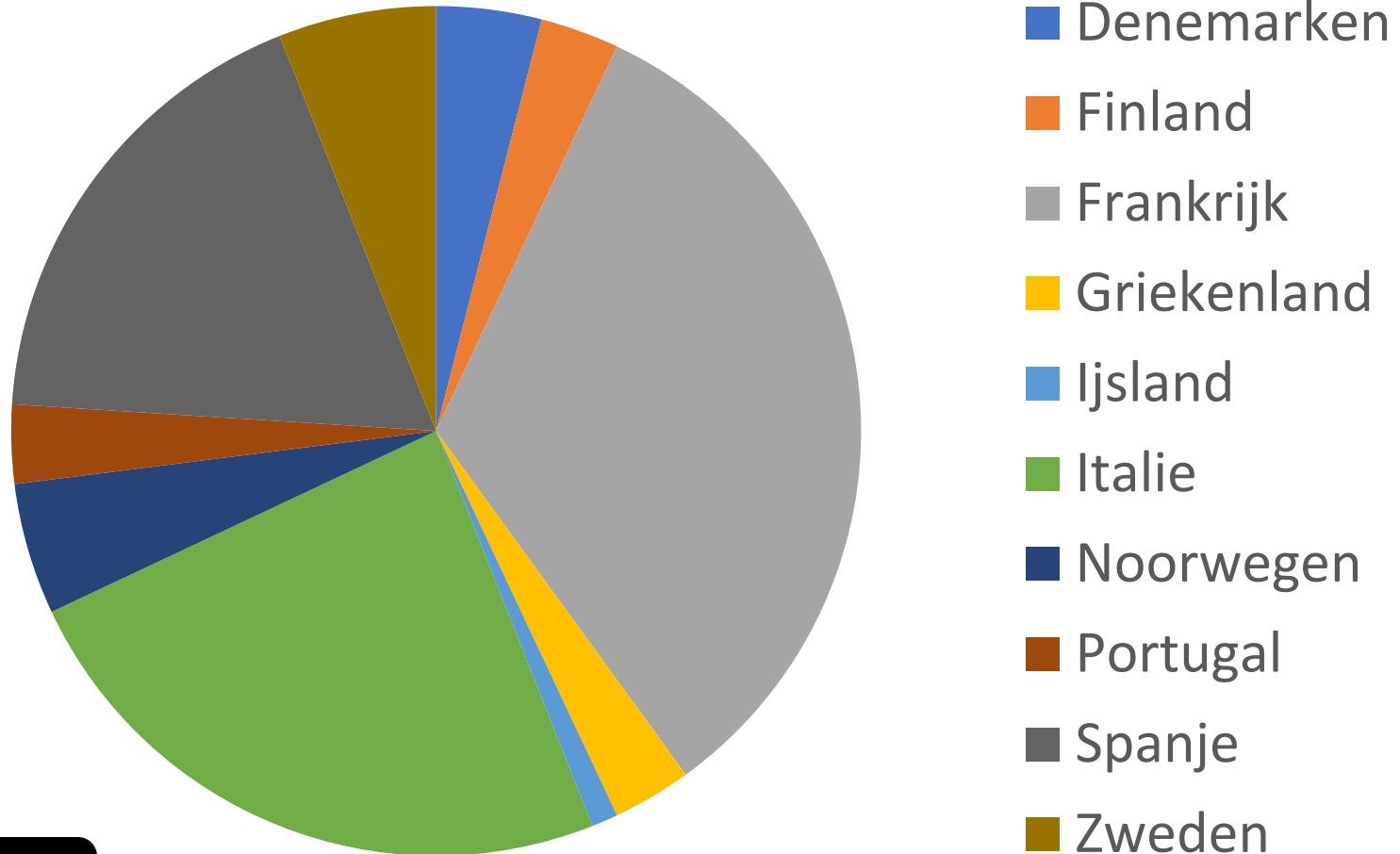


LINKS?

=

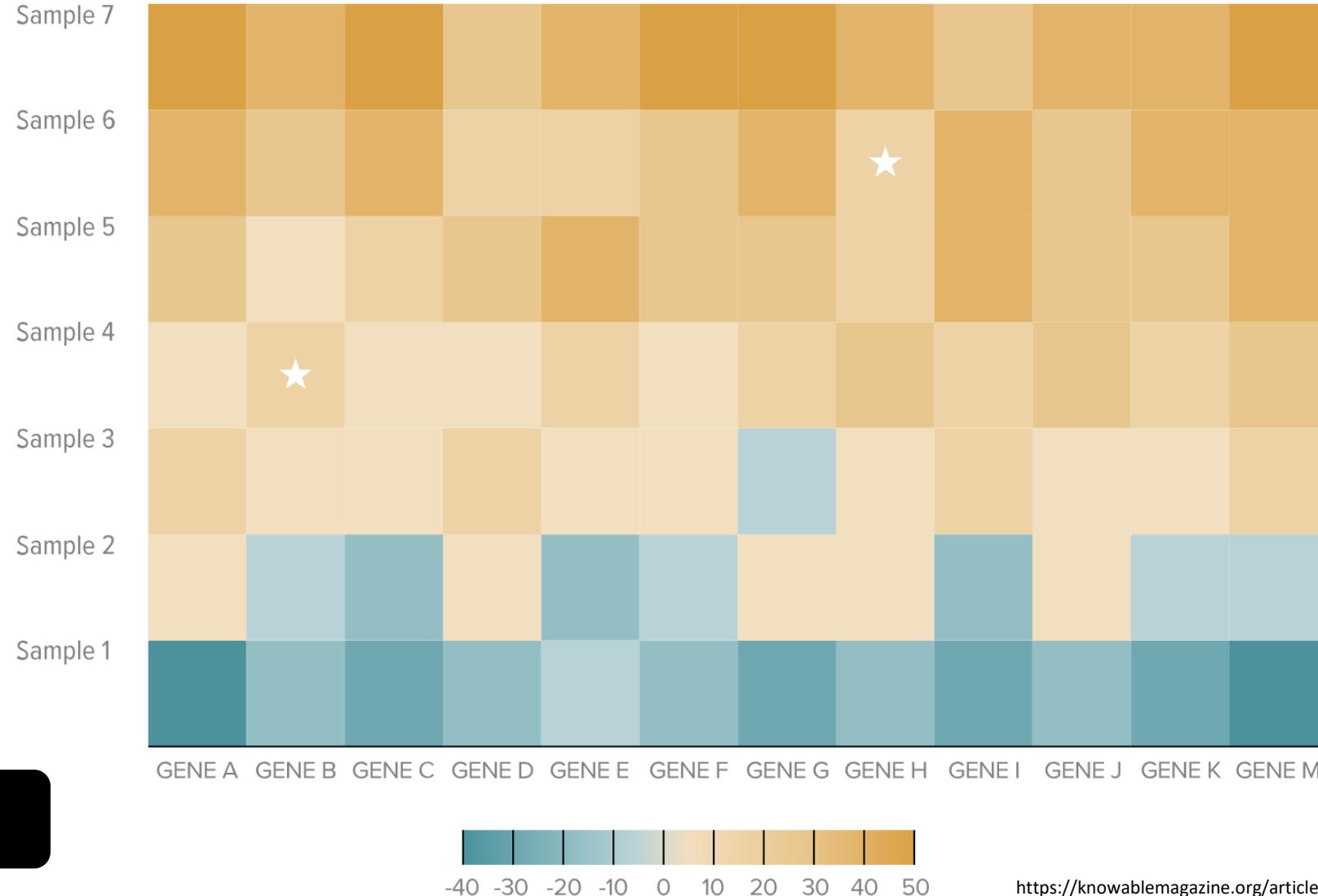
UP!

# Het vlak voor Noorwegen is groter dan het vlak voor Finland

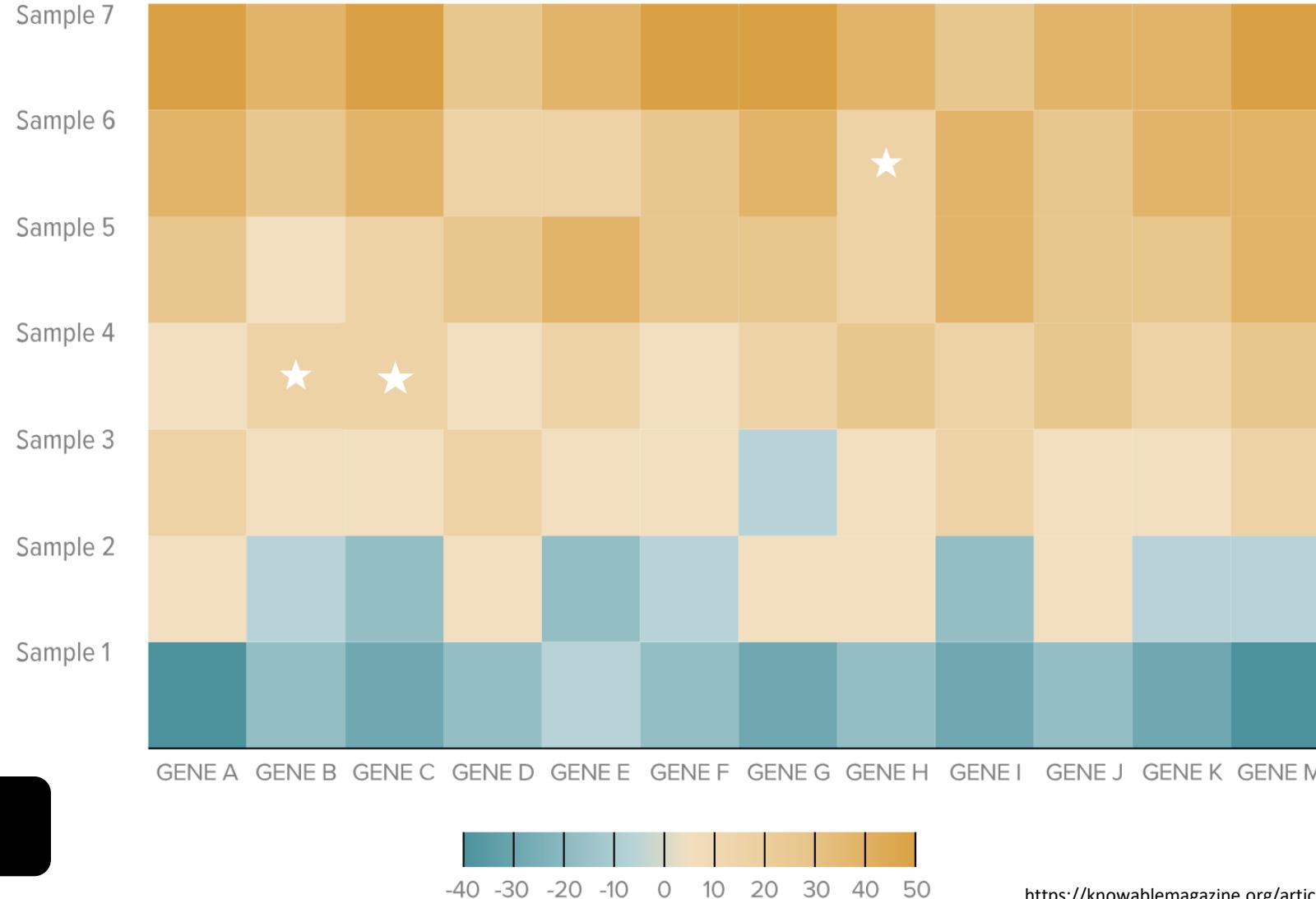


JA? = UP!

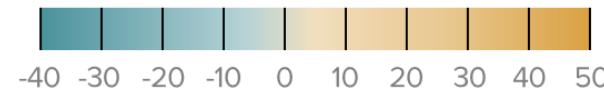
# De achtergrond met ster heeft dezelfde kleur



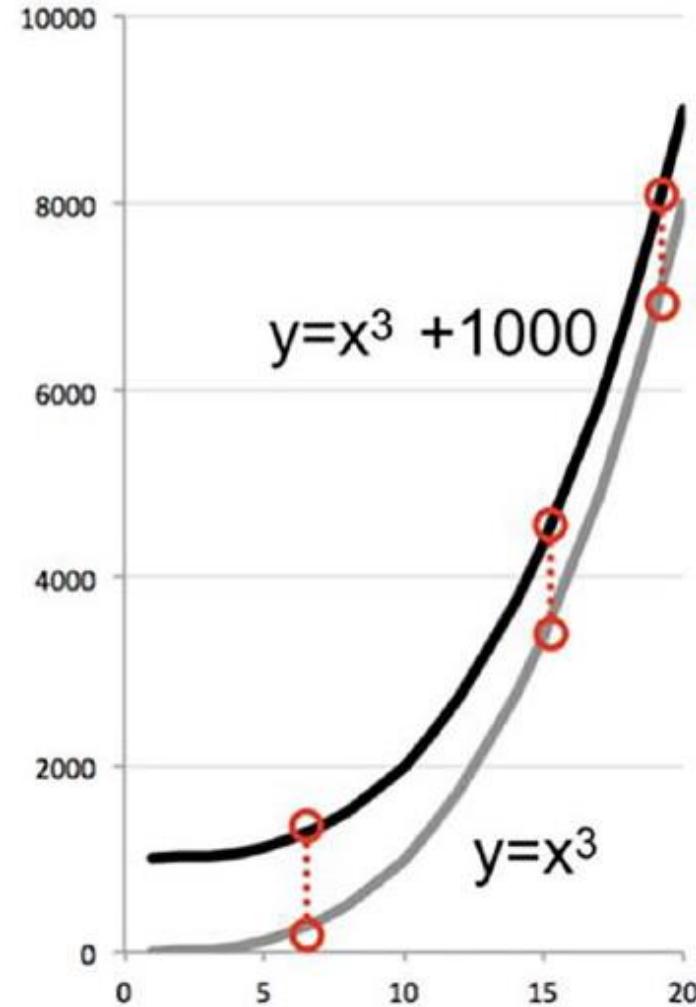
# De achtergrond met ster heeft dezelfde kleur



JA? = UP!

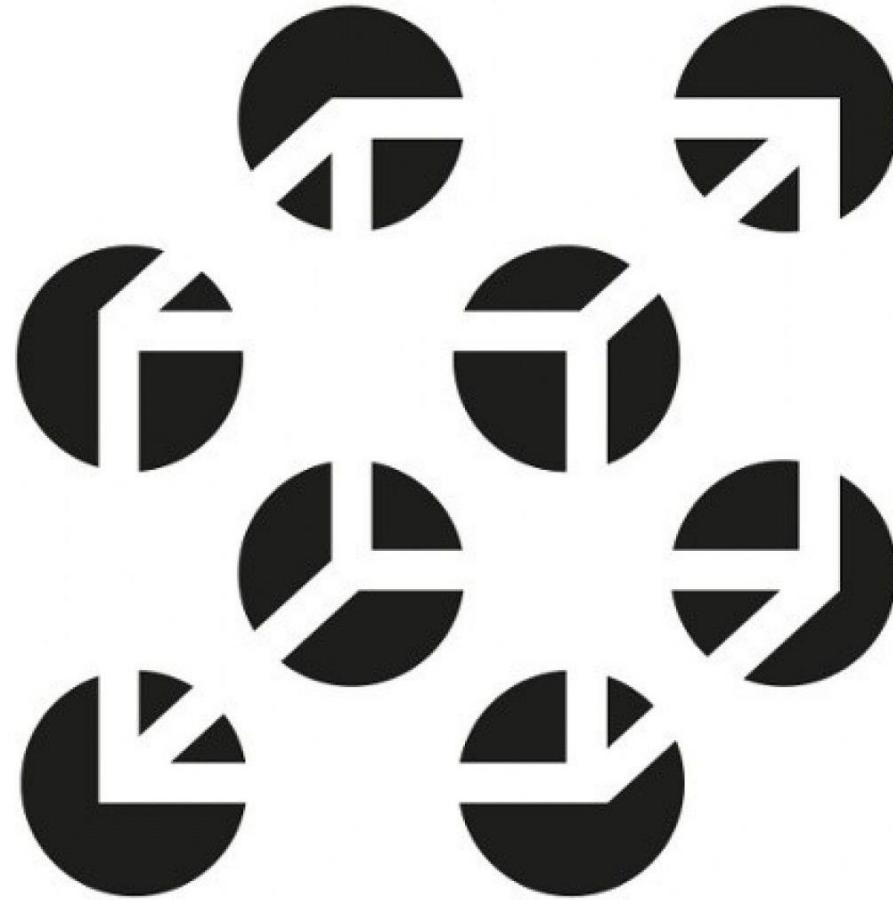


Waar is het verschil tussen de lijnen het grootst? Links of rechts?



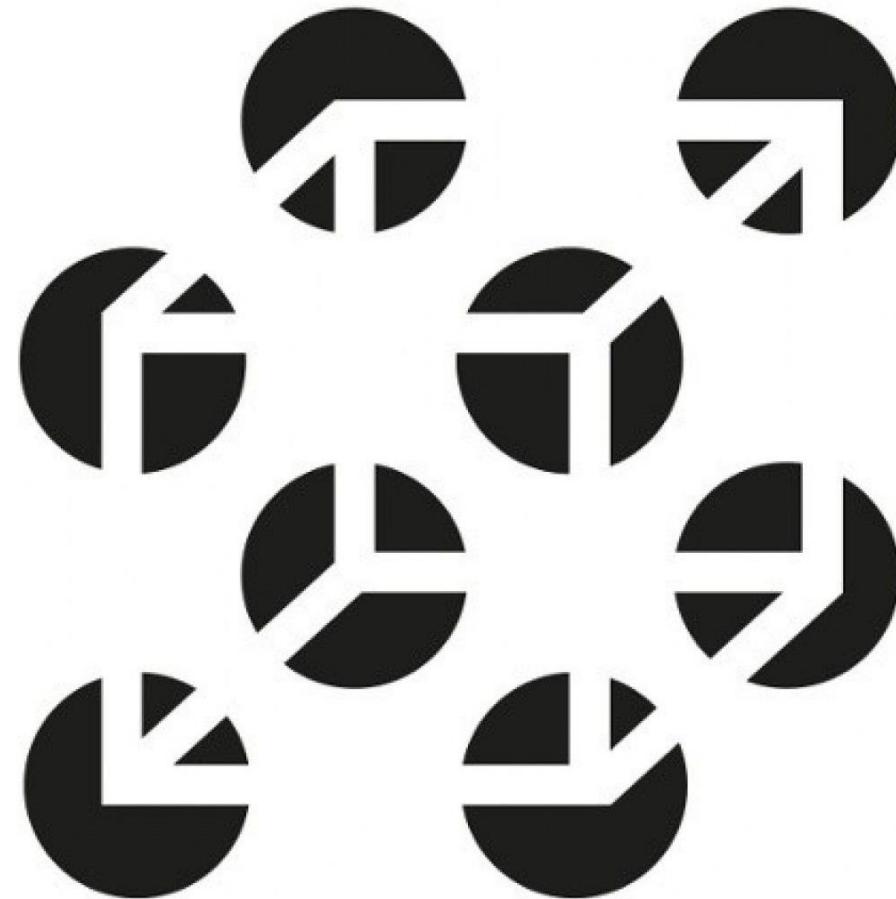
**LINKS? = UP!**

# Zie je een kubus?



JA? = UP!

# Is er een kubus?

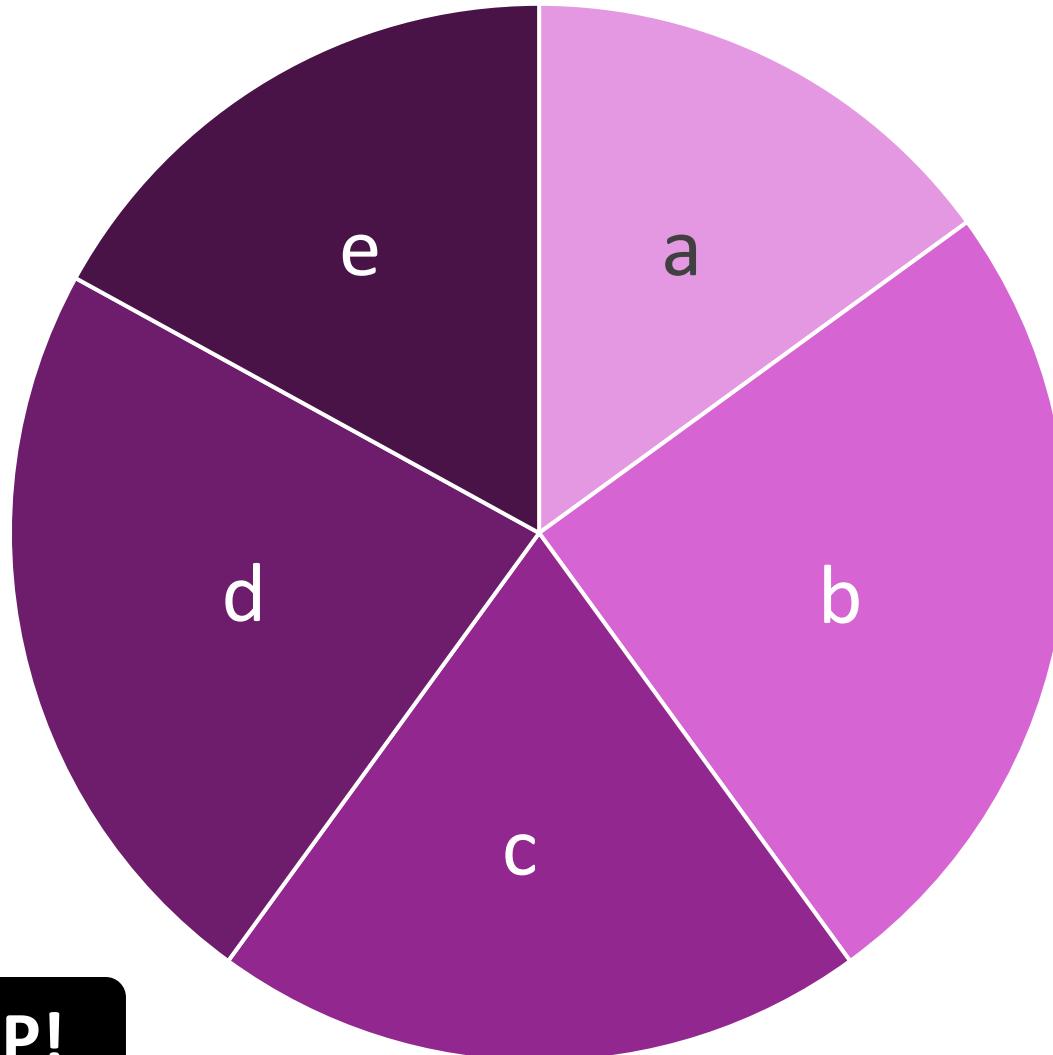


JA?

=

UP!

# Gaat hoog naar laag van b > d > c > e > a?



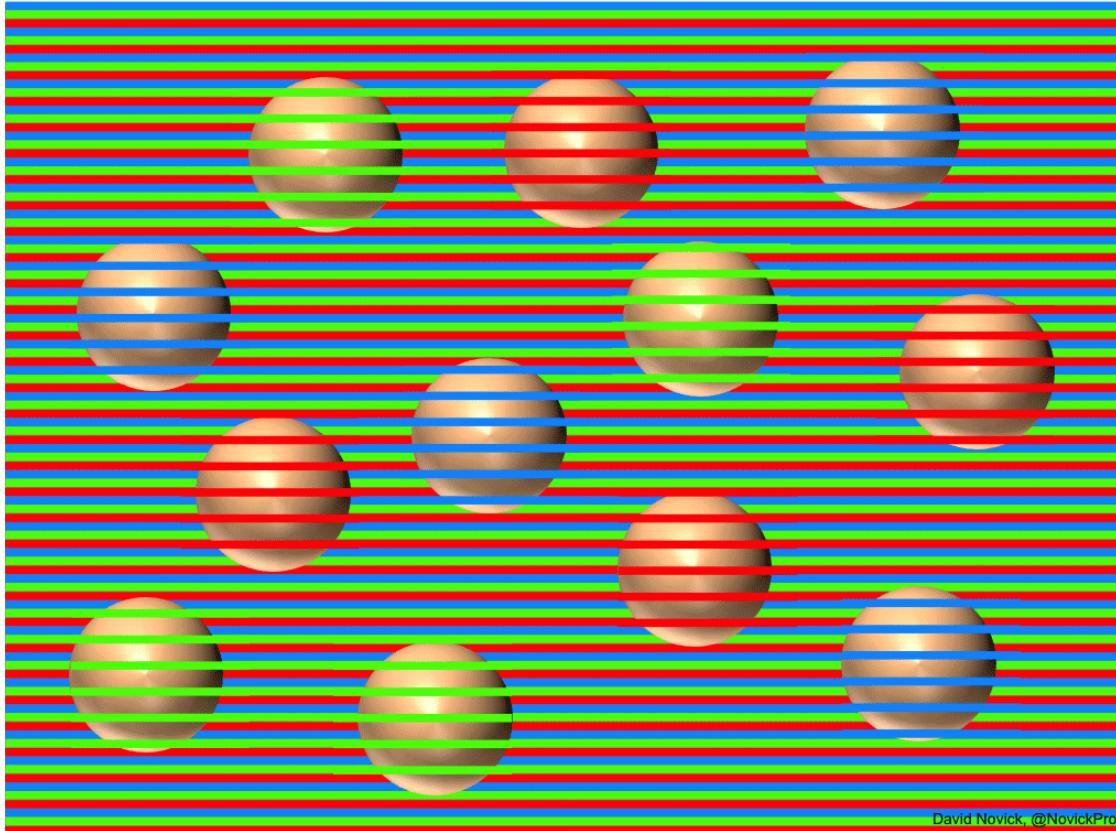
**JA? = UP!**

# Alle bollen hebben dezelfde kleur



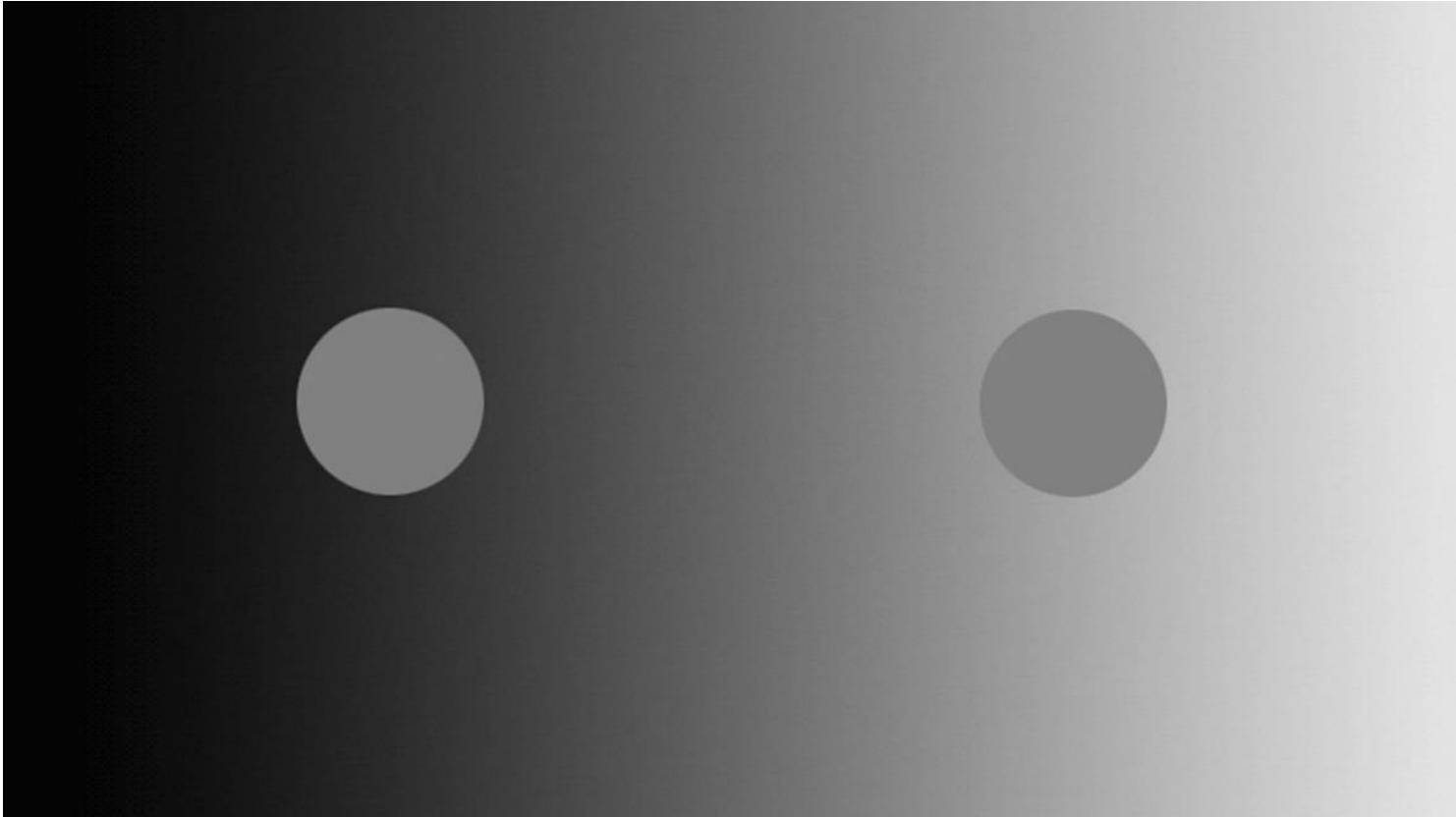
JA? = UP!

# Alle bollen hebben dezelfde kleur



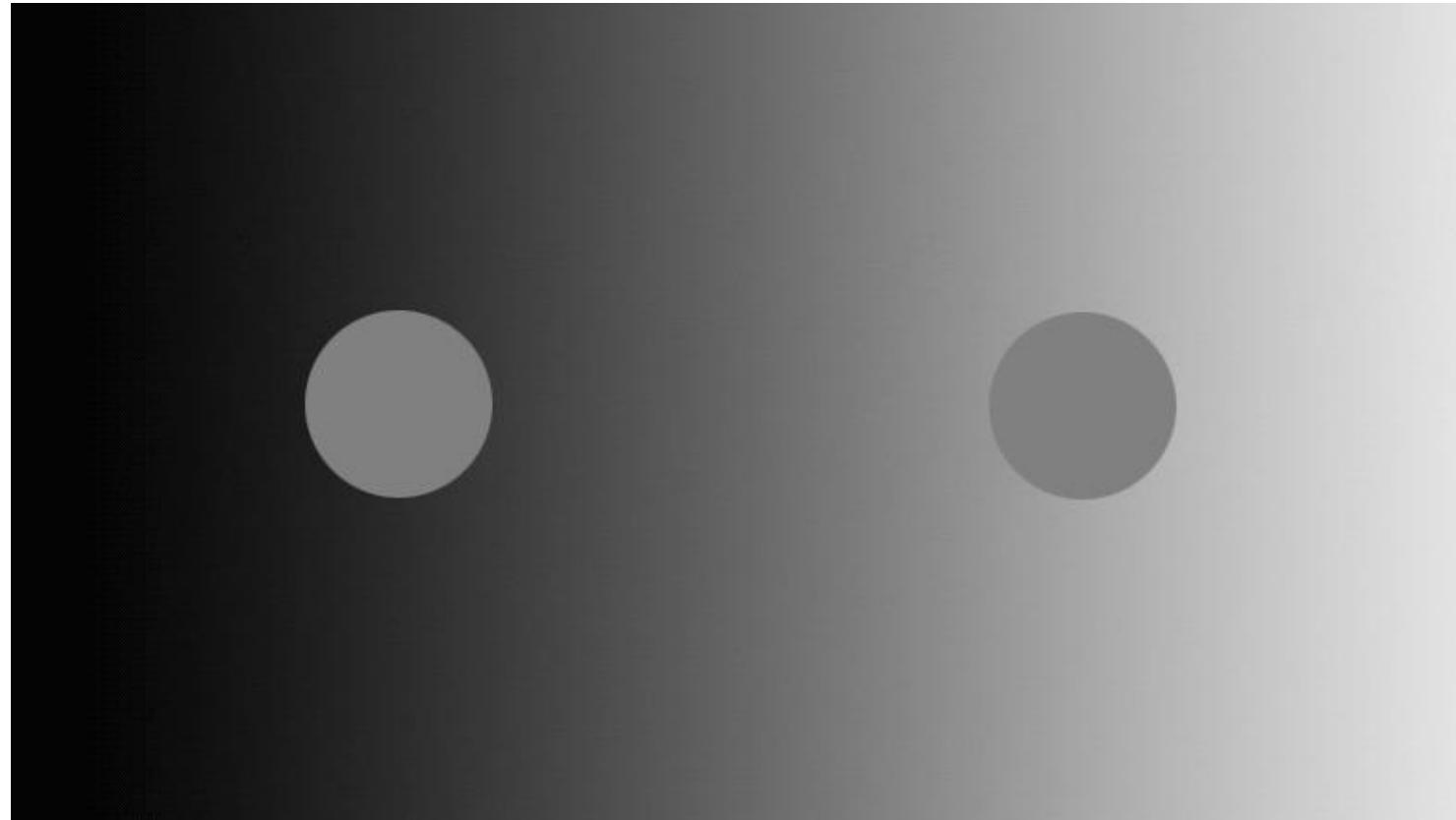
JA? = UP!

# Welke cirkel is lichter van kleur?



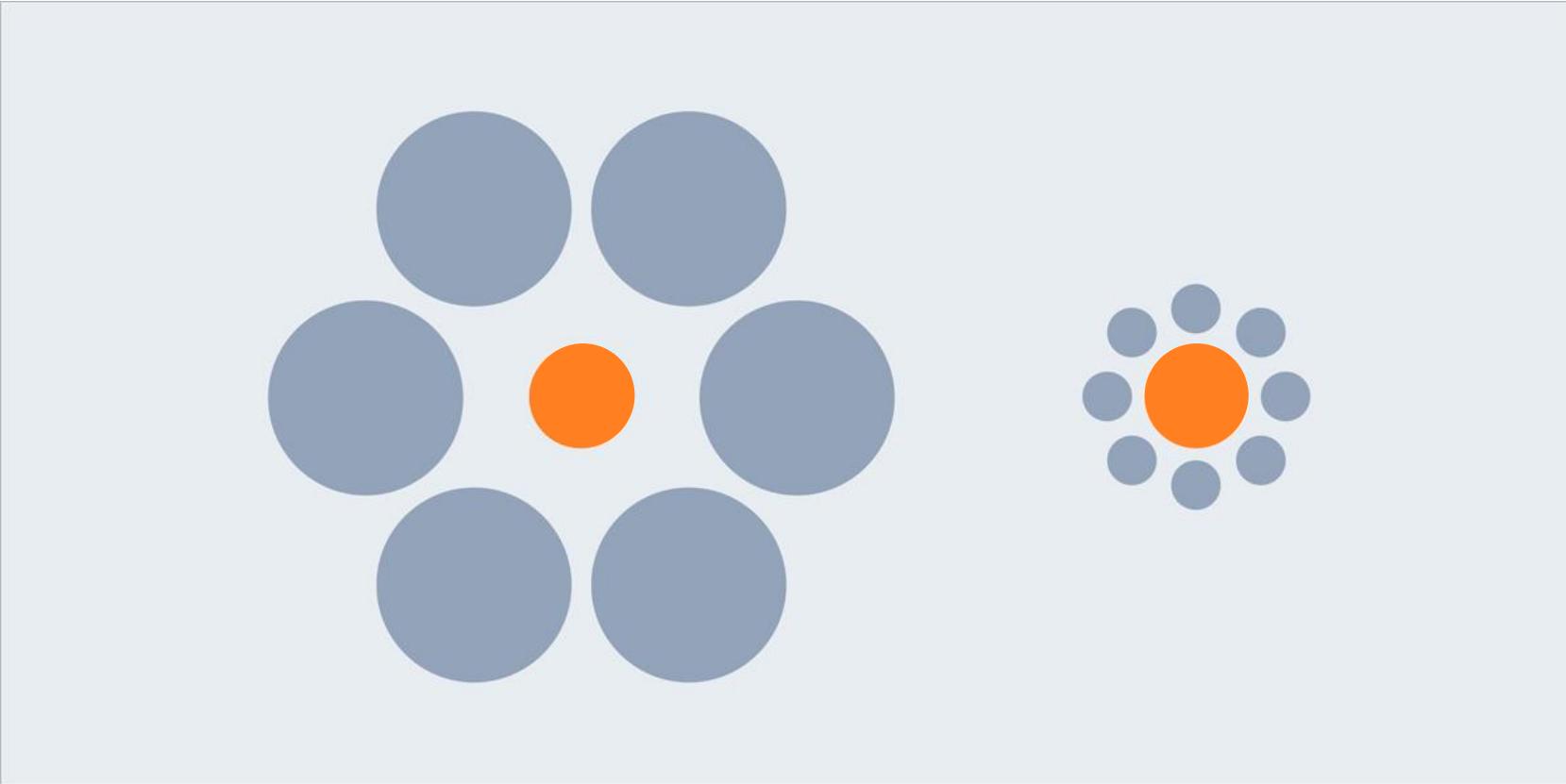
**LINKS? = UP!**

# Weet je het zeker...?



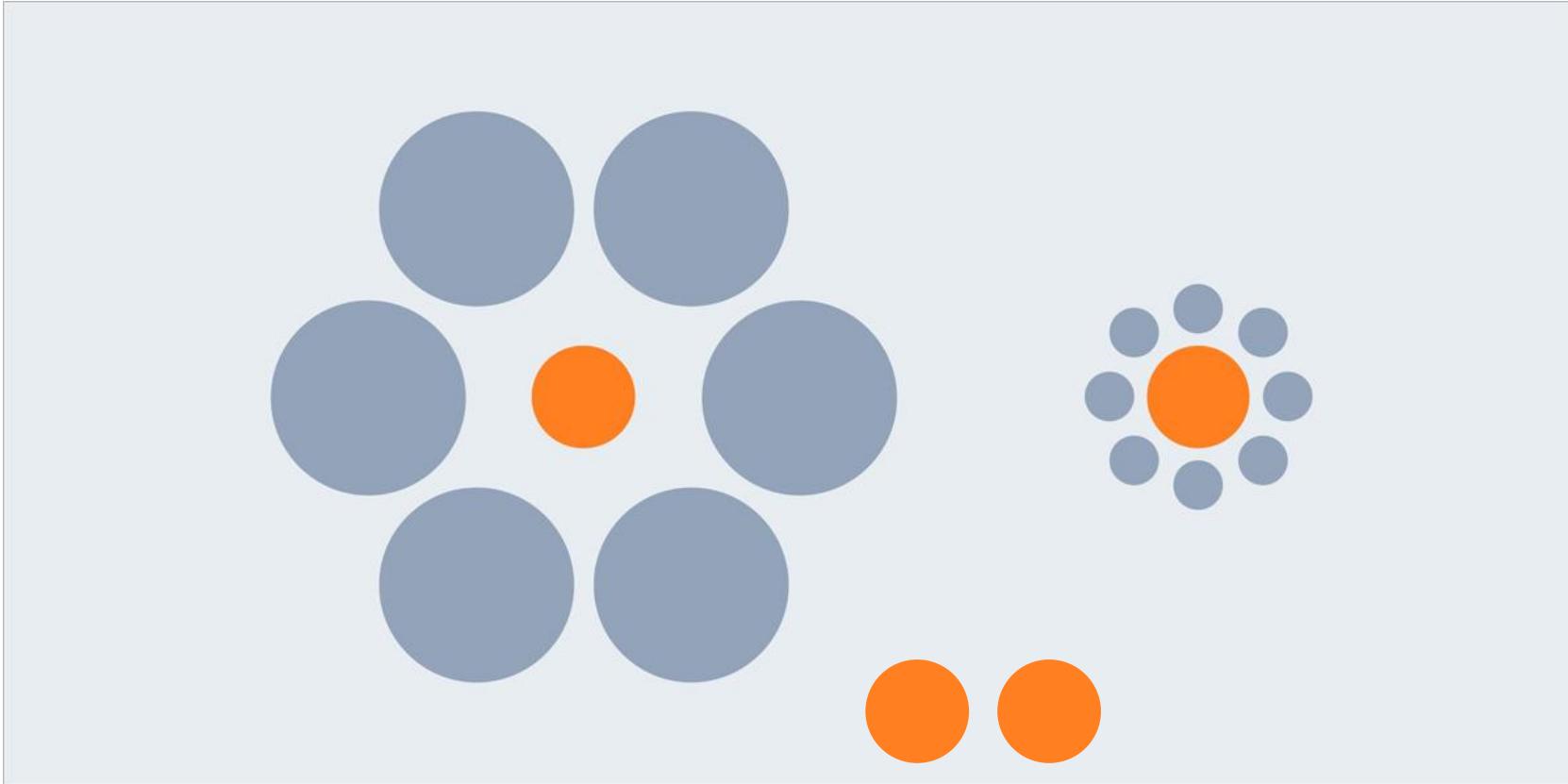
**LINKS? = UP!**

# Welke oranje cirkel is kleiner?

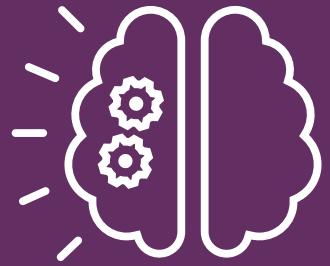


**LINKS? = UP!**

# Welke oranje cirkel is kleiner?



**LINKS? = UP!**



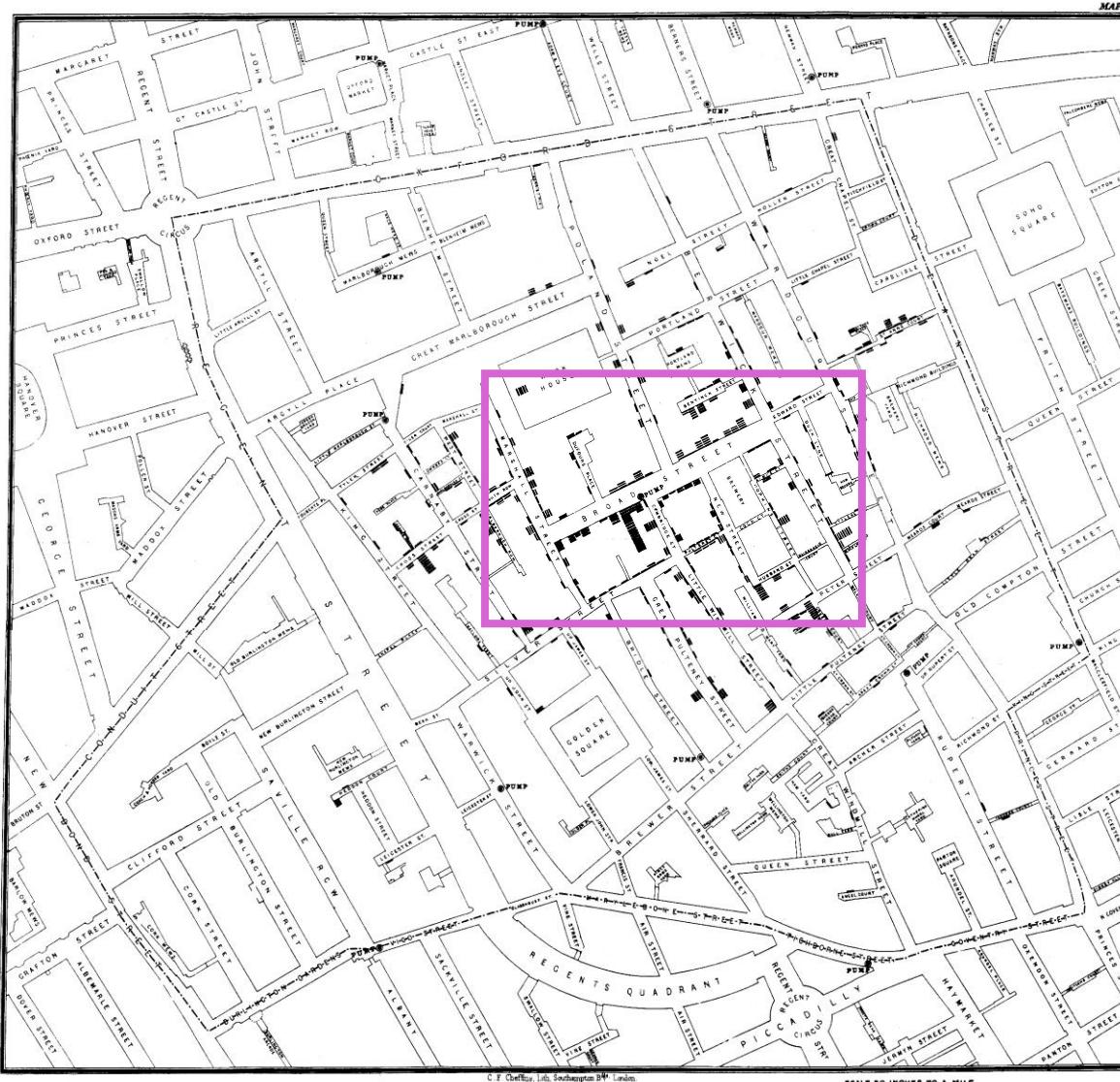
*“It’s not what you look at that  
matters, it’s what you see”*

Henry David Thoreau

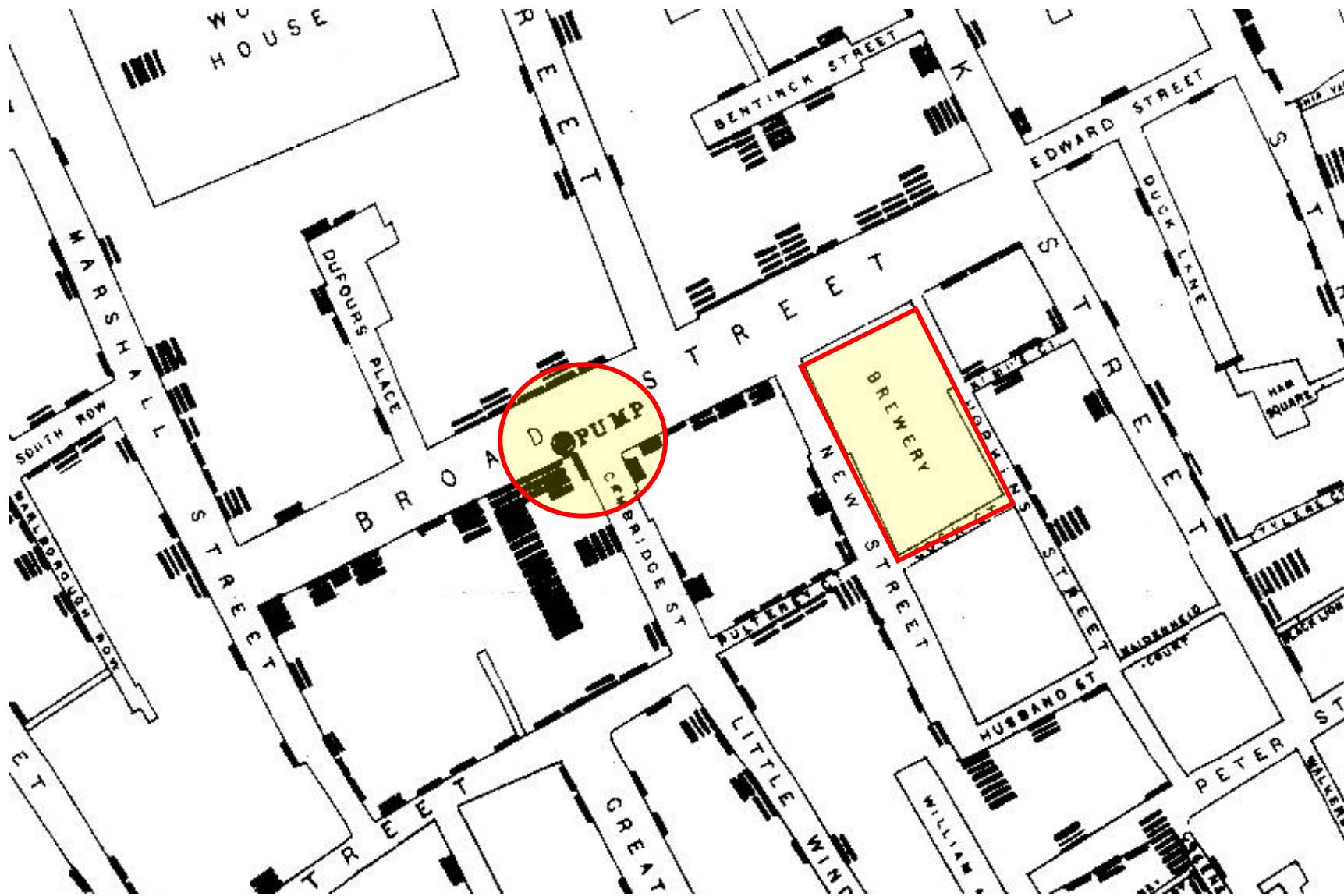
# Waarom visuele communicatie ?

*“Eén beeld zegt meer dan duizend woorden”*

# 1854: De cholera kaart van John Snow



# 1854: De cholera kaart van John Snow



# Vier datasets. Zie je iets bijzonders?

I		II		III		IV		
x	y	x	y	x	y	x	y	
10	8,04	10	9,14	10	7,46	8	6,58	
8	6,95	8	8,14	8	6,77	8	5,76	
13	7,58	13	8,74	13	12,74	8	7,71	
9	8,81	9	8,77	9	7,11	8	8,84	
11	8,33	11	9,26	11	7,81	8	8,47	
14	9,96	14	8,1	14	8,84	8	7,04	
6	7,24	6	6,13	6	6,08	8	5,25	
4	4,26	4	3,1	4	5,39	19	12,5	
12	10,84	12	9,13	12	8,15	8	5,56	
7	4,82	7	7,26	7	6,42	8	7,91	
5	5,68	5	4,74	5	5,73	8	6,89	
SUM	99,00	82,51	99,00	82,51	99,00	82,50	99,00	82,51
AVG	9,00	7,50	9,00	7,50	9,00	7,50	9,00	7,50
STDEV	3,32	2,03	3,32	2,03	3,32	2,03	3,32	2,03

# Een figuur laat zien wat data alleen niet kan!

## Het kwartet van Anscombe:

4 datasets

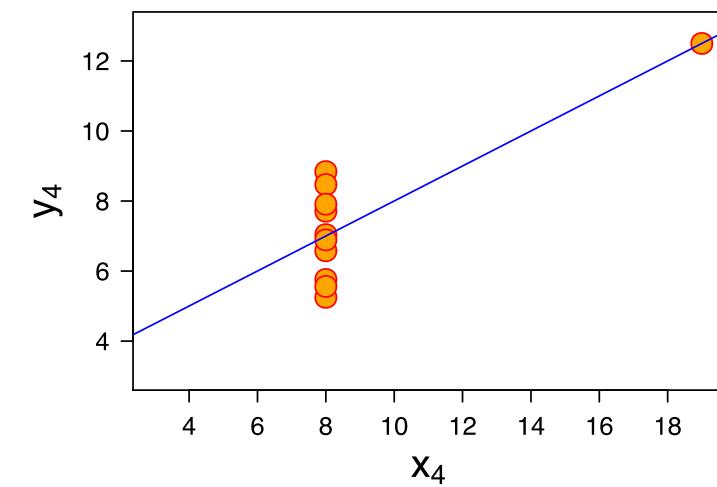
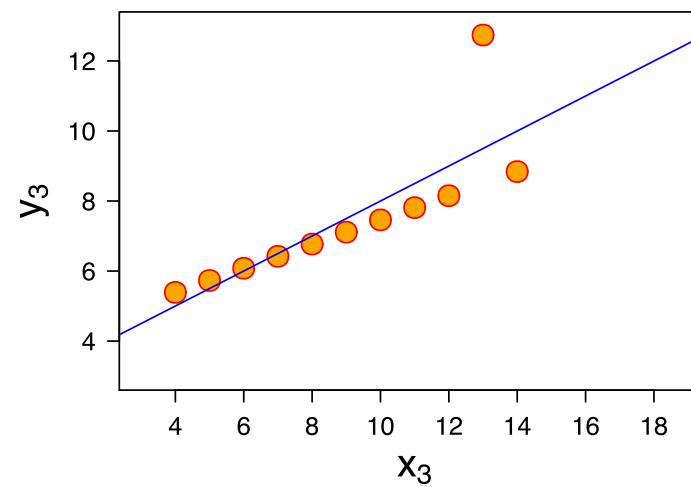
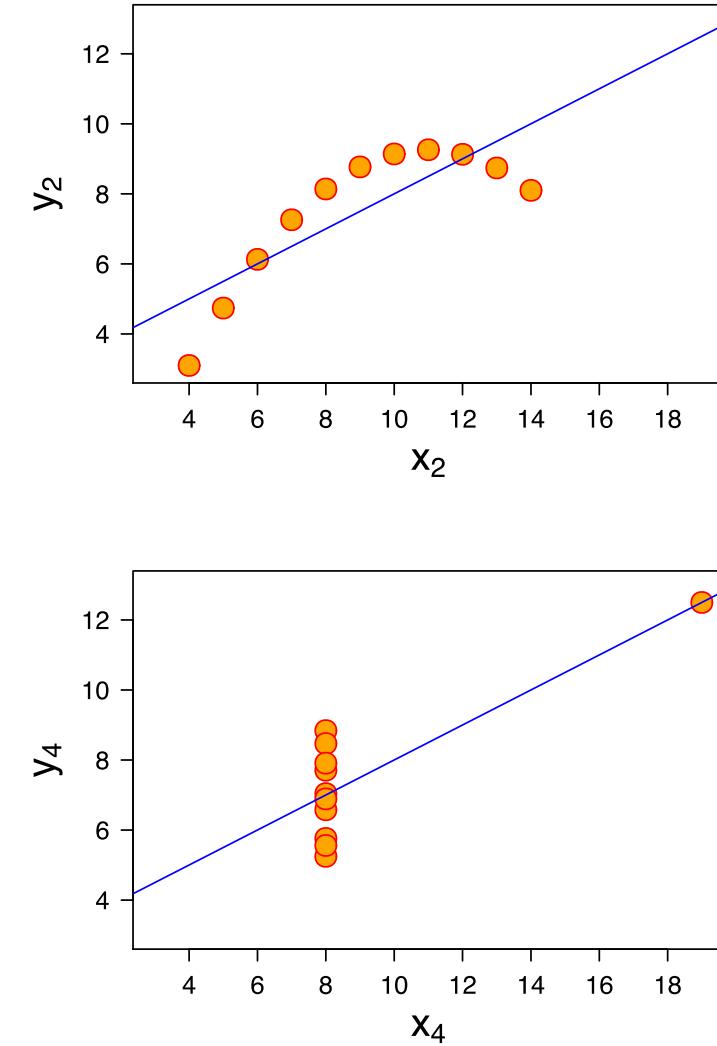
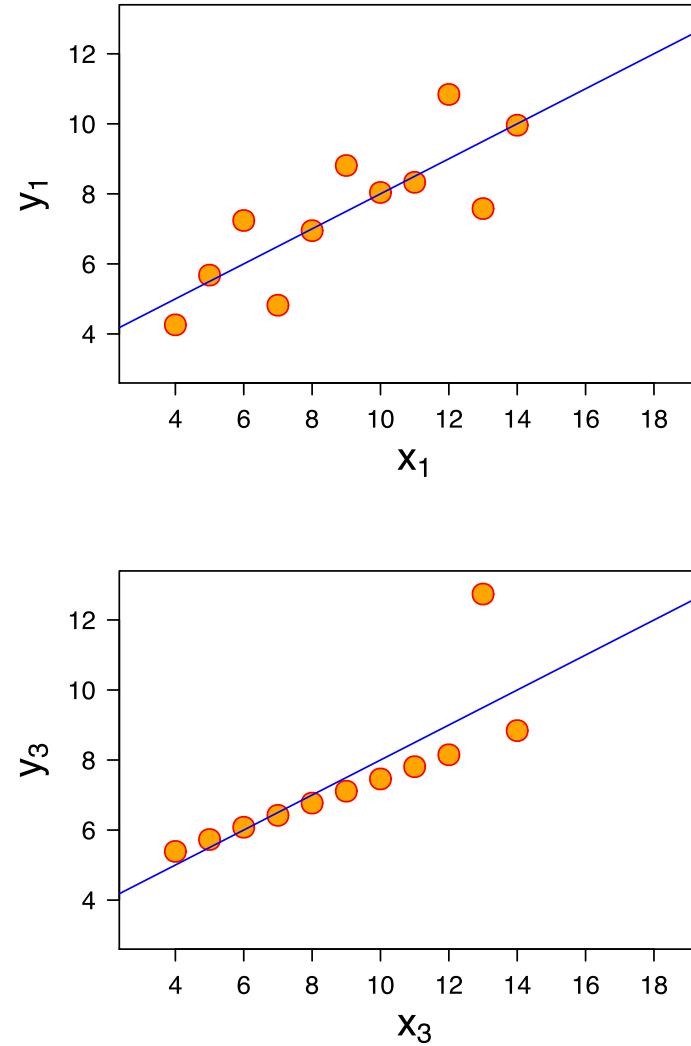
11 x-waarden

11 y-waarden

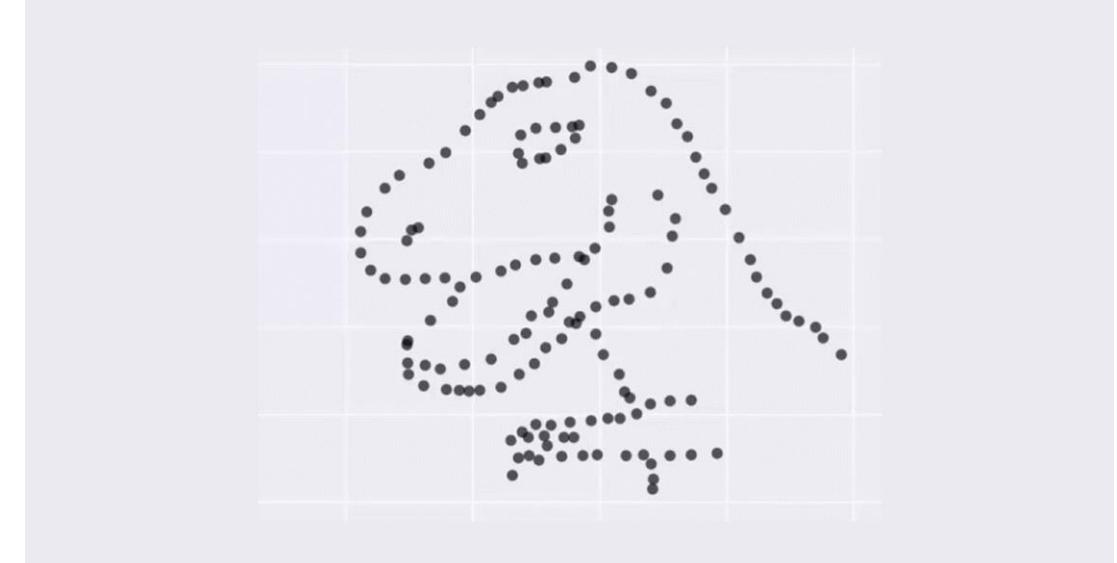
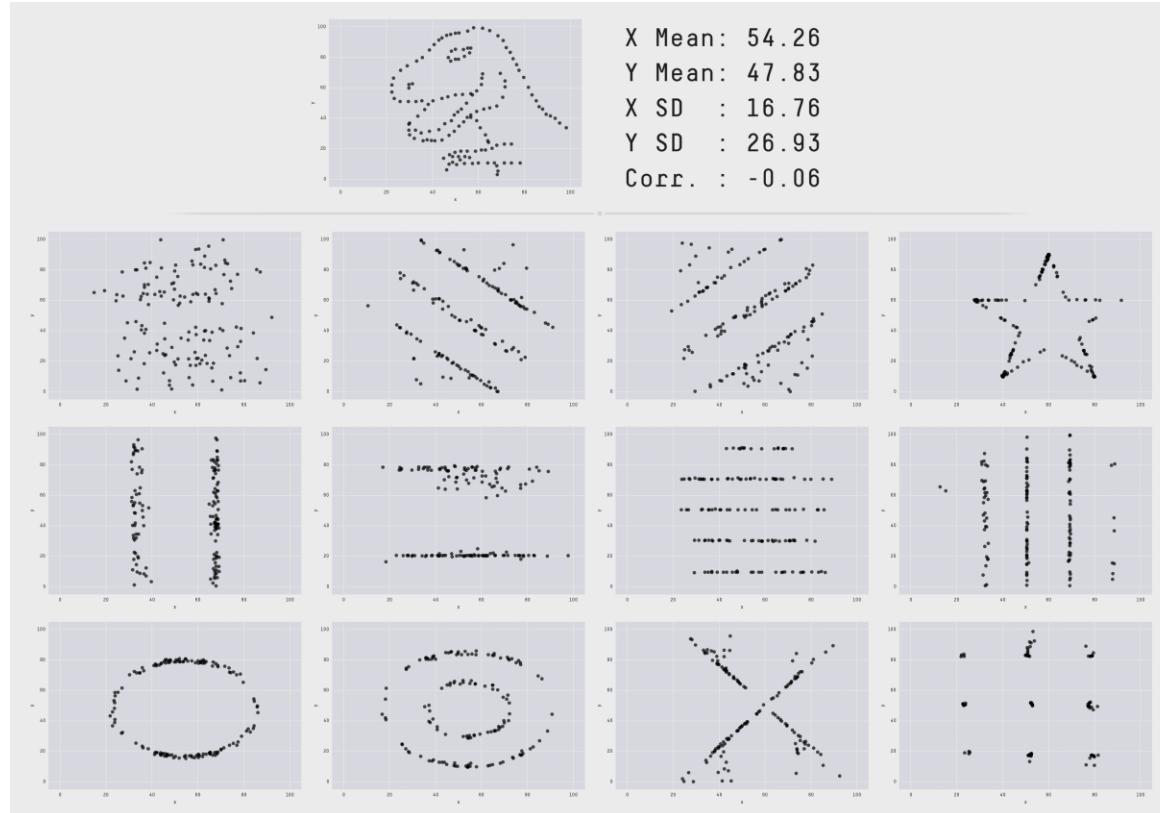
Dezelfde som

Hetzelfde gemiddelde

Dezelfde standaard deviatie

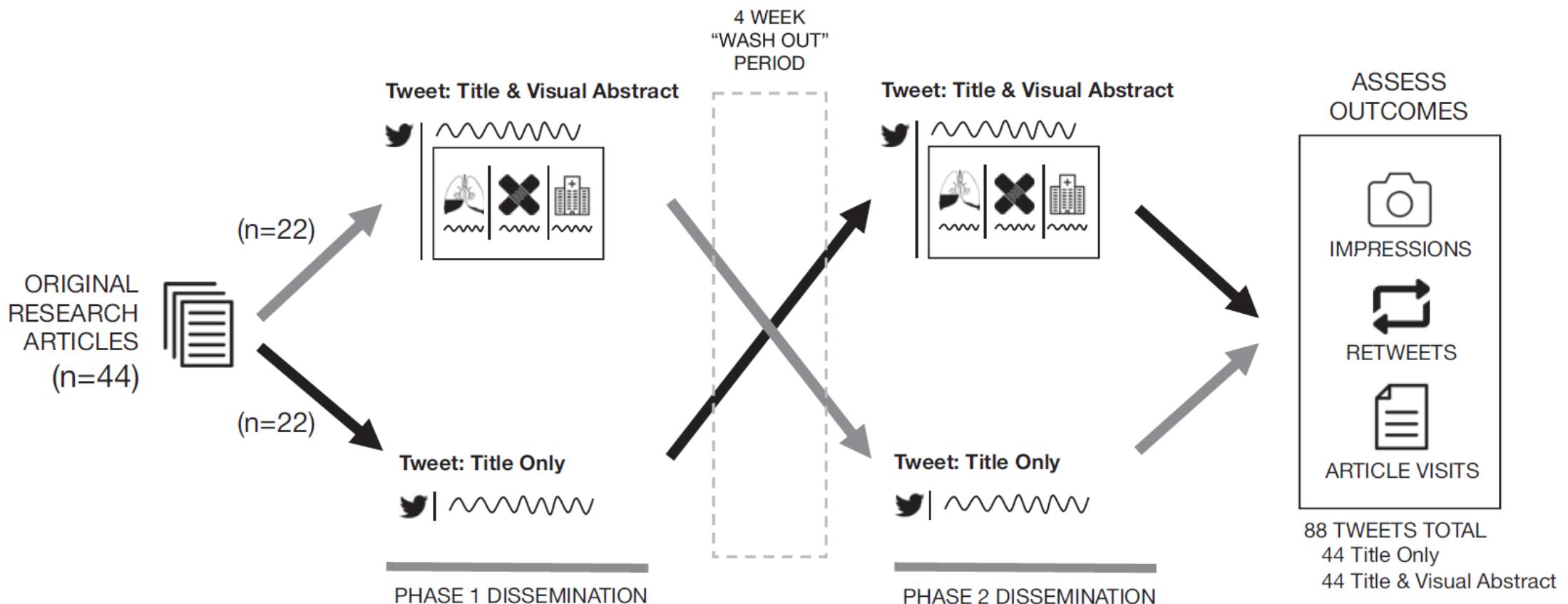


# The Datasaurus Dozen 😊: Vertrouw nooit enkel de “summary statistics”!

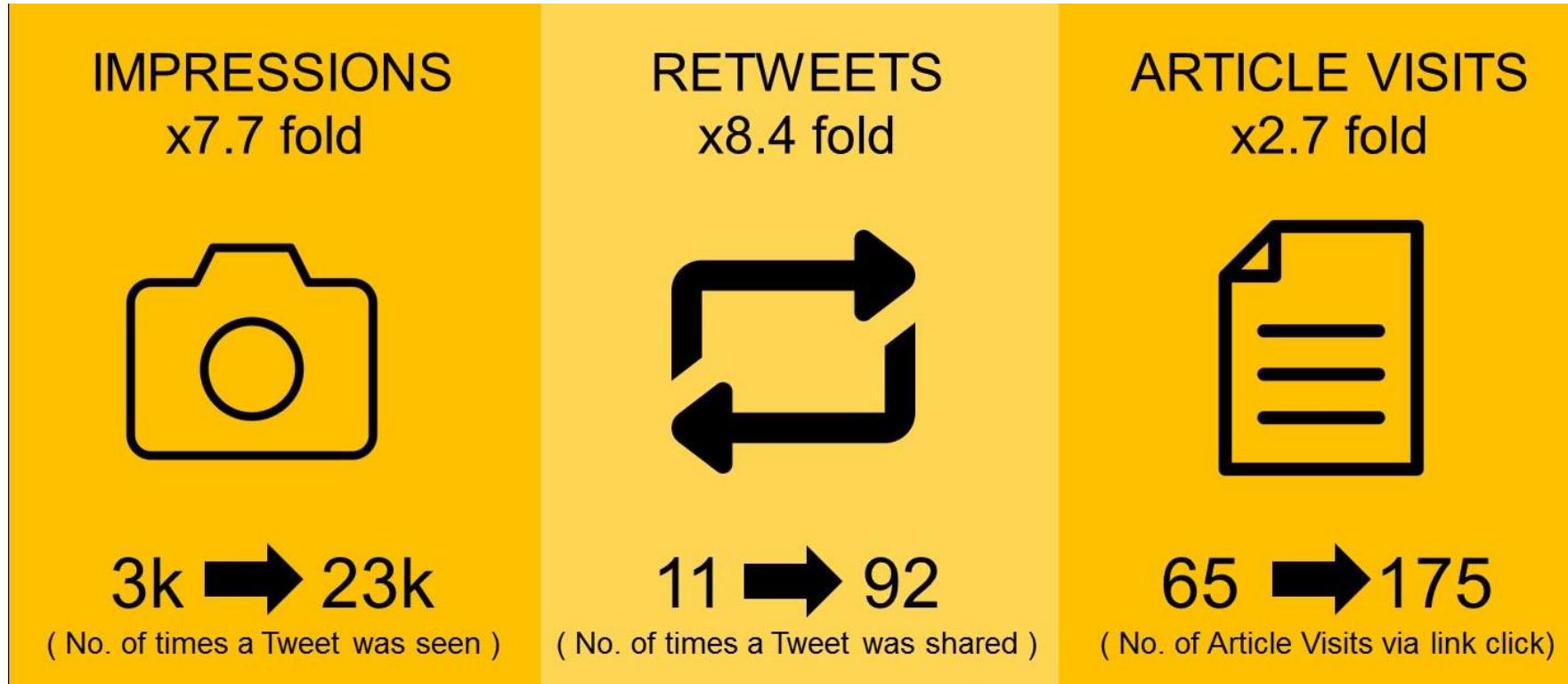


Matejka J & Fitzmaurice G (2017). *Same Stats, Different Graphs: Generating Datasets with Varied Appearance and Identical Statistics through Simulated Annealing.*  
<https://www.autodeskresearch.com/publications/samestats>.

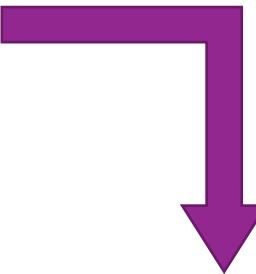
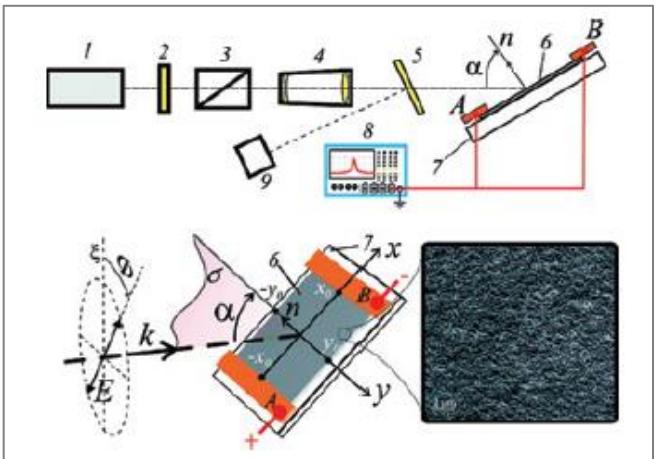
# Tweets met een plaatje krijgen meer aandacht!



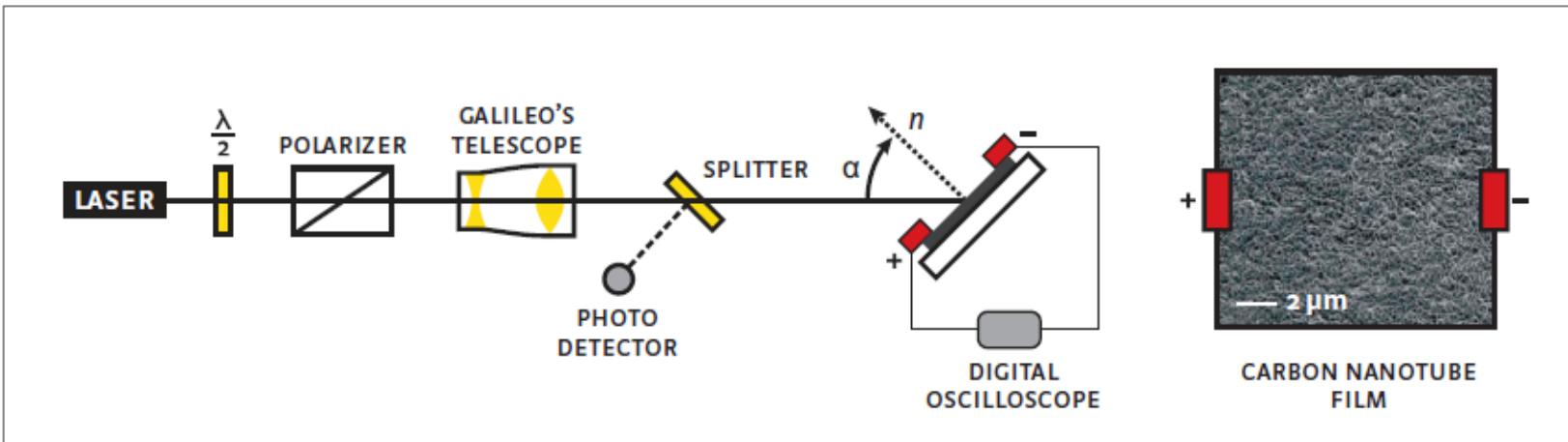
# Tweets met een plaatje krijgen meer aandacht!



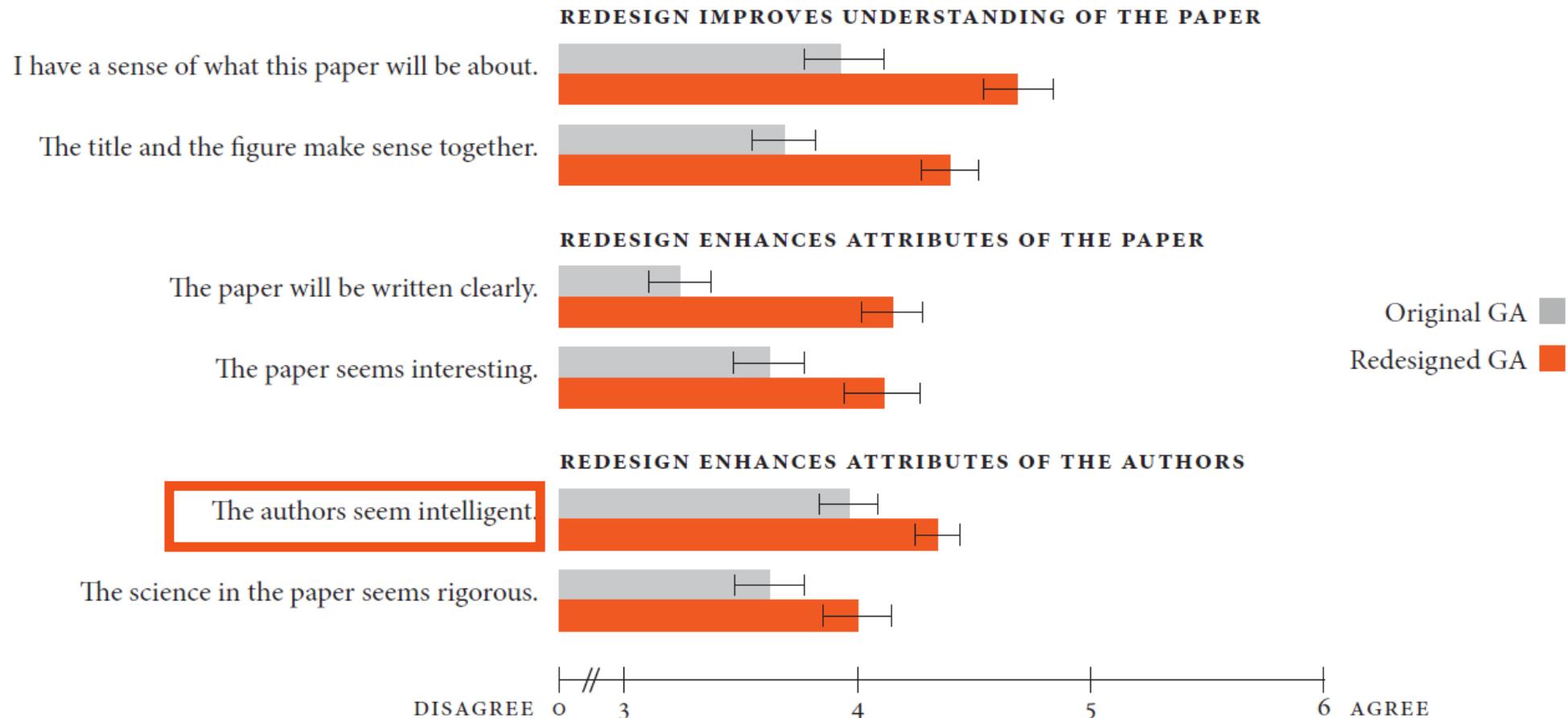
# Bonus: Een goede visualisatie maakt (dat) je slimmer (lijkt)!



10 graphical abstracts were redesigned based on visual design principles



# Bonus: Een goede visualisatie maakt (dat) je slimmer (lijkt)!





# Klimaatdata voor een groot publiek!



# Waarom visuele communicatie?

The diagram consists of a central purple circle containing the text 'Inzicht geven'. Surrounding this center are twelve purple text boxes, each containing a reason, arranged in a roughly circular pattern. Starting from the top right and moving clockwise, the reasons are:

- Begrijpen
- Motiveren
- Leren
- Bezighouden
- Emotie toevoegen
- Aandacht vragen
- Vereenvoudigen
- Onthouden
- Informeren
- Overtuigen
- Inspireren
- Herkennen
- Uitleggen
- Vermaken

**Wat** is visuele (data-)  
communicatie ?

# Er zijn vier soorten visualisaties...

## *Idea illustration*

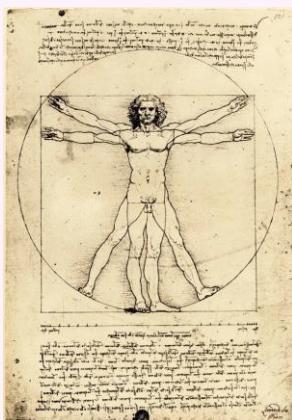


# BEWEREN

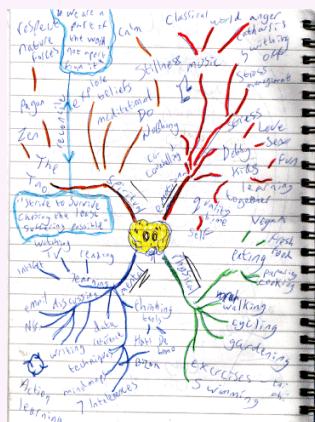


# *'Everyday' DataViz*

## *Idea generation*



# CONCEPTUEEL



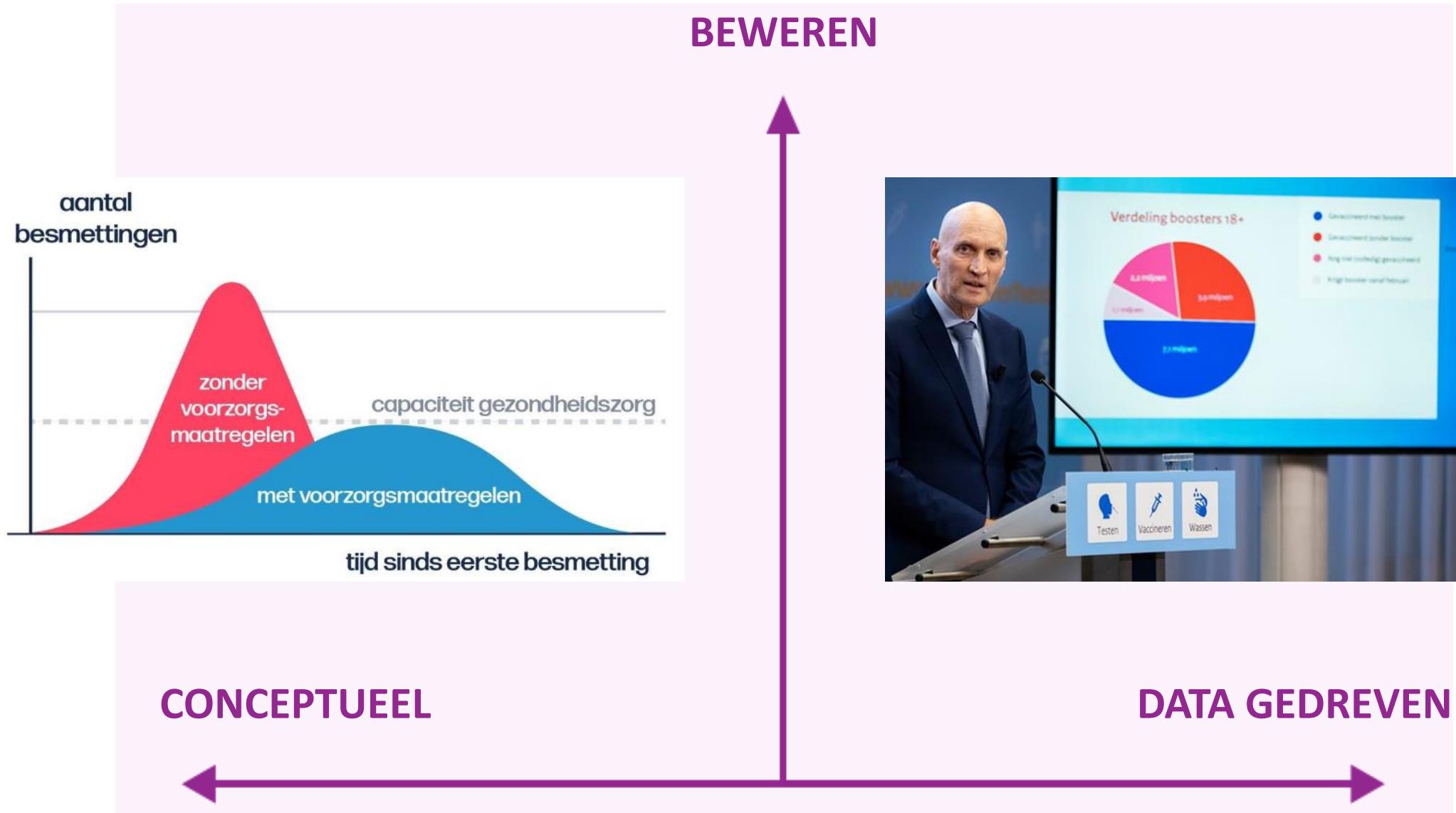
## ONTDEKKEN

This dashboard displays a variety of data visualizations across different categories:

- Age:** A large heatmap showing age distribution.
- Sex:** Box plots comparing sex across various categories.
- Dx:** Box plots comparing diagnosis across categories.
- TimeOfficiency:** Box plots comparing time off efficiency.
- MotivationDose:** Box plots comparing motivation dose.
- SurgeryPerHour:** Box plots comparing surgery per hour.
- Correlation Matrix:** A large heatmap showing correlations between all variables.
- Scatter Plots:** Various scatter plots showing relationships between variables like Age vs. Sex or Dx.
- Line Charts:** Line charts showing trends over time for specific metrics.

## *Visual discovery*

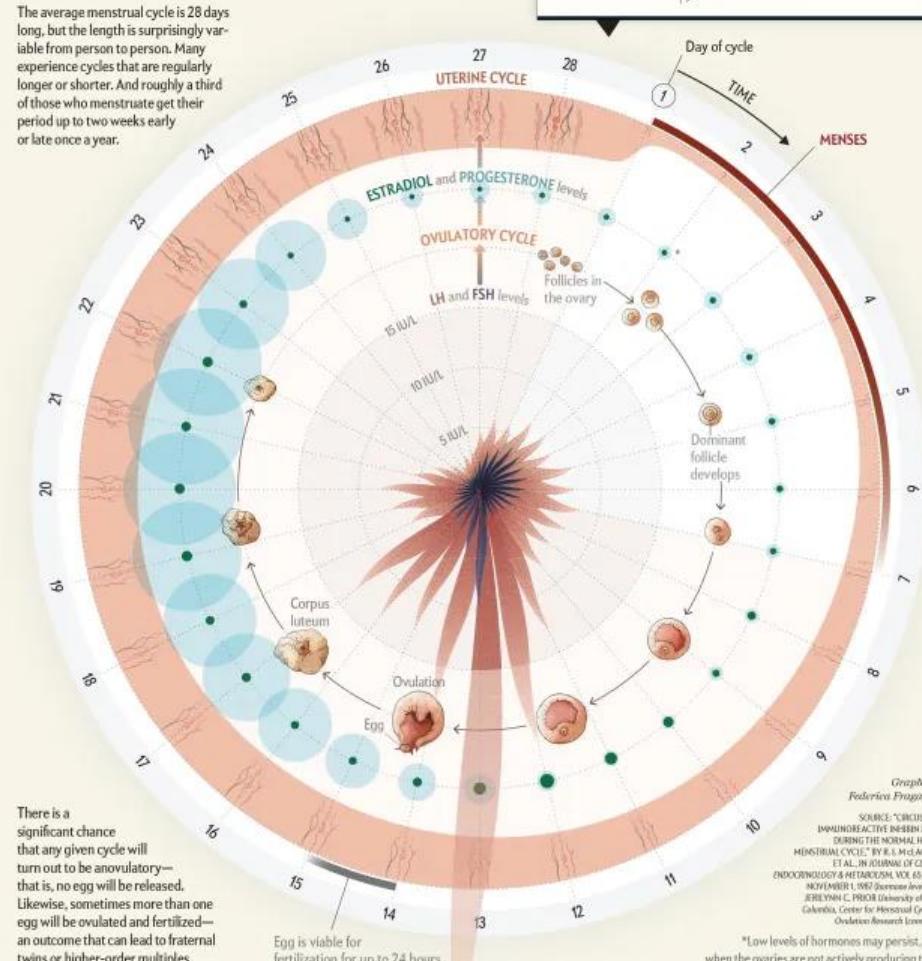
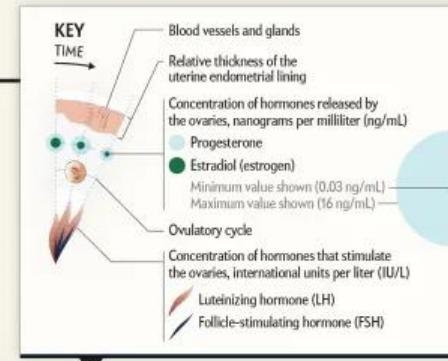
# ...en twee soorten visuele communicatie



# Conceptueel en data-gedreven

## The Menstrual Cycle

Humans are among the very few species to experience a period. The menstrual cycle starts in the brain, which sends signals to the pituitary gland (not shown) to produce hormones that stimulate the ovaries. The ovaries house egg-containing follicles that release an egg during ovulation. The ovaries also secrete hormones to help prepare the uterus to host an embryo, which results if the egg is fertilized by a sperm. If no embryo implants, the uterus disposes of its lining, and the cycle begins again.



# Conceptueel en data-gedreven

## Lunge Feeding

Scientists tracking fin whales have created the first detailed model of how they feed. After gliding to depths of more than 600 feet in search of krill, a fin whale will repeatedly accelerate and open its mouth wide, engulfing about 20 pounds of krill and more than its own weight in water as it grinds to a halt.



**START OF LUNGE**  
**Lunge**  
After accelerating into a school of krill, the whale opens its mouth.  
SPEED  
... 5 miles per hour  
0 6 seconds



**2 SECONDS**  
Grooves in the blubber between the lower jaws begin to expand.



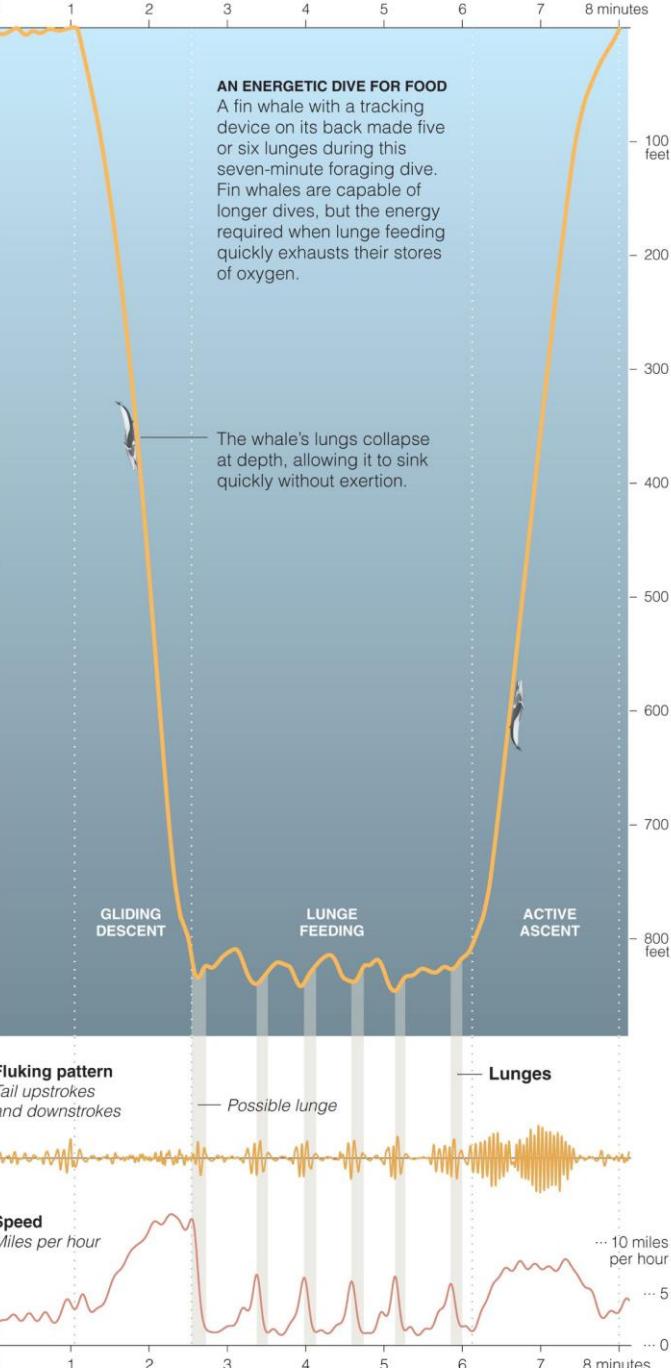
**3 SECONDS**  
Now fully open, the mouth causes massive drag and deceleration.



**4 SECONDS**  
The closing mouth continues to drag as the whale pushes forward.



**6 SECONDS**  
The whale starts to filter out the krill and prepare for another lunge.  
SPEED  
... 5 miles per hour  
0 6 seconds

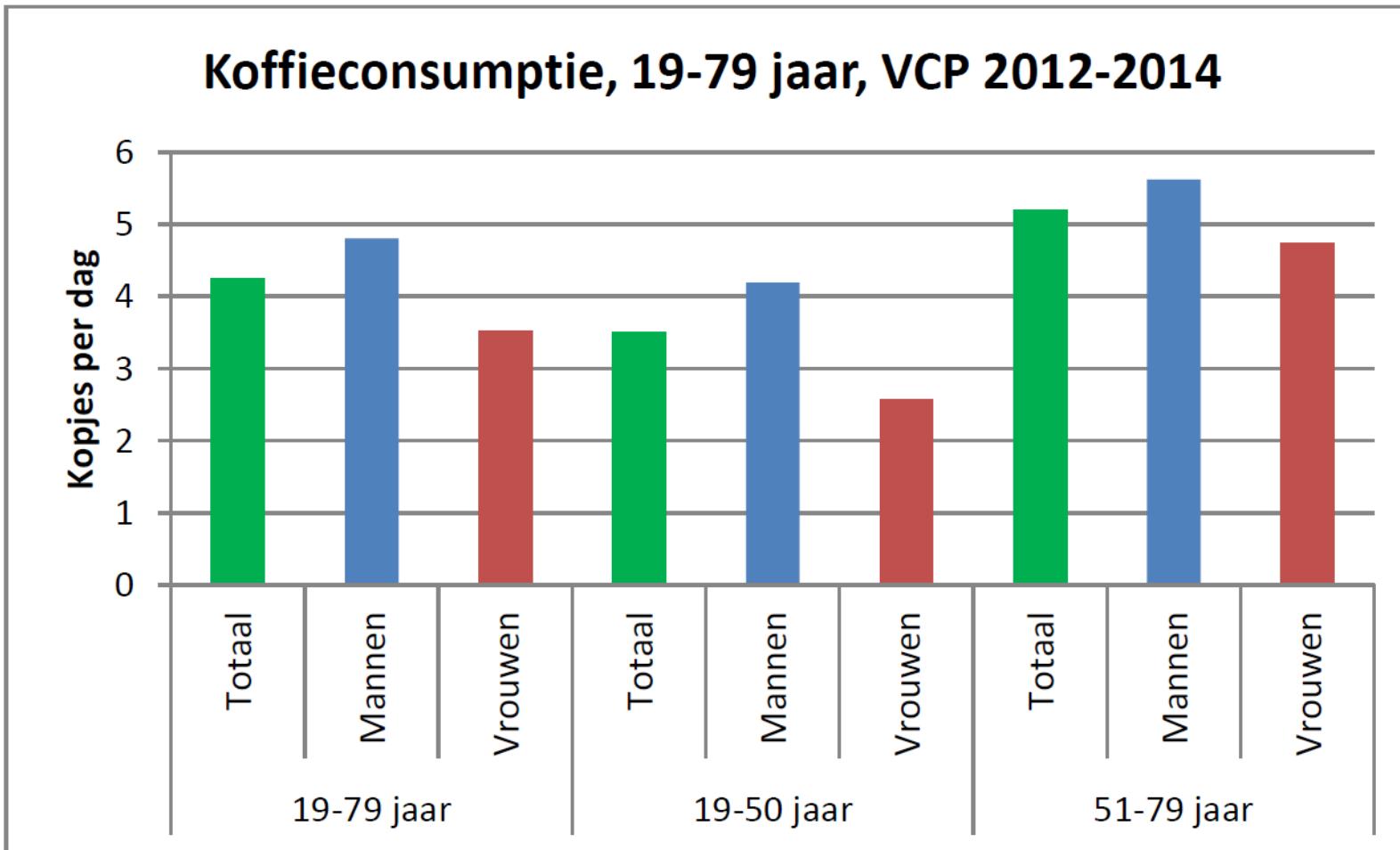


Sources: Jeremy A. Goldbogen; Nicholas D. Pyenson; Journal of Experimental Biology; Marine Ecology Progress Series

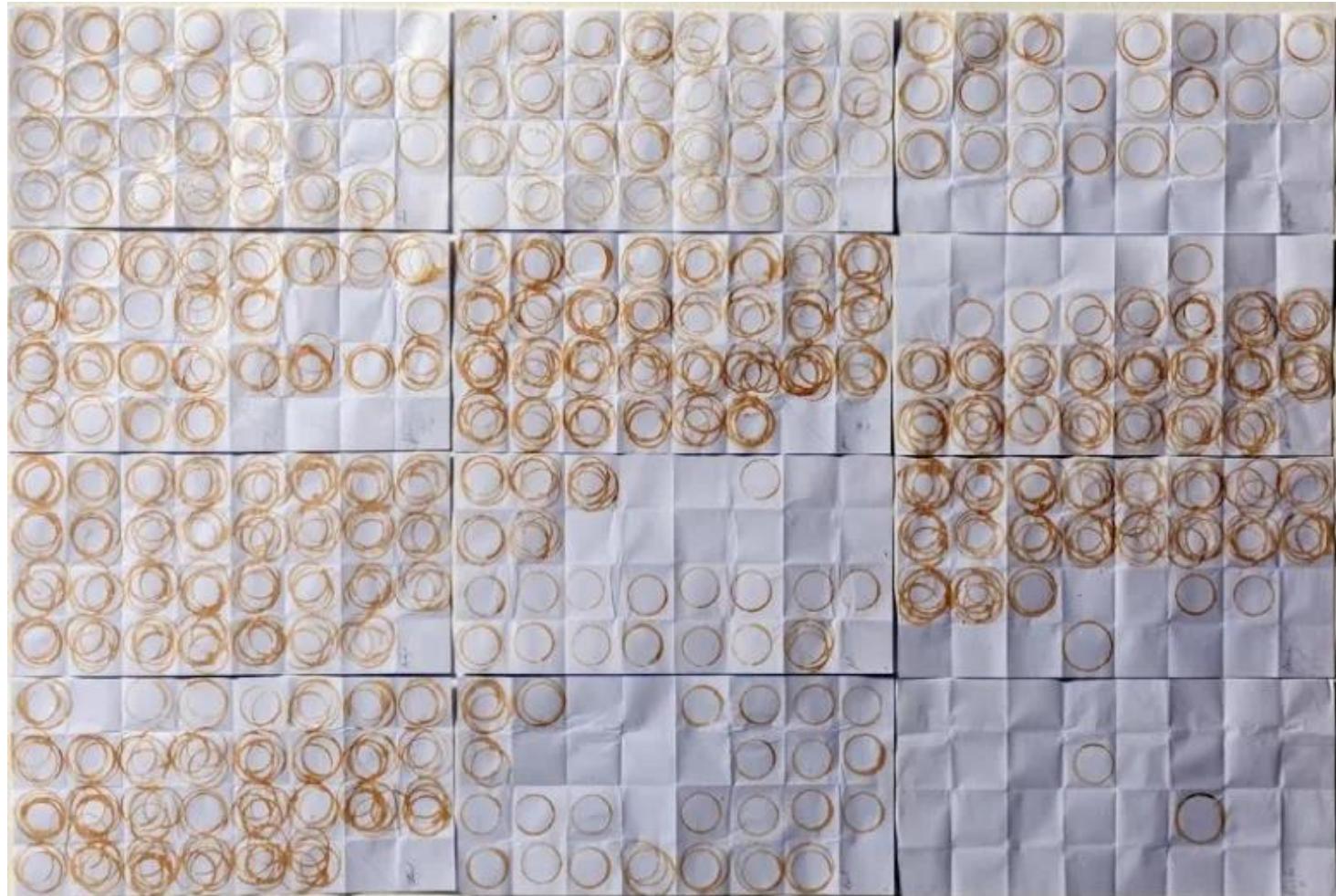
JONATHAN CORUM/THE NEW YORK TIMES;  
WHALE ILLUSTRATIONS BY NICHOLAS D. PYENSON

Jonathan Corum,  
The New York Times

# Data-gedreven: Koffieconsumptie in beeld



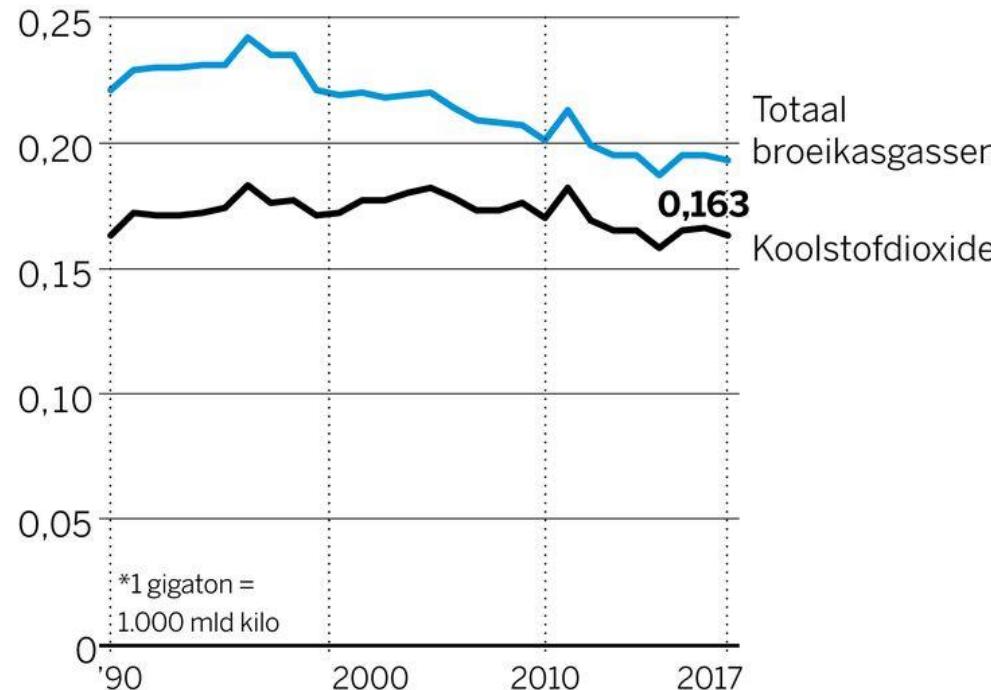
# Data-gedreven? Koffieconsumptie in beeld



# Data-gedreven: CO<sub>2</sub> uitstoot in beeld

## CO<sub>2</sub> NEDERLAND DAALT

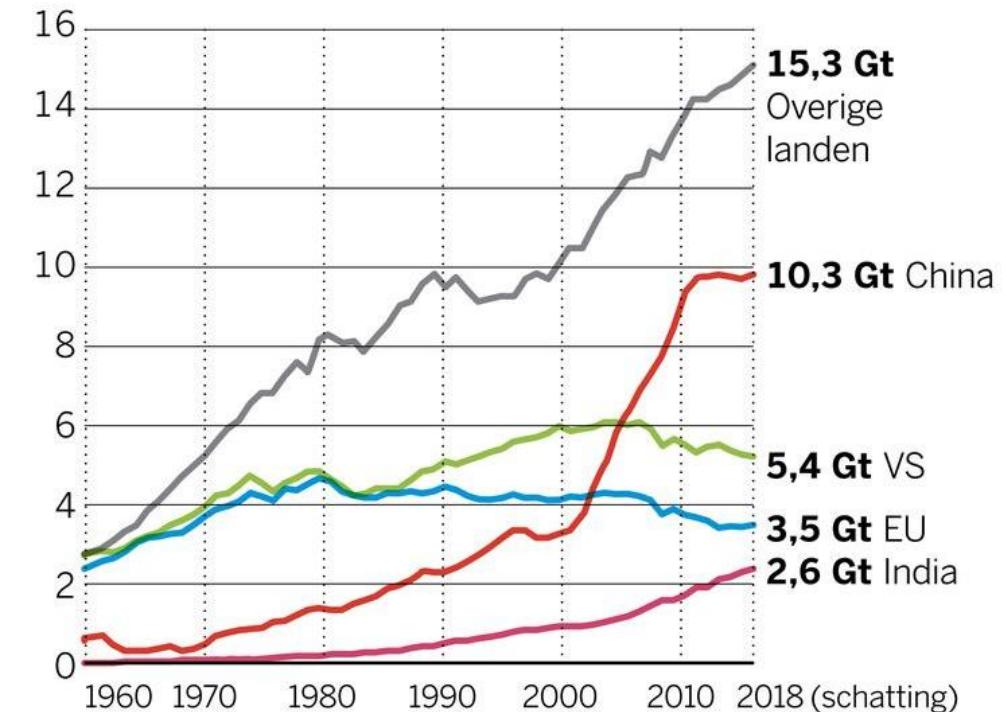
Uitstoot in gigaton\* CO<sub>2</sub>-equivalenten



051218 © VK. Bron: CBS, RIVM/Emissieregistratie

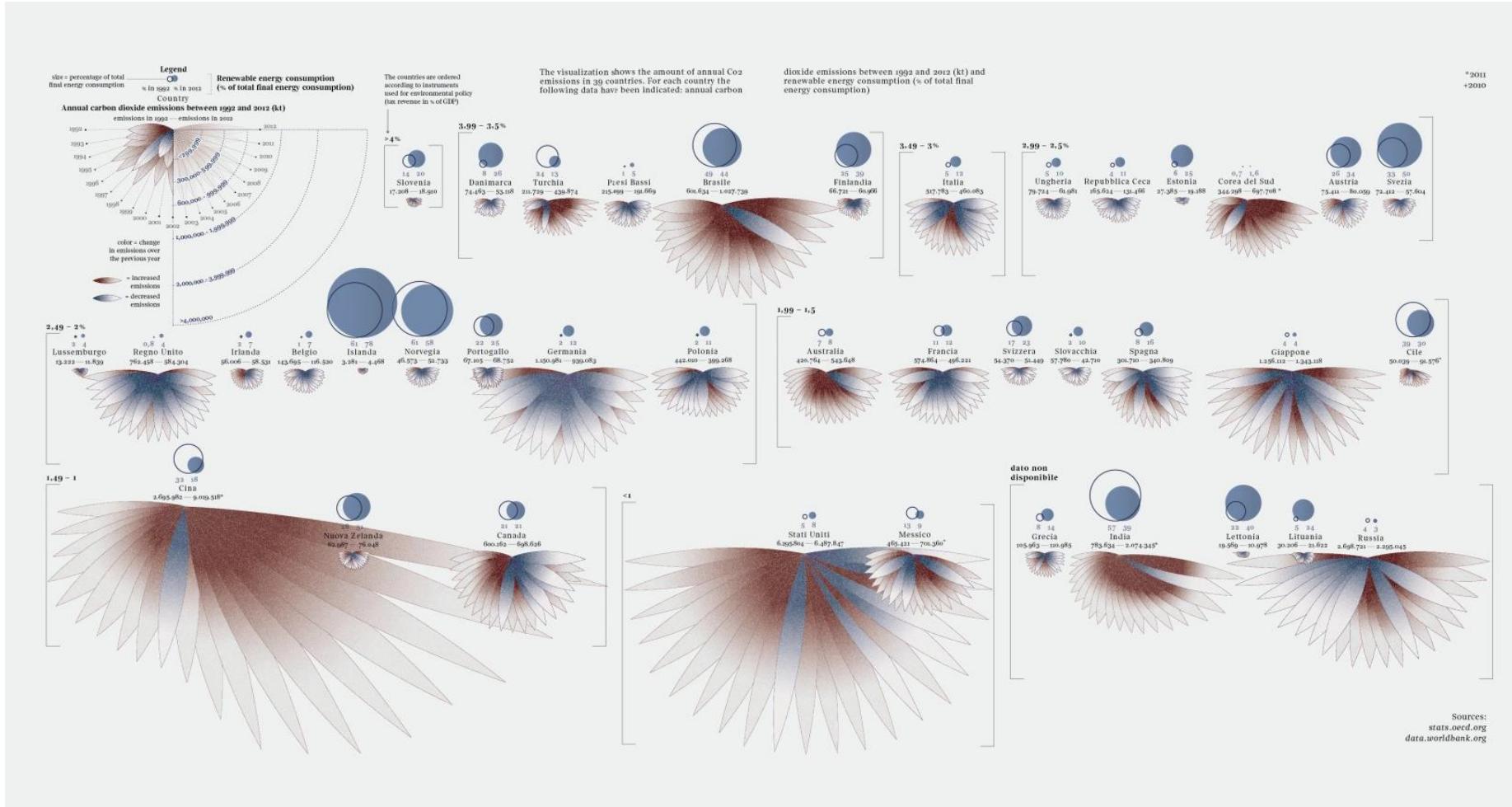
## CHINA KOPLOPER UITSTOOT

CO<sub>2</sub>-uitstoot uit fossiele brandstoffen in gigaton



051218 © de Volkskrant . Bron: Global Carbon Project

# Data-gedreven: CO<sub>2</sub> uitstoot in beeld

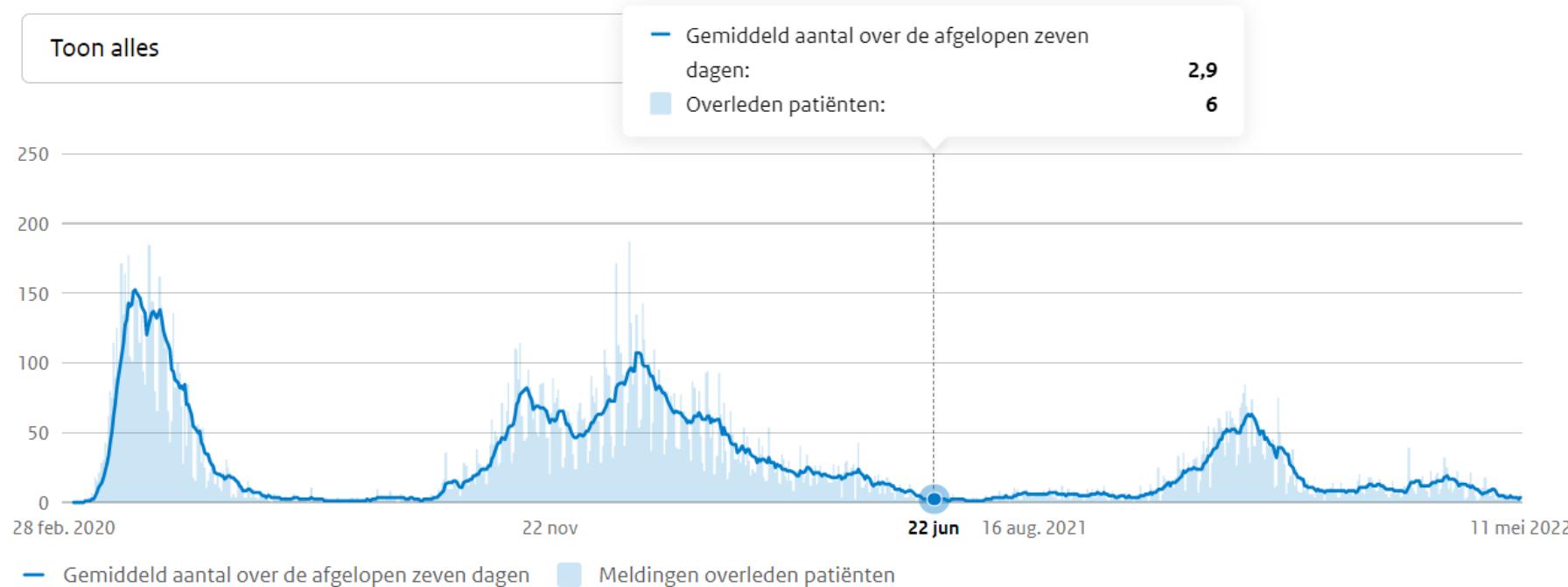


# Data-gedreven: Covid-19 sterfte in beeld

## Meldingen van aan COVID-19 overleden patiënten door de tijd heen



Deze grafiek laat zien van hoeveel COVID-19-patiënten gemeld is dat ze zijn overleden. In de grafiek tonen we ook gemiddelden over de afgelopen zeven dagen.



Bron: RIVM

# Data-gedreven? Covid-19 sterfte in beeld



Kristin Briney,  
<https://nightingaledvs.com/crafting-a-covid-visualization/>

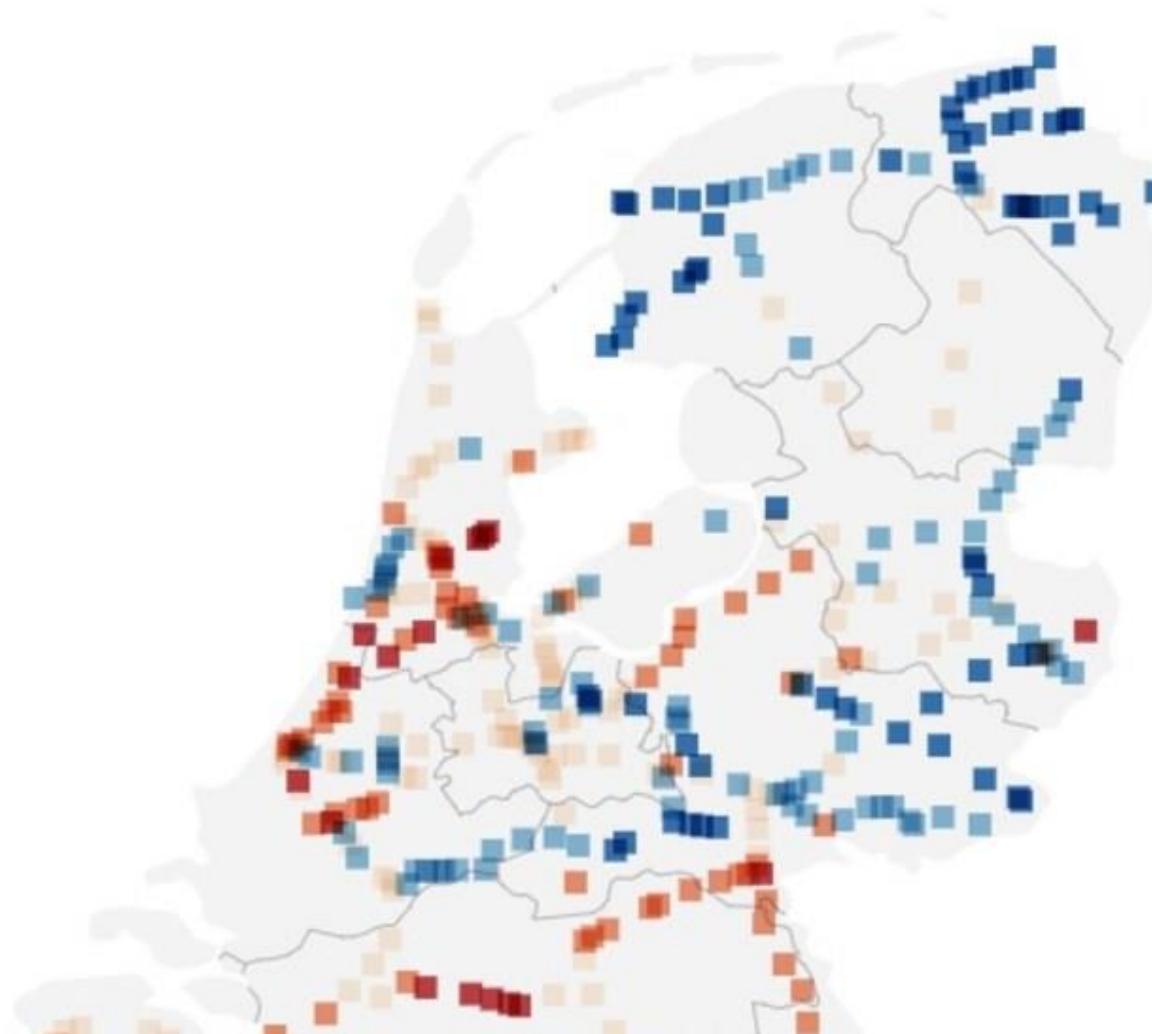


Suzanne Firstenberg,  
<https://suzannefirstenberg.com/in-america-covid-19-white-flags-in-dc-suzanne-firstenberg/>

# Data-gedreven: Treinvertragingen in beeld

Hoe vaak rijdt  
de trein op tijd?

- < 93%
- 93 - 94,5%
- 94,5 - 96%
- 96 - 97,5%
- > 97,5%



# Data-gedreven? Treinvertragingen in beeld



Sara Weber @sara\_weber

...

Meine Mutter ist Pendlerin im Münchener Umland. Und begeisterte Strickerin. 2018 hat sie einen "Bahn-Verspätungsschal" gestrickt. Pro Tag zwei Reihen: Grau bei unter 5 Minuten, rosa bei 5 bis 30 Minuten Verspätung, rot bei Verspätung auf beiden Fahrten oder einmal über 30 Minuten.

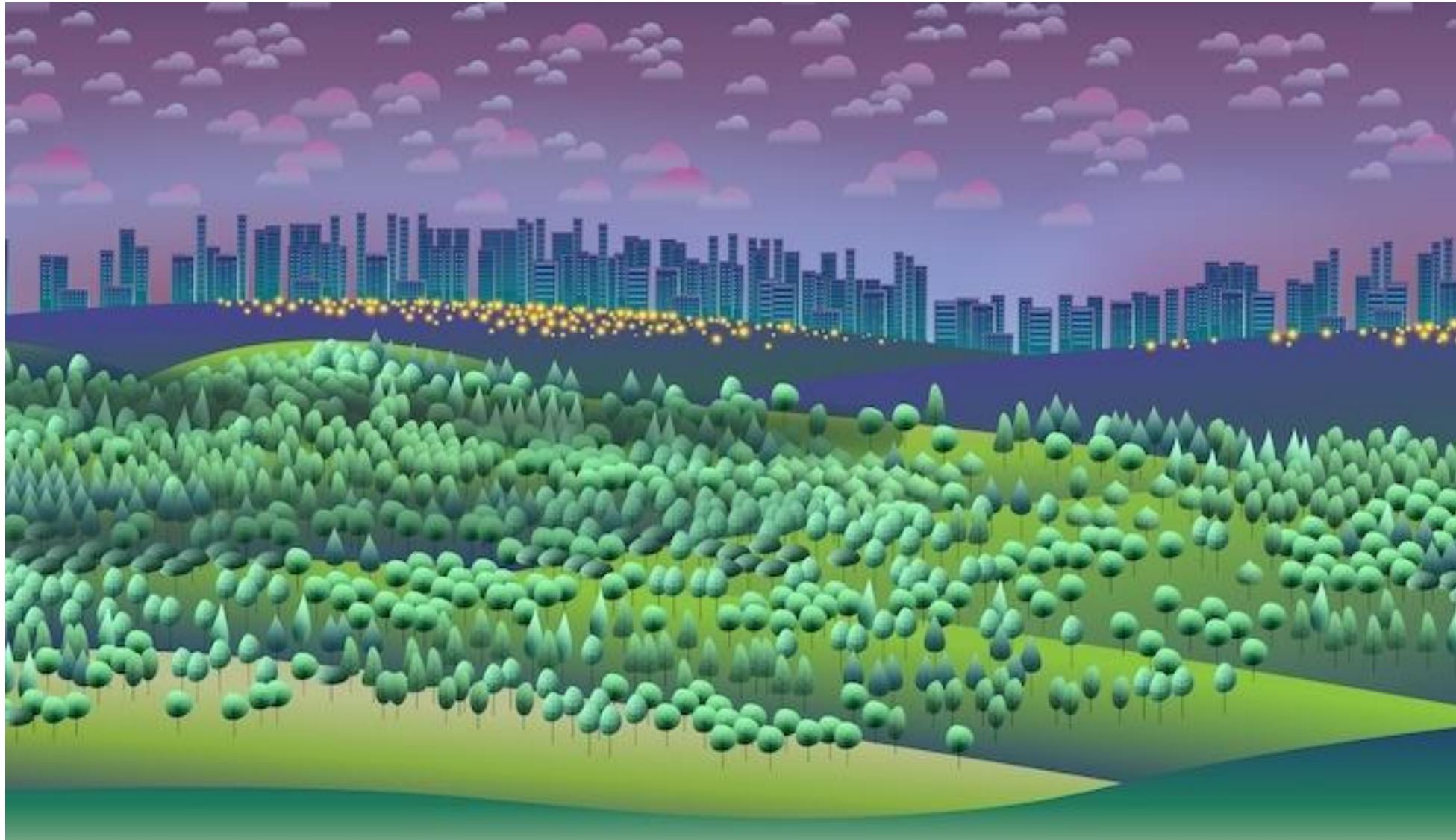
[Translate Tweet](#)



5:29 PM · Jan 6, 2019 · Twitter Web Client

6,213 Retweets 993 Quote Tweets 22K Likes

# Het kan statisch...



# Of interactief...

why do cats | why does my cat  
bite when...

being pet | happy | i shout | they  
groom | you pet them

purr

why does a cat | why do cats | why  
does my cat

purr

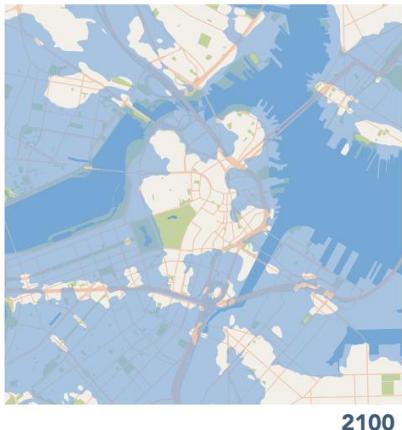
and throw themselves | constantly |  
nonstop | when he sees me | when i  
play cat videos | when they are  
happy | while sleeping

my  
lick

why do cats | why does my cat  
lick my...

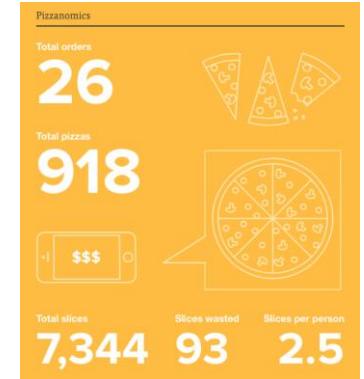
blanket | ear | face and bite my nose |  
feet | hair in the morning | hand for  
so long | hands and bite my nail | nose  
then bite it | other cats bum

# Of gewoon... op straat!



# Maar ook een **getal** is een datavisualisatie

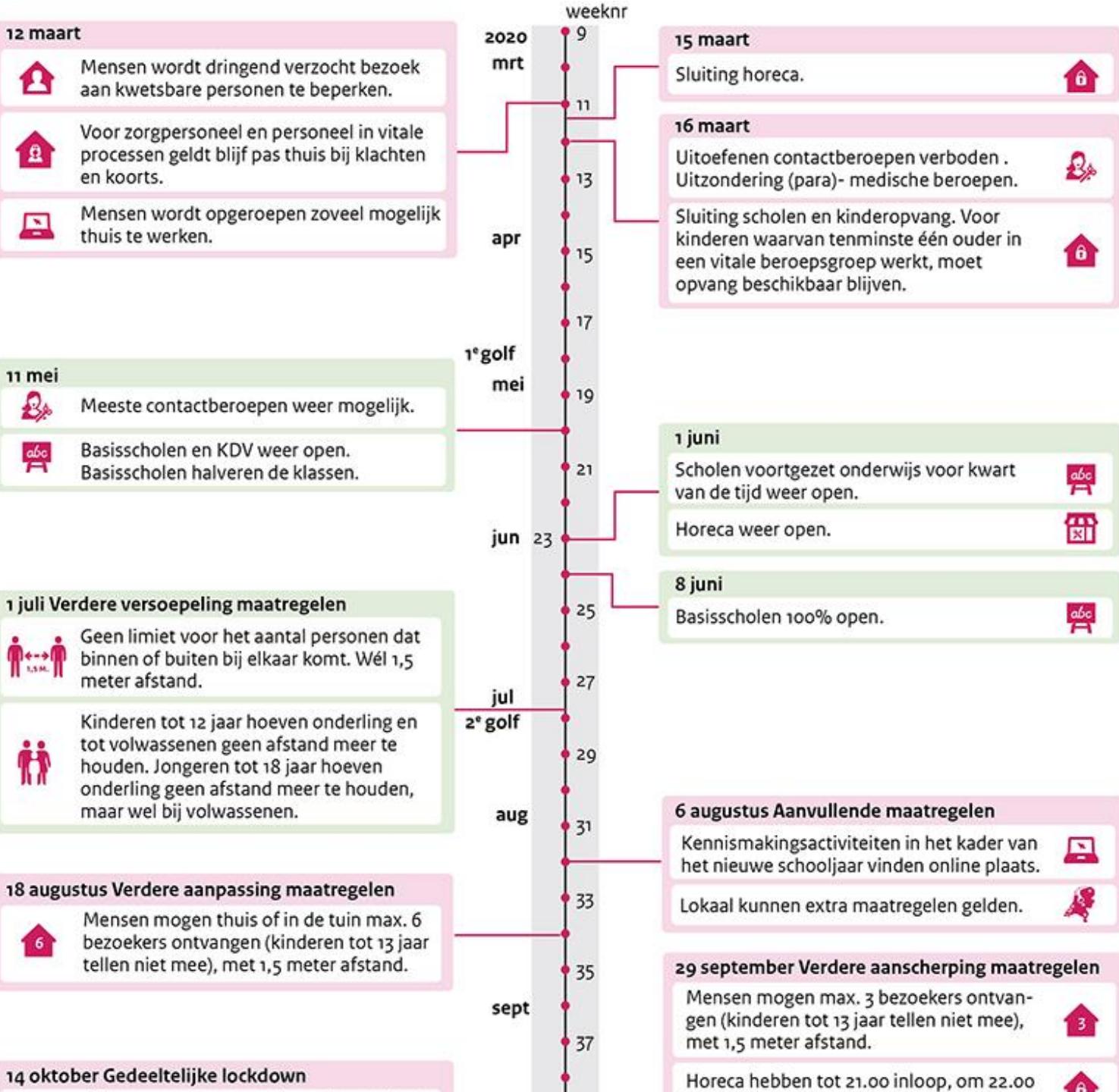
39  
users



# Een tabel...

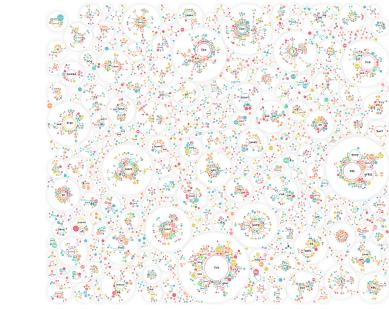
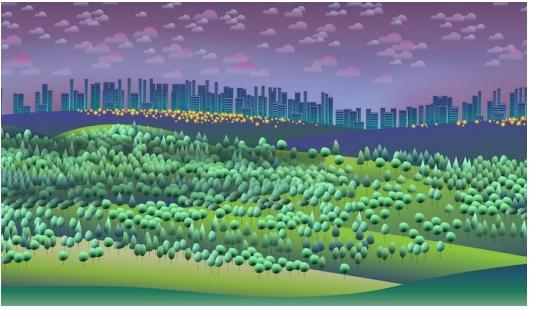
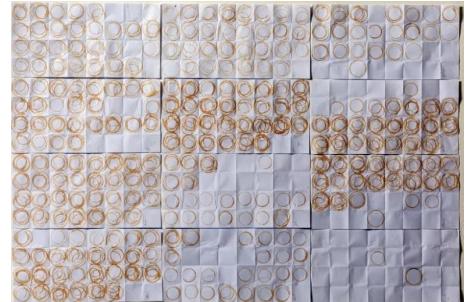
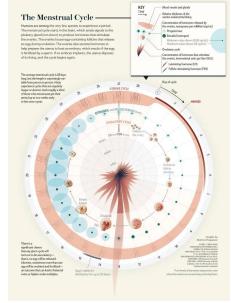
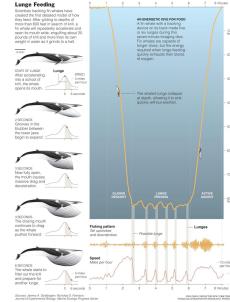
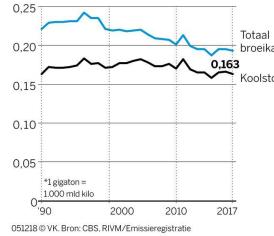
<b>Veiligheidsregio</b>	<b>Aantal meldingen per 100.000 gedurende de afgelopen 7 dagen</b>
Amsterdam-Amstelland	410
Rotterdam-Rijnmond	408
Haaglanden	347
Zuid-Holland-Zuid	324
Utrecht	315
Zaanstreek-Waterland	302,
Hollands-Midden	285
Brabant-Zuidoost	261
Gooi en Vechtstreek	260
Twente	257
Kennemerland	244
Midden- en West-Brabant	242
Gelderland-Zuid	224
Gelderland-Midden	220
Brabant-Noord	215
Drenthe	196
Limburg-Noord	173
Groningen	170
Flevoland	167
Fryslân	166
IJsselland	154
Noord- en Oost-Gelderland	153
Noord-Holland-Noord	122
Limburg-Zuid	107
Zeeland	89
<b>Nederland-totaal</b>	<b>252</b>

# Een tijdlijn...



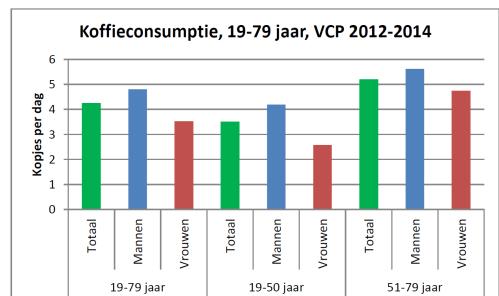
## CO<sub>2</sub> NEDERLAND DAALT

Uitstoot in gigaton\* CO<sub>2</sub>-equivalente



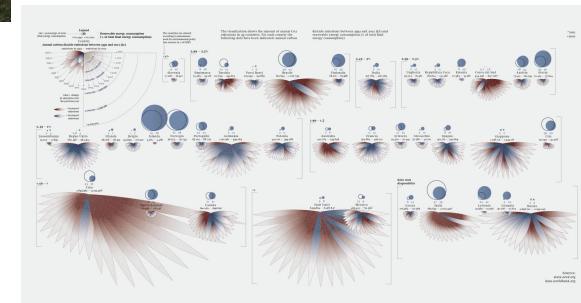
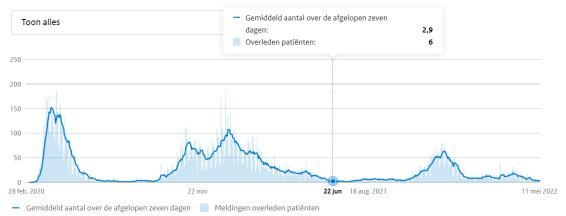
Hoe vaak rijdt  
de trein op tijd?

- < 93%
- 93 - 94,5%
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## Meldingen van aan COVID-19 overleden patiënten door de tijd heen

Deze grafiek laat zien van hoeveel COVID-19-patiënten gemeld is dat ze zijn overleden. In de grafiek tonen we ook gemiddelden over de afgelopen zeven dagen.

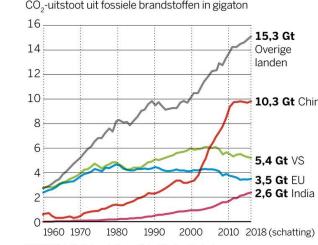


39  
users



## CHINA KOPLOPER UITSTOOT

CO<sub>2</sub>-uitstoot uit fossiele brandstoffen in gigaton

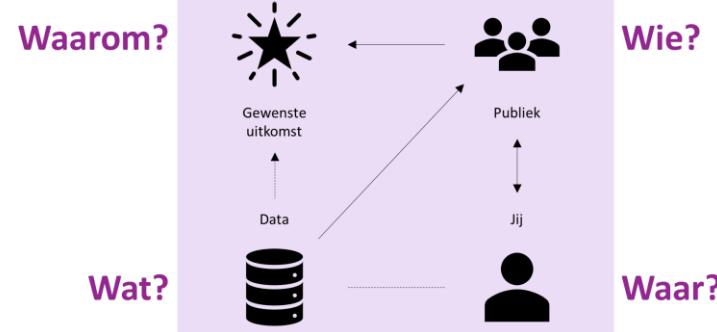


Hoe visuele (data-)  
communicatie ?

# Zoveel mogelijkheden, hoe kies je?

1.

Wat is de context?



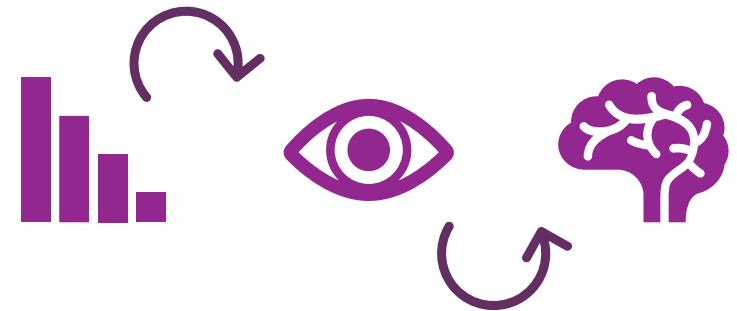
2.

Wat wil je laten zien?



3.

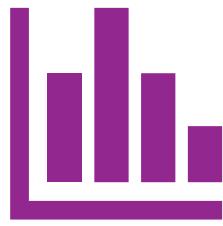
Hoe verwerkt ons brein visuele informatie?



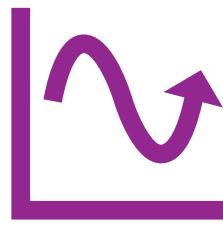
*STORY*

*DATA*

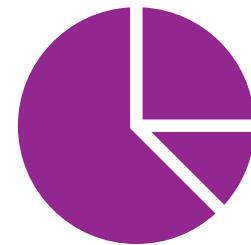
*DESIGN*



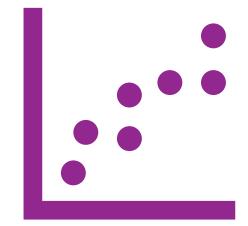
Vergelijking



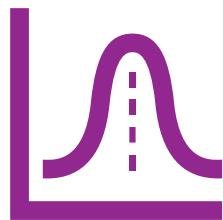
Trend



Deel van een  
geheel



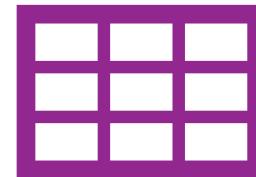
Relatie



Verdeling



Lokatie



Exacte waarden

## 1) Kies je grafiek

## Wat wil je laten zien?



categorie



tijd



deel van geheel



distributie



geospatiaal



relatie



exacte waarde

6



Gebruik deze grafiek om te

onderzoeken

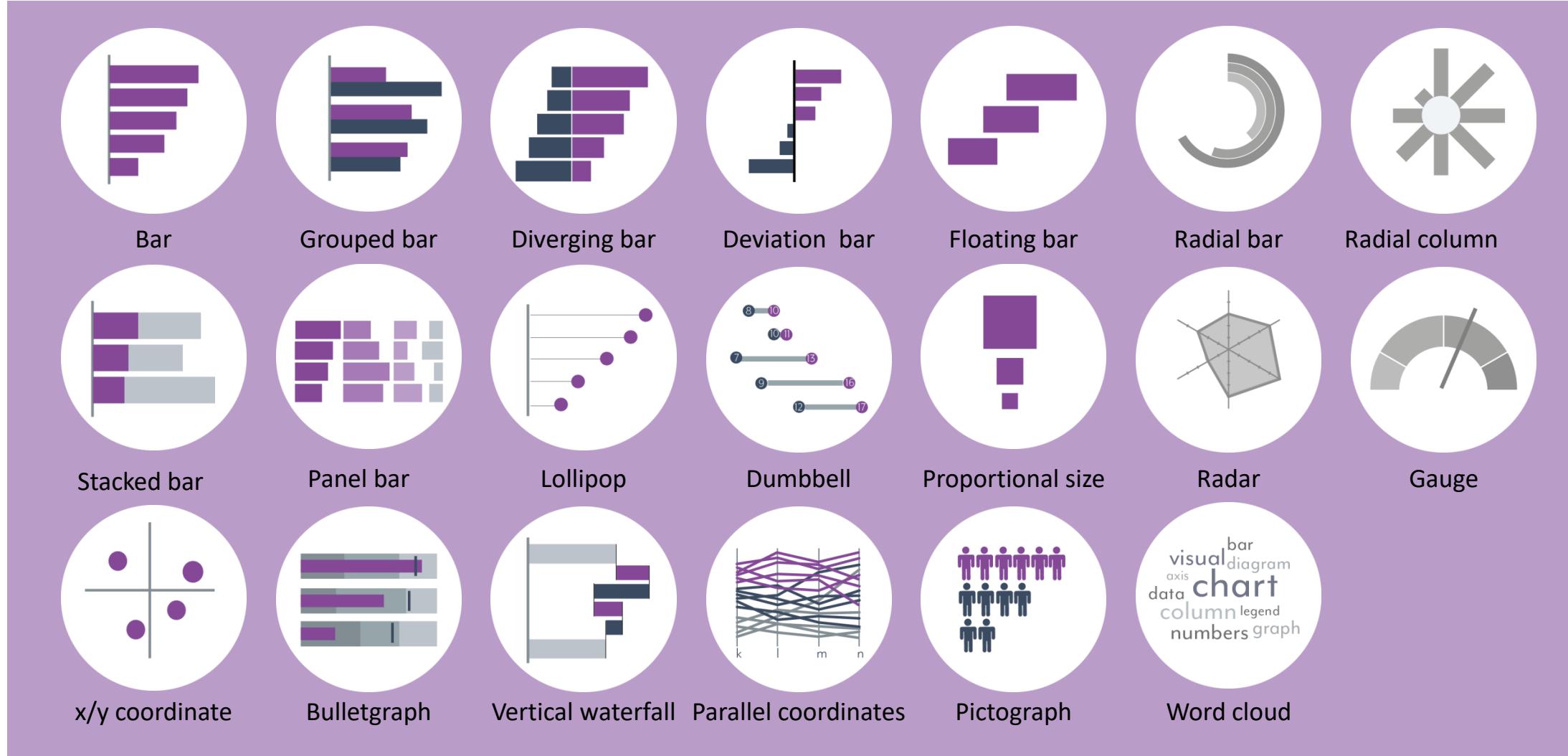
communiceren

monitoren

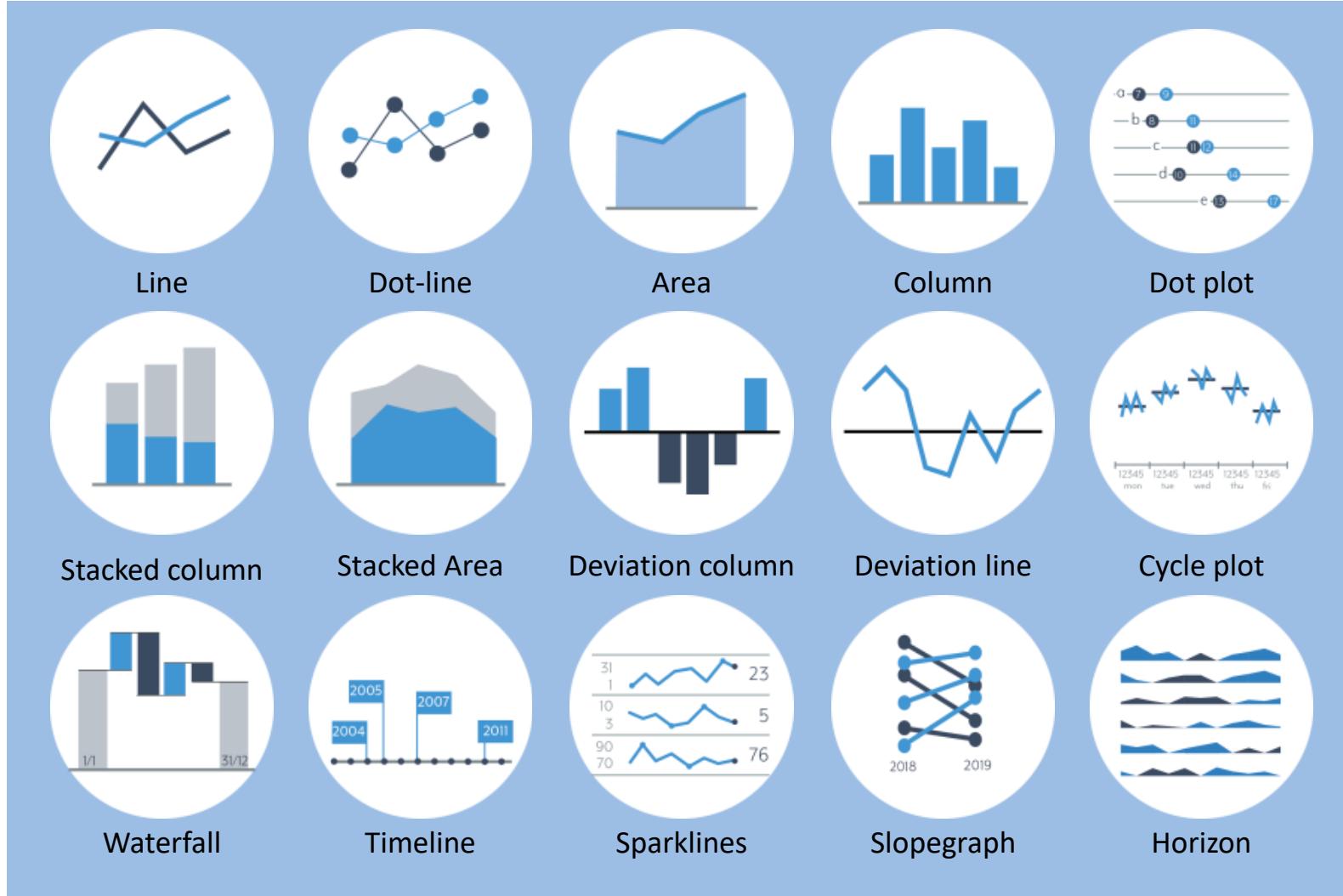
verwarmen

Meer tips over grafiek keuze en grafiek ontwerp kun je vinden op

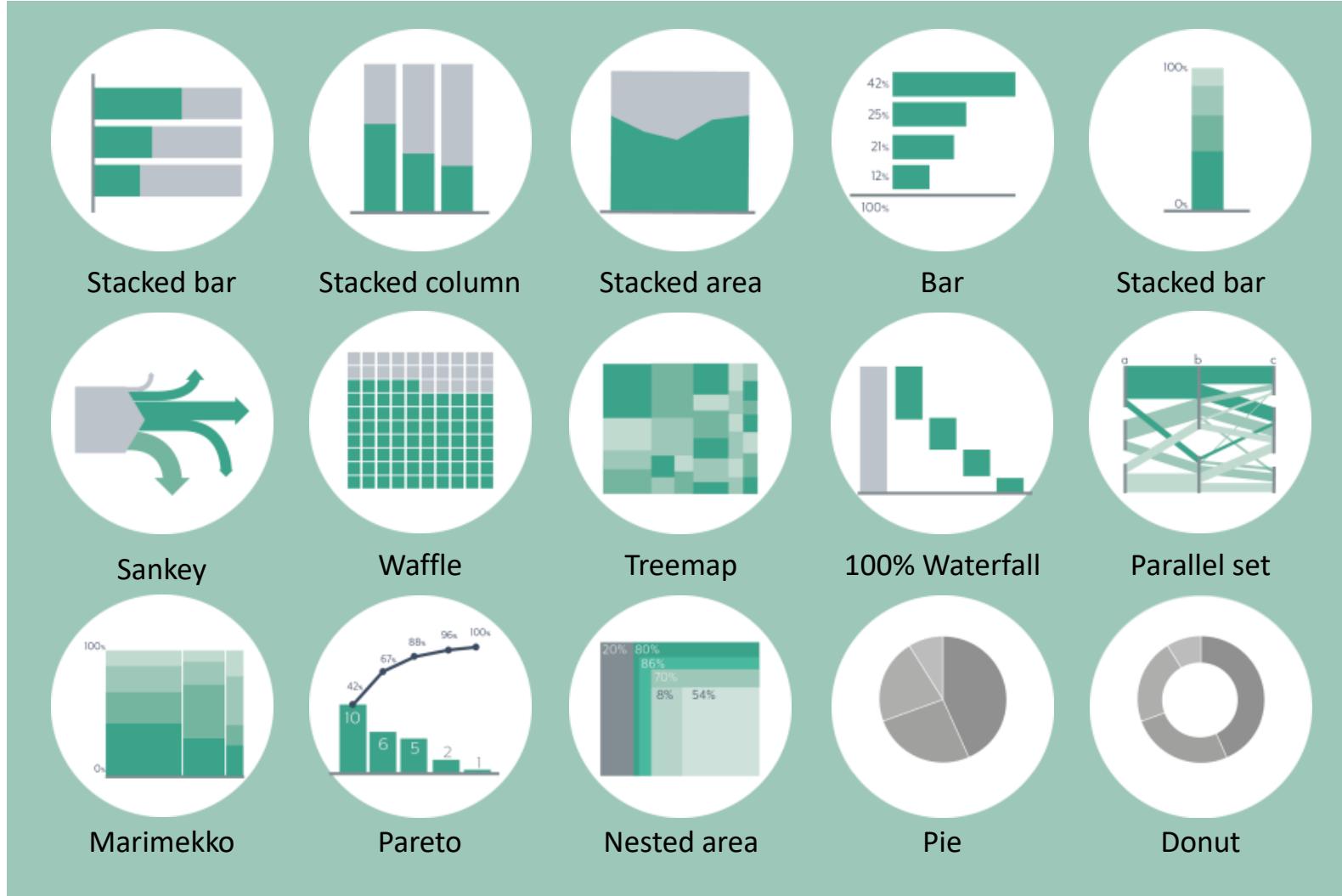
# Vergelijking



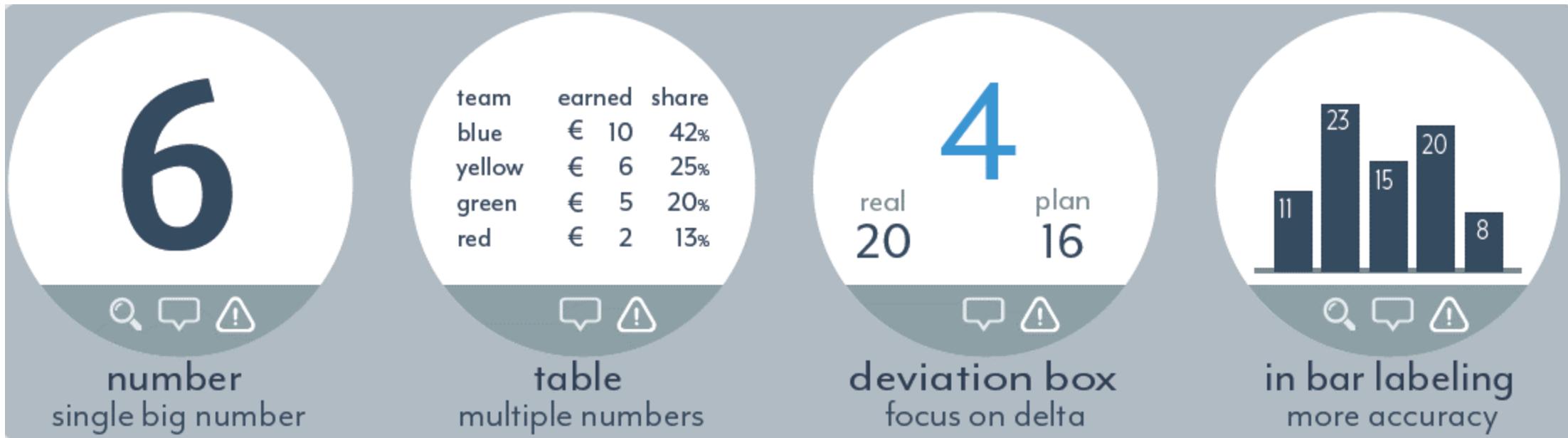
# Trend



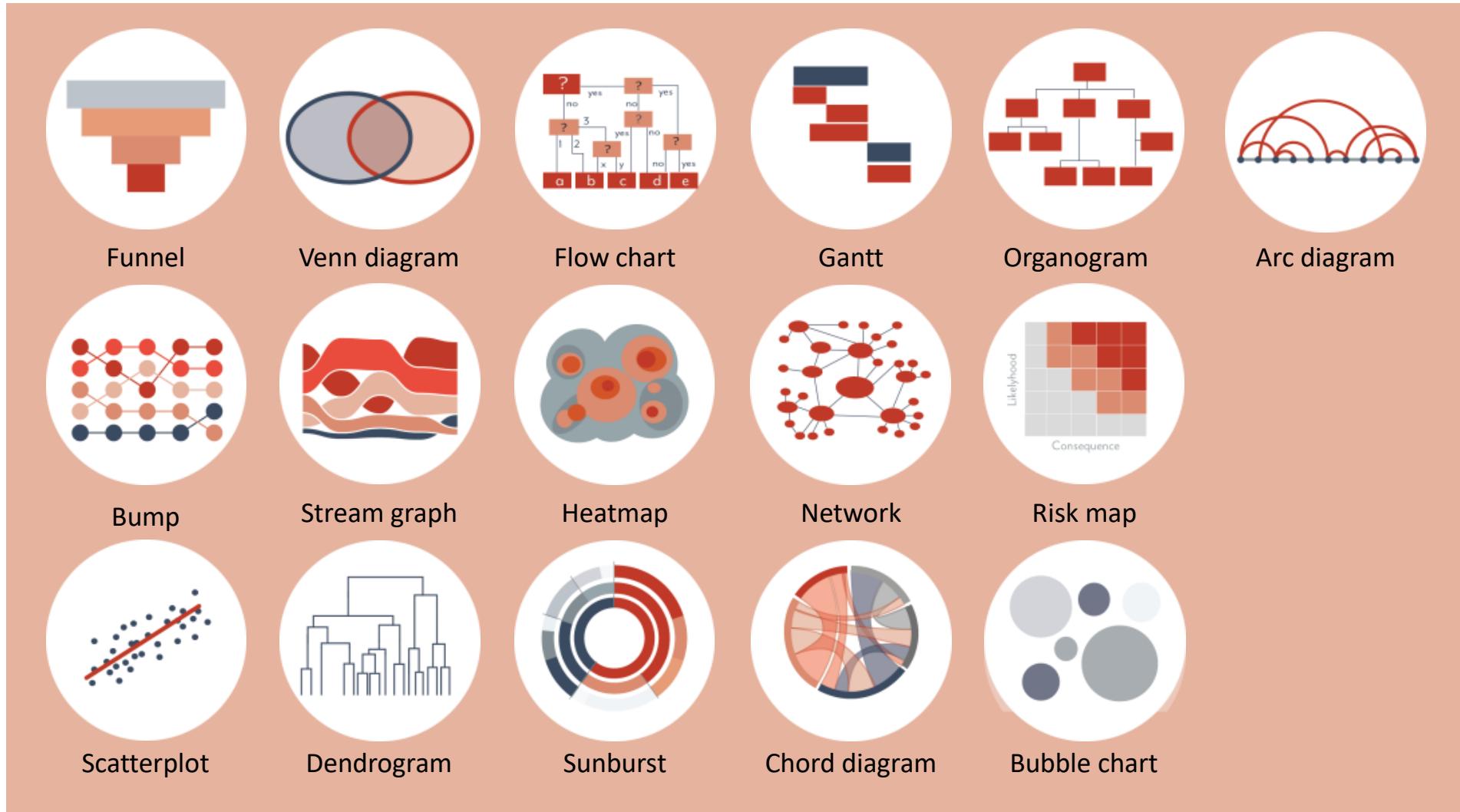
# Deel van een geheel

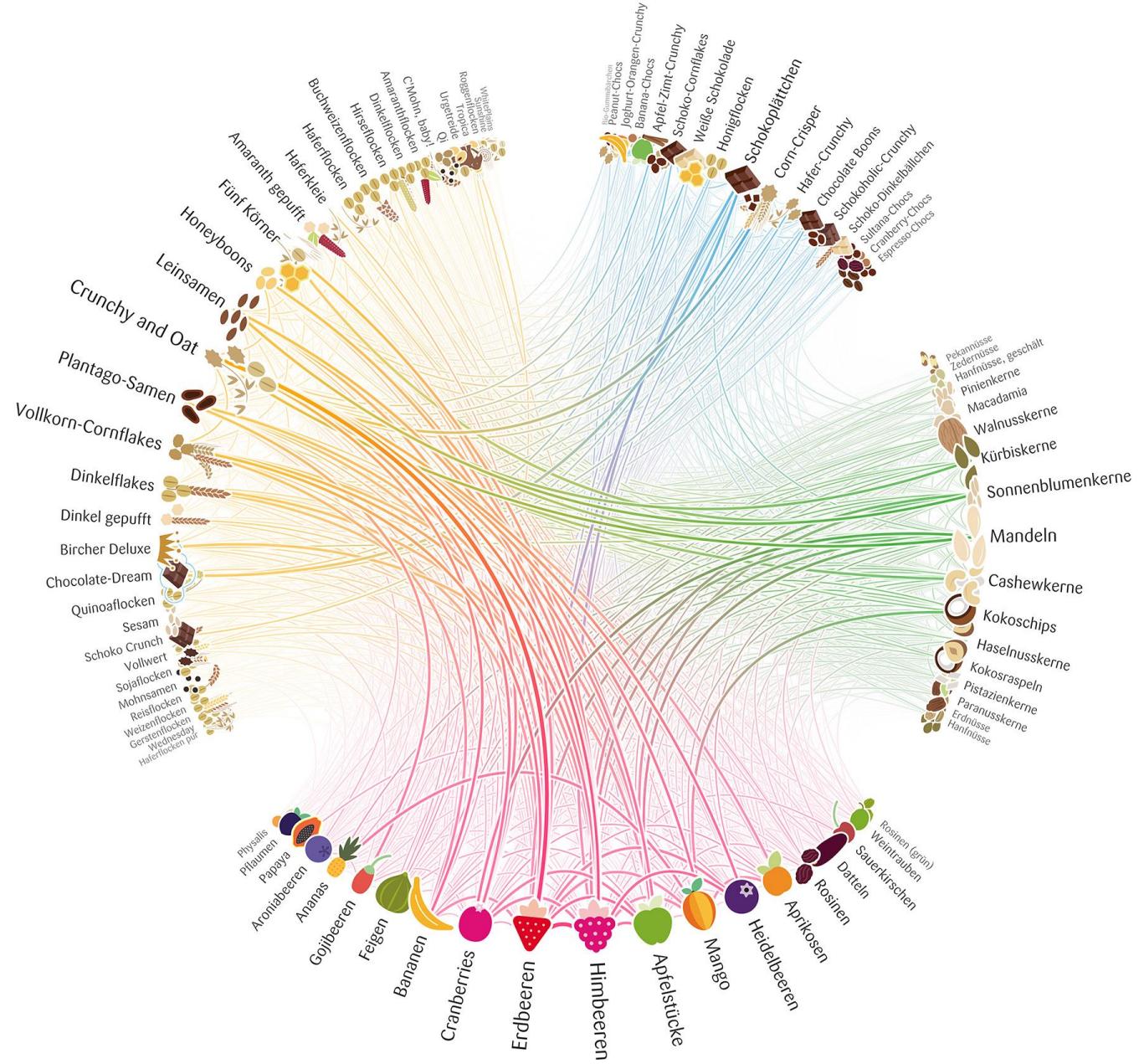


# Exacte waarden

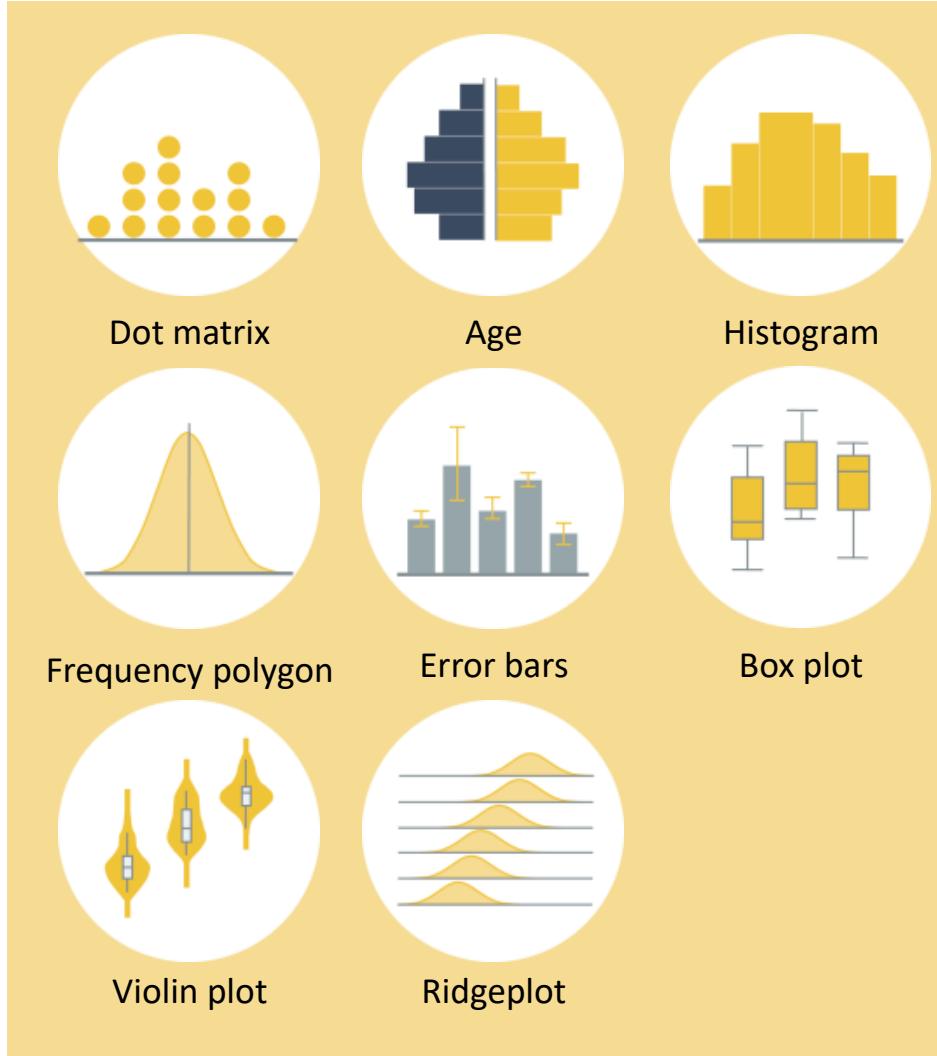


# Relatie



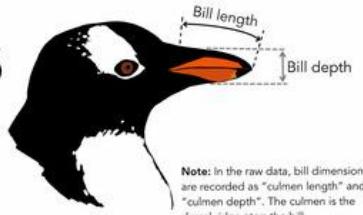


# Verdeling

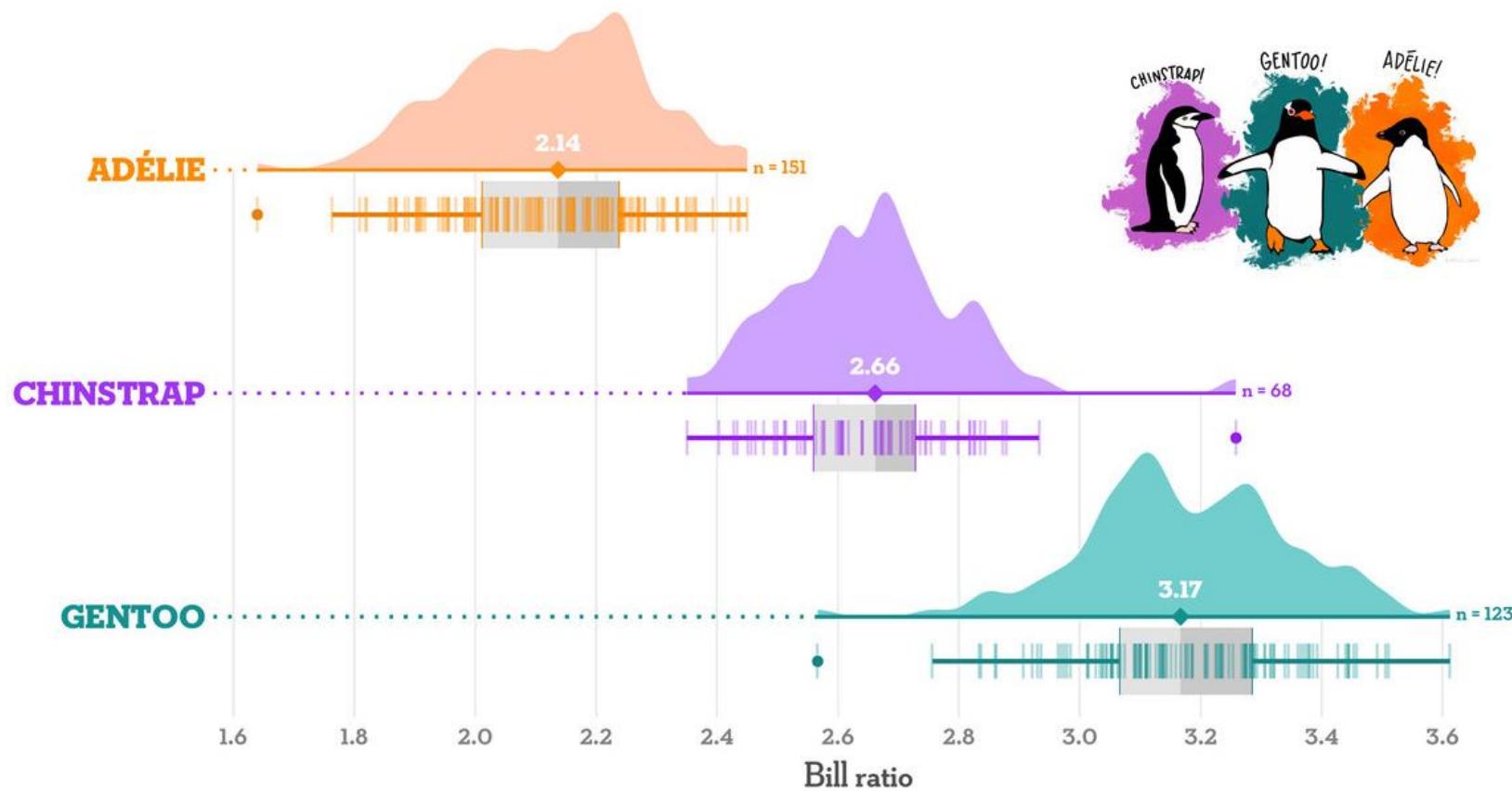


# BILL DIMENSIONS OF BRUSH-TAILED PENGUINS

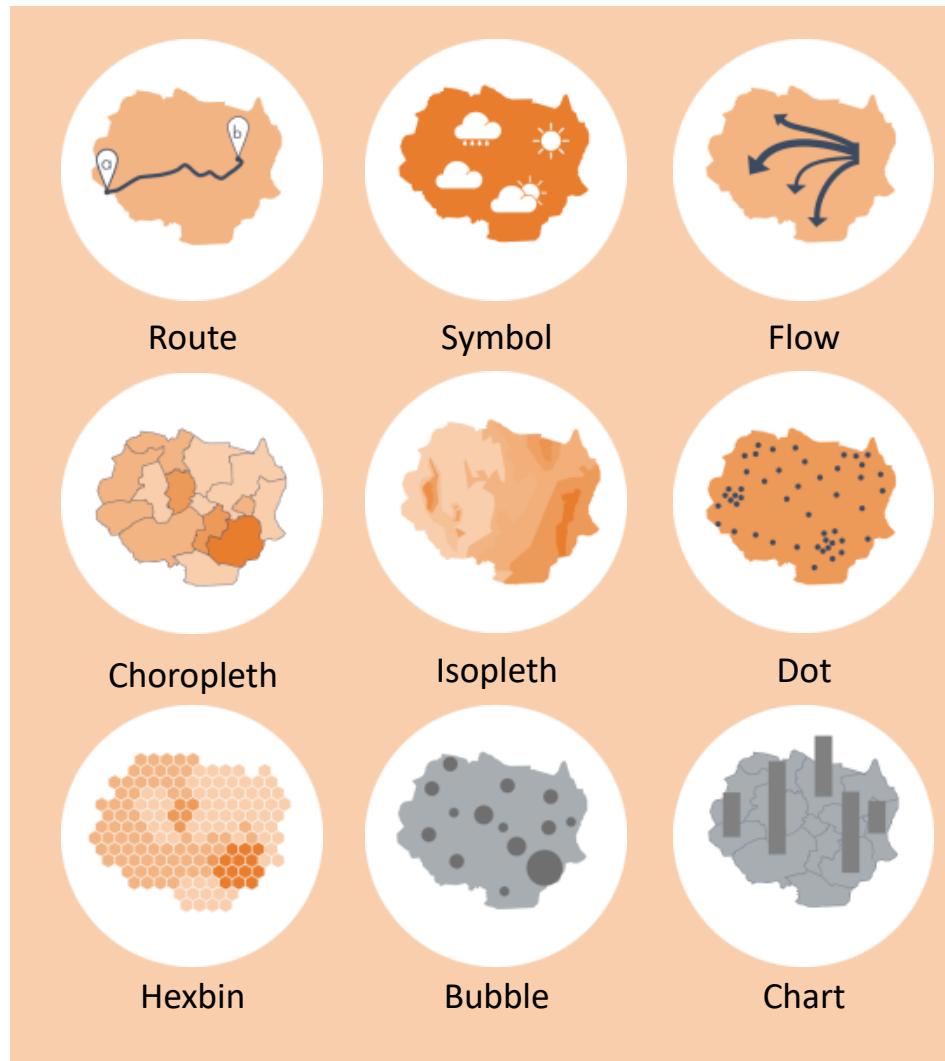
*Pygoscelis adélieae* (Adélie penguin) • *P. antarctica* (Chinstrap penguin) • *P. papua* (Gentoo penguin)



Note: In the raw data, bill dimensions are recorded as "culmen length" and "culmen depth". The culmen is the dorsal ridge atop the bill.



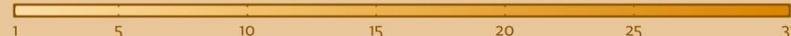
# Locatie



# Show Me the Honey: Where My Beekeepers At?!



Counts of Beekeepers in Germany Listed in OpenStreetMap



Graphic: Cédric Scherer • Source: OpenStreetMap Contributors

Cédric Scherer, <https://www.cedricscherer.com/>

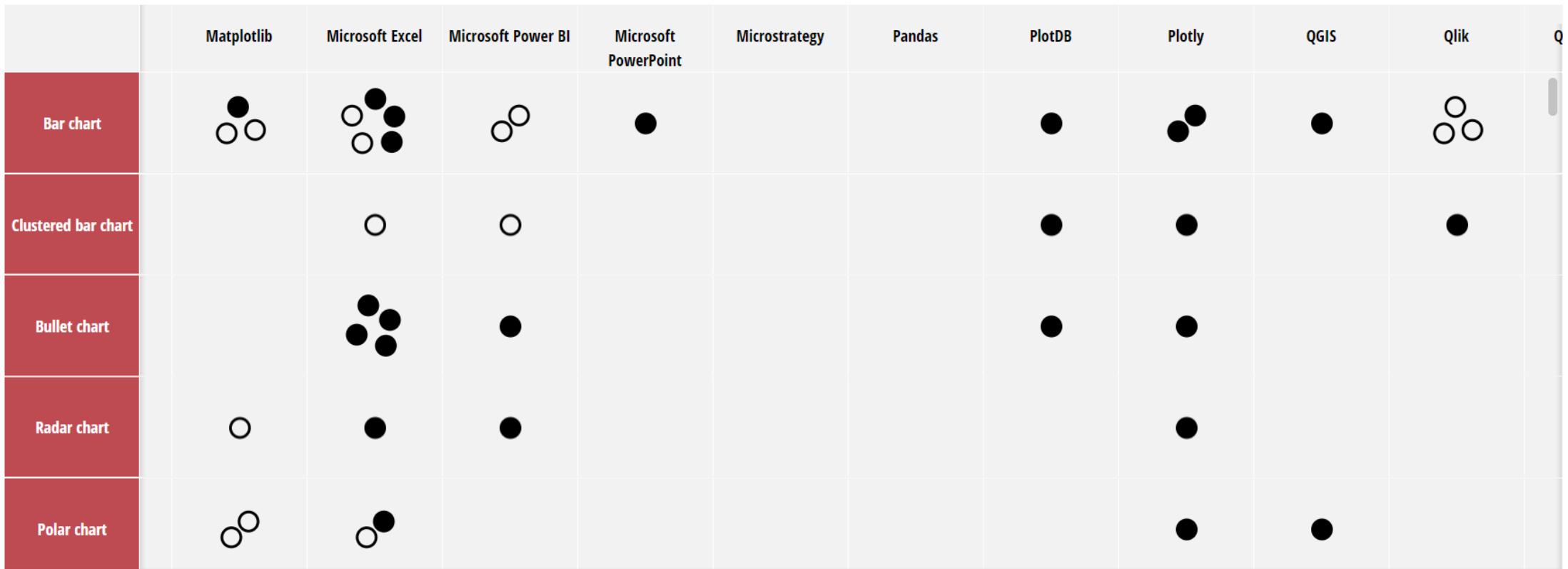
# The Chartmaker directory

## ⊕ THE CHARTMAKER DIRECTORY

ABOUT

Filter by chart name or AKA

Reference Type: ● Example   ● Solution | Chart Families: ● Categorical   ● Hierarchical   ● Relational   ● Temporal   ● Spatial



# Oefening:

## Twee getallen

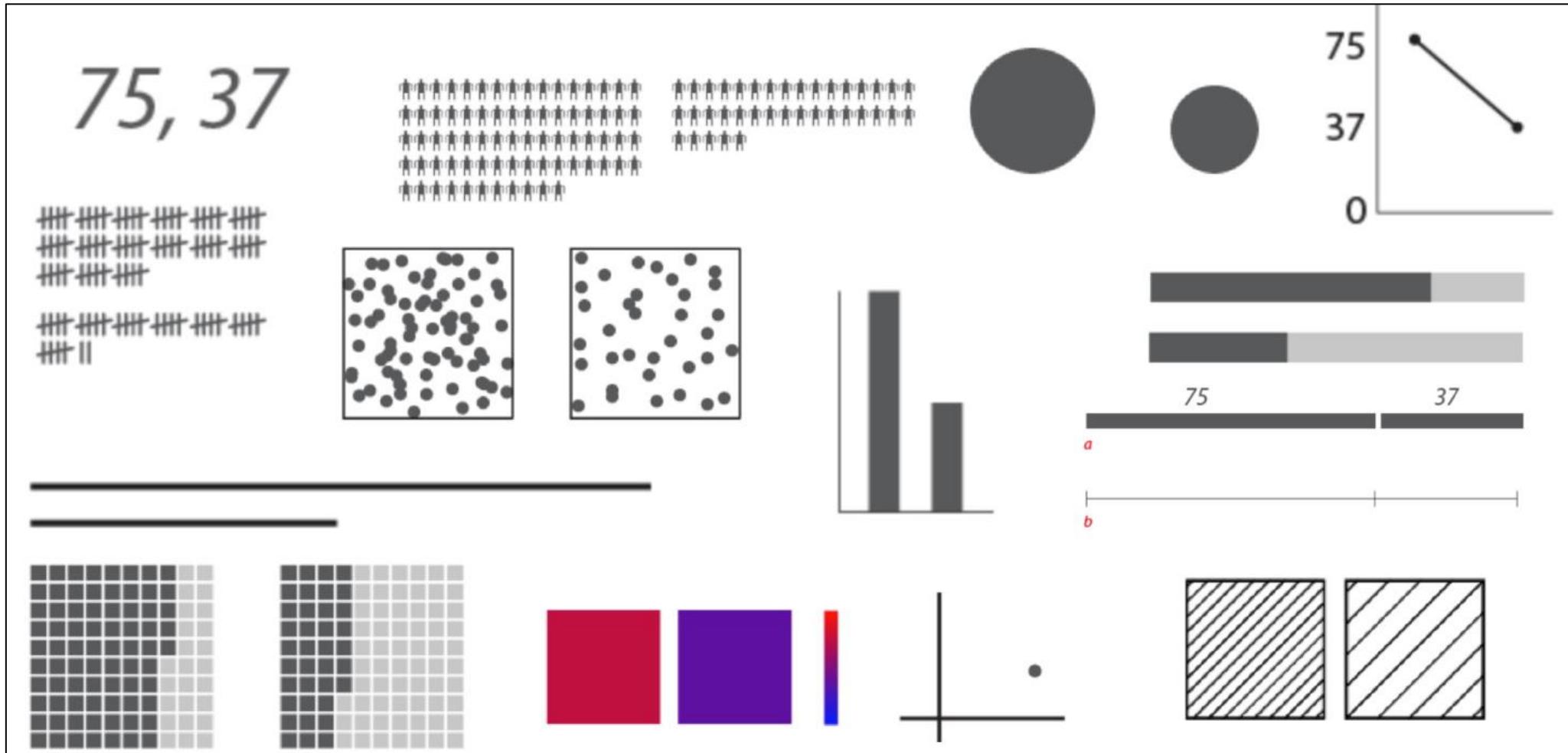
Twee getallen:

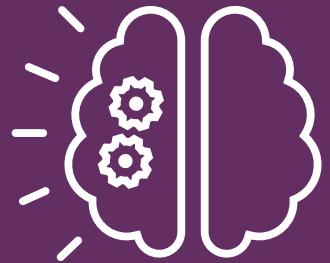
**75 en 37**



5 min

# Een paar van de 45...





Hoe verwerkt ons brein visuele informatie?

# Waar zijn we **goed** in?

*“The eyes only see what the mind is prepared to comprehend.” – Henri Bergson.*

# Hoeveel 5-en zie je?

321654643216465132168461321  
646432136748651349687463123  
668432616266984892536496874  
651687964649843616984616957  
465167412323161689312439873  
421432875943869234987596387

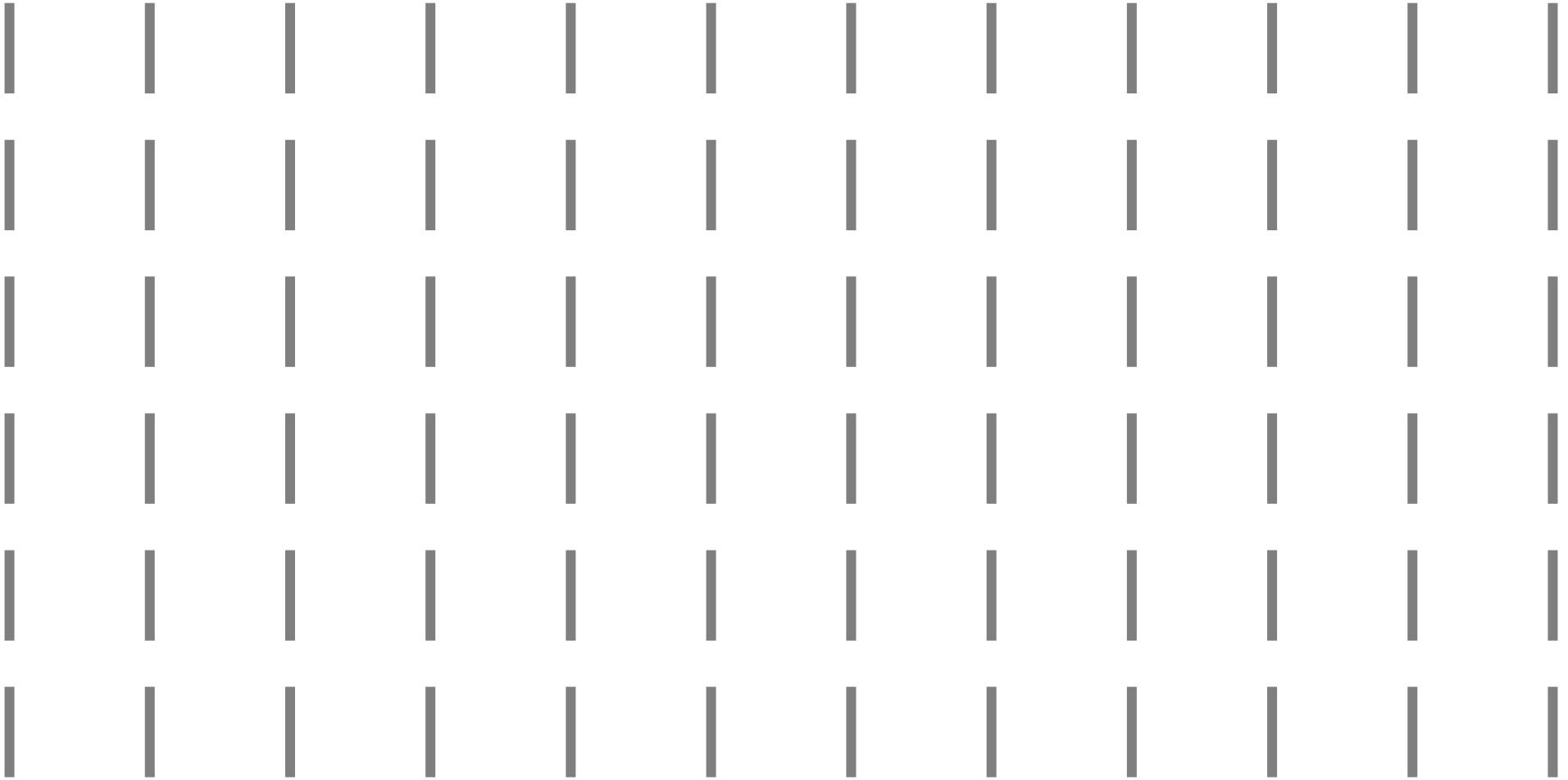
# Hoeveel 5-en zie je?

321654643216465132168461321  
646432136748651349687463123  
668432616266984892536496874  
651687964649843616984616957  
465167412323161689312439873  
421432875943869234987596387

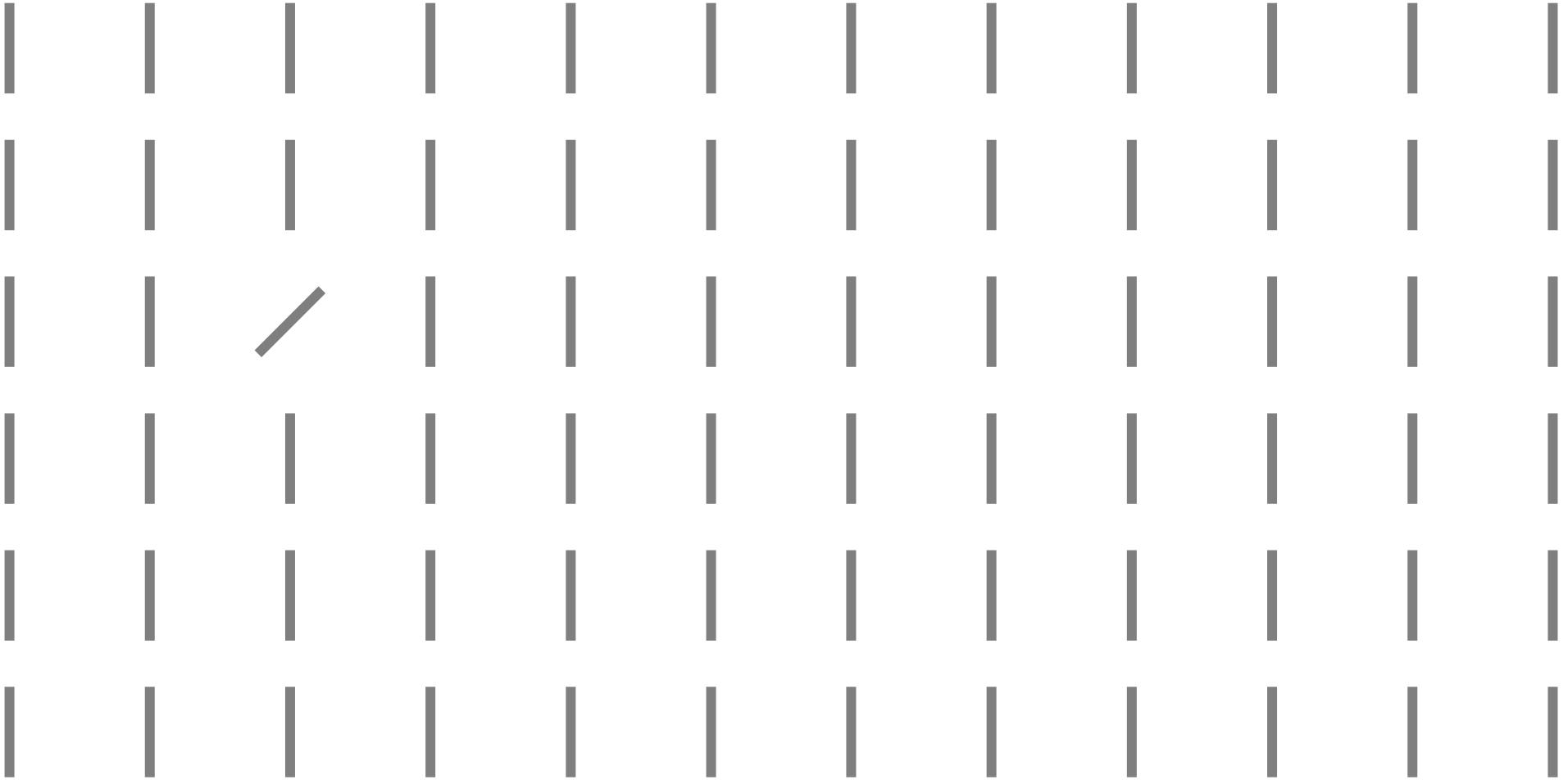
**Pre-attentieve eigenschappen** helpen de lezer te laten zien wat je wil dat ze zien!

321654643216465132168461321  
646432136748651349687463123  
668432616266984892536496874  
651687964649843616984616957  
465167412323161689312439873  
421432875943869234987596387

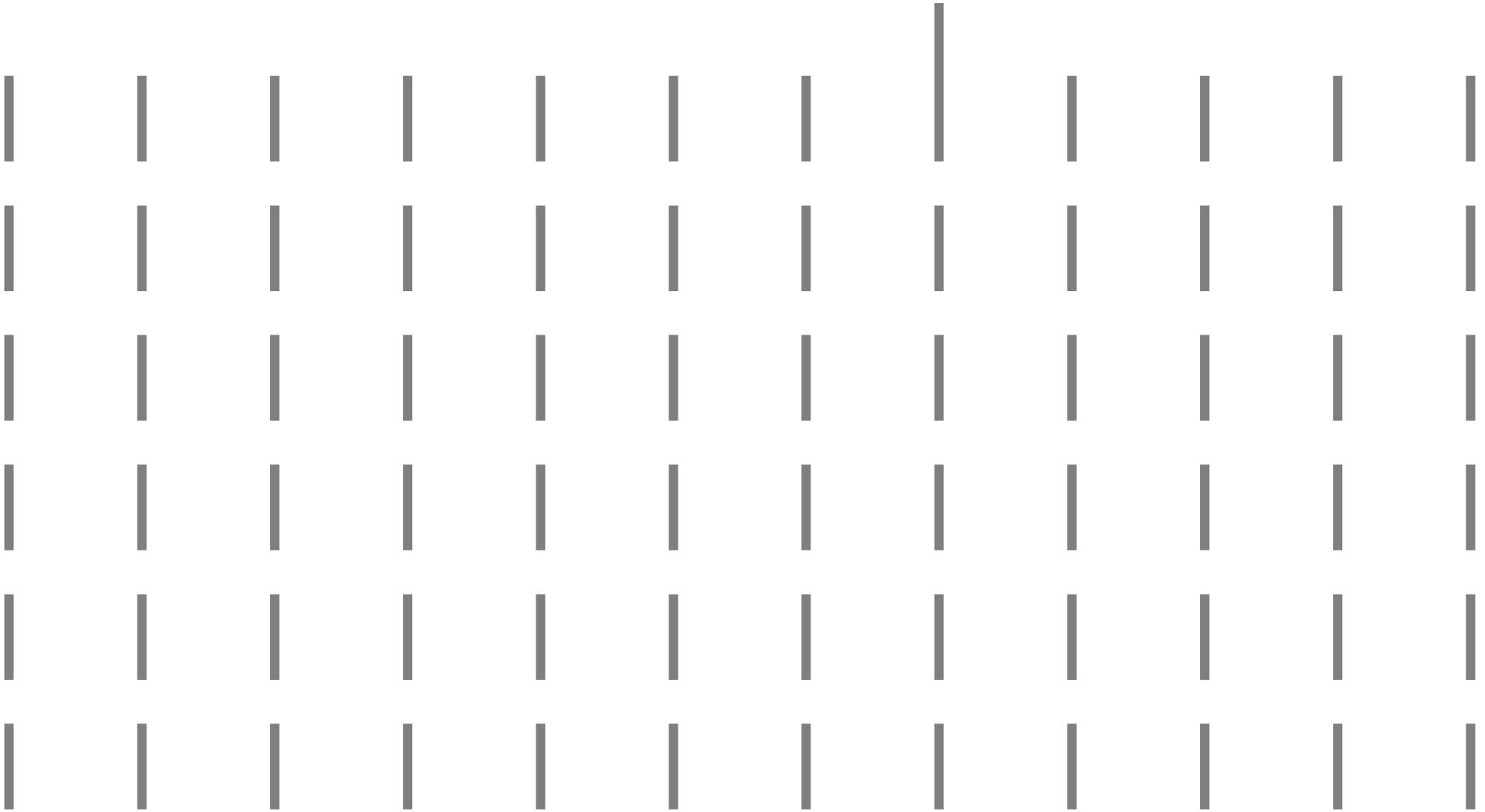
# Pre-attentieve eigenschappen



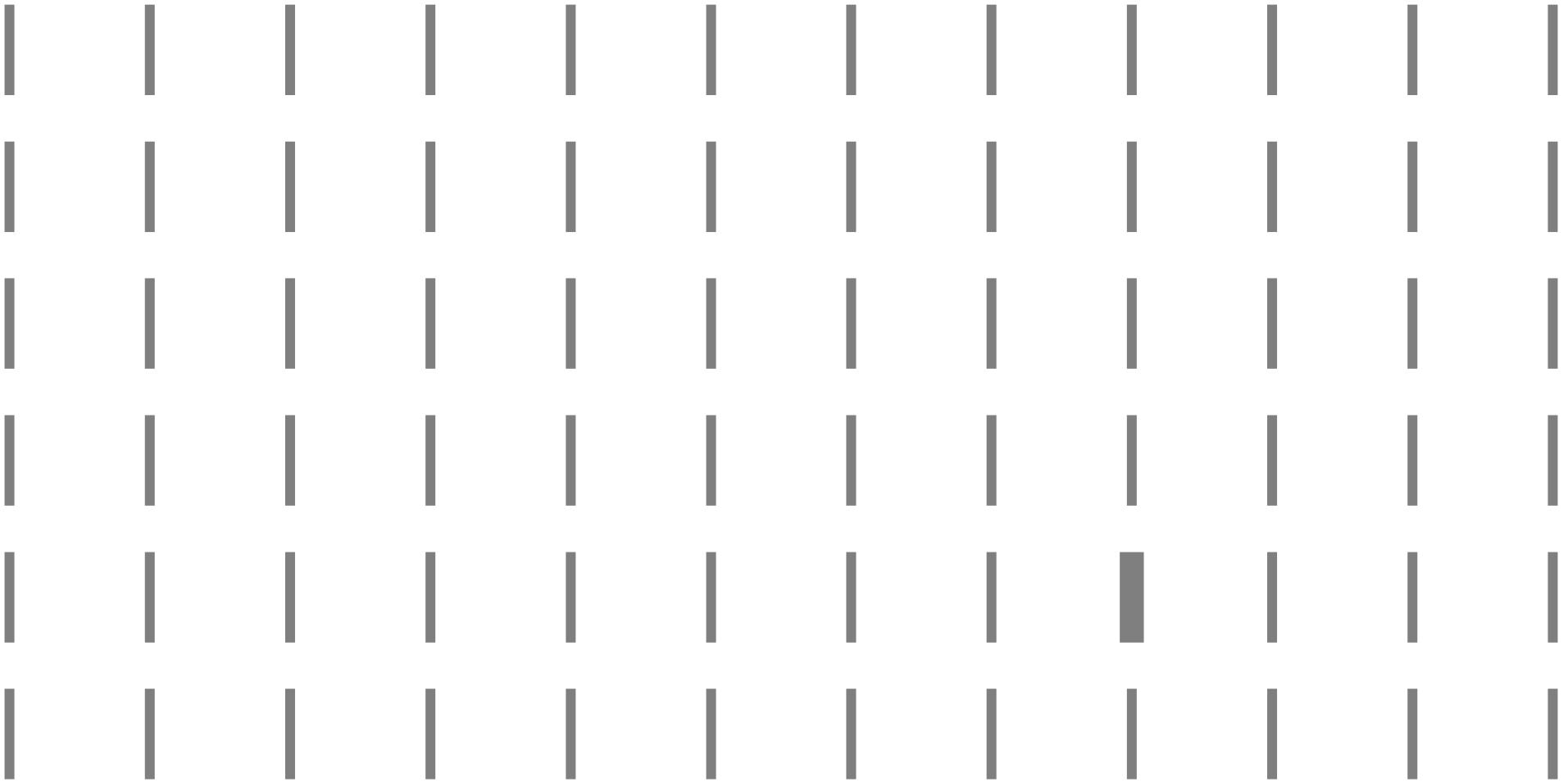
# Pre-attentieve eigenschappen



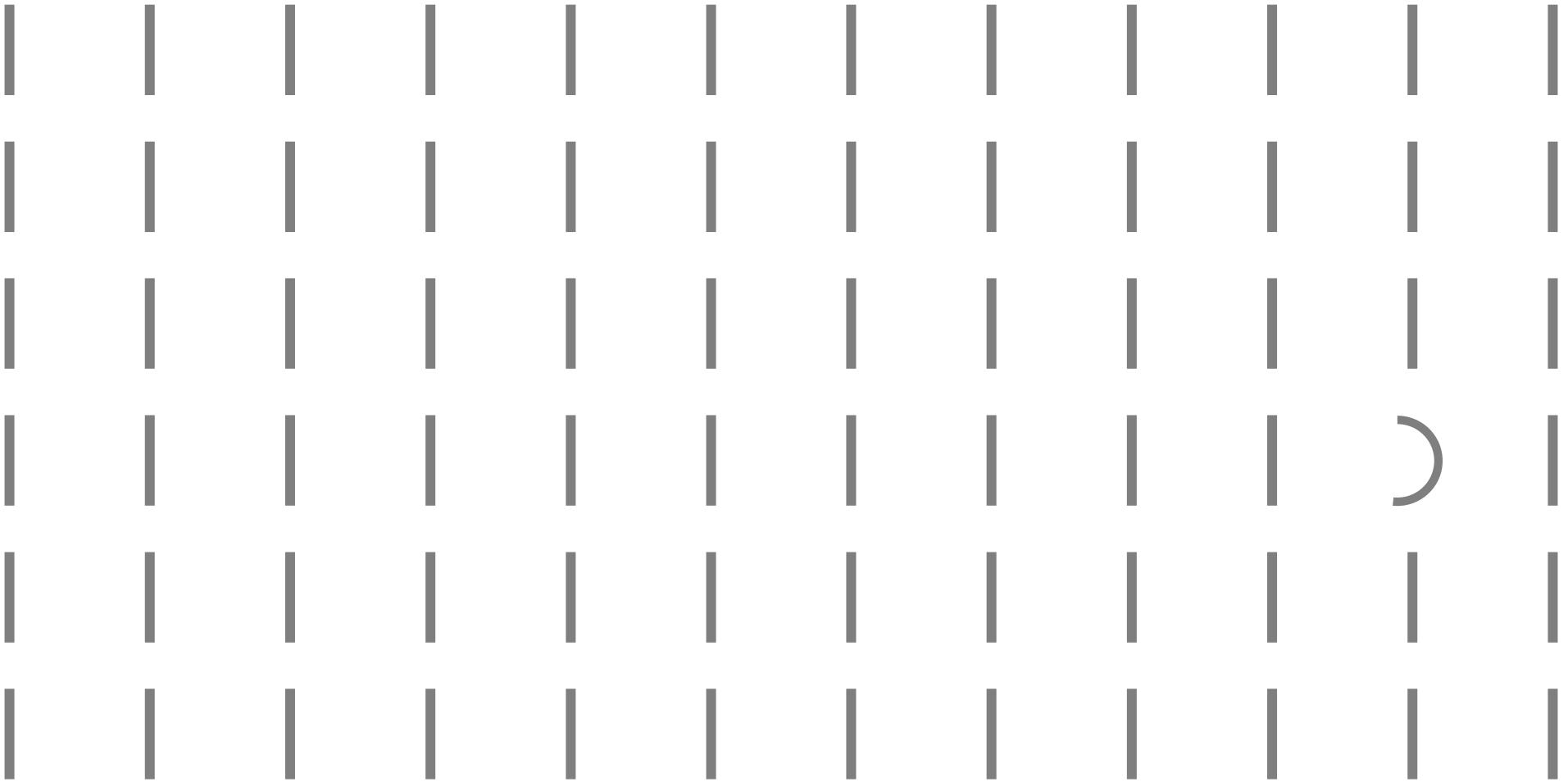
# Pre-attentieve eigenschappen



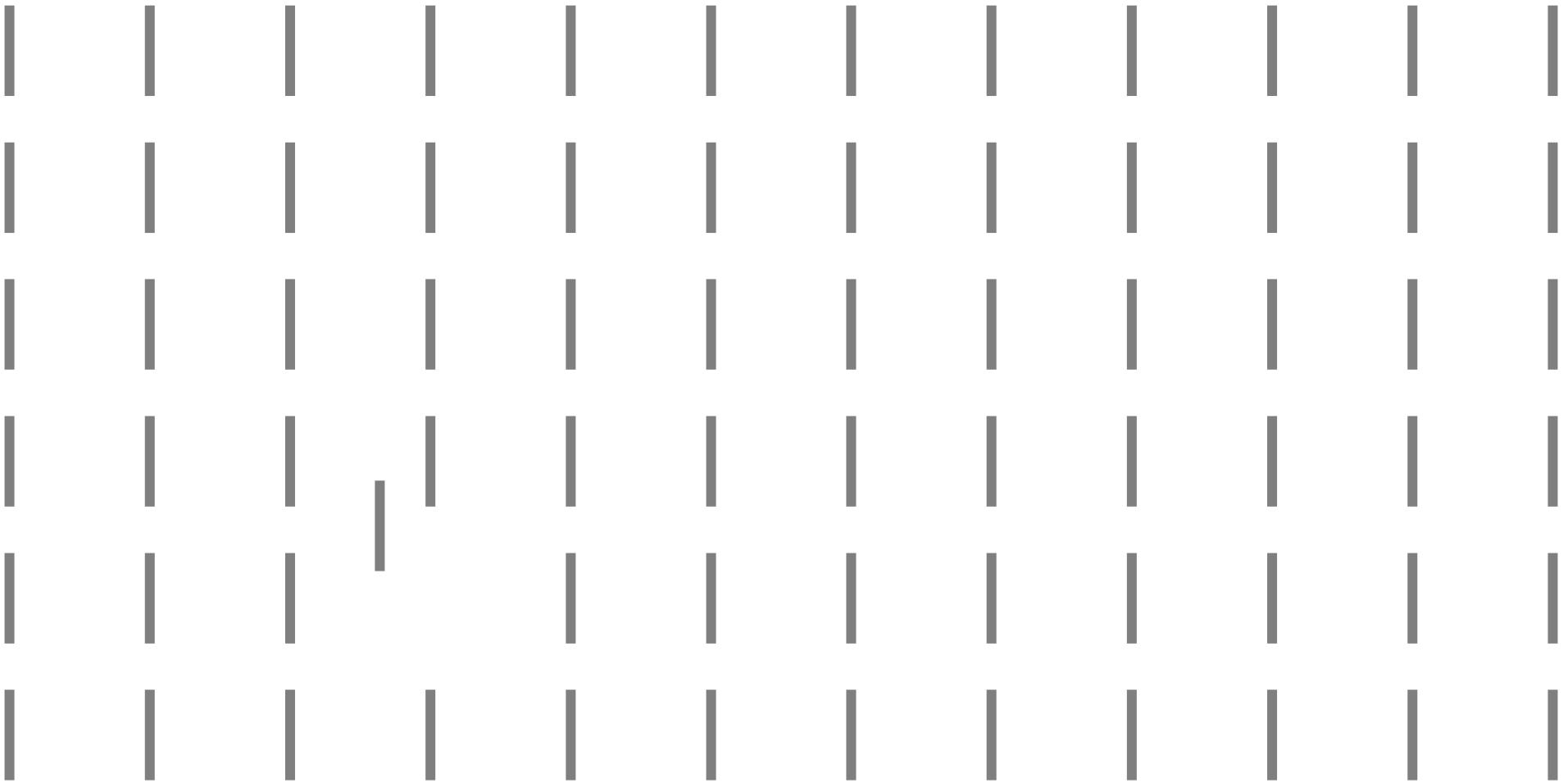
# Pre-attentieve eigenschappen



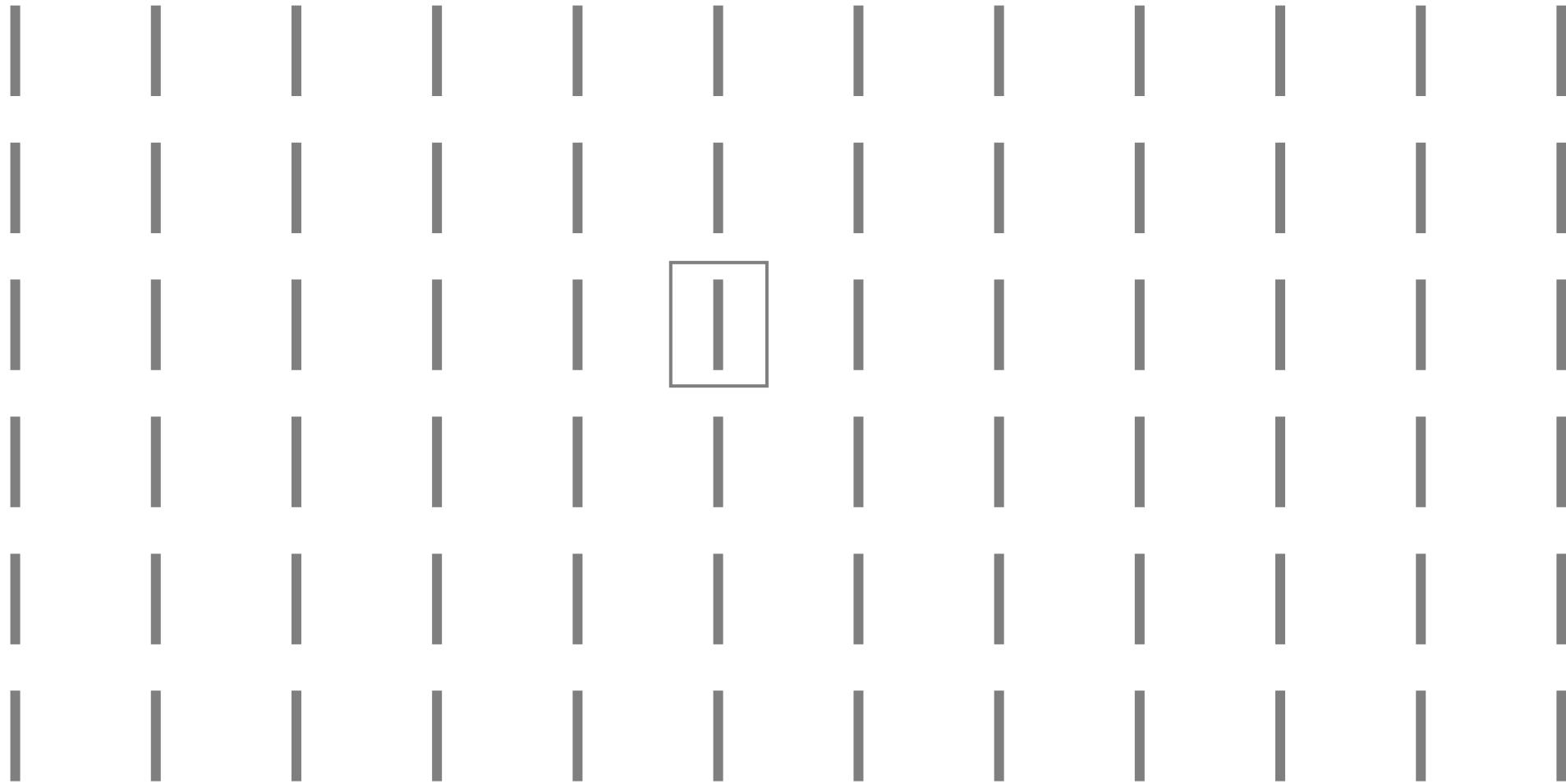
# Pre-attentieve eigenschappen



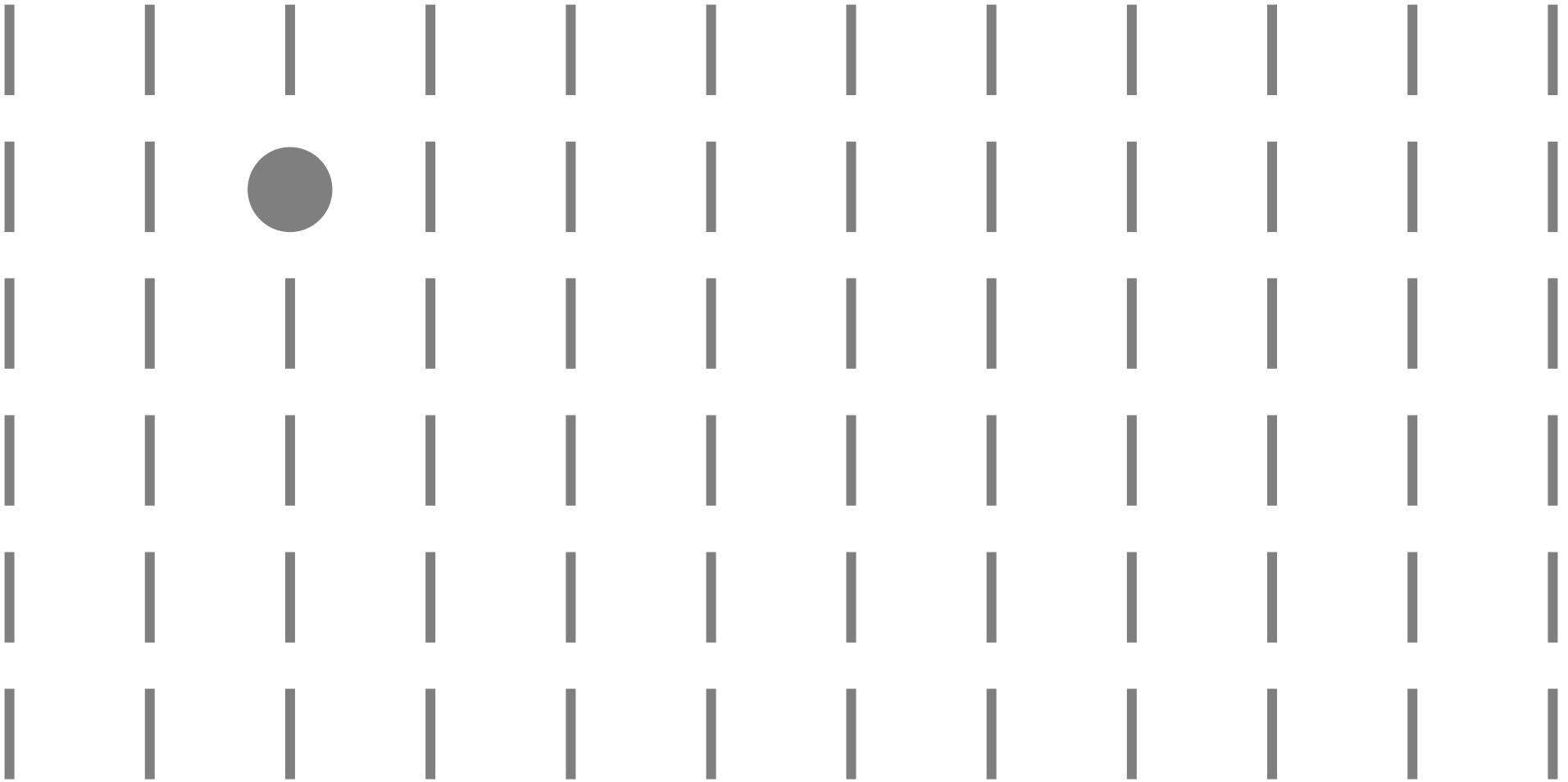
# Pre-attentieve eigenschappen



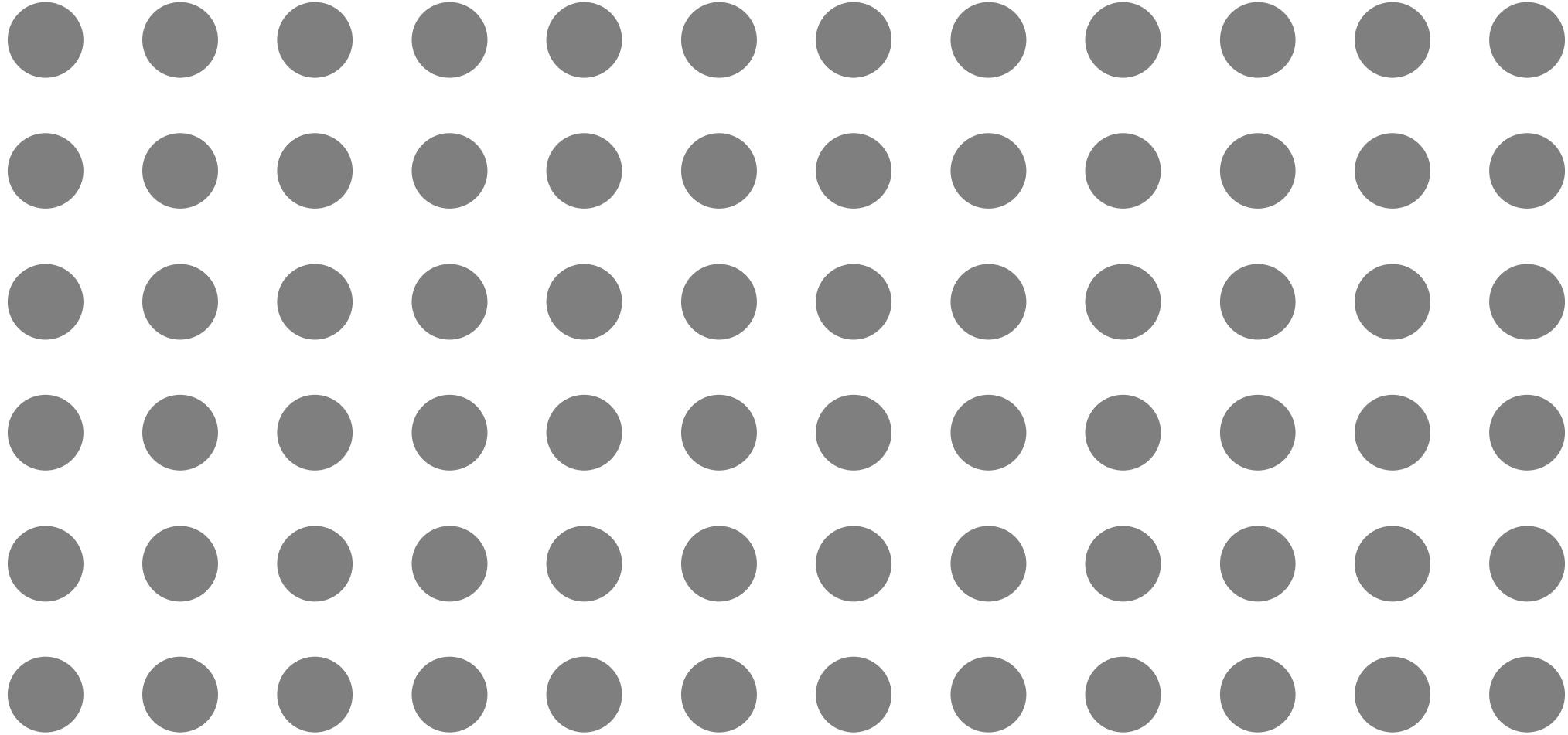
# See what you see before seeing it!



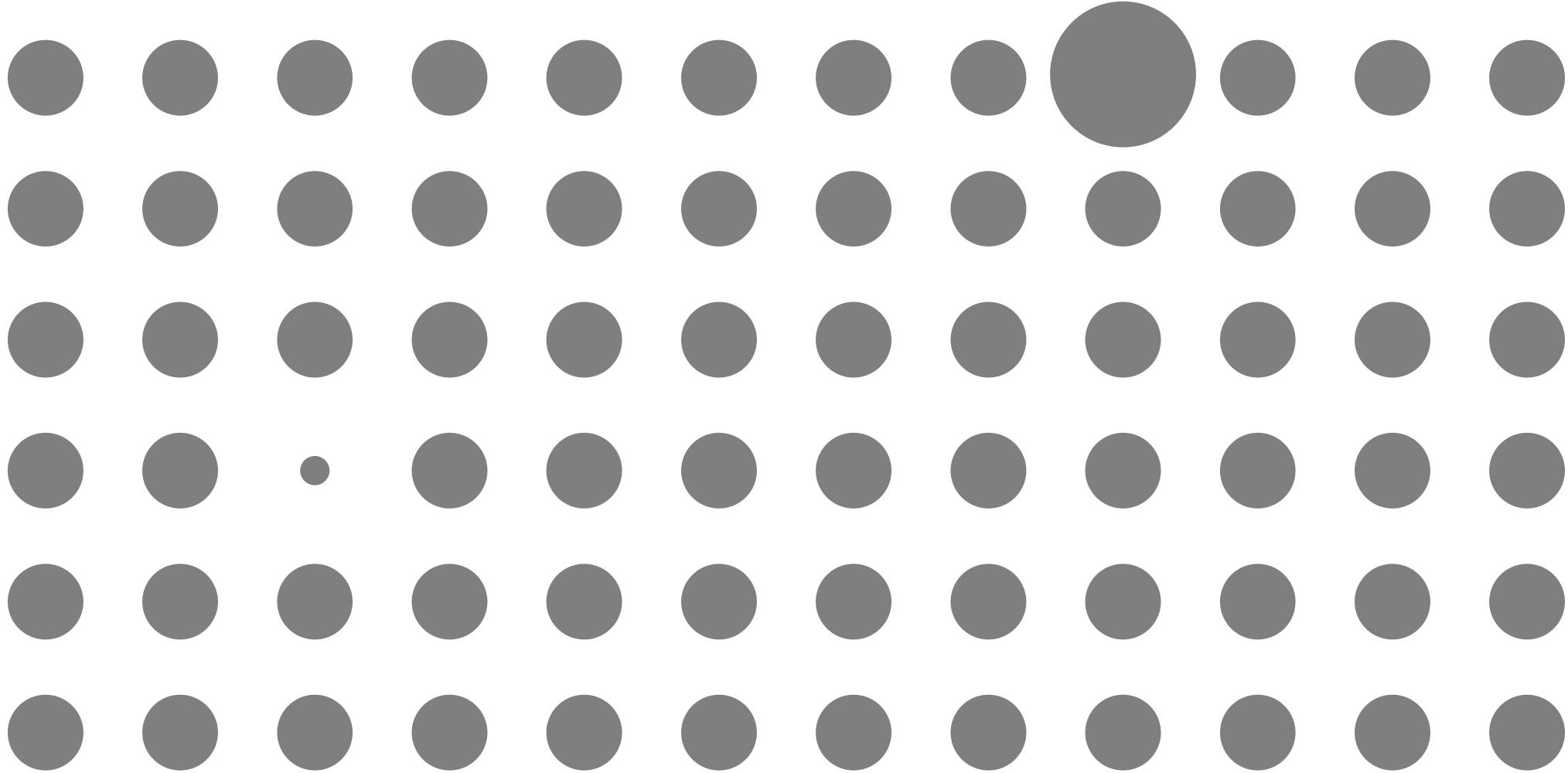
# Pre-attentieve eigenschappen



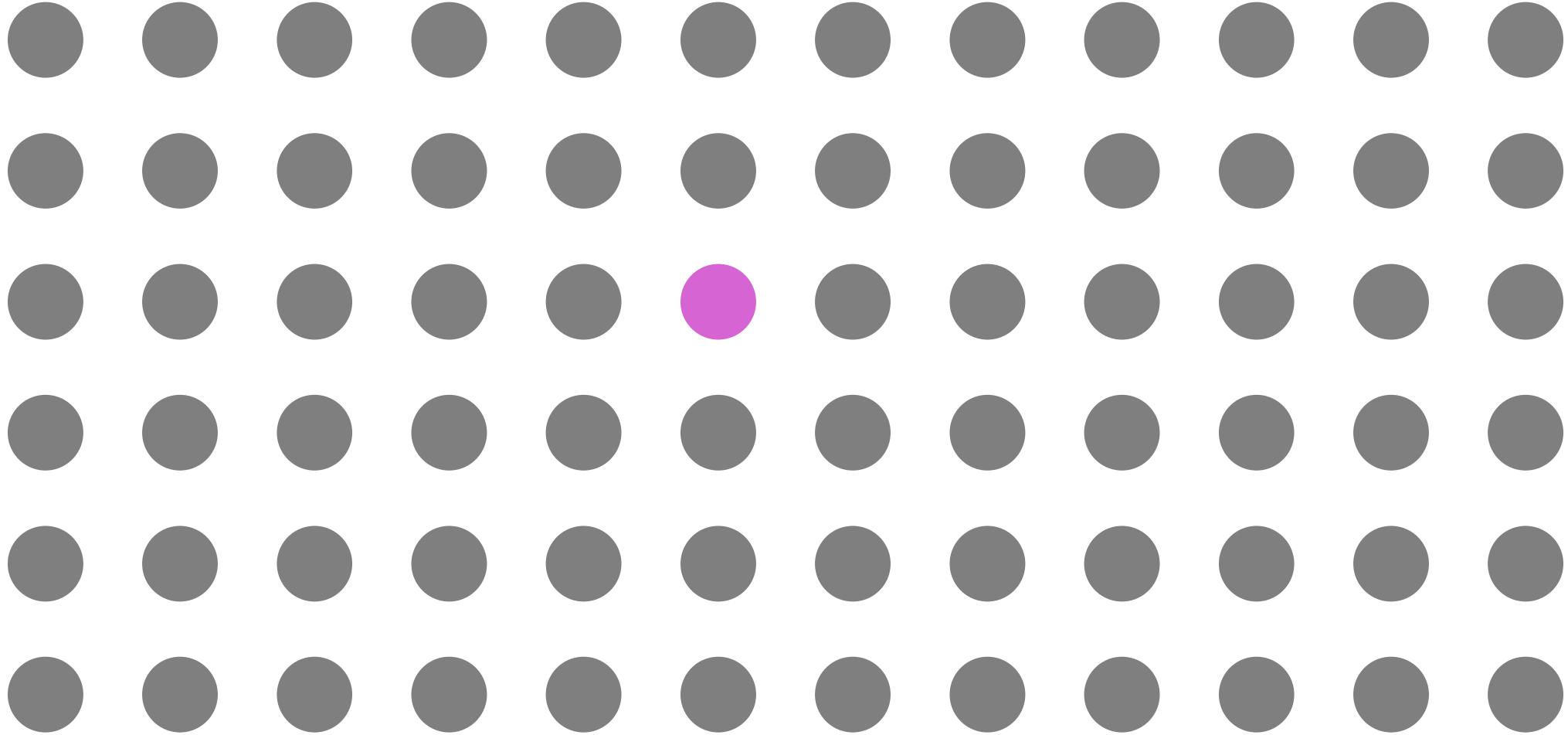
# Pre-attentieve eigenschappen



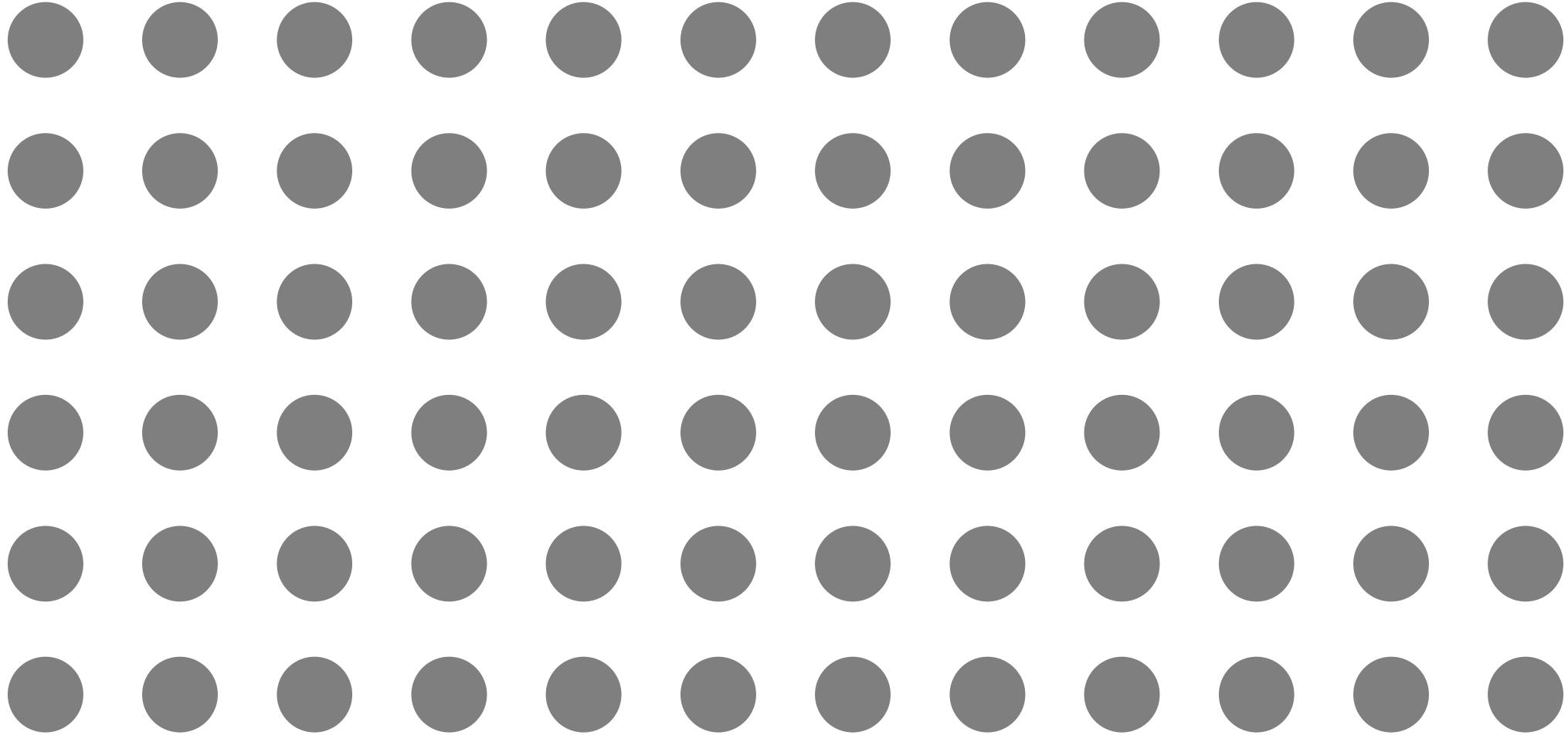
# Pre-attentieve eigenschappen



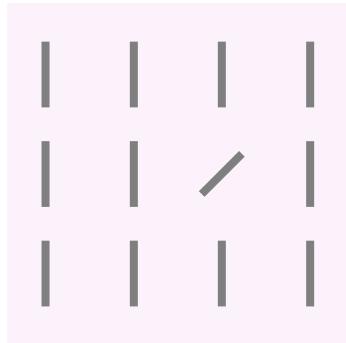
# Pre-attentieve eigenschappen



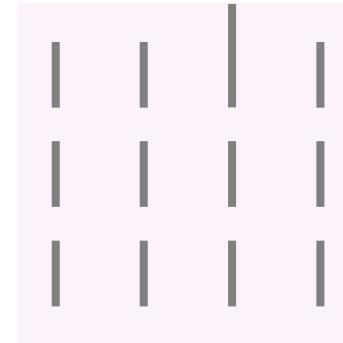
# Pre-attentieve eigenschappen



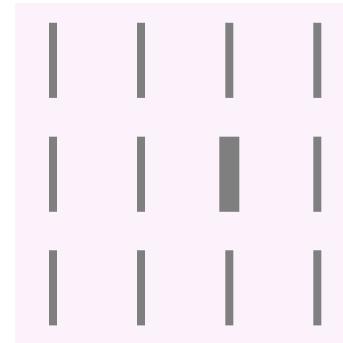
# Pre-attentieve eigenschappen helpen de lezer te laten zien wat je wil dat ze zien!



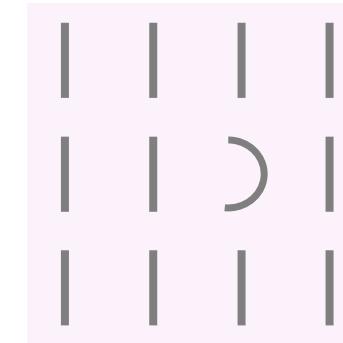
Oriëntatie



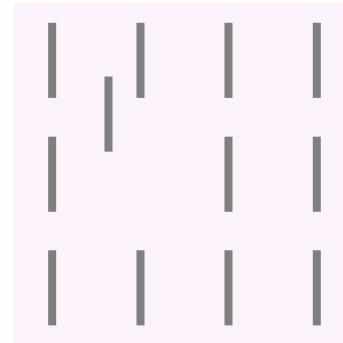
Lengte



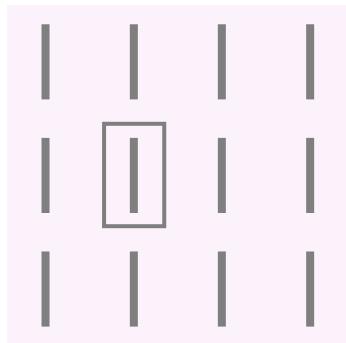
Breedte



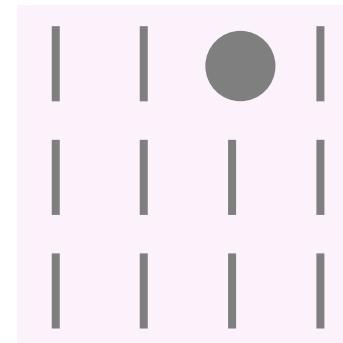
Kromming



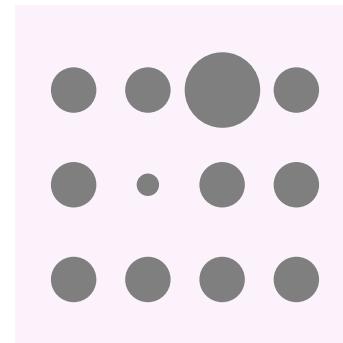
Positie



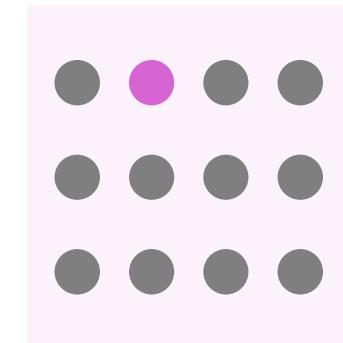
Omsluiting



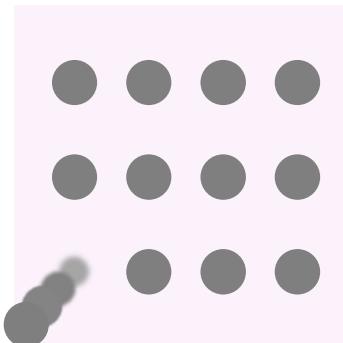
Vorm



Grootte



Kleur



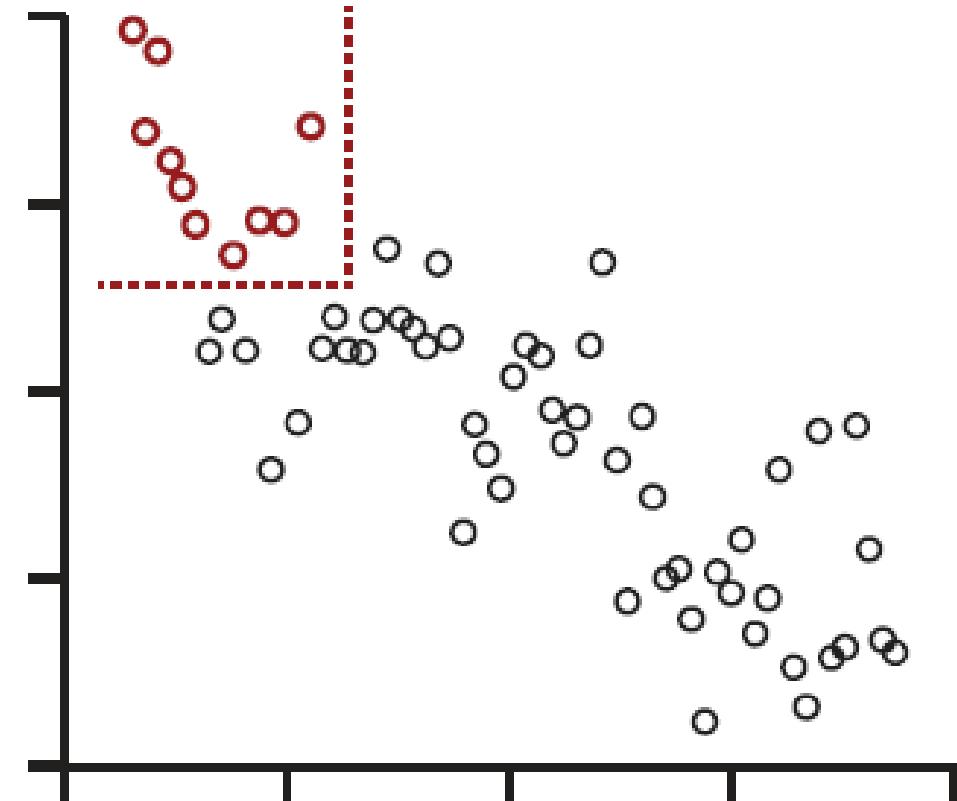
Beweging

# Je kunt pre-attentieve visuele eigenschappen gebruiken in tabellen

Color name	RGB (1-255)
Black	0, 0, 0
Orange	230, 159, 0
Sky blue	86, 180, 233
Bluish green	0, 158, 115
Blue	0, 114, 178
Vermillion	213, 94, 0

Je kunt pre-attentieve visuele eigenschappen gebruiken in tabellen en grafieken

Color name	RGB (1-255)
Black	0, 0, 0
Orange	230, 159, 0
Sky blue	86, 180, 233
Bluish green	0, 158, 115
Blue	0, 114, 178
Vermillion	213, 94, 0



# Maar ook in tekst

## Hoe kun je pre-attentieve eigenschappen benutten in tekst?

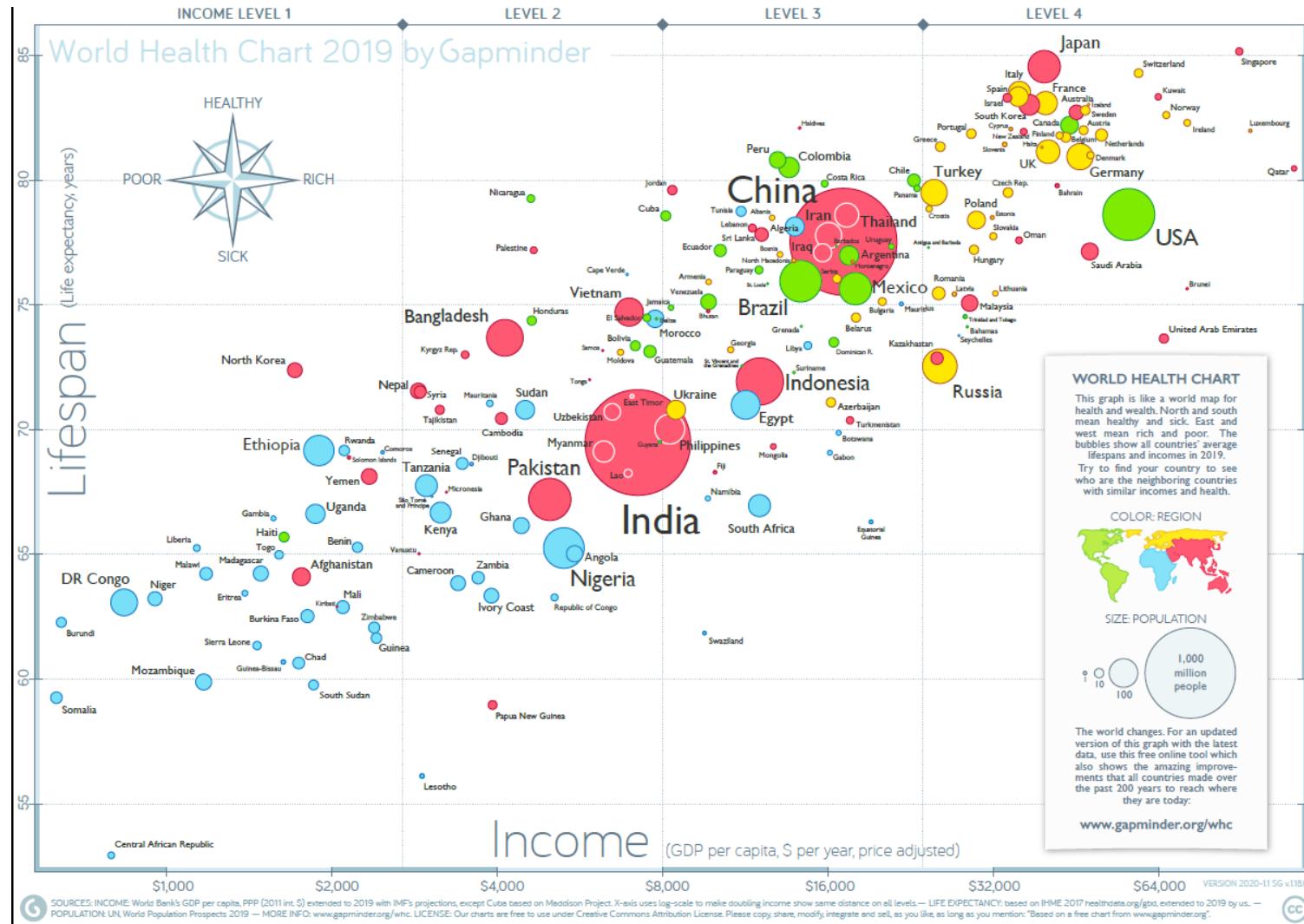
Zonder pre-attentieve eigenschappen heb je enkel kale tekst. Of een kale figuur. De aandacht van de lezer wordt niet getrokken door een specifiek onderdeel. Soms weet de lezer niet goed waar hij/zij moet kijken.

Met pre-attentieve eigenschappen kun je:

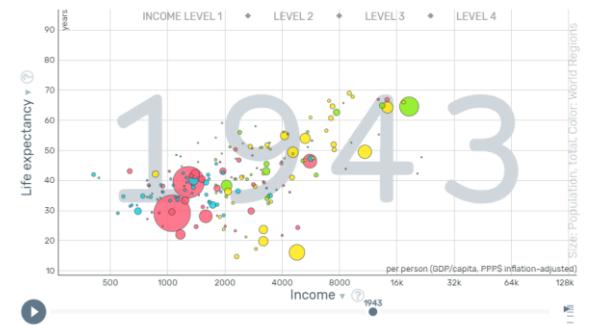
- (1) *De aandacht van de lezer trekken naar* waar je wilt dat hij kijkt, en
- (2) *Een visuele hiërarchie van informatie creëren.*

Dit geldt voor zowel **grafieken** als **tekst**!

# Hans Rosling's Bubble chart



Positie  
Grootte  
Kleur  
Beweging



<https://www.gapminder.org/tools>  
<https://www.youtube.com/watch?v=jbkSRLYSojo>

# Pre-attentieve visuele eigenschappen helpen om kwantitatieve gegevens weer te geven

Welke staaf is het hoogst?

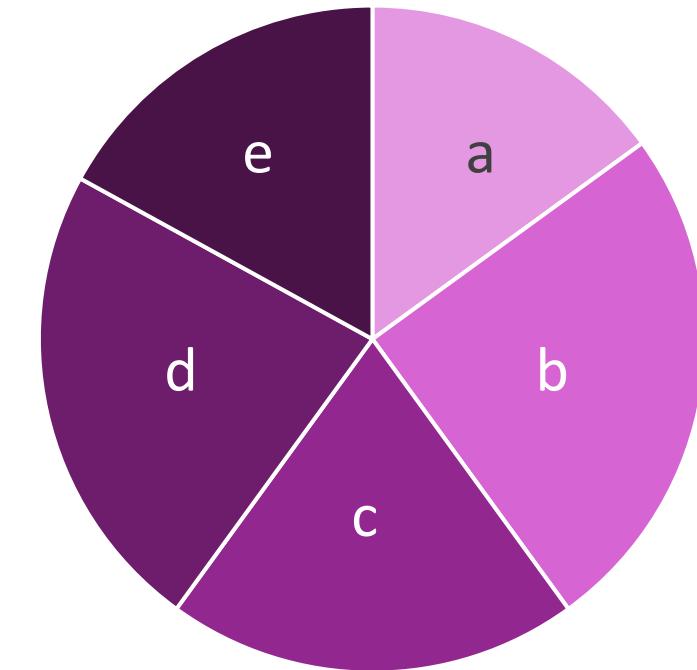


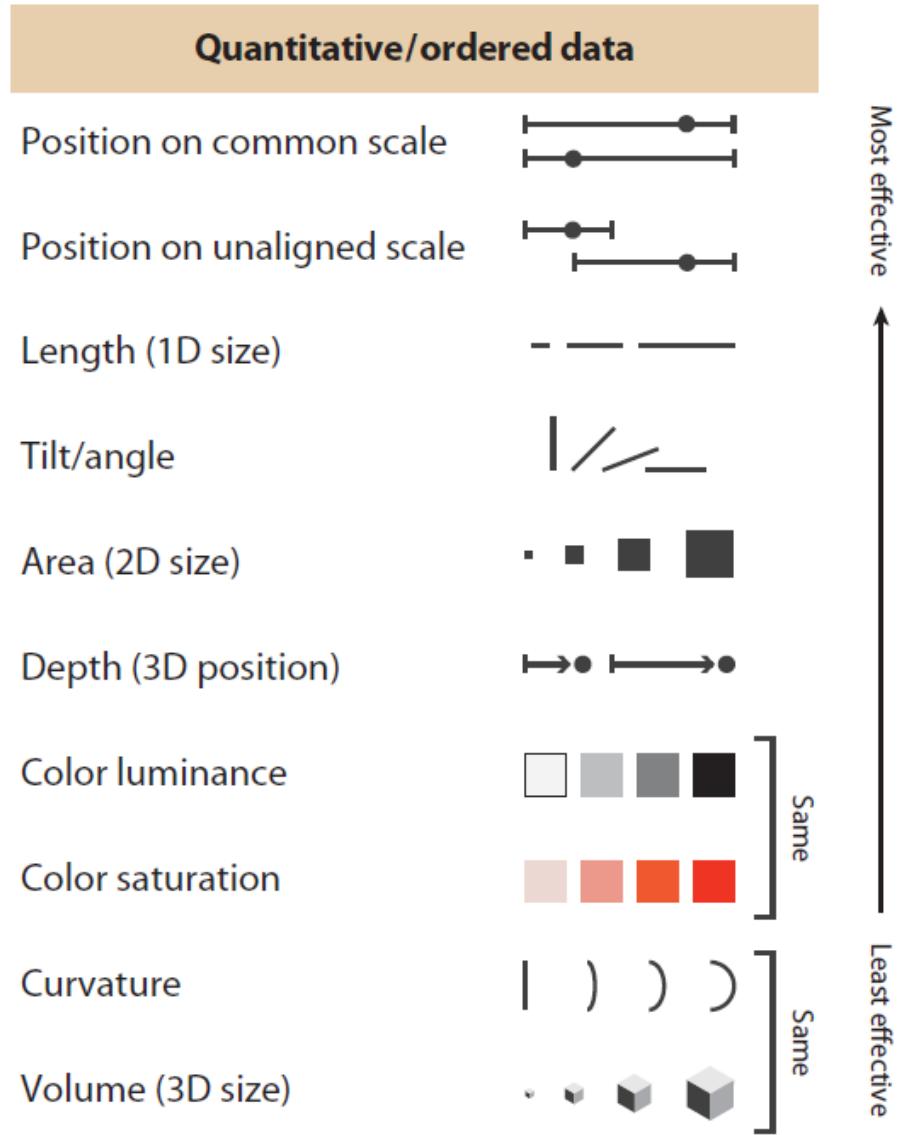
# Maar let op: de één is nauwkeuriger dan de ander!

Welke staaf is het hoogst?



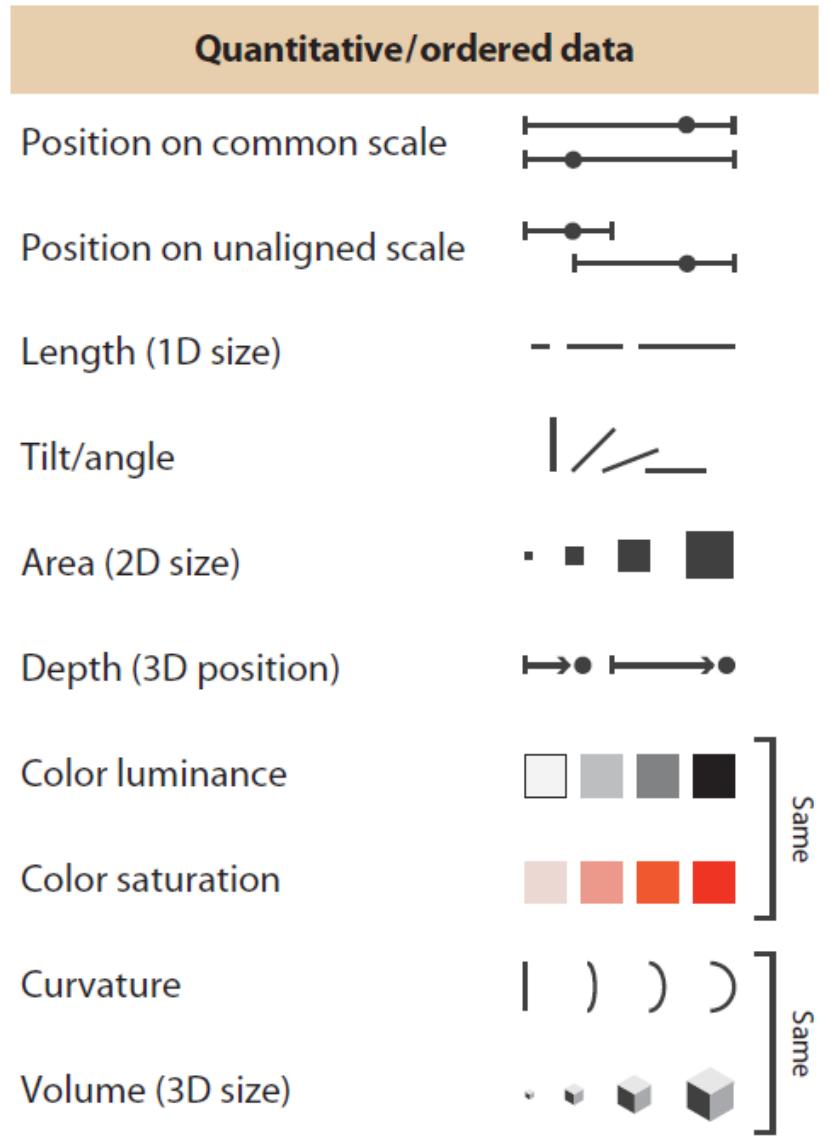
Welk punt is het grootst?



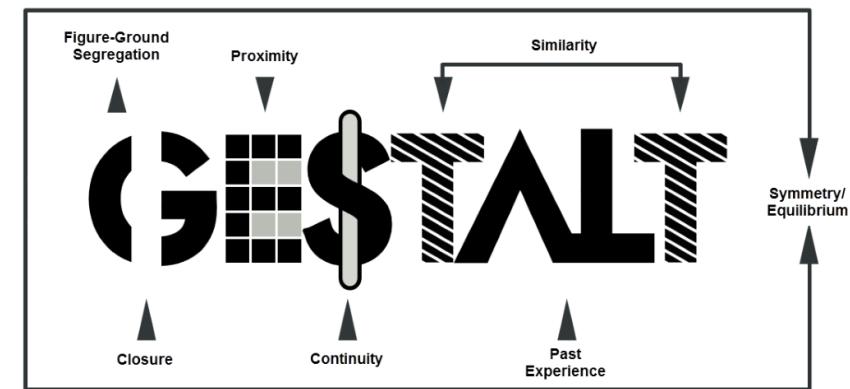
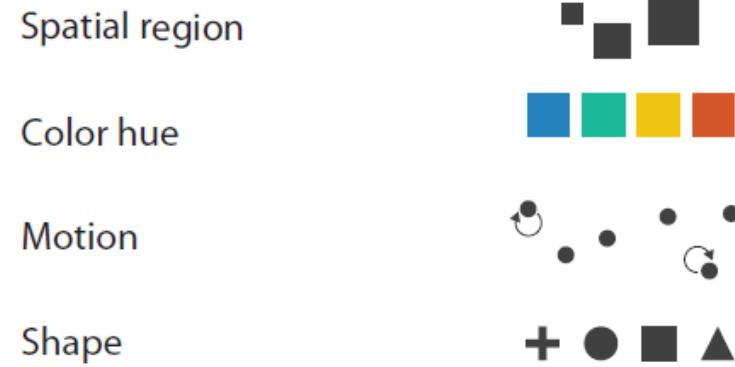


Figuur uit: O'Donoghue SI et al. (2018) Visualization of biomedical data. Annu. Rev. Biomed. Data Sci 1: 275-304

Gebaseerd op het werk van Cleveland en McGill, Graphical Perception: Theory, Experimentation, and Application to the Development of Graphical Methods. JASA 1984; 387 (79): 531-554.

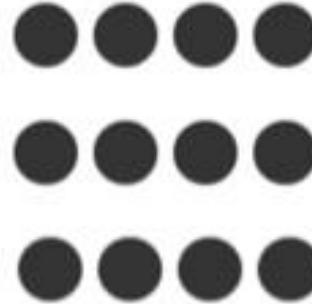


**Categorical data**

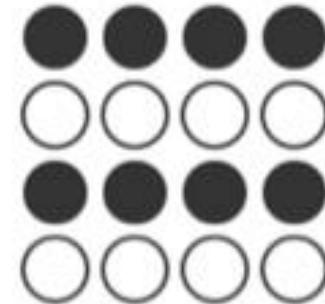


# Gestalt principes: Het geheel is meer dan de som der delen.

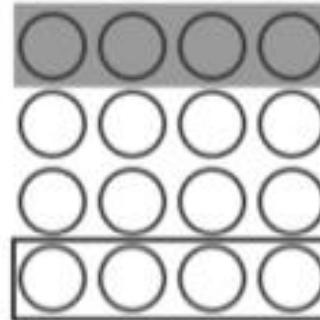
Nabijheid



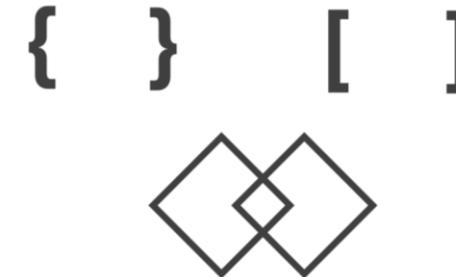
Overeenkomst



Omsluiting



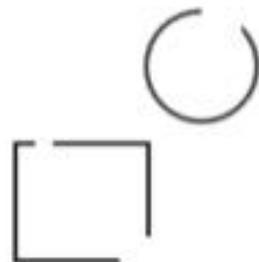
Symmetrie



Voor- en achtergrond



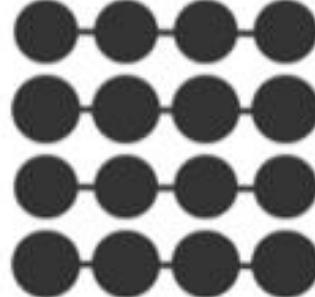
Afsluiting



Continuïteit



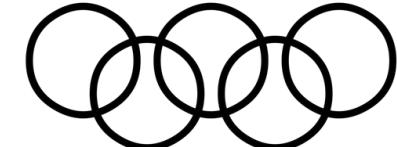
Verbinding



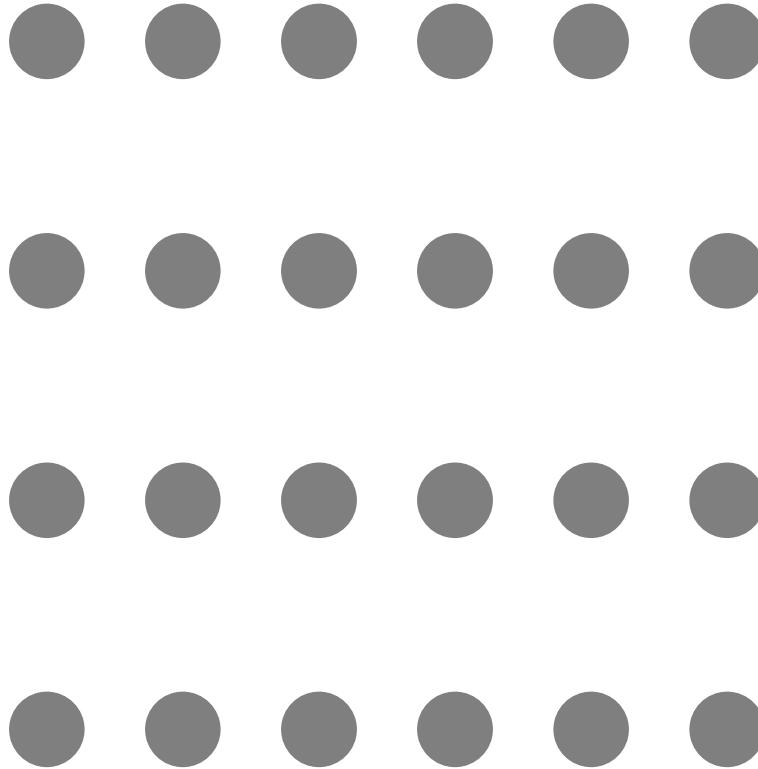
Gelijke richting



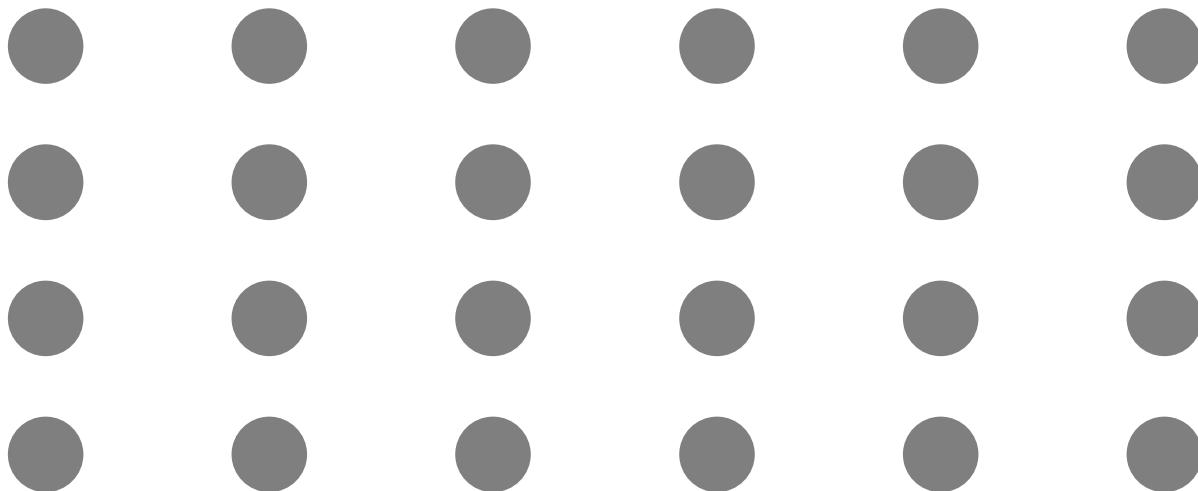
Eenvoud



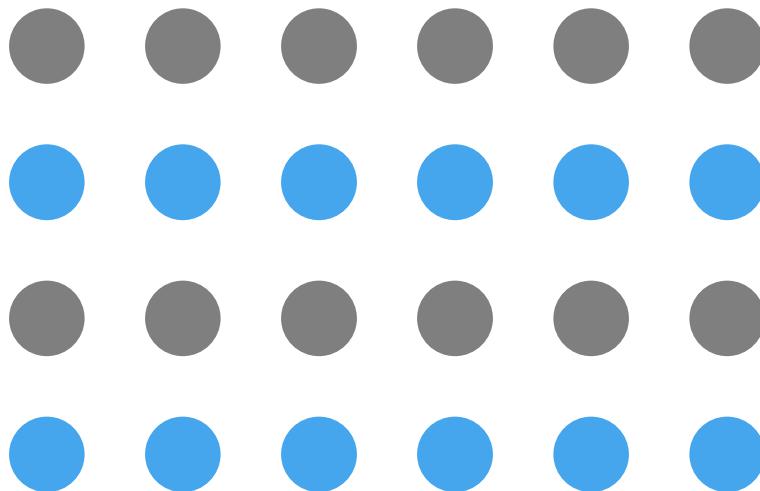
Zie je 4 rijen of 6 kolommen?



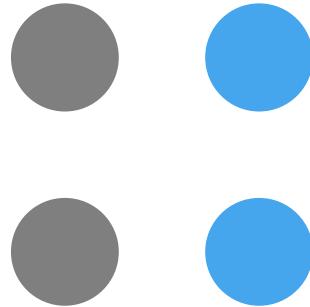
En nu?



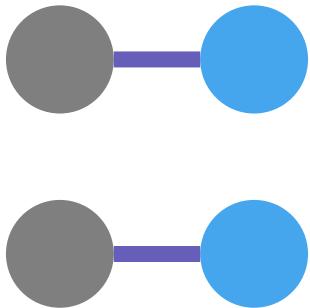
Zie je 4 rijen of 6 kolommen?



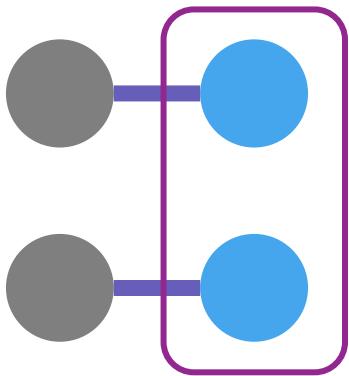
# Welke stippen horen bij elkaar?



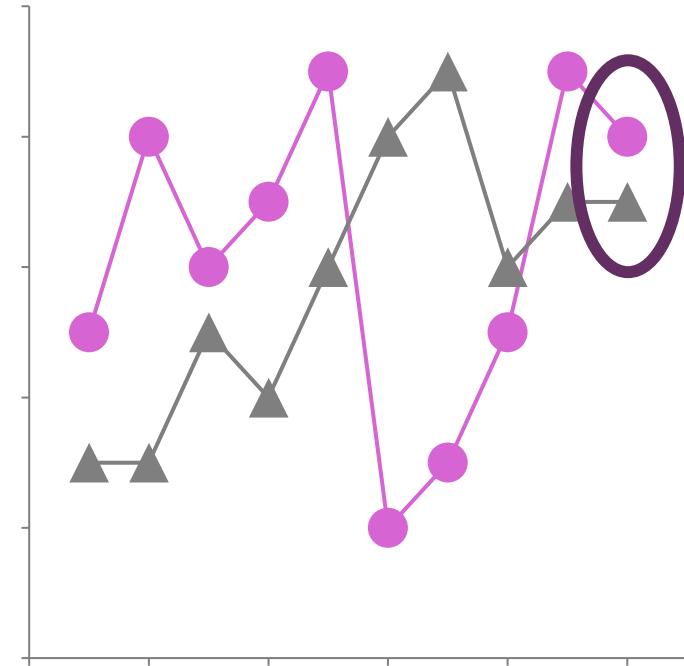
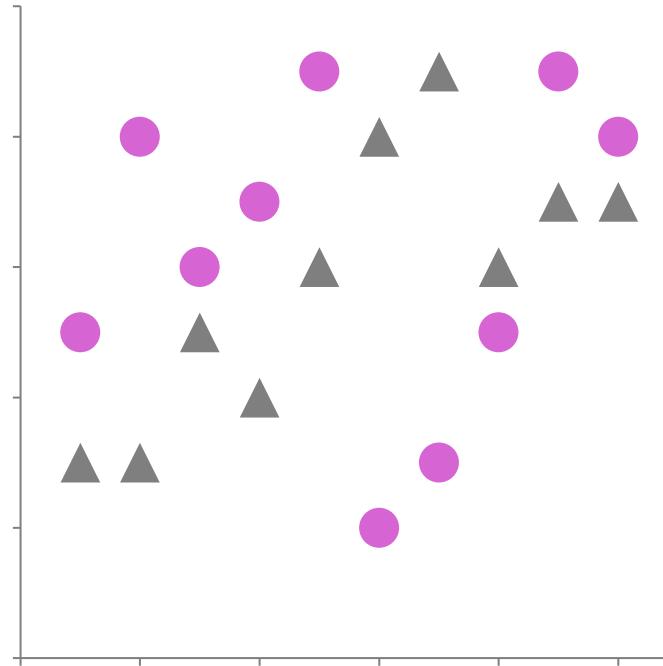
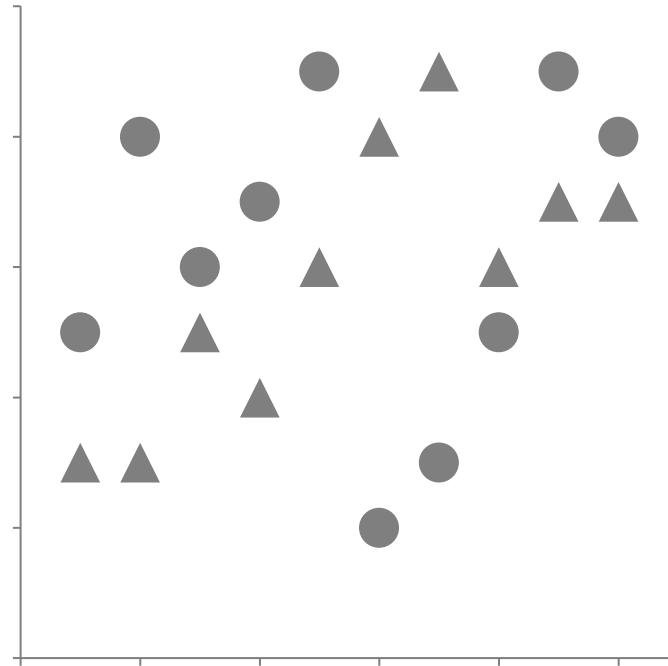
En nu...?



En nu...?

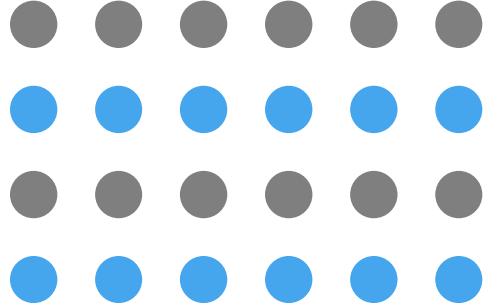


# Gestalt Principles van nabijheid, overeenkomst, verbinding en omsluiting in grafieken

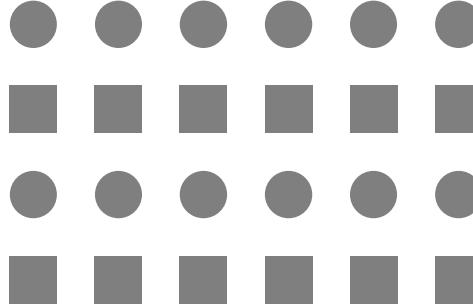


# Groeperen op overeenkomst...

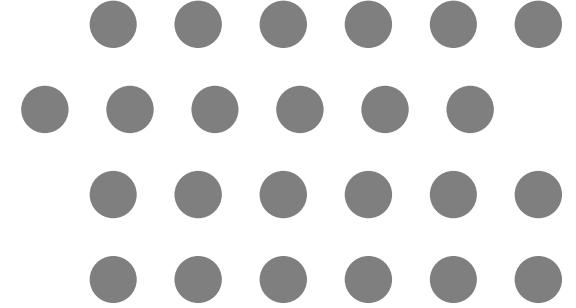
Kleur



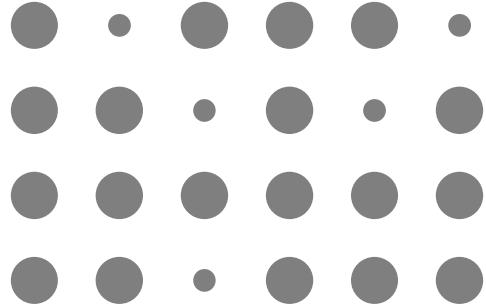
Vorm



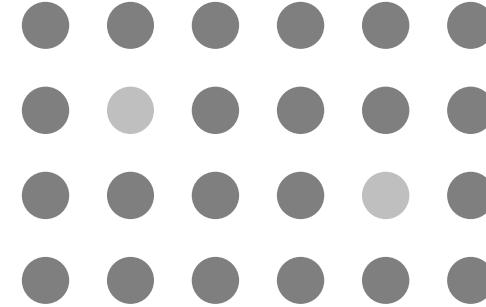
Positie



Grootte



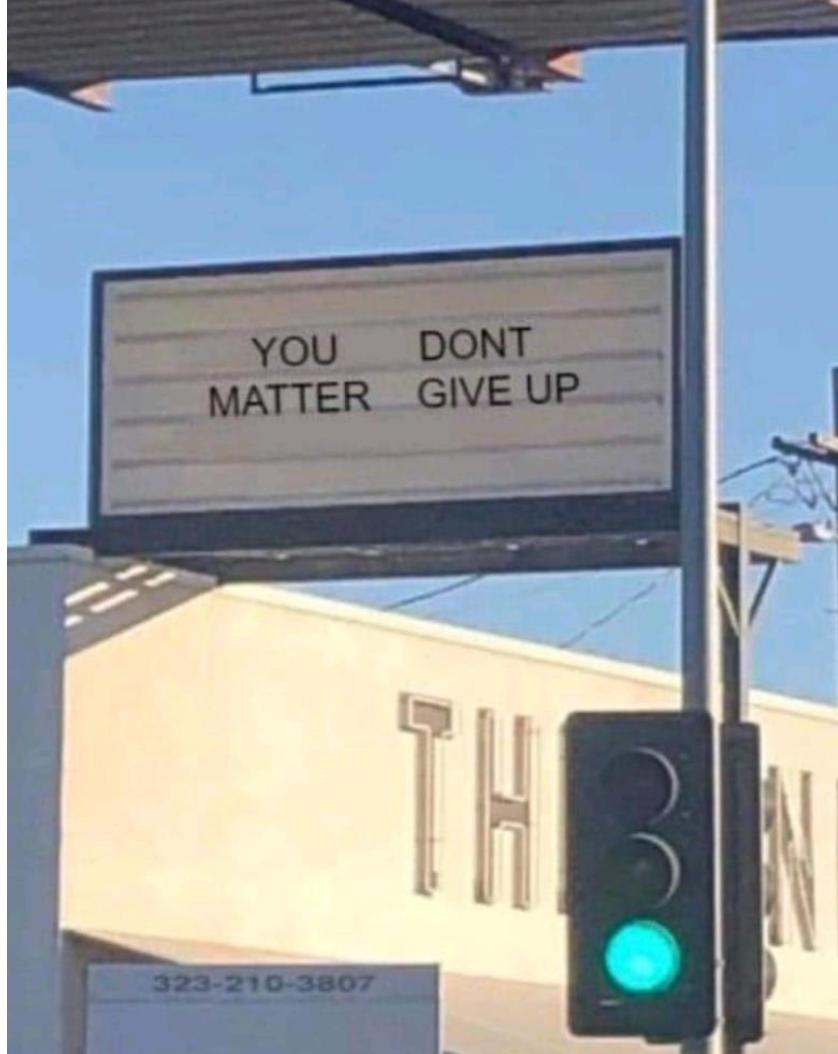
Tint



# ...werkt niet altijd!



# Groeperen op nabijheid ook niet...

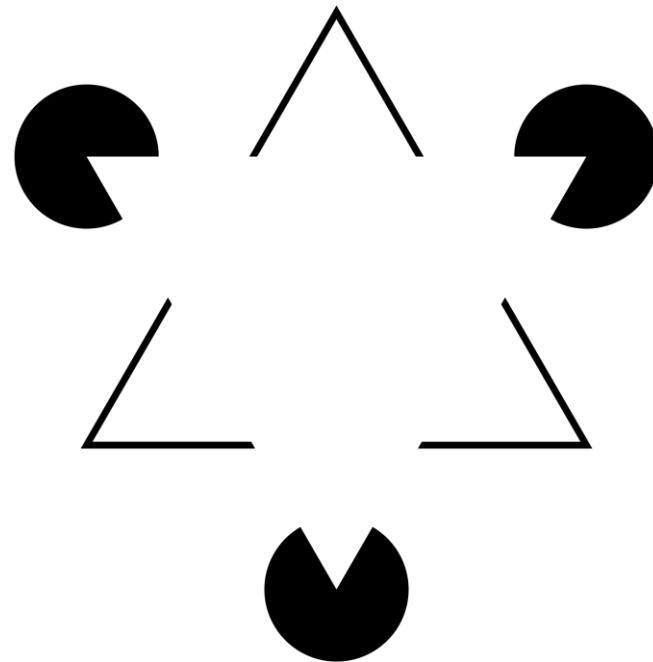
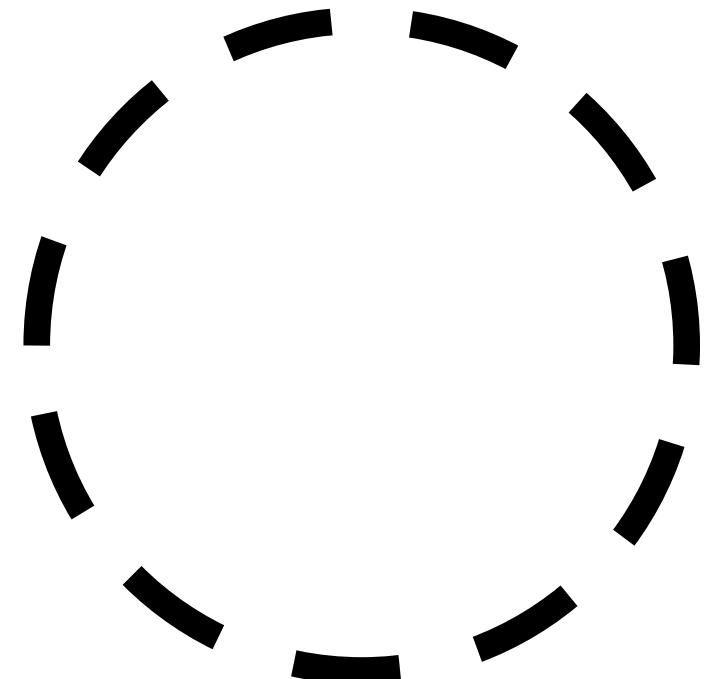


# Wat staat hier?

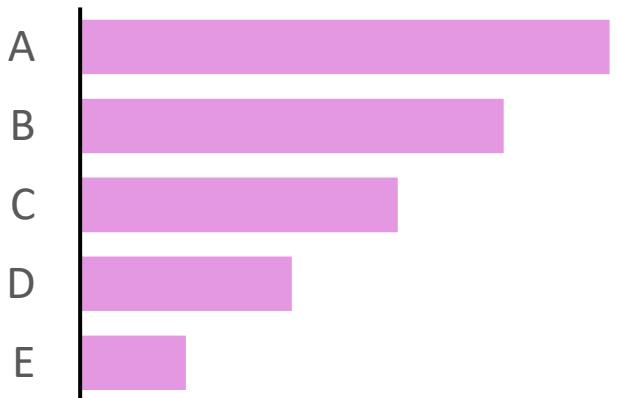
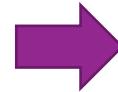
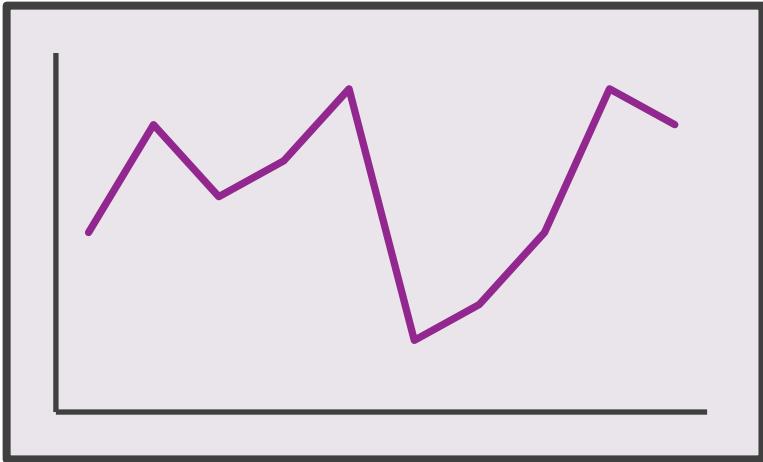
Vlgones een oznrdeeok op een Egliese uvinretsiet mkaat  
het neit uit in wlkee vloogdre de Itteers in een wrood saatn,  
het einge wat blegnaijrk is is dat de eretse en de Itaatse  
Itteer op de jiutse patals saatn.

De rset van de Itteers mgoen wlelikueirg gpletaast wdoren  
en je knut vrelvogens gwoeon lzeen wat er saatt. Odmat we  
neit ekle Itteer op zcih lzeen maar het wrood als gheel.

Ons brein is goed in het zien van dingen die er niet expliciet hoeven zijn

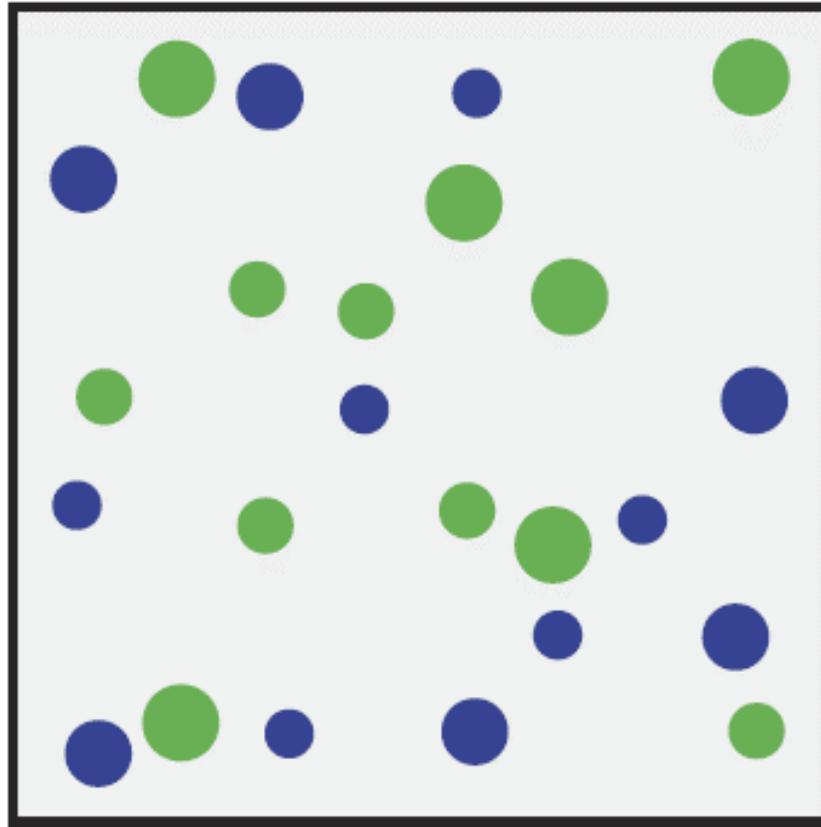


Je kunt dus best (onnodige) elementen uit een grafiek weglaten!

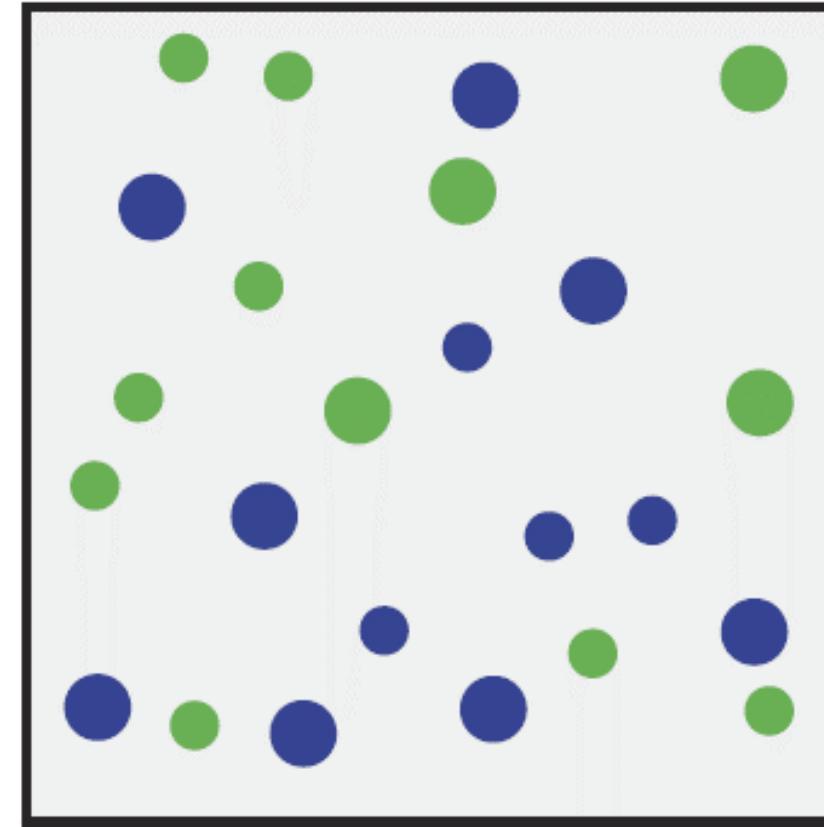


# Waar zijn de **groene** stippen het grootst?

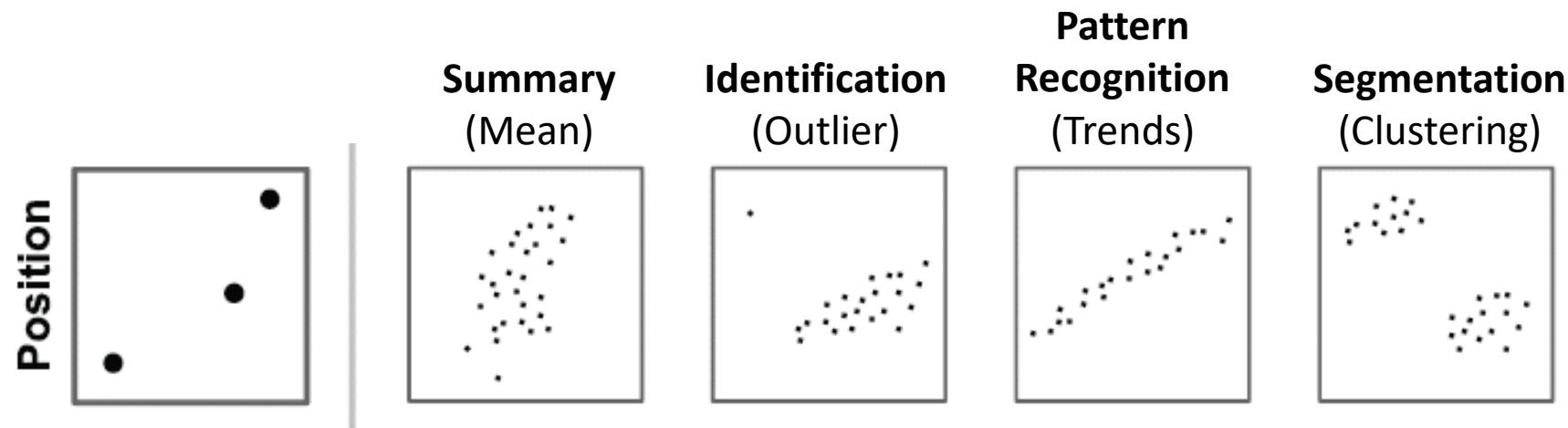
A



B

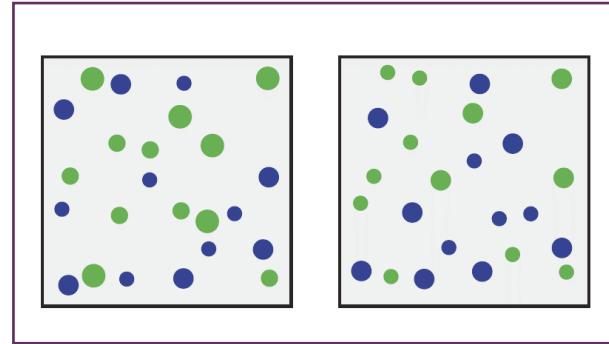
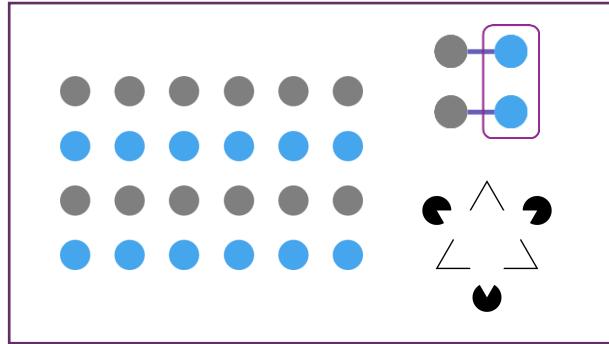


# Ons brein kan ontzettend snel basale statistiek bedrijven op grond van visuele informatie!



# Waar zijn we **goed** in?

321654643216465132168461321  
646432136748651349687463123  
668432616266984892536496874  
651687964649843616984616957  
465167412323161689312439873  
421432875943869234987596387



**1.**

Zien wat eruit springt  
(Pre-attentieve  
eigenschappen)

**2.**

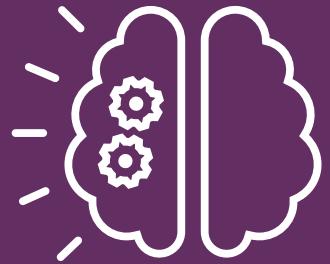
Zien wat bij elkaar hoort  
en informatie invullen  
(Gestalt Principles)

**3.**

Kwantitatieve informatie  
afleiden uit visuele  
vormen

**4.**

Basale descriptieve  
statistiek bedrijven

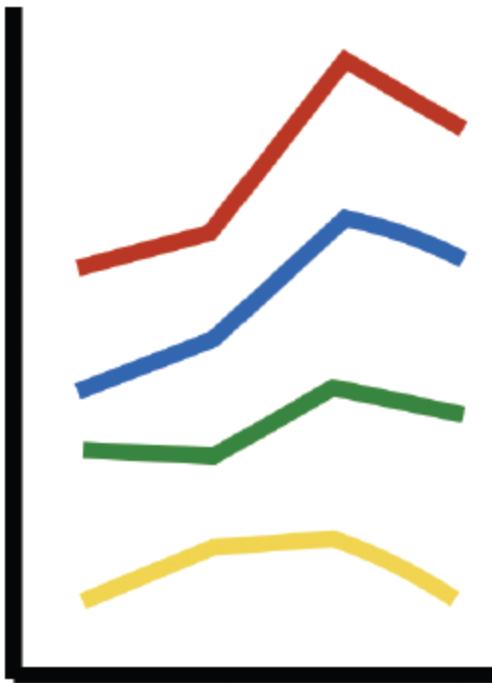
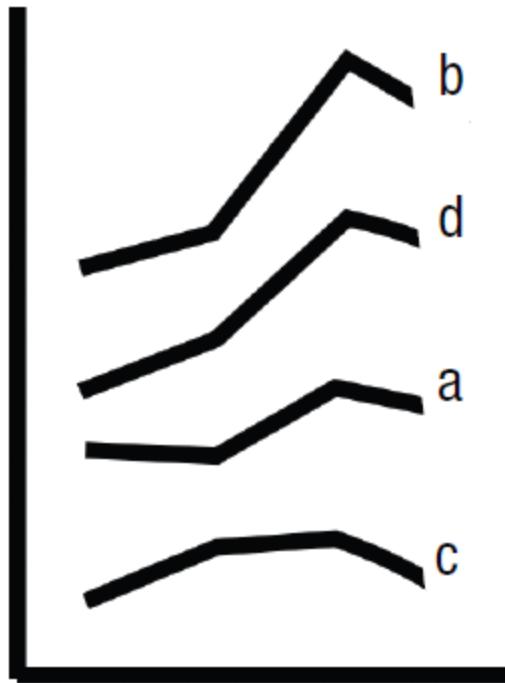


Visuele perceptie

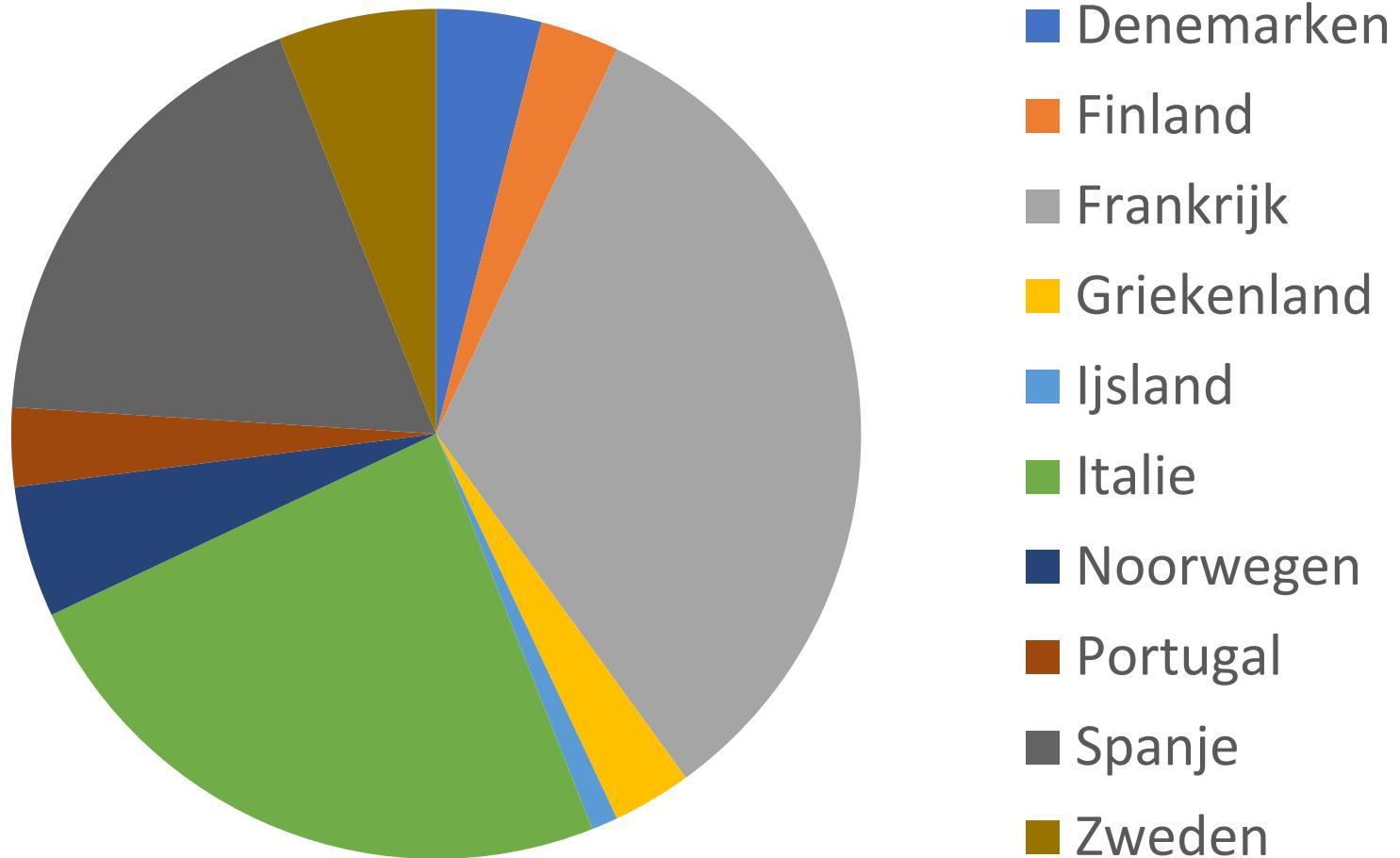
# Waar zijn we **slecht** in?

*“The eyes only see what the mind is prepared to comprehend.”* – Henri Bergson.

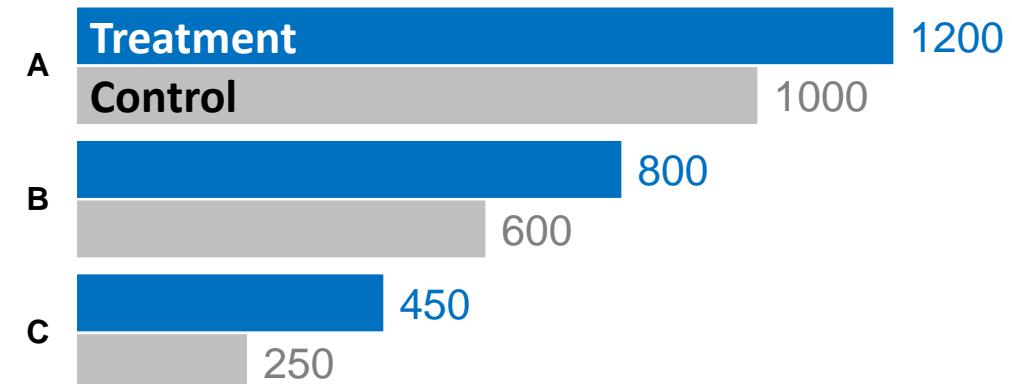
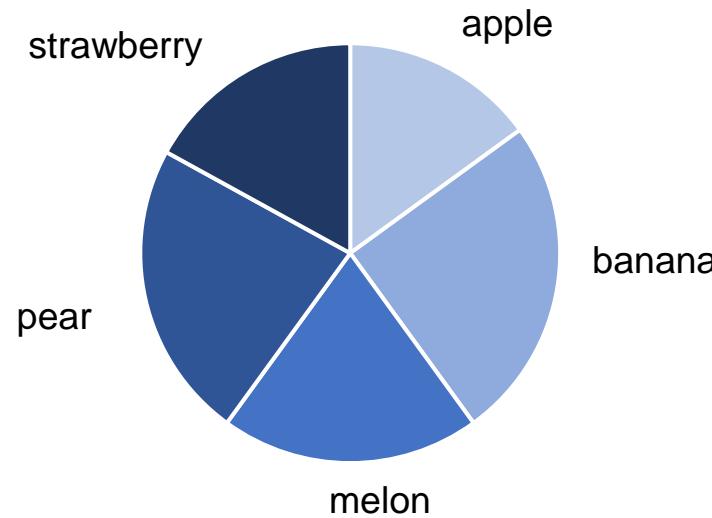
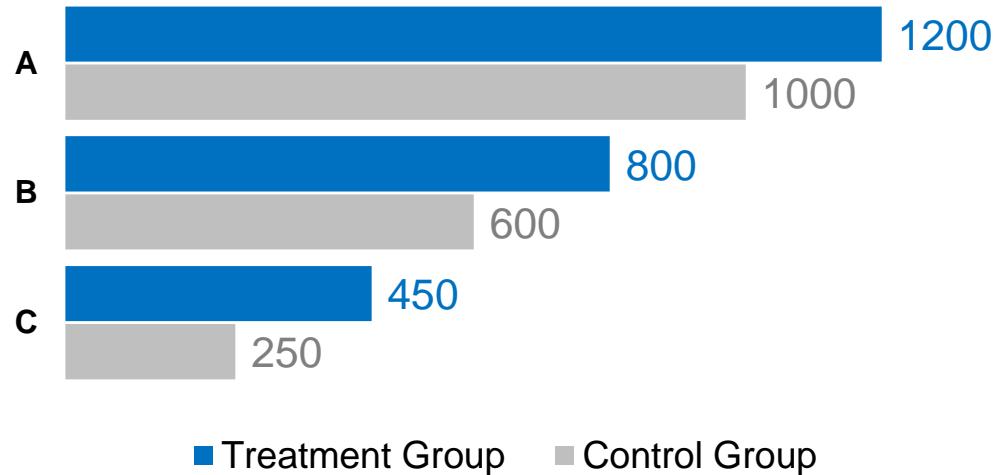
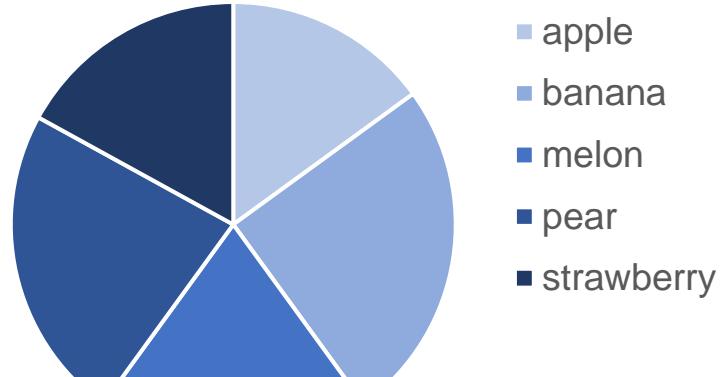
# Waar zijn we slecht in? Alles waar we ons korte-termijn geheugen bij gebruiken!



# Is het vlak voor Noorwegen groter dan het vlak voor Finland?

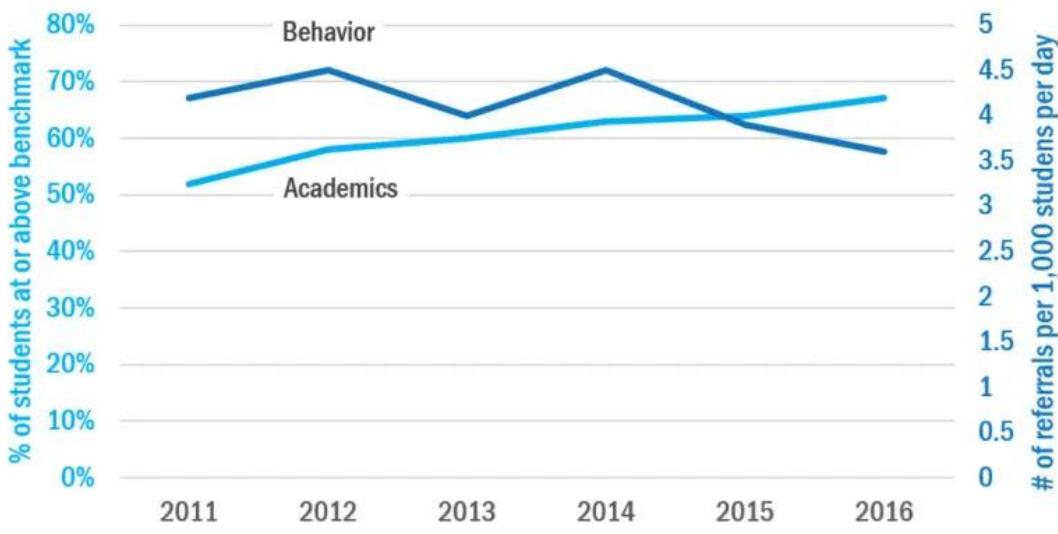


# Vermijd legenda's als dat kan...

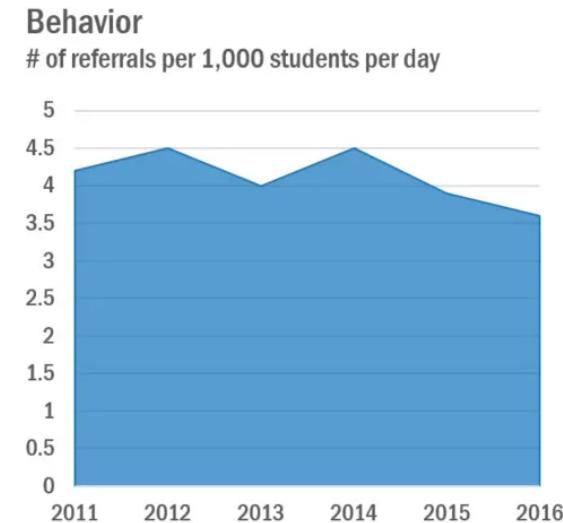
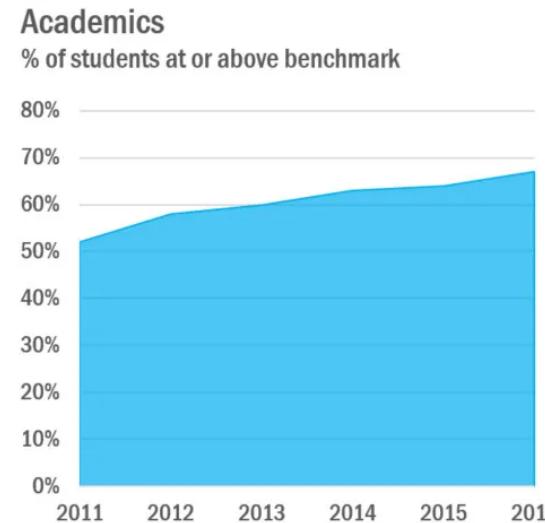


# Vermijd dubbele assen...

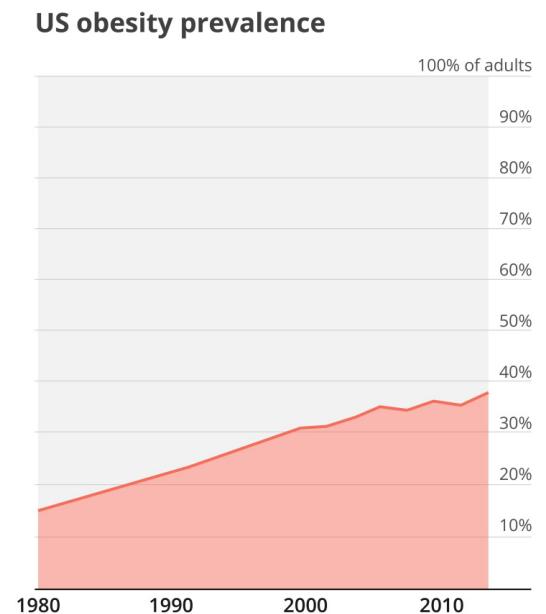
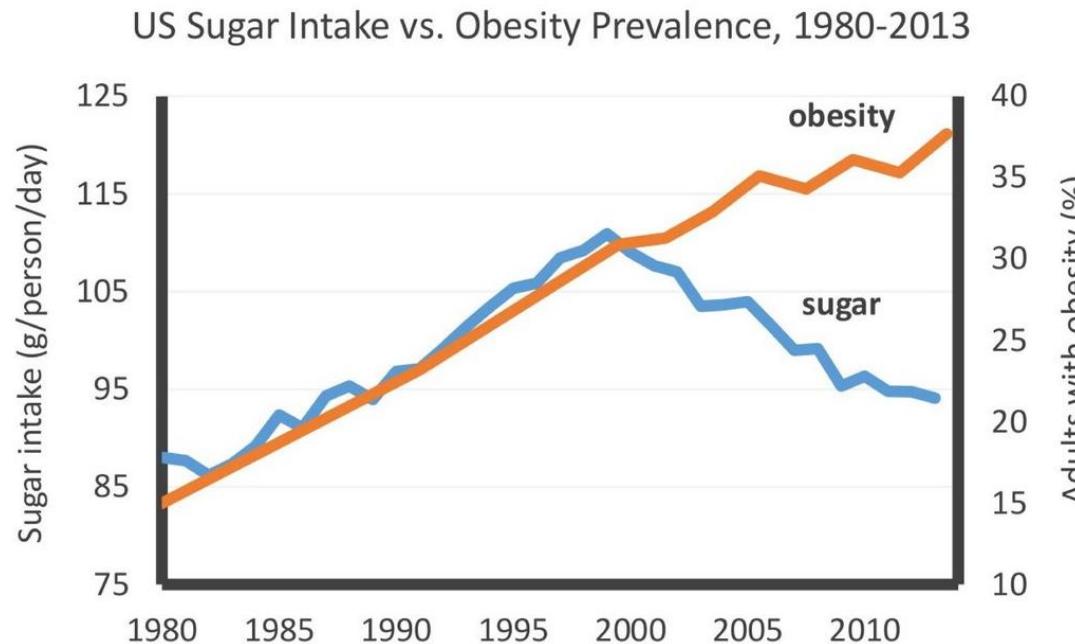
Participating schools improved students' **academic** performance and reduced **behavioral** referrals.



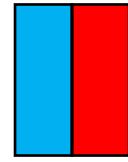
Participating schools improved students' **academic** performance and reduced **behavioral** referrals.



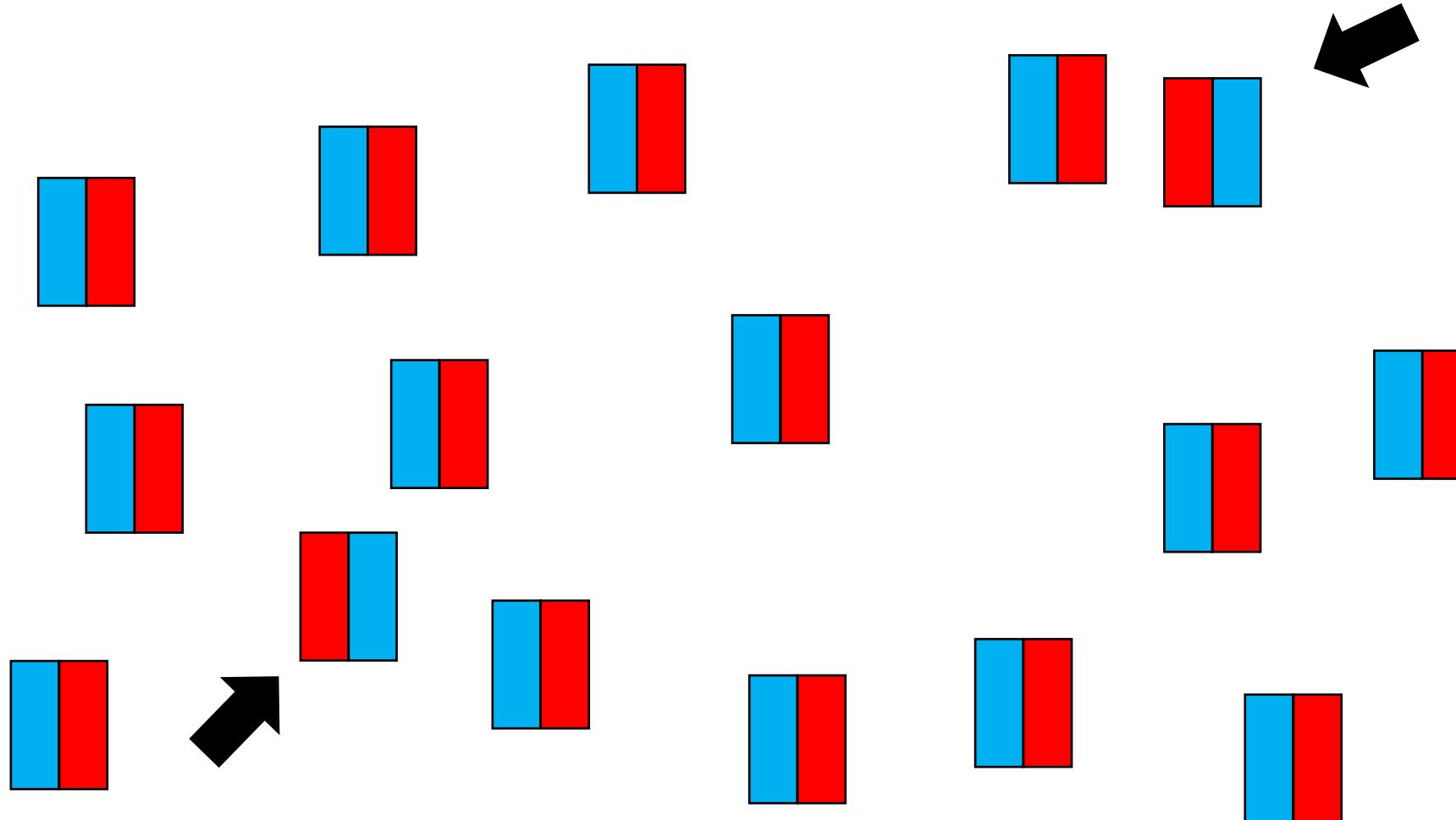
# Dubbele assen kunnen ook misleiden...



# 1 set van 2 kleuren vergelijken is gemakkelijk



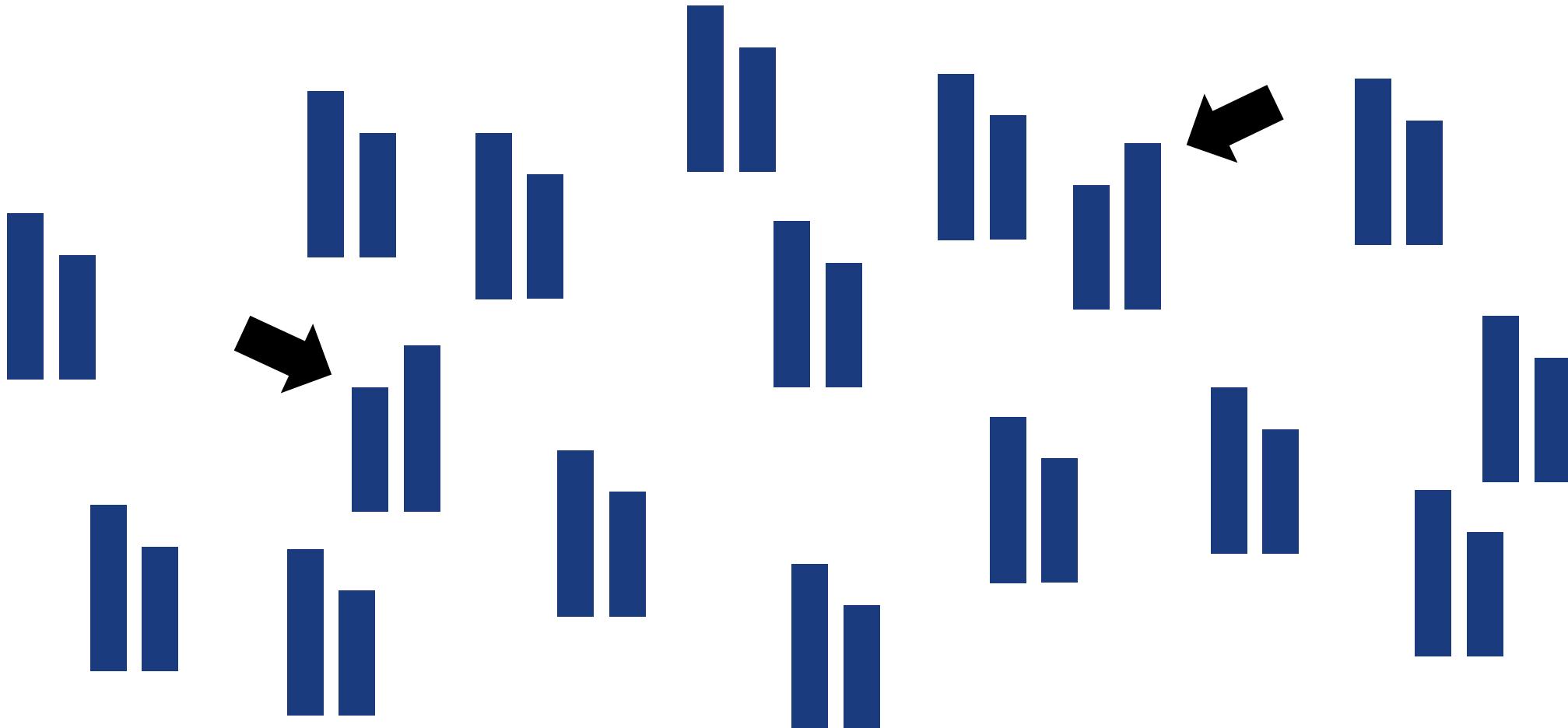
# Maar: welke is anders dan de anderen?



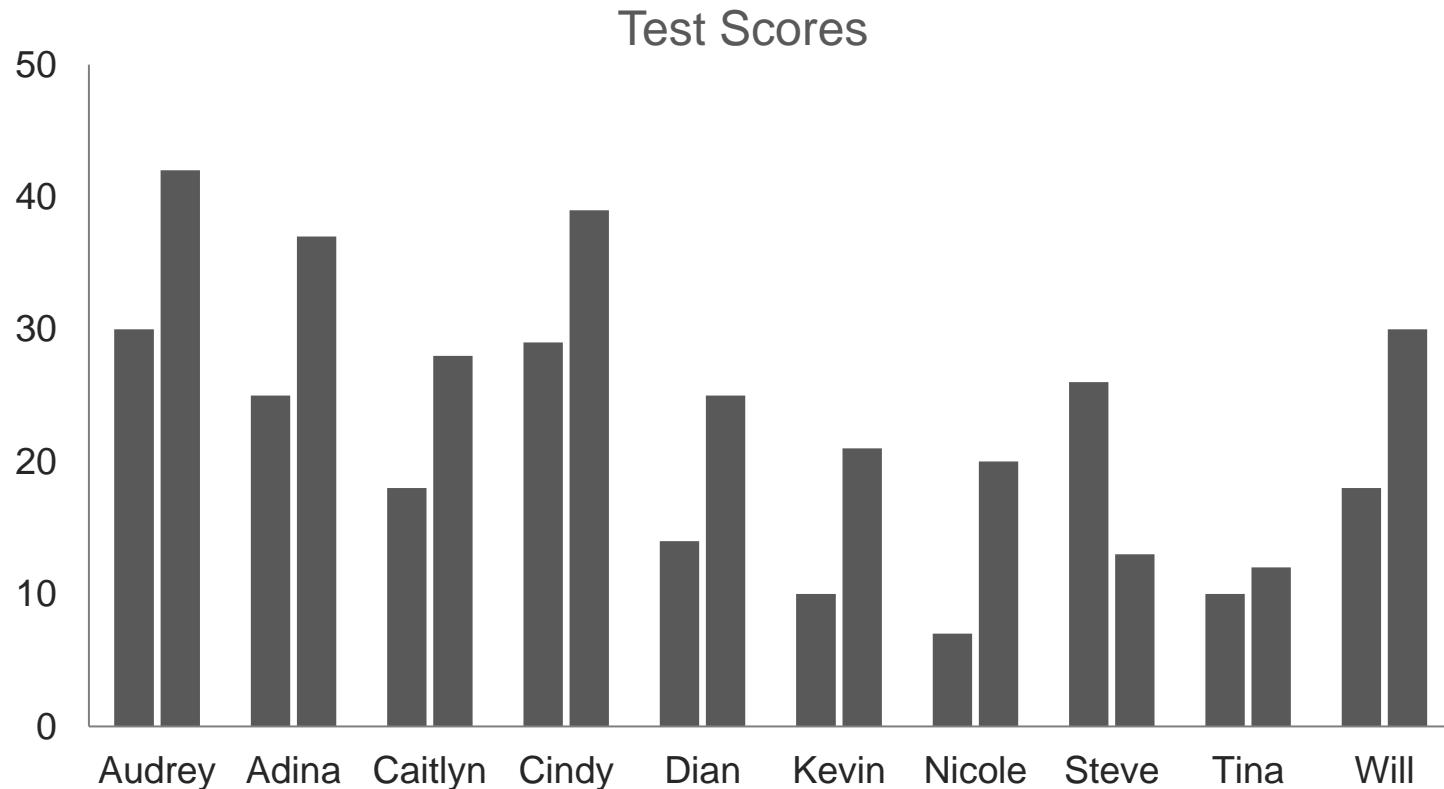
# Ook gemakkelijk: Links is groter dan rechts



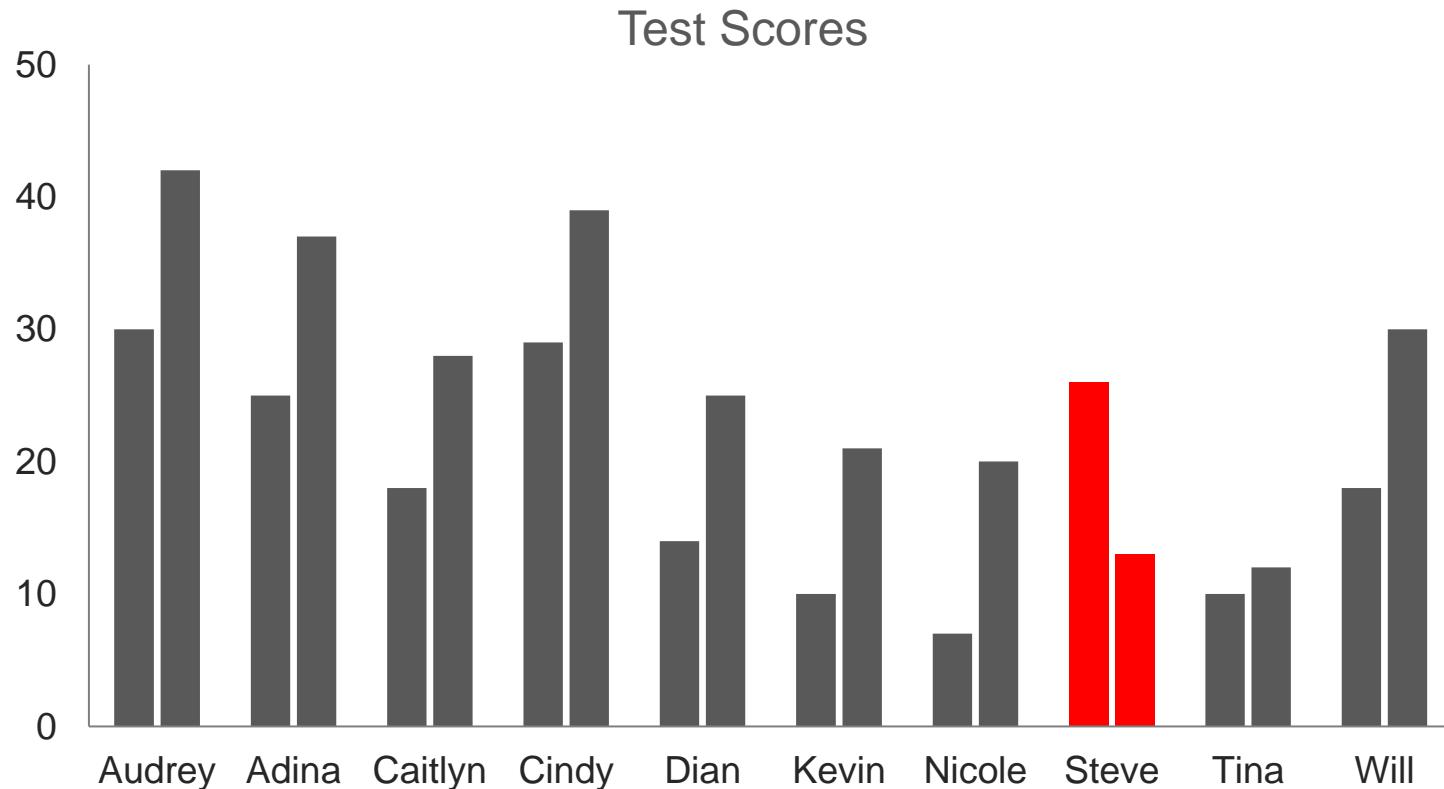
# Maar: welke is anders dan de anderen?



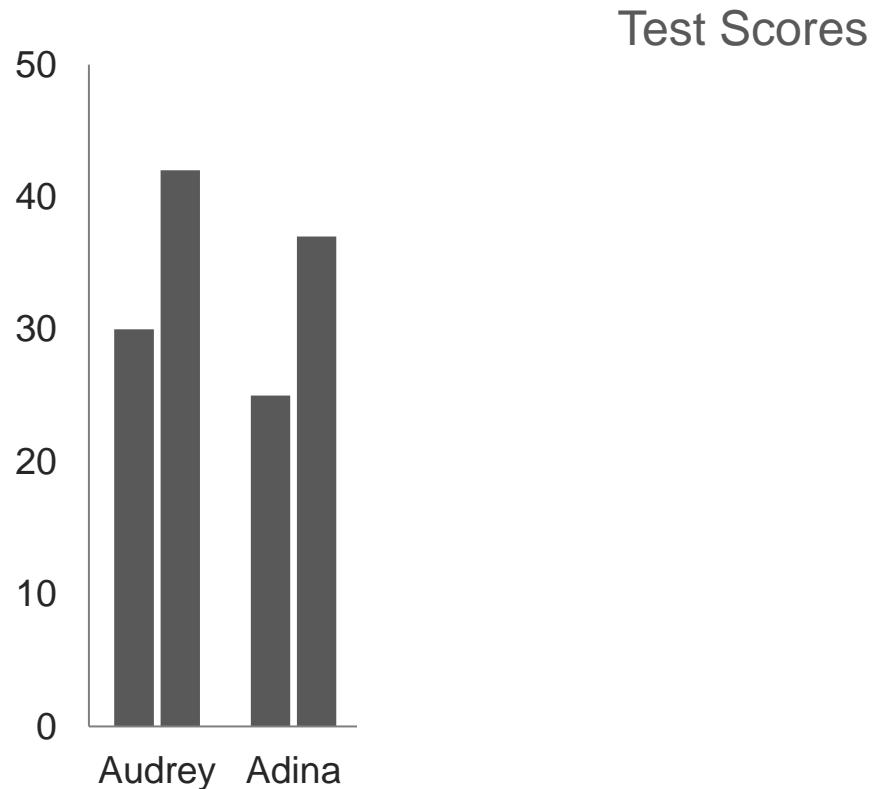
# Welke student scoorde slechter op de 2e test?



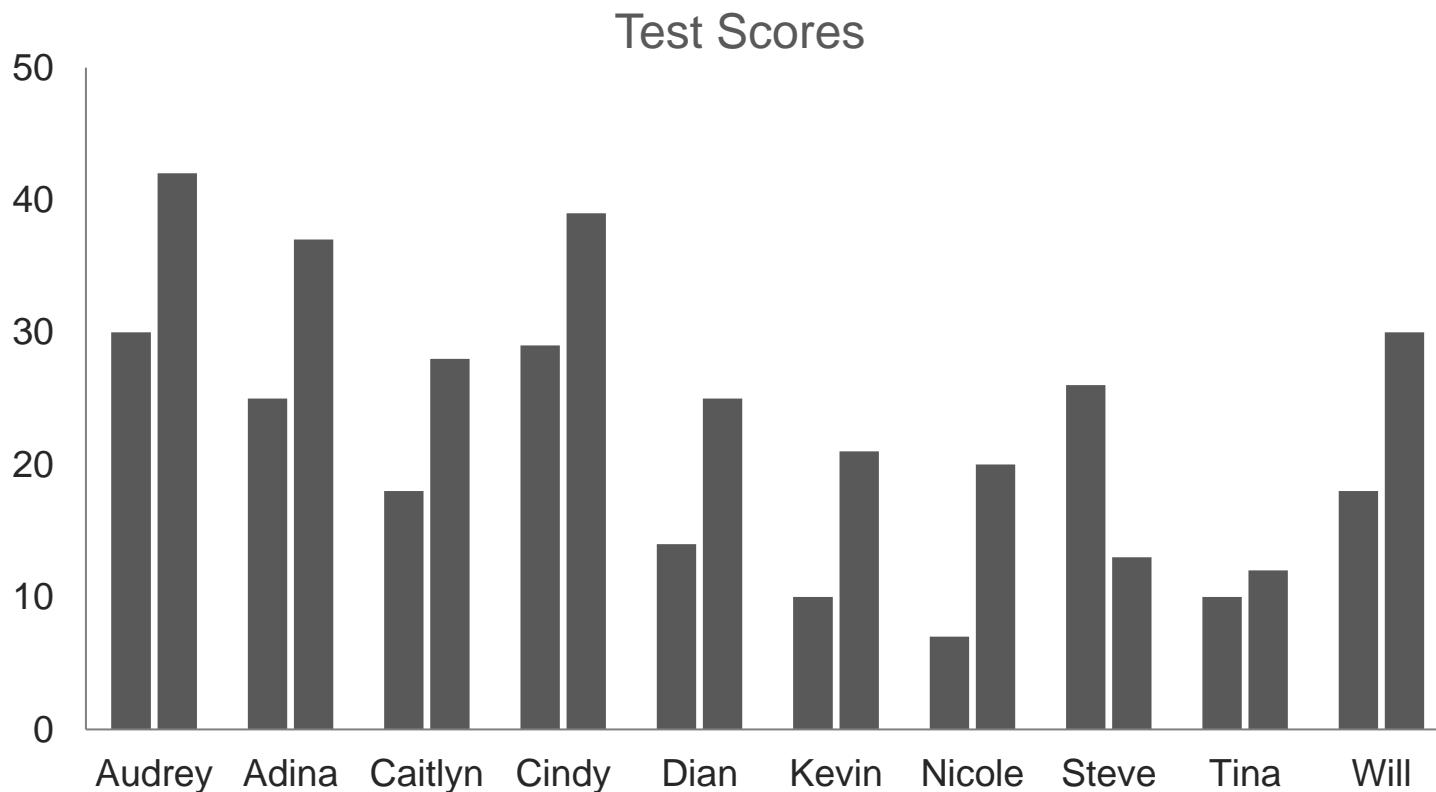
# Welke student scoorde slechter op de 2e test?



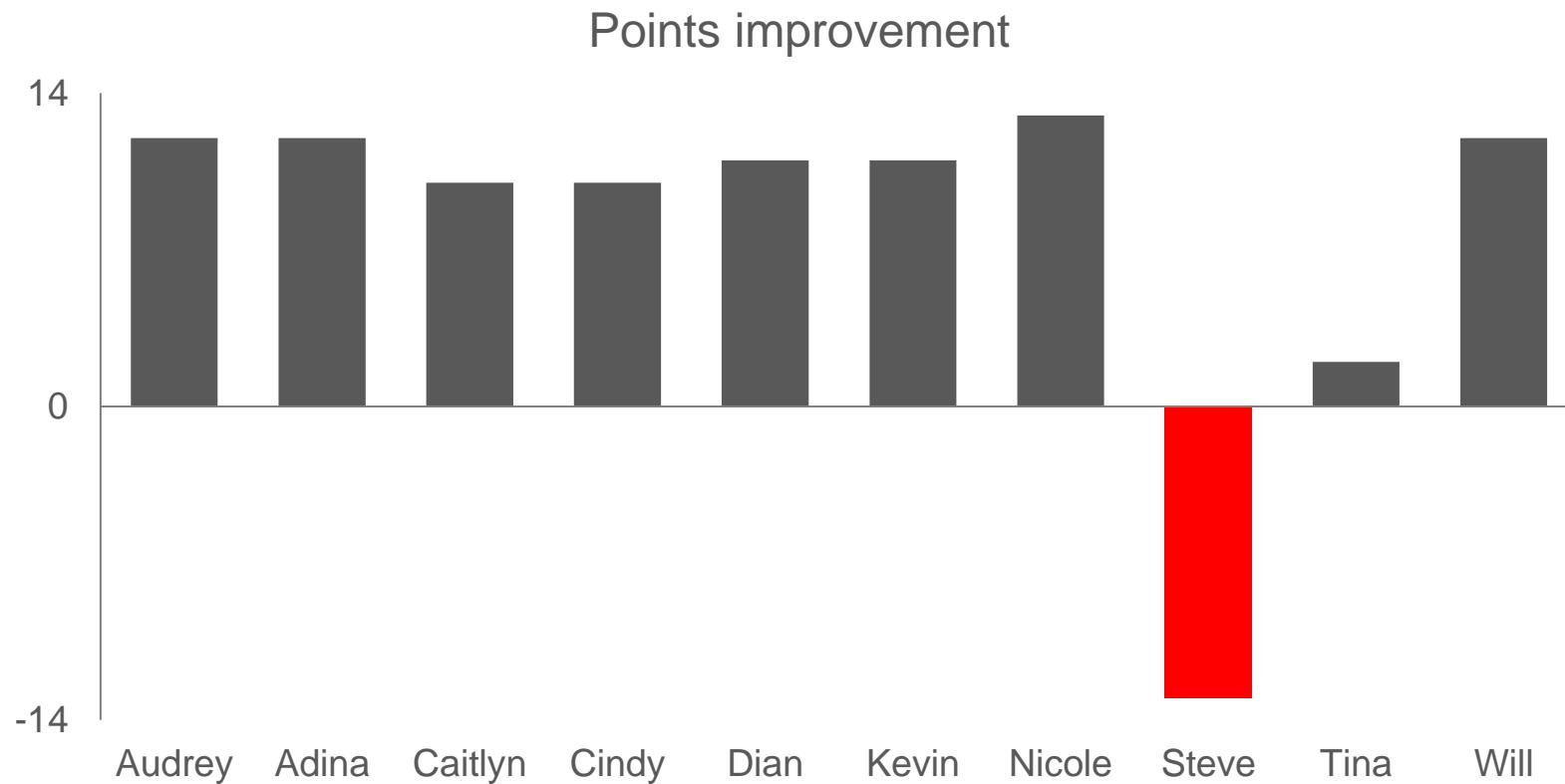
# Het gemiddelde verschil is...



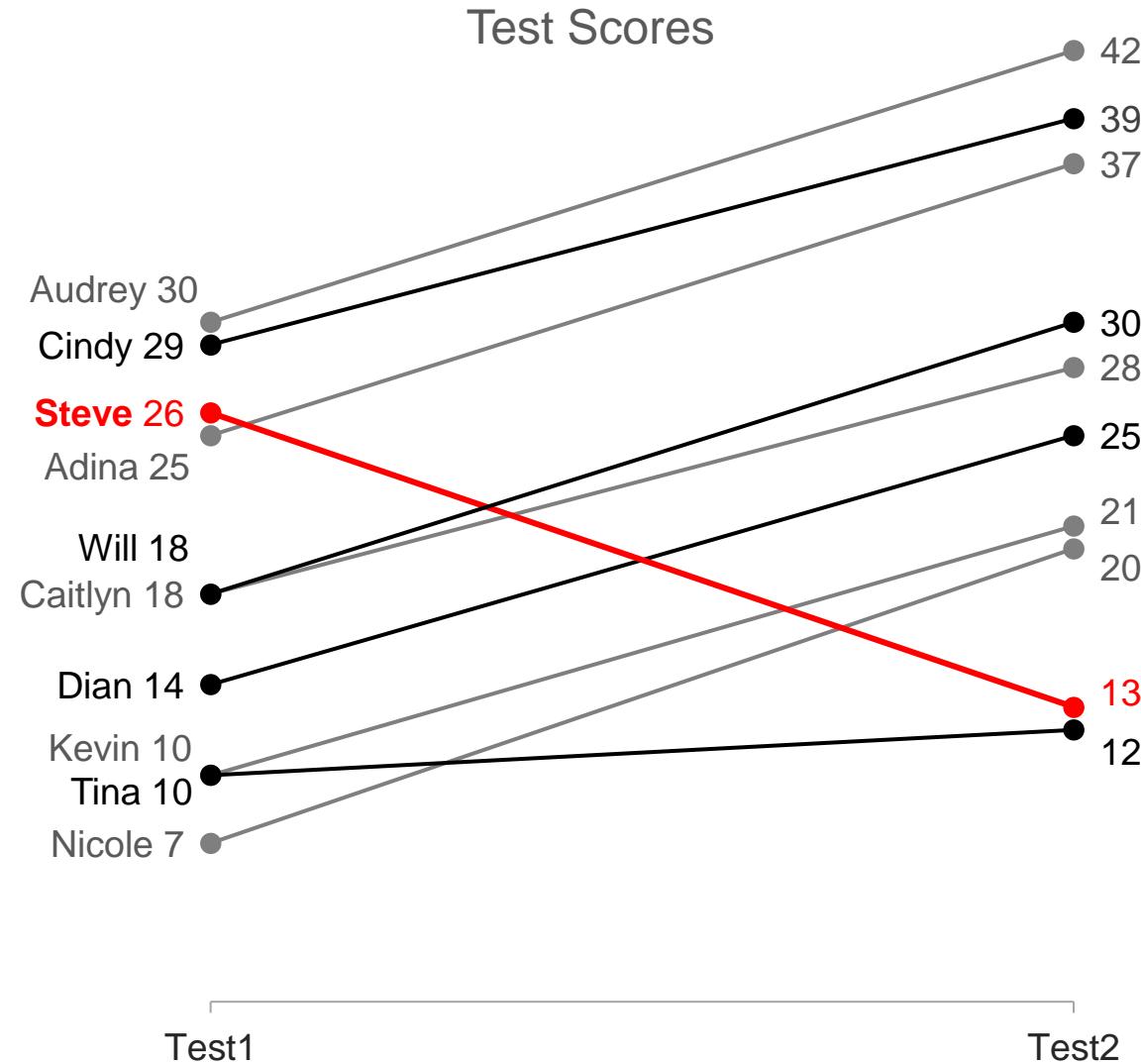
# Maar nu...?



# Zorg voor directe vergelijkingen...

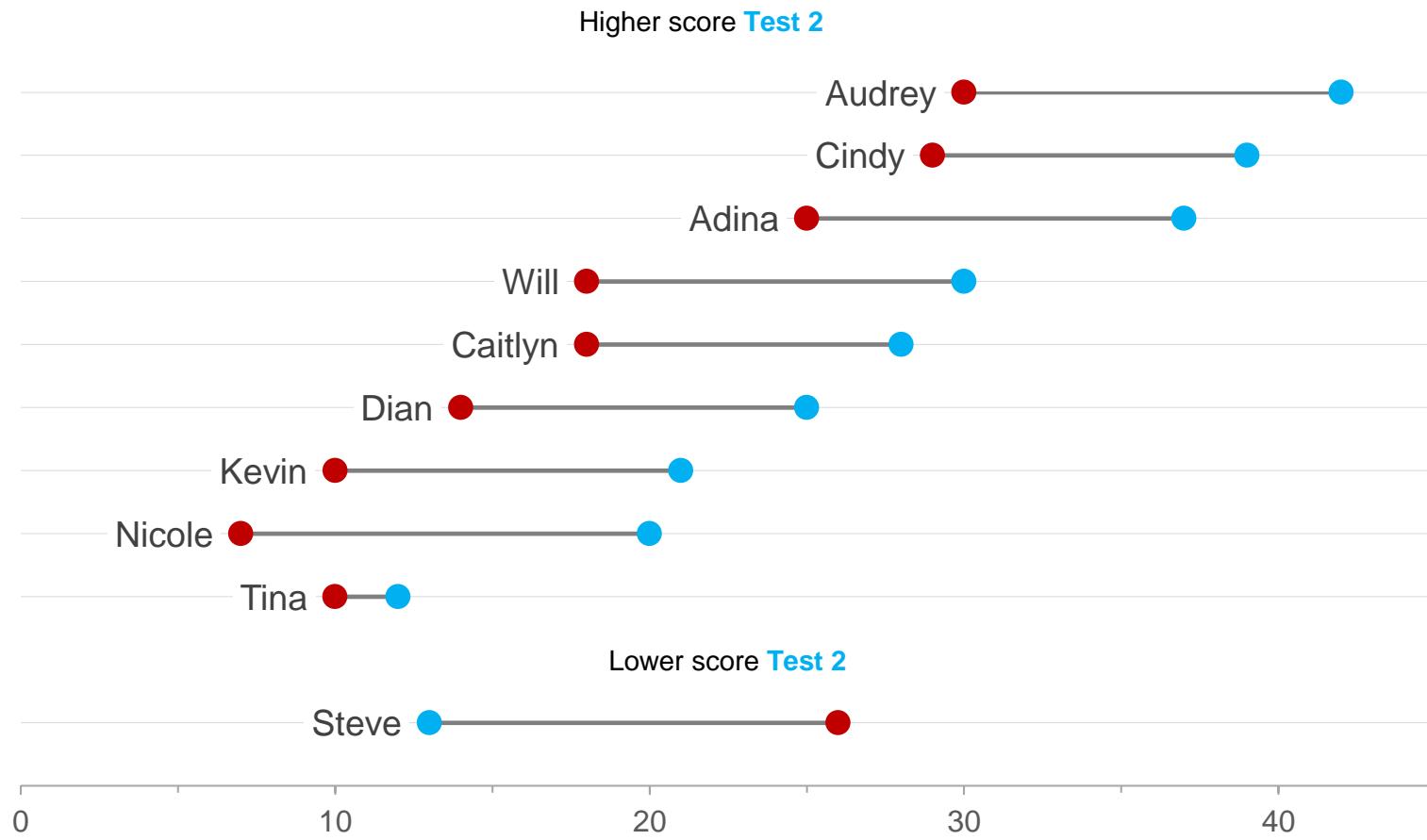


# Of probeer een slope chart als alternatief...

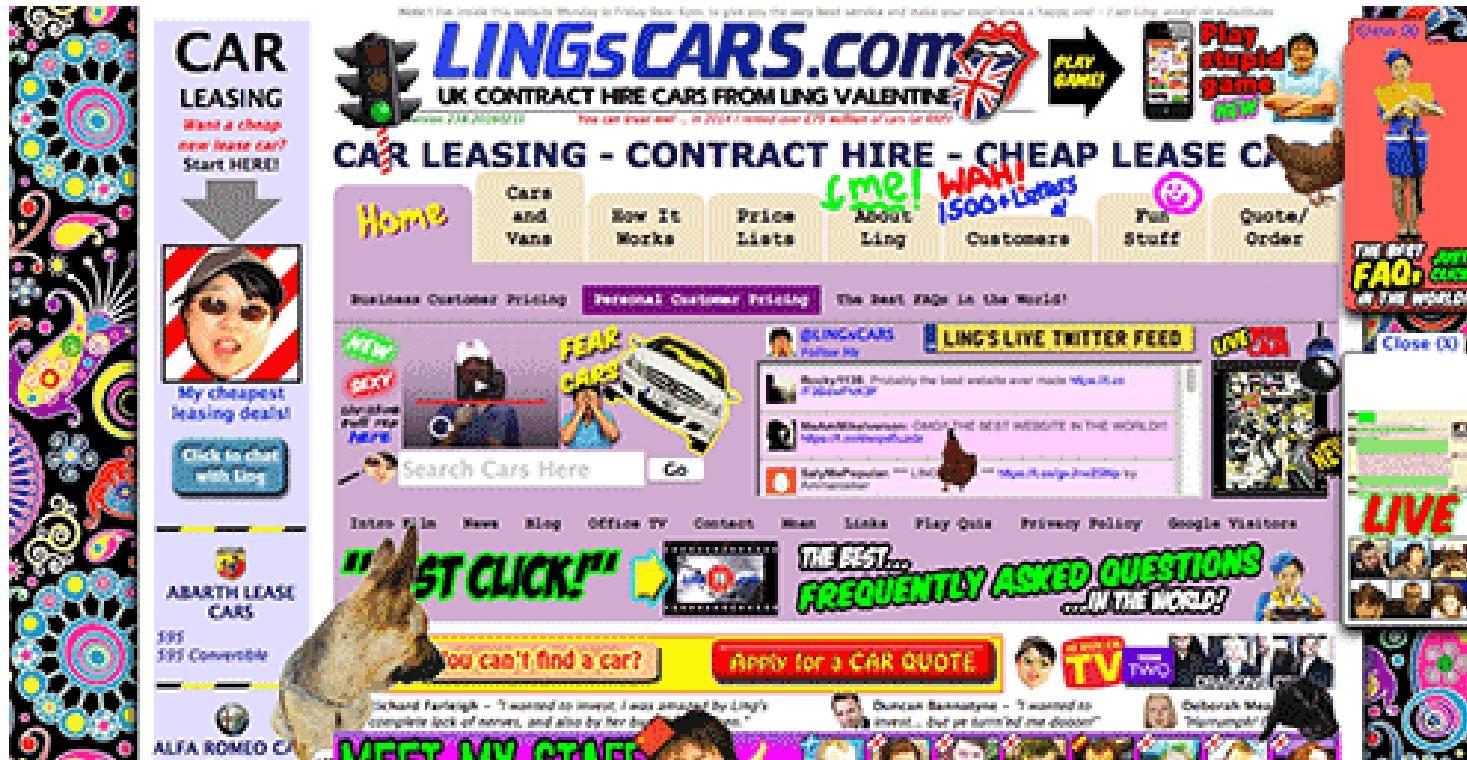


# Of een dumbbell dot plot...

Scores for **Test1** and **Test2**



# Waar zijn we slecht in? Teveel informatie tegelijkertijd verwerken!

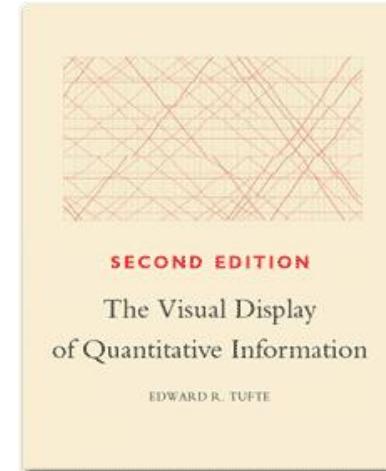


# De data-ink ratio

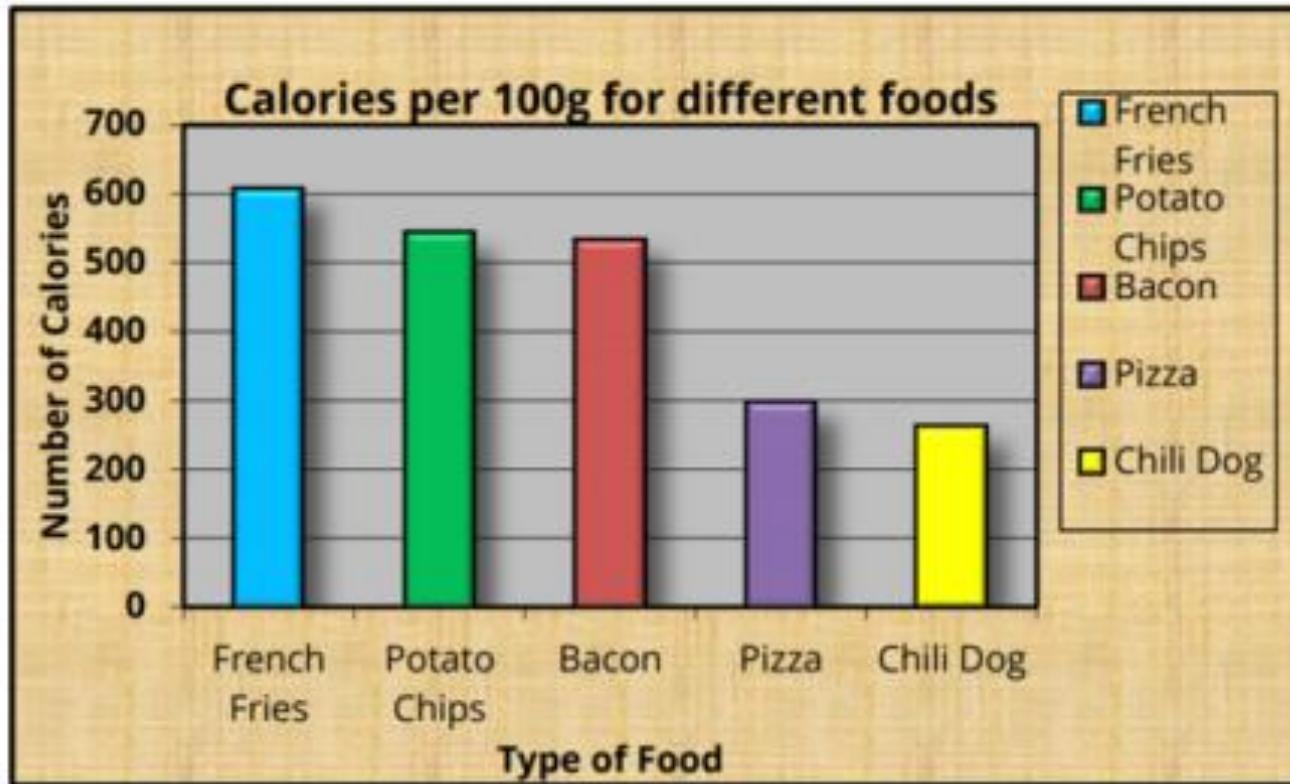
**Data-ink ratio** = 
$$\frac{\text{Data-ink}}{\text{Total ink used to print the graphic}}$$

= proportion of a graphic's ink devoted to the non-redundant display of data-information

= 1.0 – proportion of a graphic that can be erased



# De data-inkt ratio: remove to improve



# De data-ink ratio: remove to improve

**Remove**  
to improve  
(the **data-ink** ratio)

# Data-inkt ratio: geldt ook voor tabellen

Student	Test1	Test2	Difference
Audrey	30.00	42.00	12.00 pts
Adina	25.00	37.00	12.00 pts
Caitlyn	18.00	28.00	10.00 pts
Cindy	29.00	39.00	10.00 pts
Dian	14.00	25.00	11.00 pts
Kevin	10.00	21.00	11.00 pts
Nicole	7.00	20.00	13.00 pts
<b>Steve</b>	<b>26.00</b>	<b>13.00</b>	<b>-13.00 pts</b>
Tina	10.00	12.00	2.00 pts
Will	18.00	30.00	12.00 pts

Student	Test1	Test2	Difference (pts)
Audrey	30	42	12
Adina	25	37	12
Caitlyn	18	28	10
Cindy	29	39	10
Dian	14	25	11
Kevin	10	21	11
Nicole	7	20	13
<b>Steve</b>	<b>26</b>	<b>13</b>	<b>-13</b>
Tina	10	12	2
Will	18	30	12

# Vermijd onnodige afleiding of “chart junk”



Effective. Not optimal.

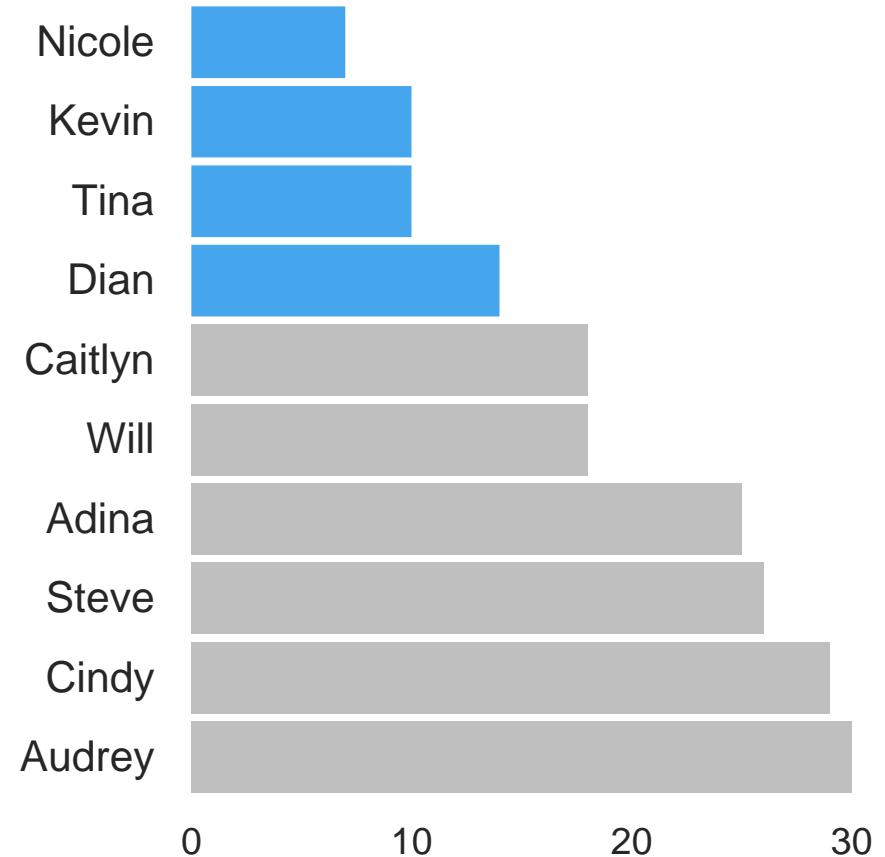
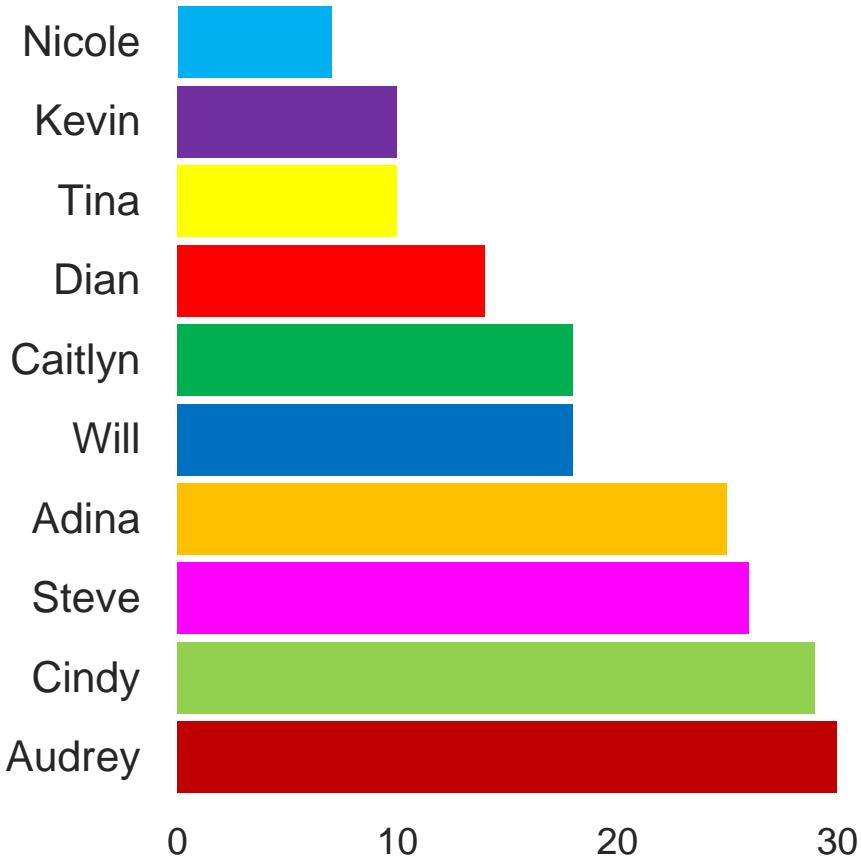


Simple, effective, optimal.

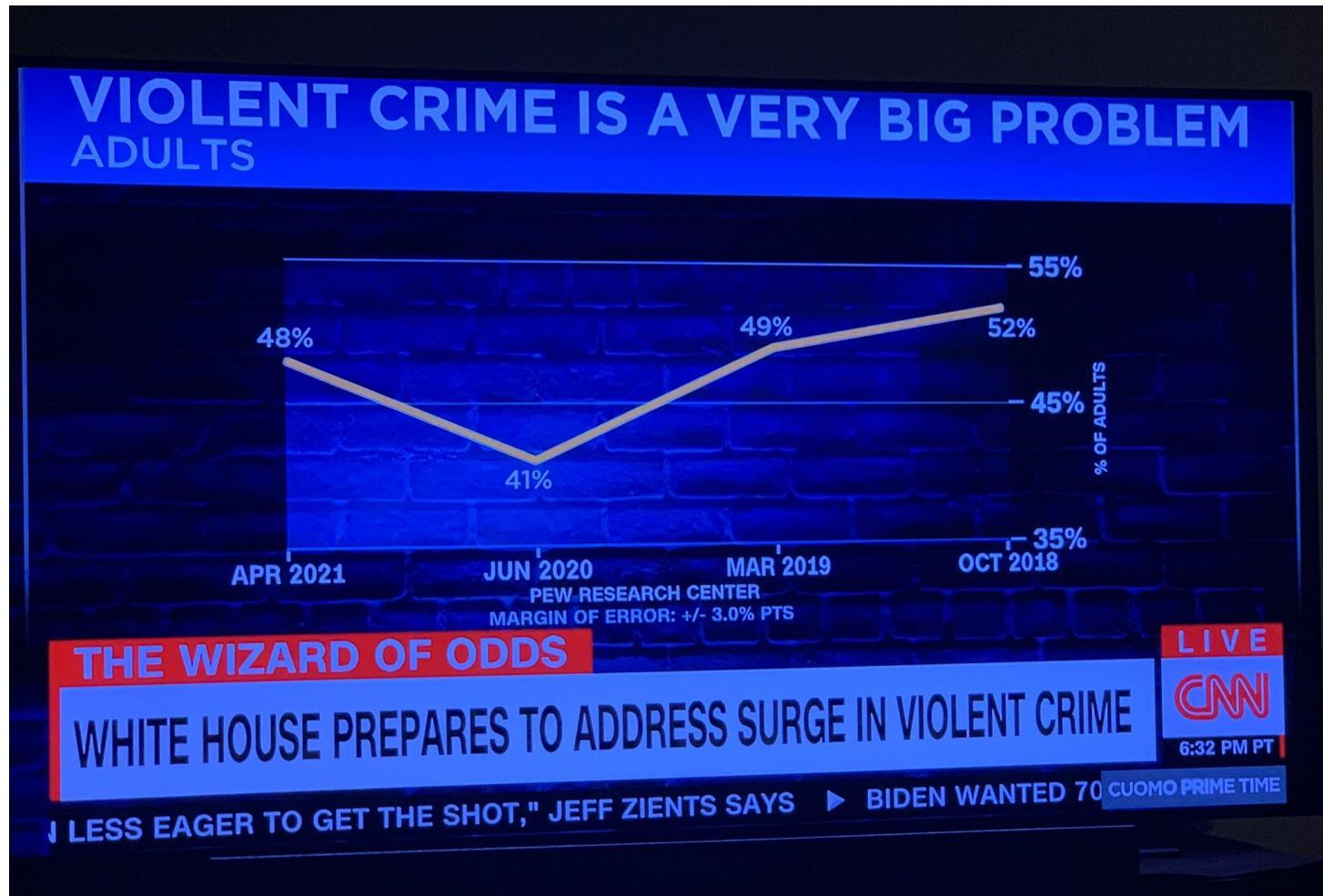


Bad.

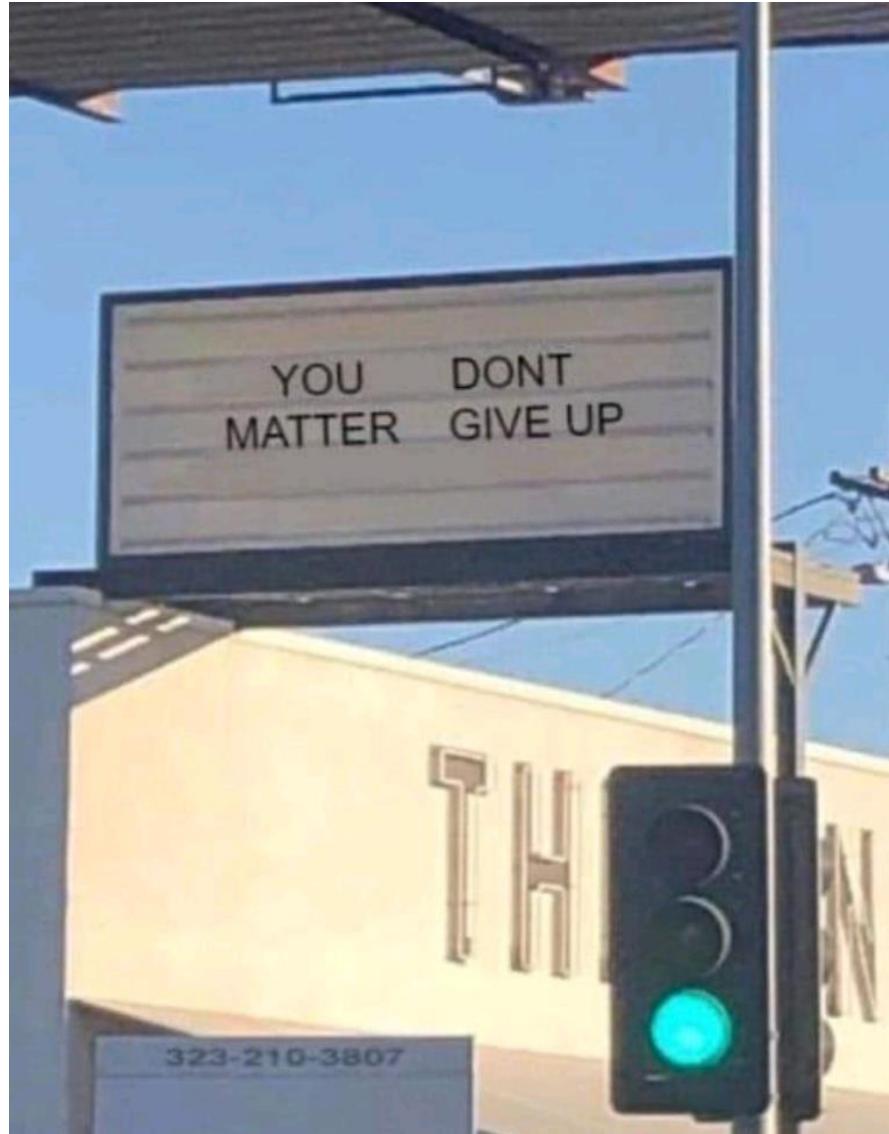
# Onnodige afleiding: geldt ook voor kleuren



# Waar zijn we slecht in? Tegen de natuurlijke flow in gaan!

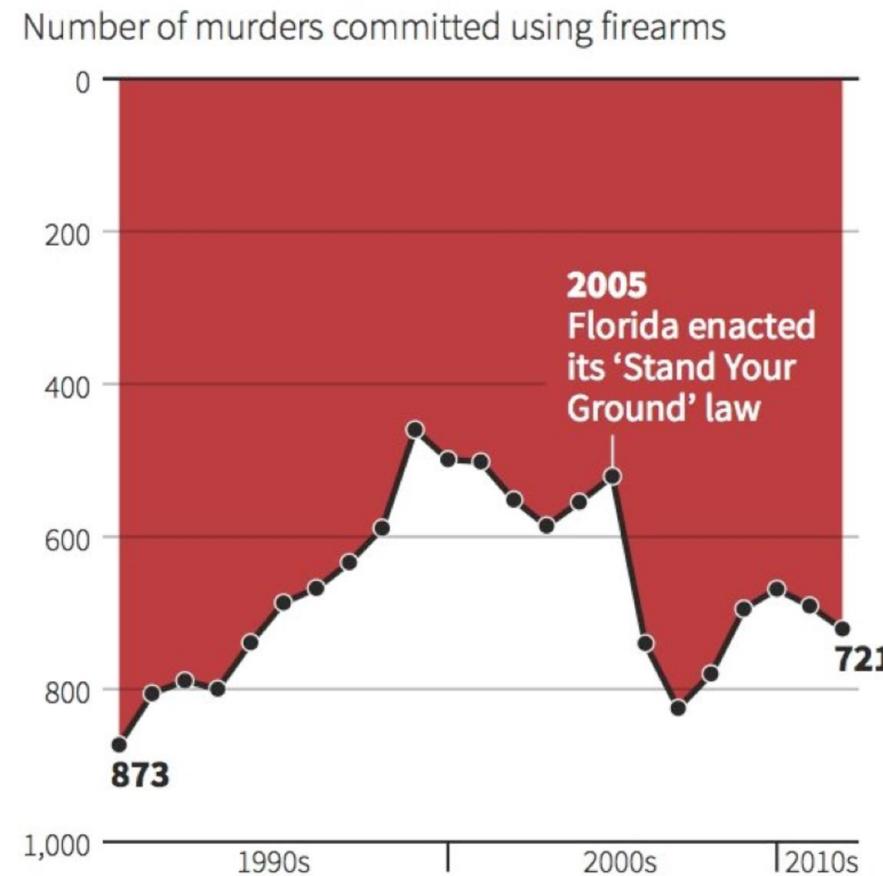


# Deze zagen we al...



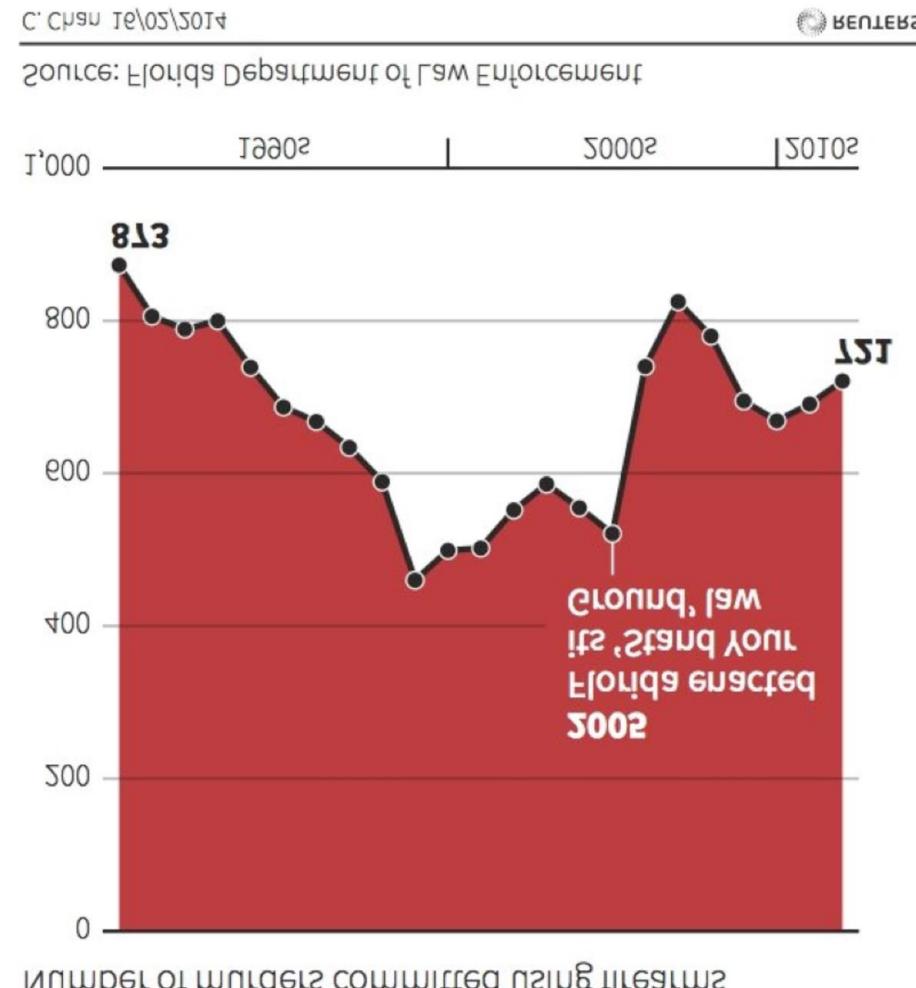
# Naar beneden betekent minder, of niet?

## Gun deaths in Florida



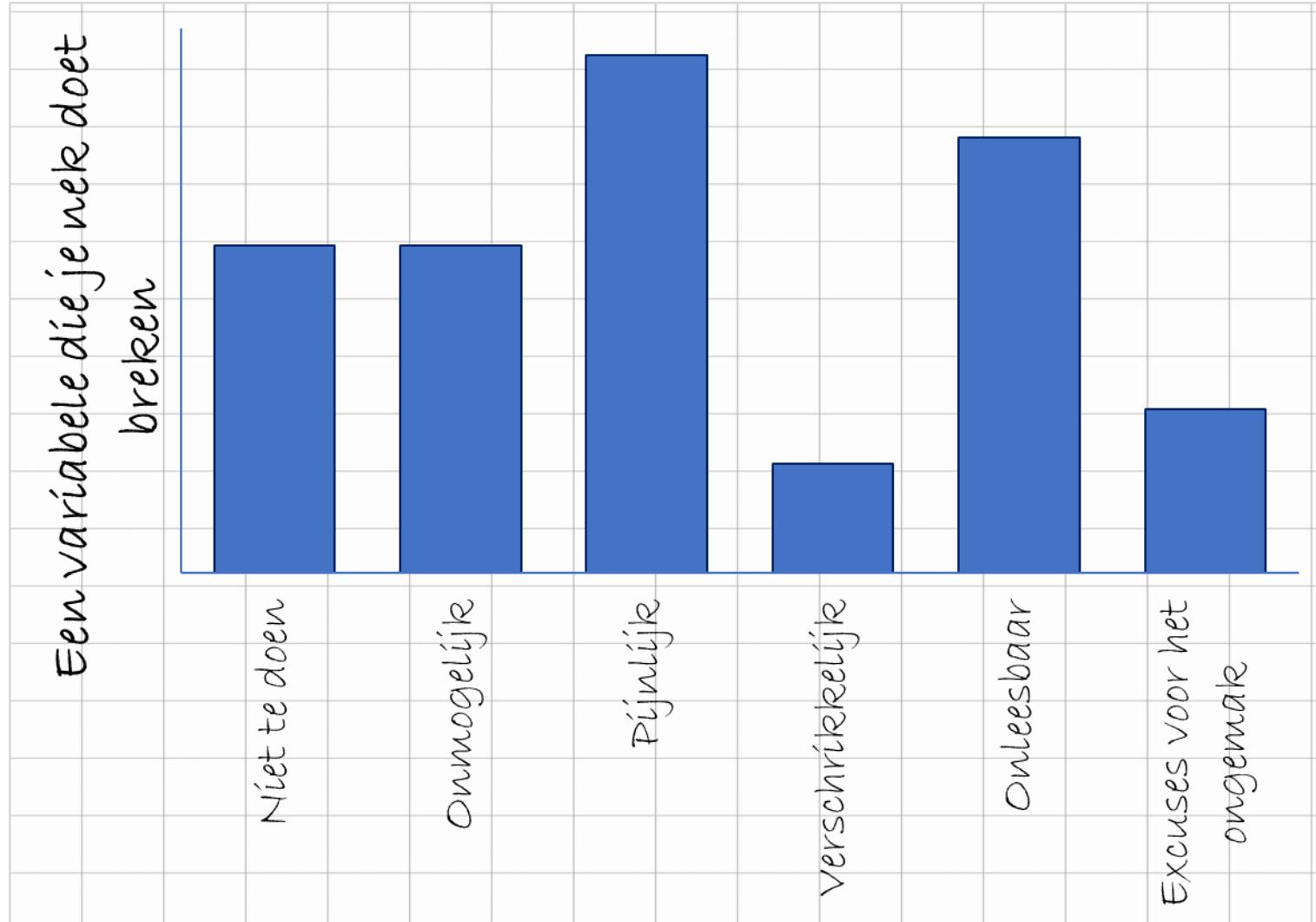
Source: Florida Department of Law Enforcement

# Naar beneden betekent minder, of niet?



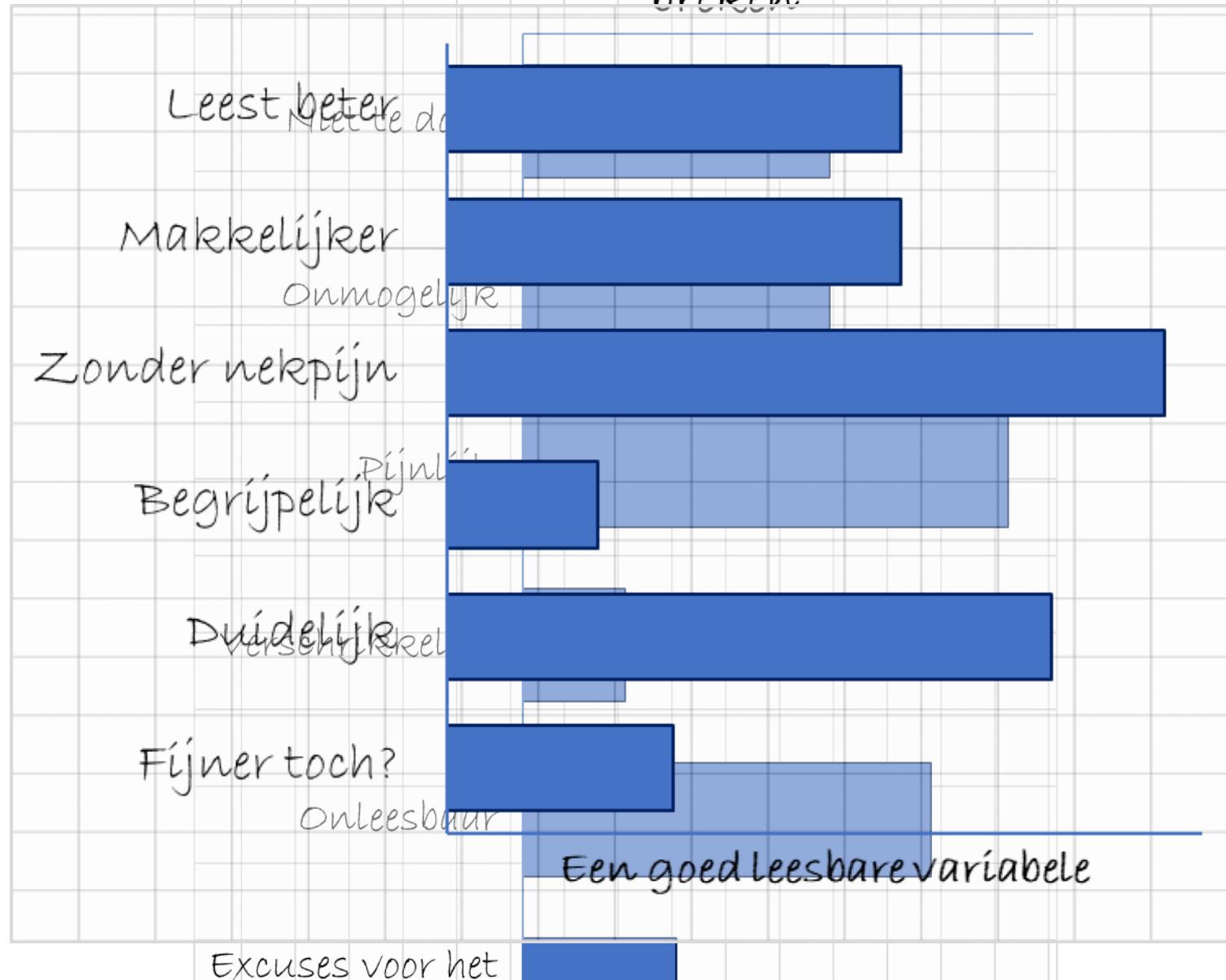
en deelt u in Florida

# Hoe is het om deze labels te lezen?

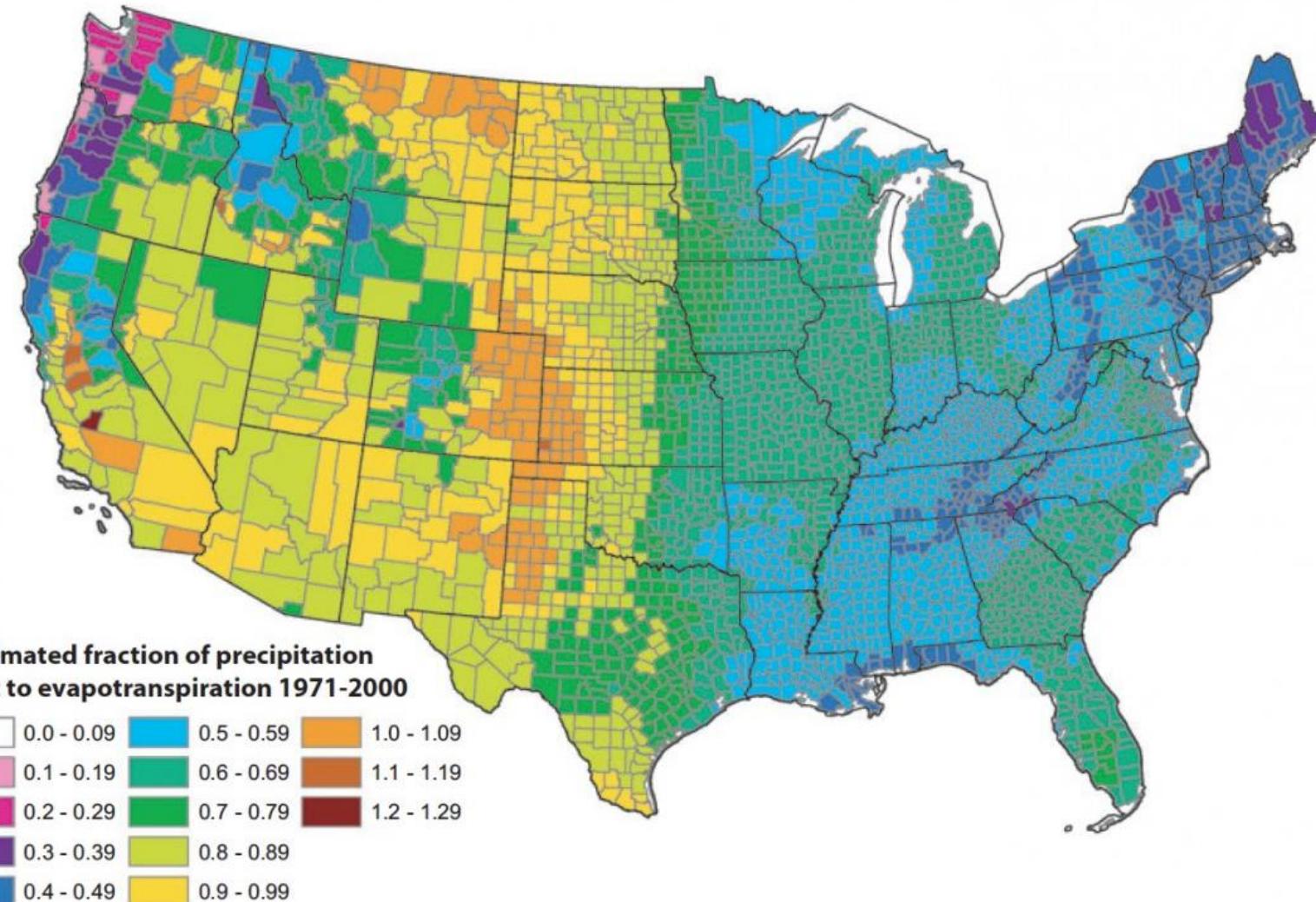


# Hoe is het om deze labels te lezen?

Een variabelenlabel die je niet doet  
breken.



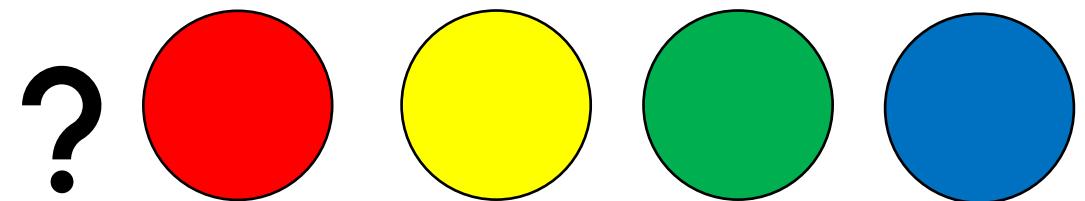
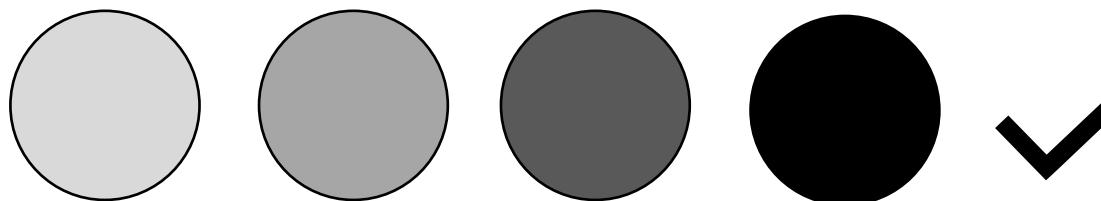
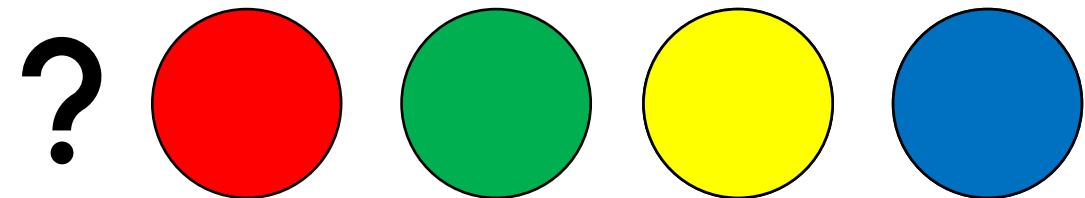
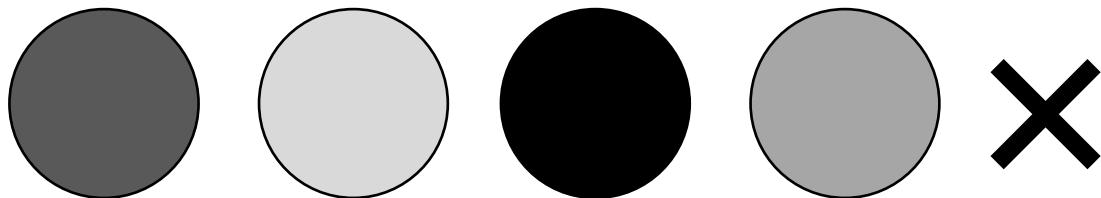
# Waar zijn we slecht in? Correct kwantificeren van kleur!



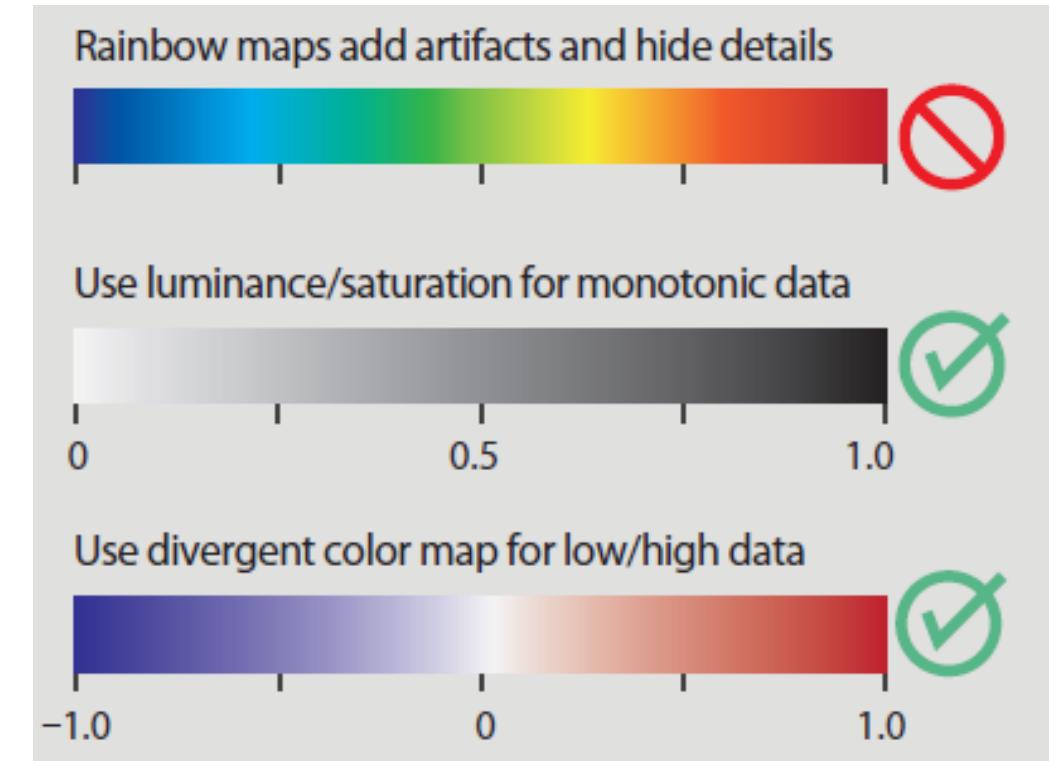
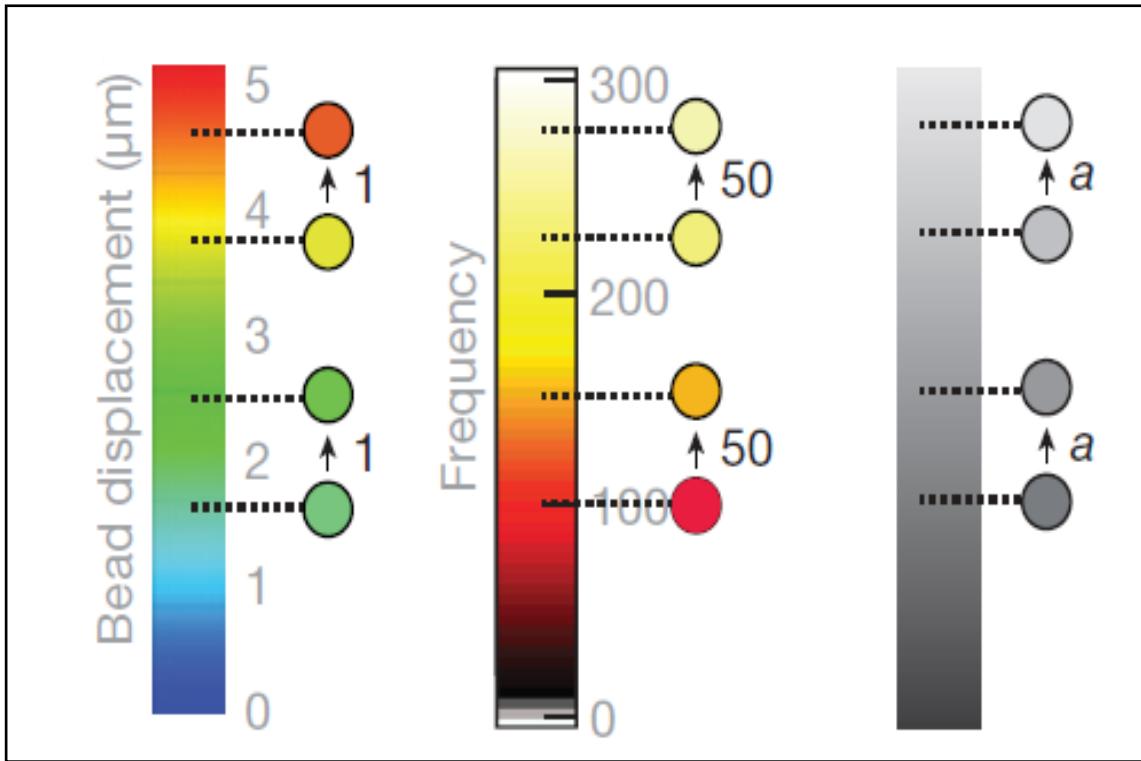
# Hoe plaats je de cirkels van laag naar hoog?



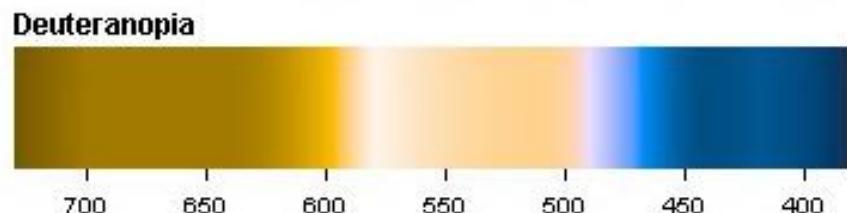
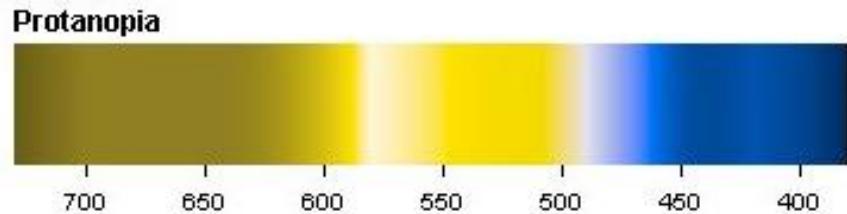
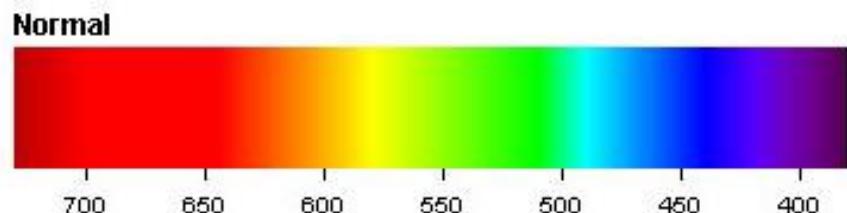
# Hoe plaats je de cirkels van laag naar hoog?



# Vermijd regenboogkleuren voor kwantitatieve data...

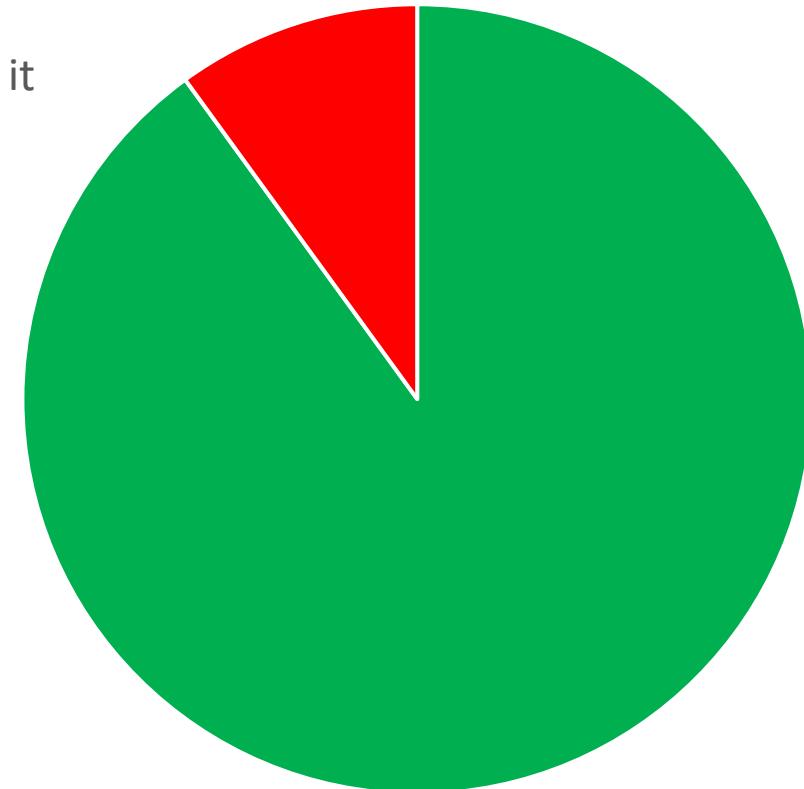


# Kleurenblindheid



Rood-groenkleurenblindheid bij mannen

- Don't have it
- Have it



# Kleurenblindheid



## Color Oracle

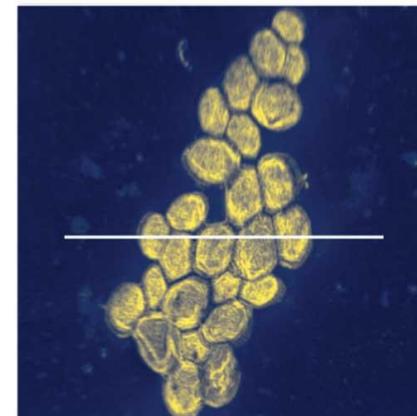
Design for the Color Impaired



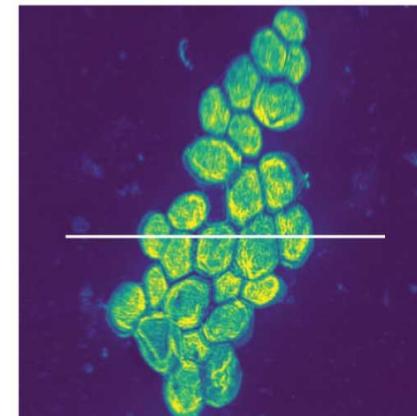
Color Oracle is a free color blindness simulator for Windows, Mac and Linux. It takes the guesswork out of designing for color blindness by showing you in real time what people with common color vision impairments will see.

Color Oracle applies a full screen color filter to art you are designing, independently of the software in use. Eight percent of all males are affected by color vision impairment – make sure that your graphical work is readable by the widest possible audience.

Cividis



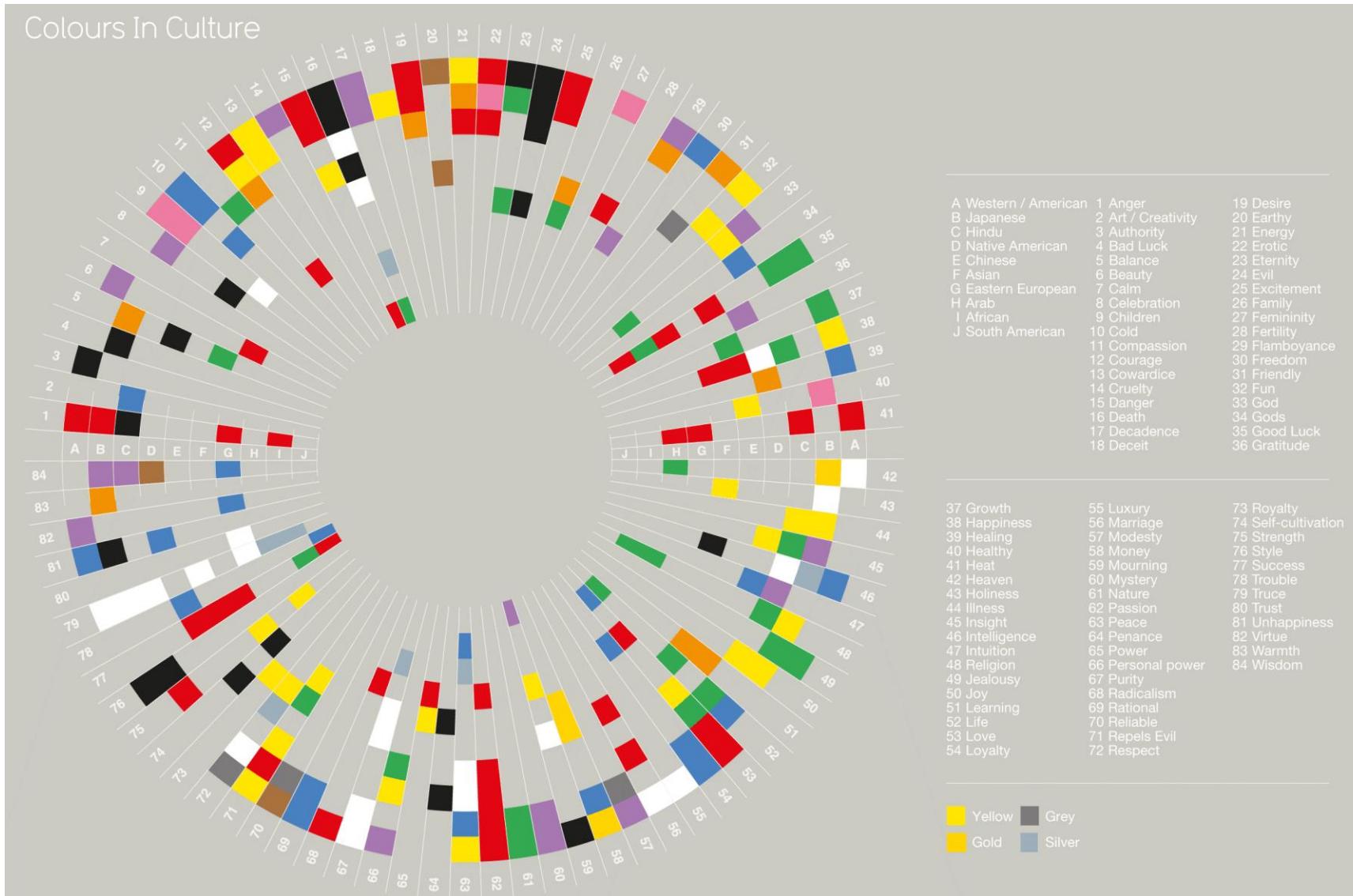
Viridis



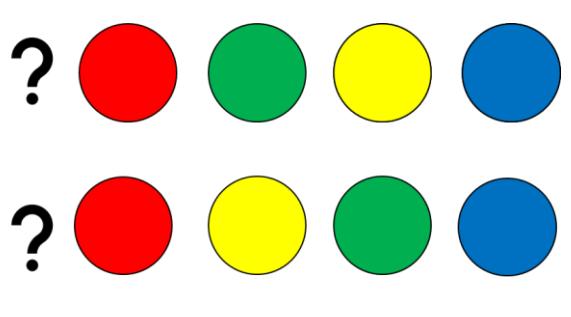
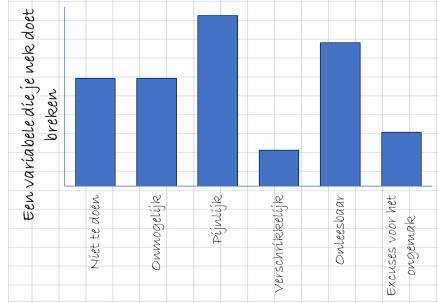
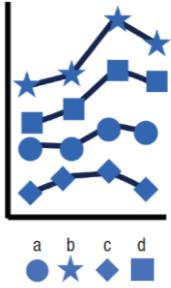
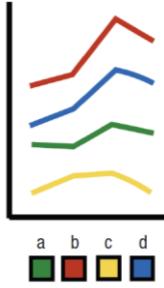
# Tenslotte: Wees je bewust dat we kleuren associëren met gevoelens



# Deze associaties verschillen per cultuur



# Waar zijn we **slecht** in?



1.

Korte-termijn geheugen  
gebruiken

2.

Teveel informatie  
tegelijkertijd verwerken

3.

Tegen de natuurlijke flow  
ingaan

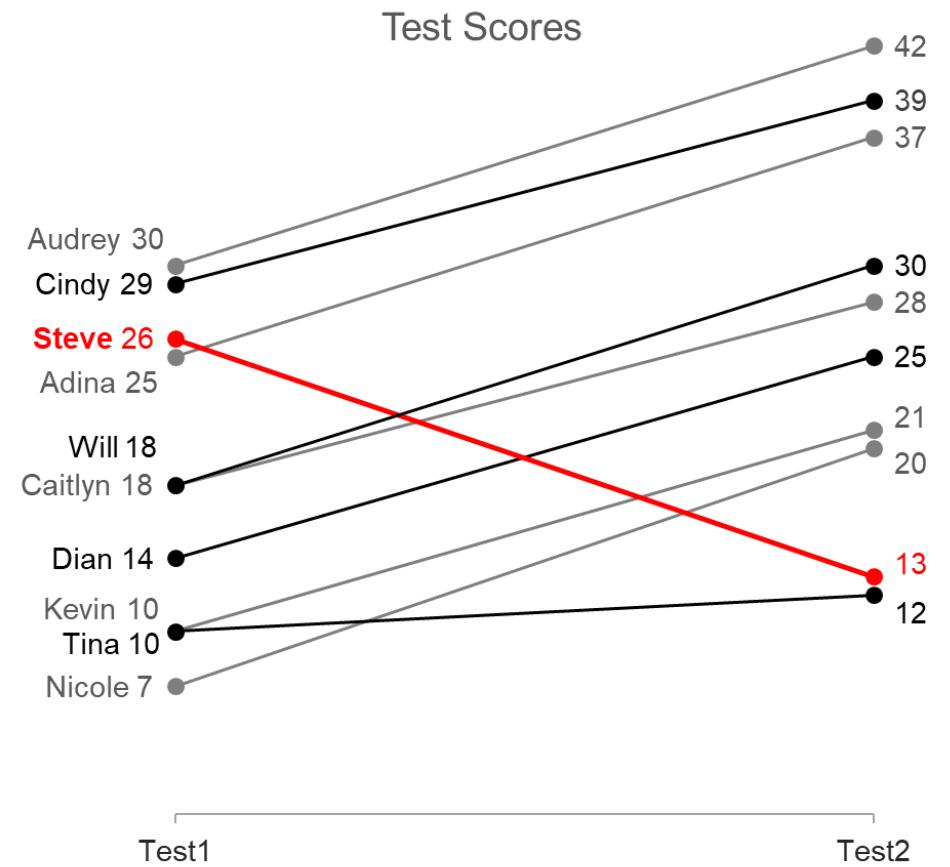
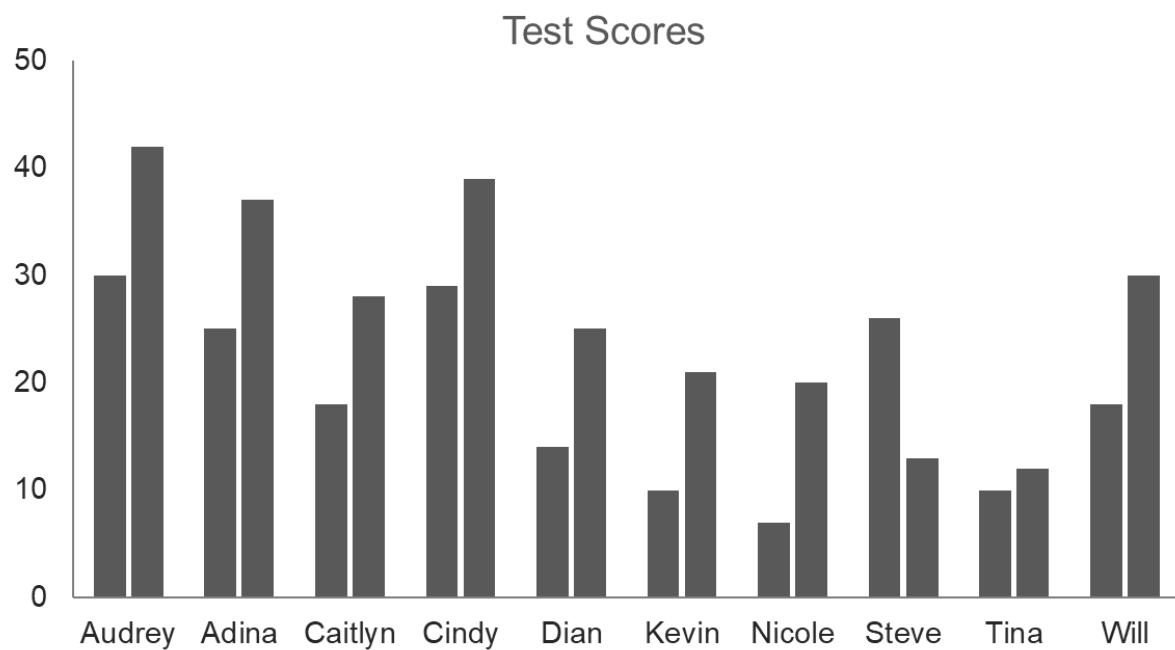
4.

Correct kwantificeren van  
kleur

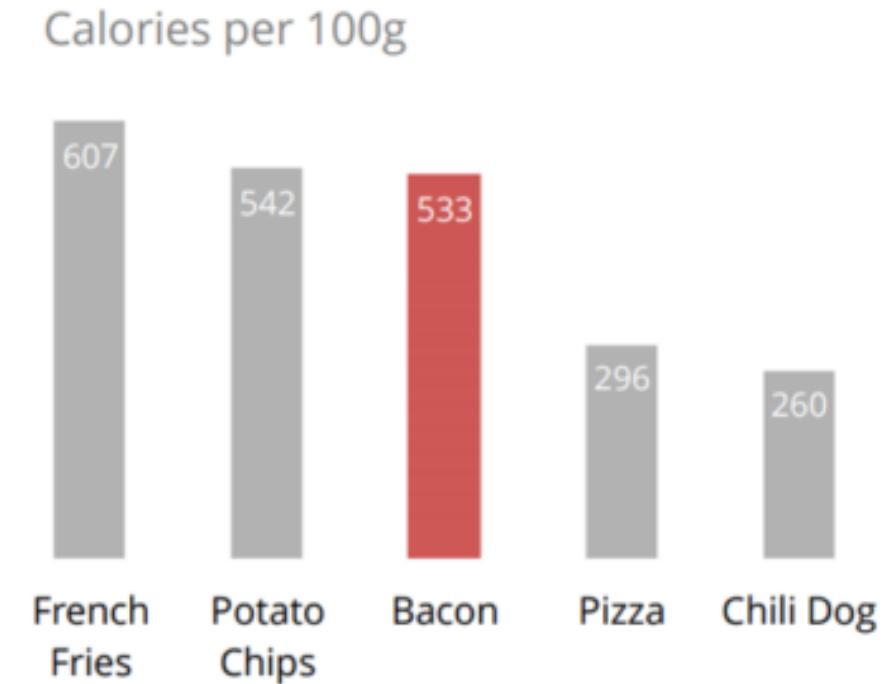
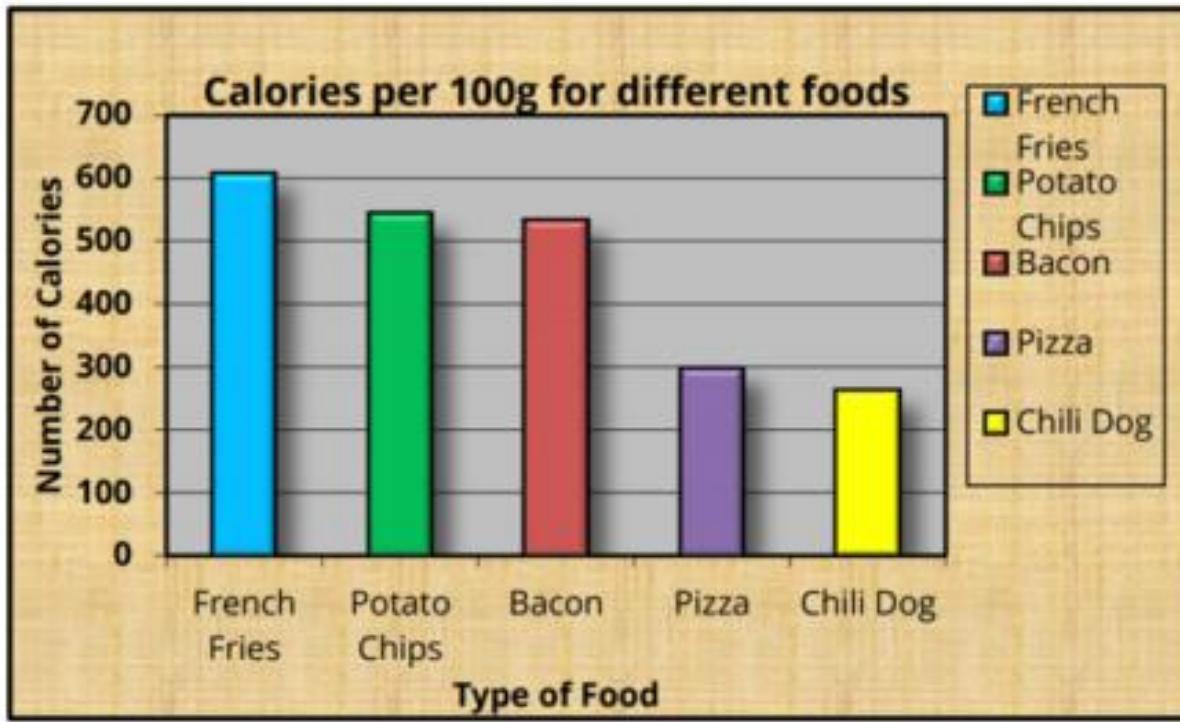
# 5 vereisten voor een effectieve visualisatie

1.  **Eenvoudig**
2.  **Helder**
3.  **Duidelijk**
4.  **Intuitief**
5.  **Toegankelijk**

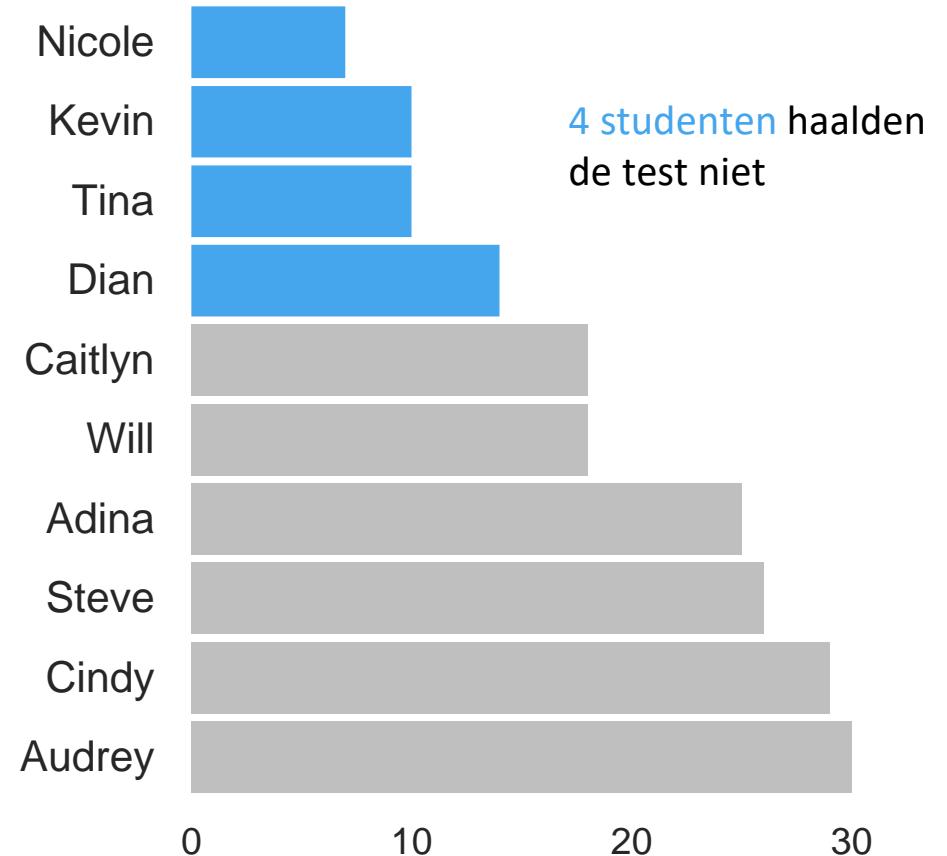
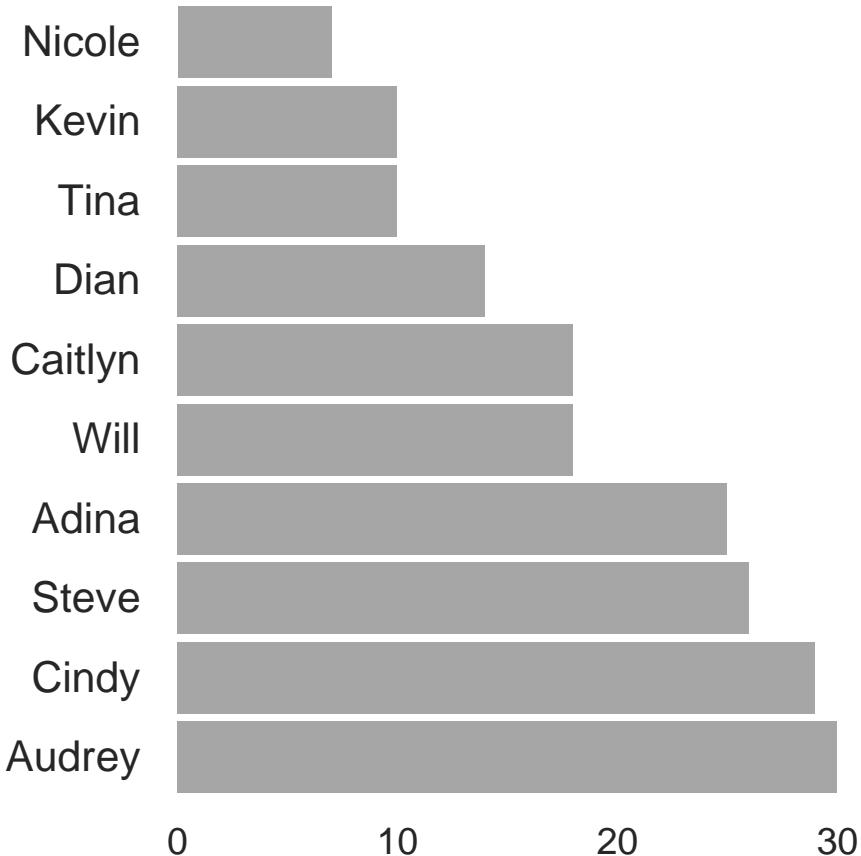
# 1. Eenvoudig: zorg voor directe vergelijkingen



## 2. Helder: verwijder onnodige elementen

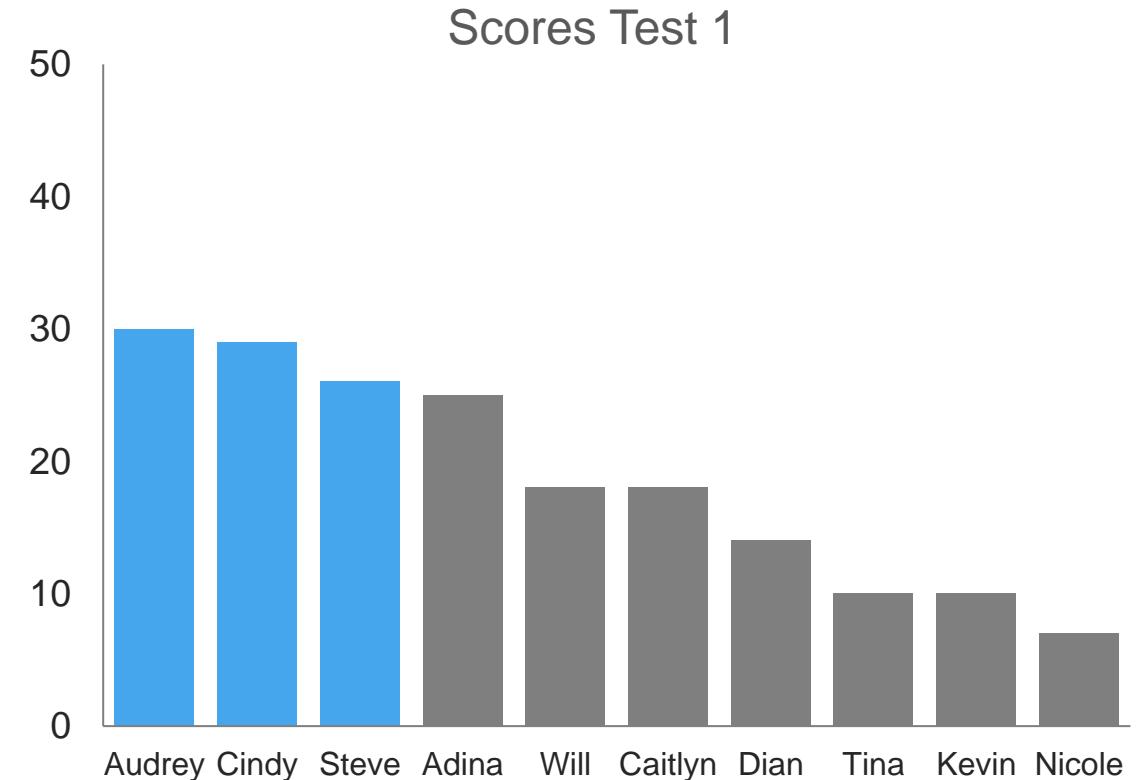
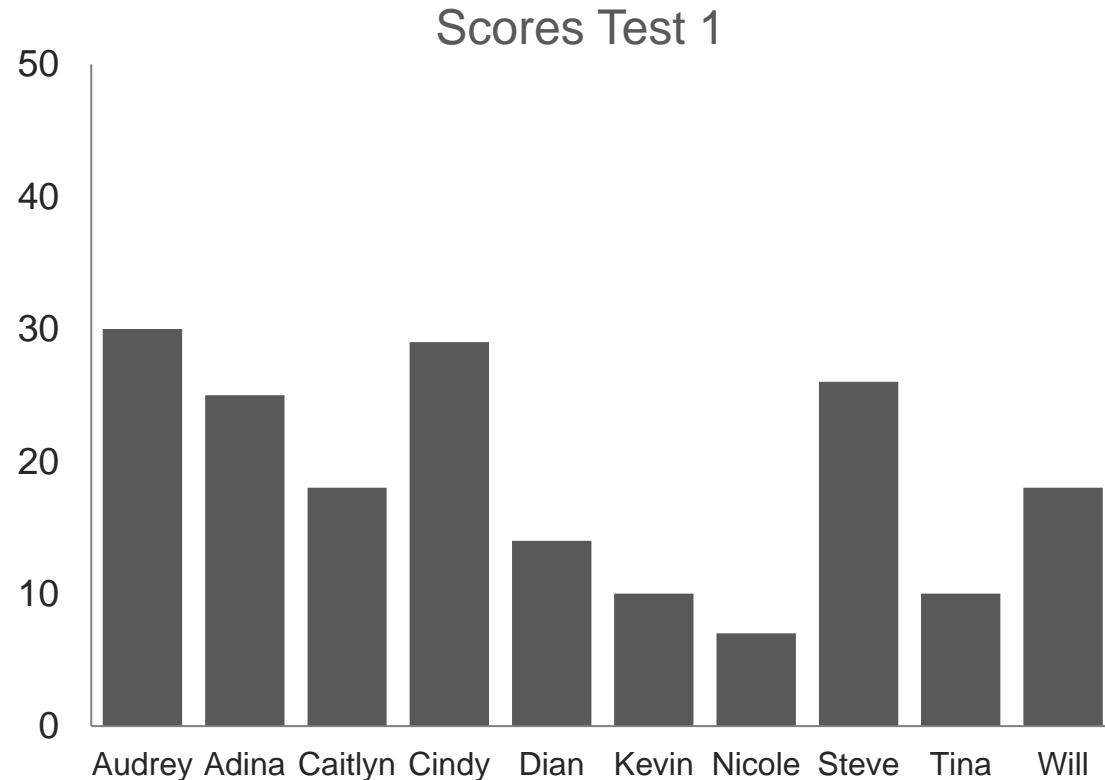


### 3. Duidelijk: benadruk wat belangrijk is

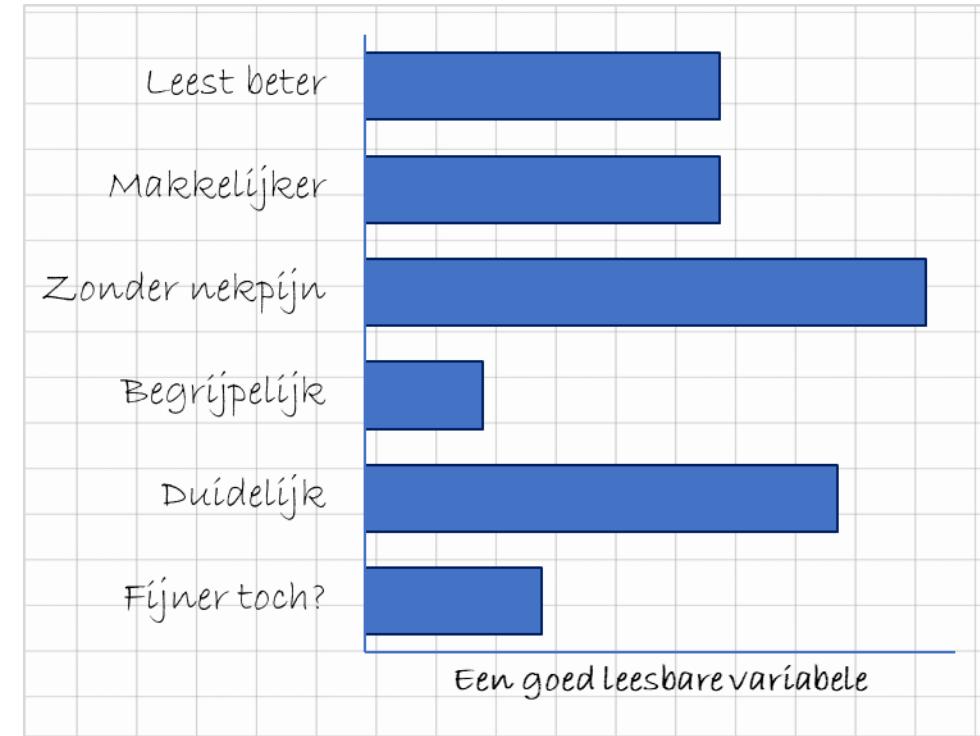
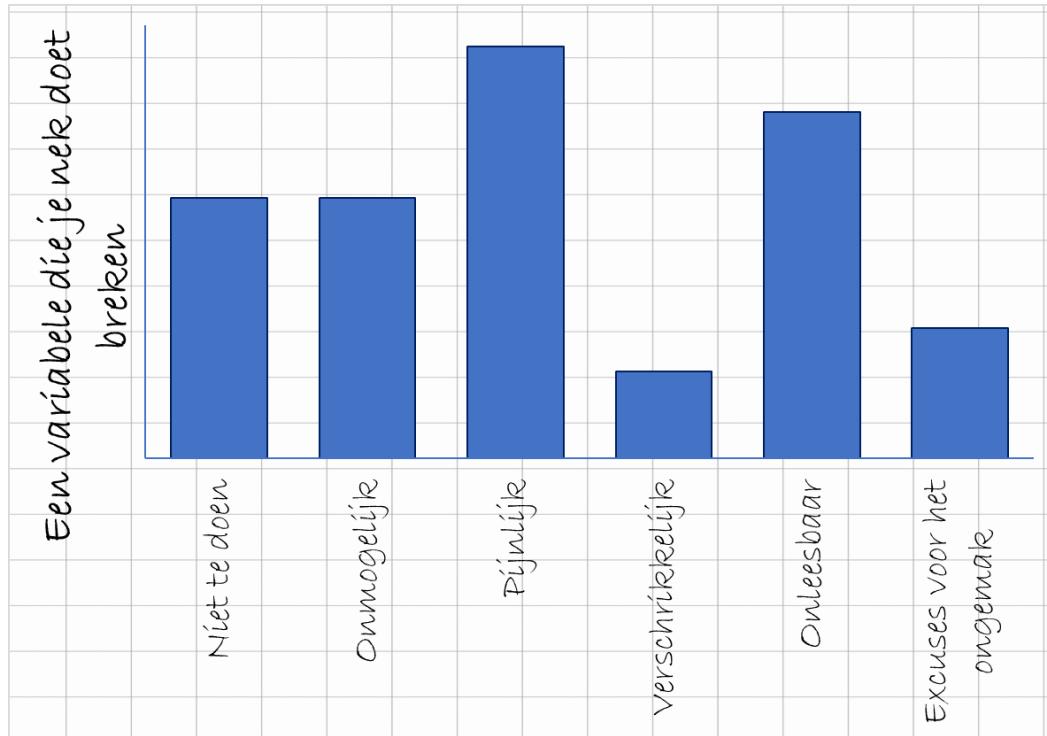


# 4. Intuïtief: volg een natuurlijke flow

Wie zijn de beste 3 studenten?



# 5. Toegankelijk: Denk aan leesbaarheid en gekozen kleuren



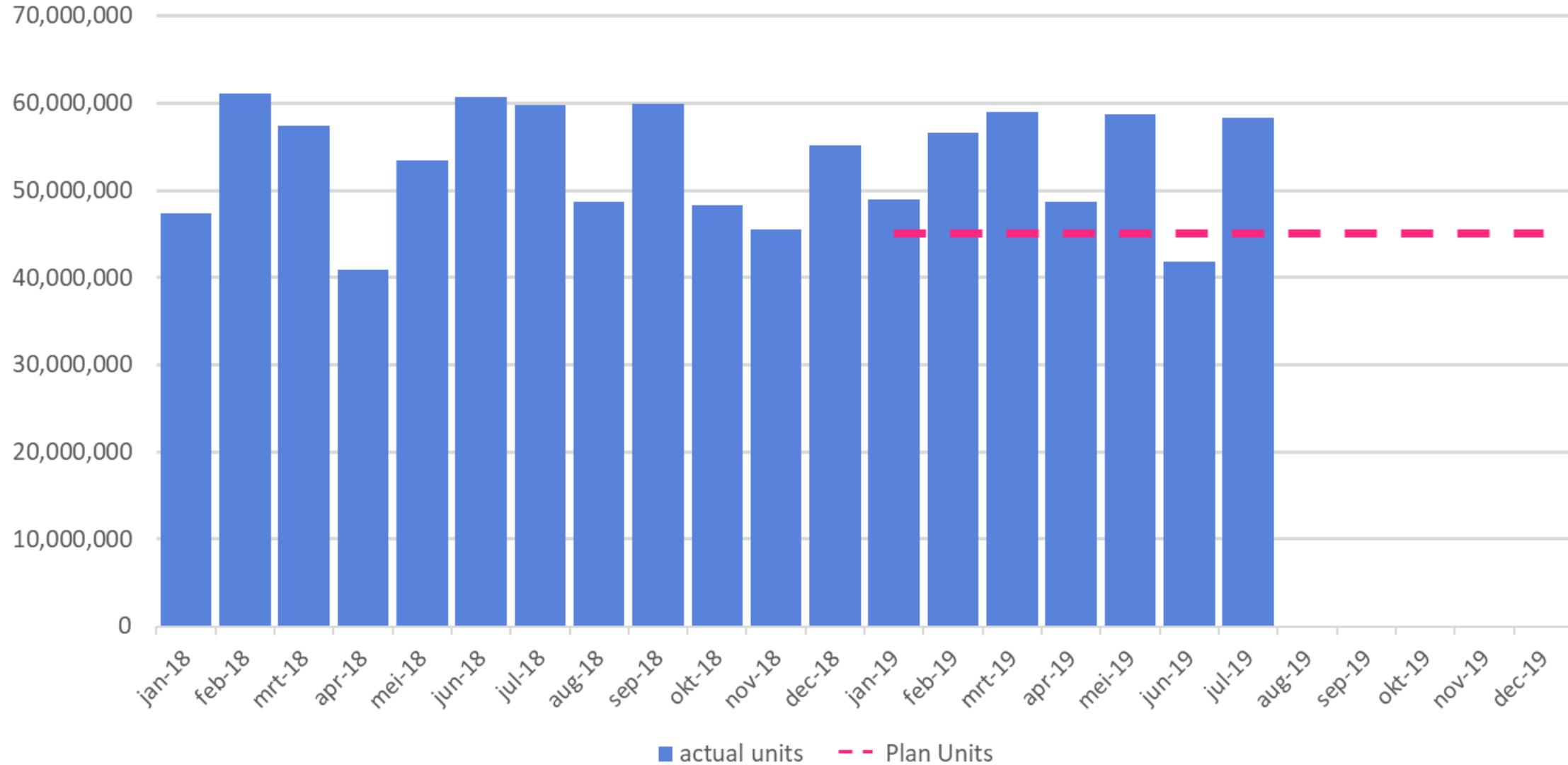
# Oefening: Make-over

- Eenvoudig:** Moet de lezer rekenen, iets onthouden of zoeken?
  - Is het gekozen grafiektype de beste manier om de boodschap weer te geven?
  - Kunnen labels/legenda direct naast de data geplaatst worden?
- Helder:** Zijn er onnodige of herhaalde elementen?

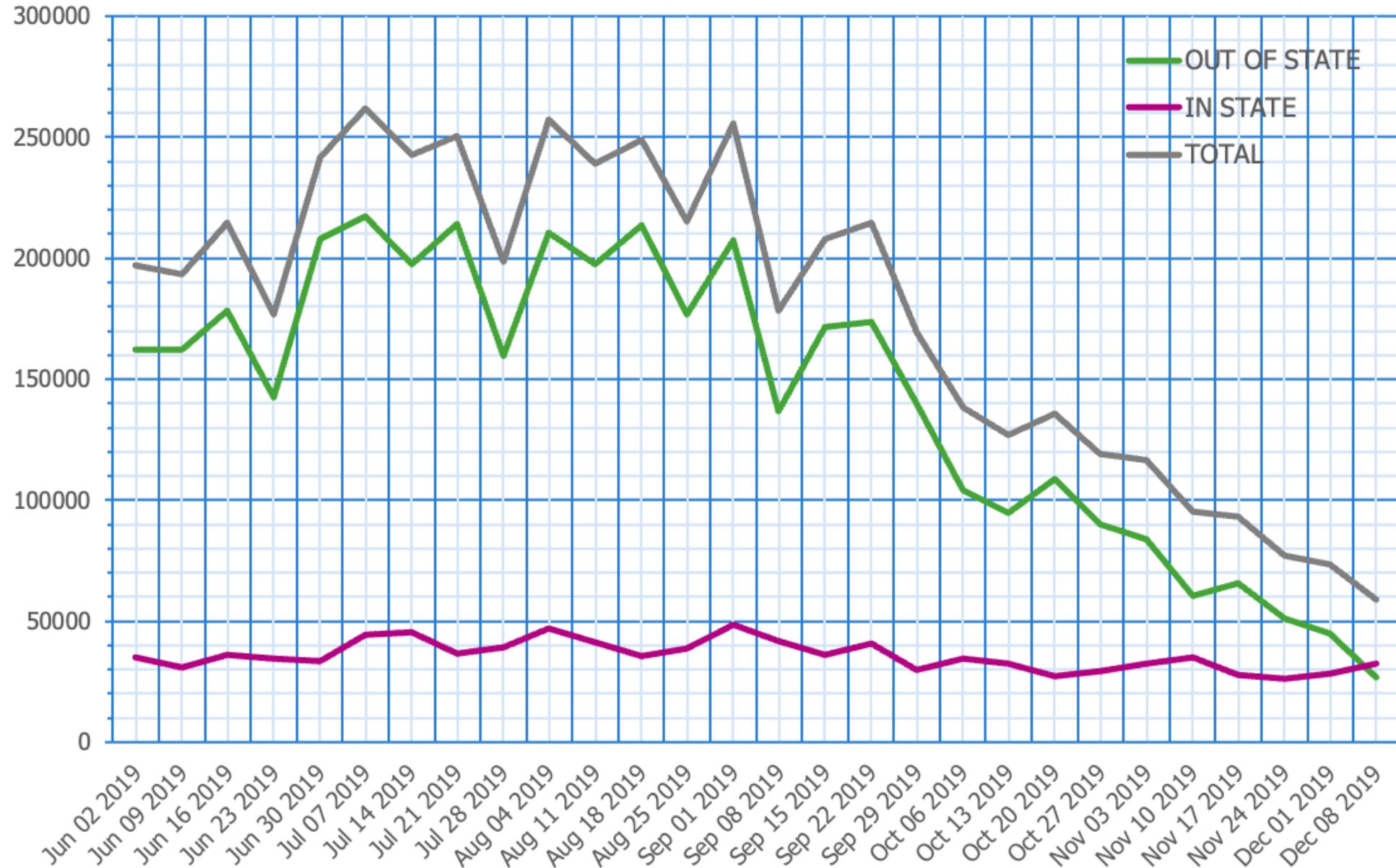
*Denk aan randen (om de gehele grafiek, om de figuur, om elementen), lijnen (rasterlijnen, assen, maatstreeppjes), kleuren, getallen, labels, versieringen etc.*

  - Wat kan weg?
  - Wat kan minder?
- Duidelijk:** Komt de boodschap over? Weet de lezer waar te kijken?
  - Is de titel beschrijvend? Kun je een betere (onder-)titel bedenken?
  - Kun je de boodschap benadrukken door pre-attentieve eigenschappen (bv. kleur, omsluiting)?
  - Kunnen labels of annotaties de lezer helpen om de boodschap te begrijpen?
- Intuïtief:** Volgen de figuur en tekst de natuurlijke leesrichting?
  - Leest de figuur van links-naar-rechts en van boven-naar-beneden?
  - Staan de data in een logische volgorde?
- Toegankelijk:** Kan iedereen de visualisatie begrijpen?
  - Is alle tekst leesbaar (lettergrootte, uitlijning, leesrichting)?
  - Zijn de kleuren goed gekozen (kleurenblindvriendelijk, geschikt voor zwart-wit print, passend bij de boodschap)?

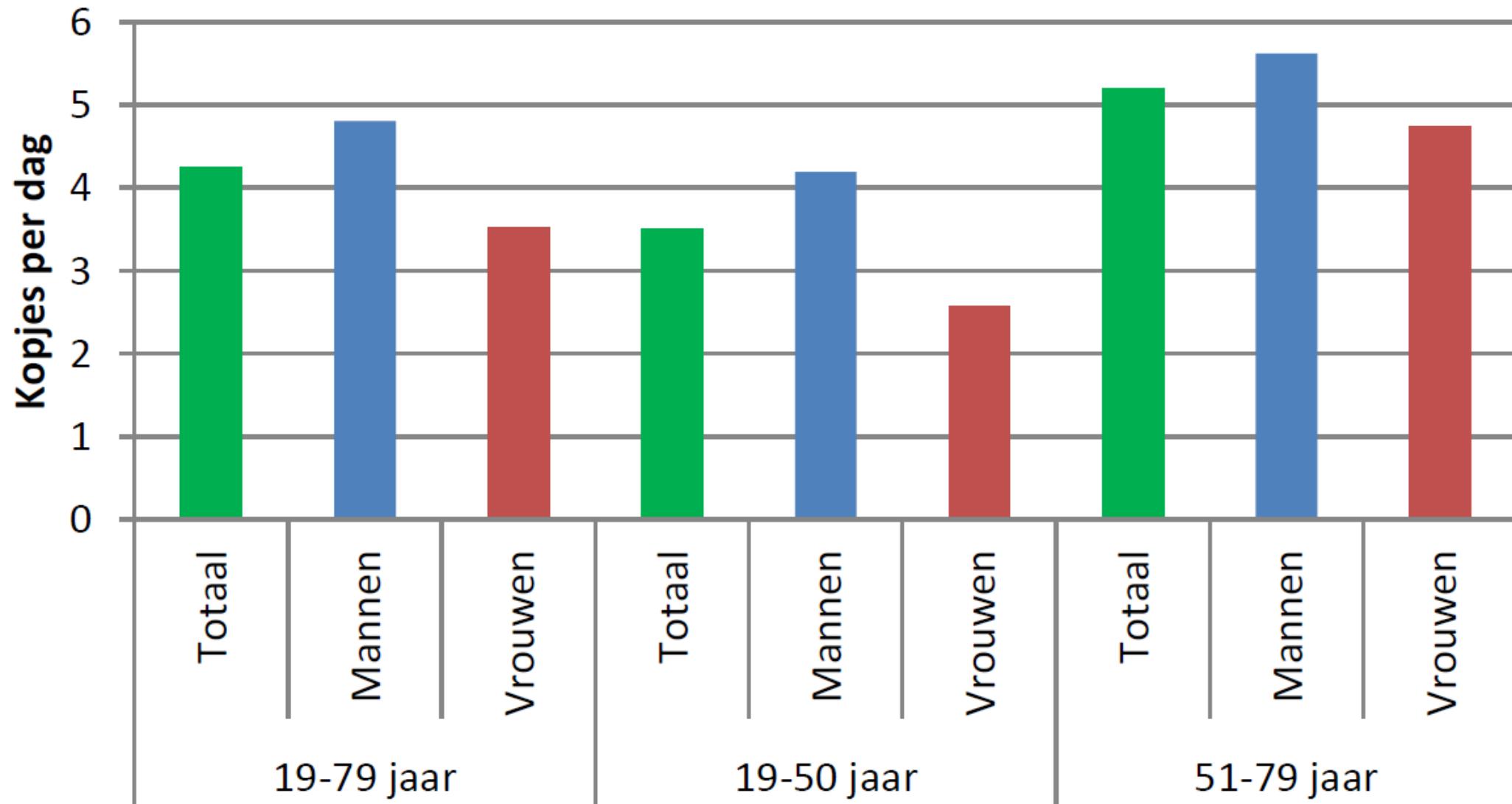
## PRIMARY PRODUCT Units



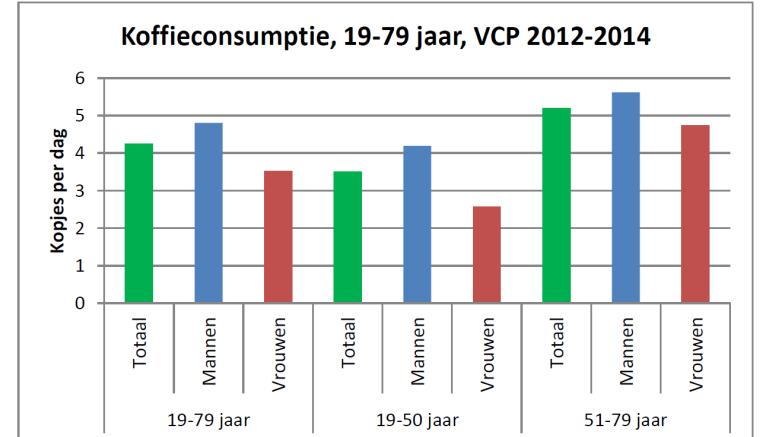
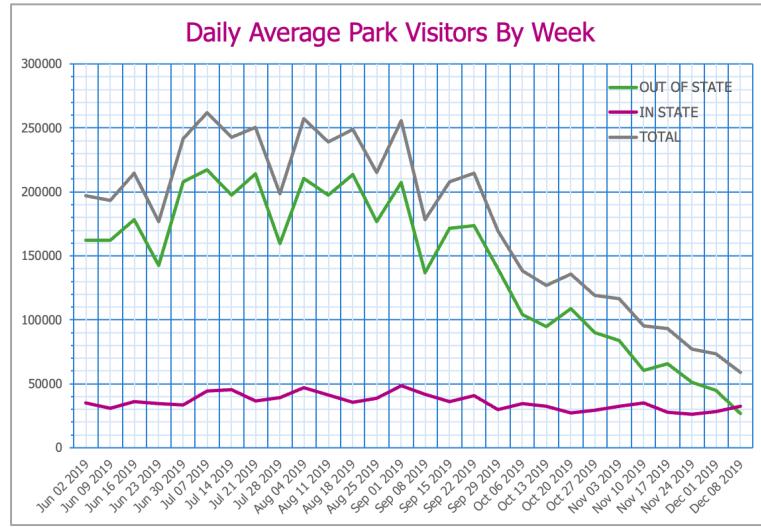
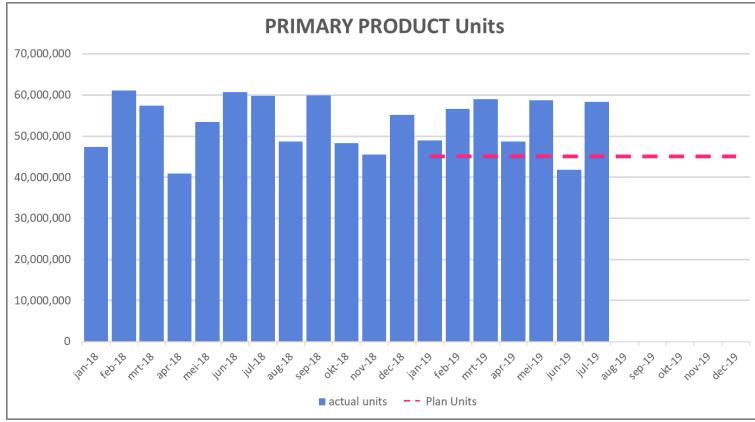
# Daily Average Park Visitors By Week



# Koffieconsumptie, 19-79 jaar, VCP 2012-2014

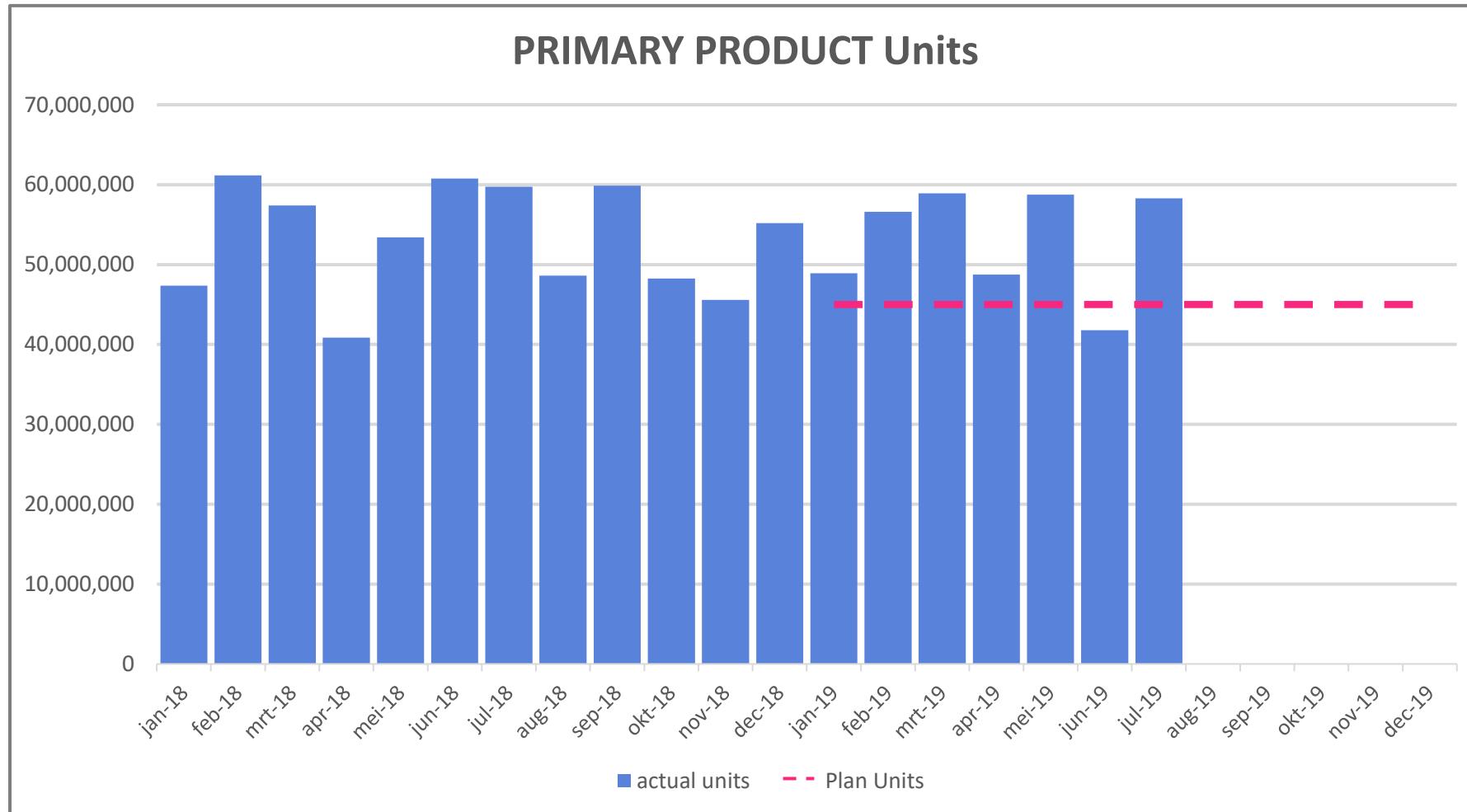


# Zien, verwonderen en verbeteren



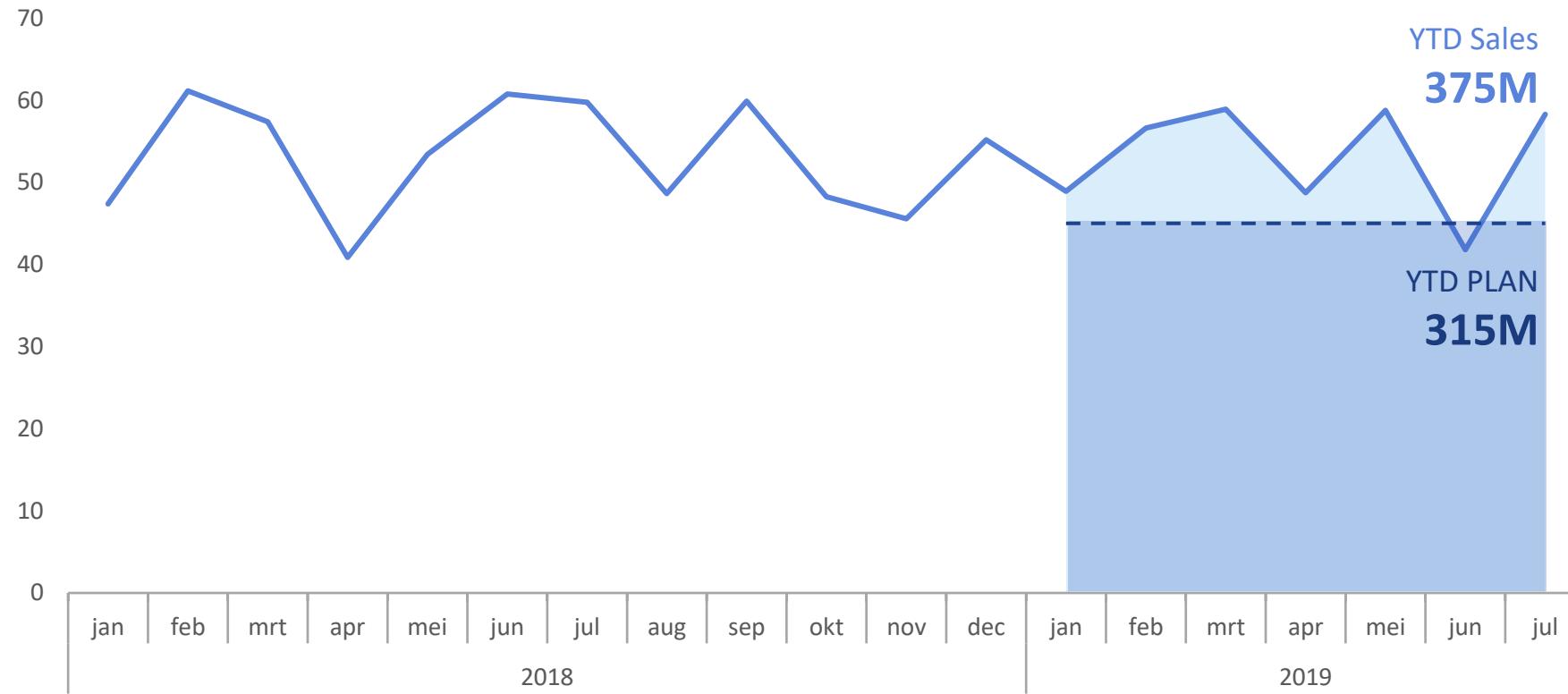
10 min



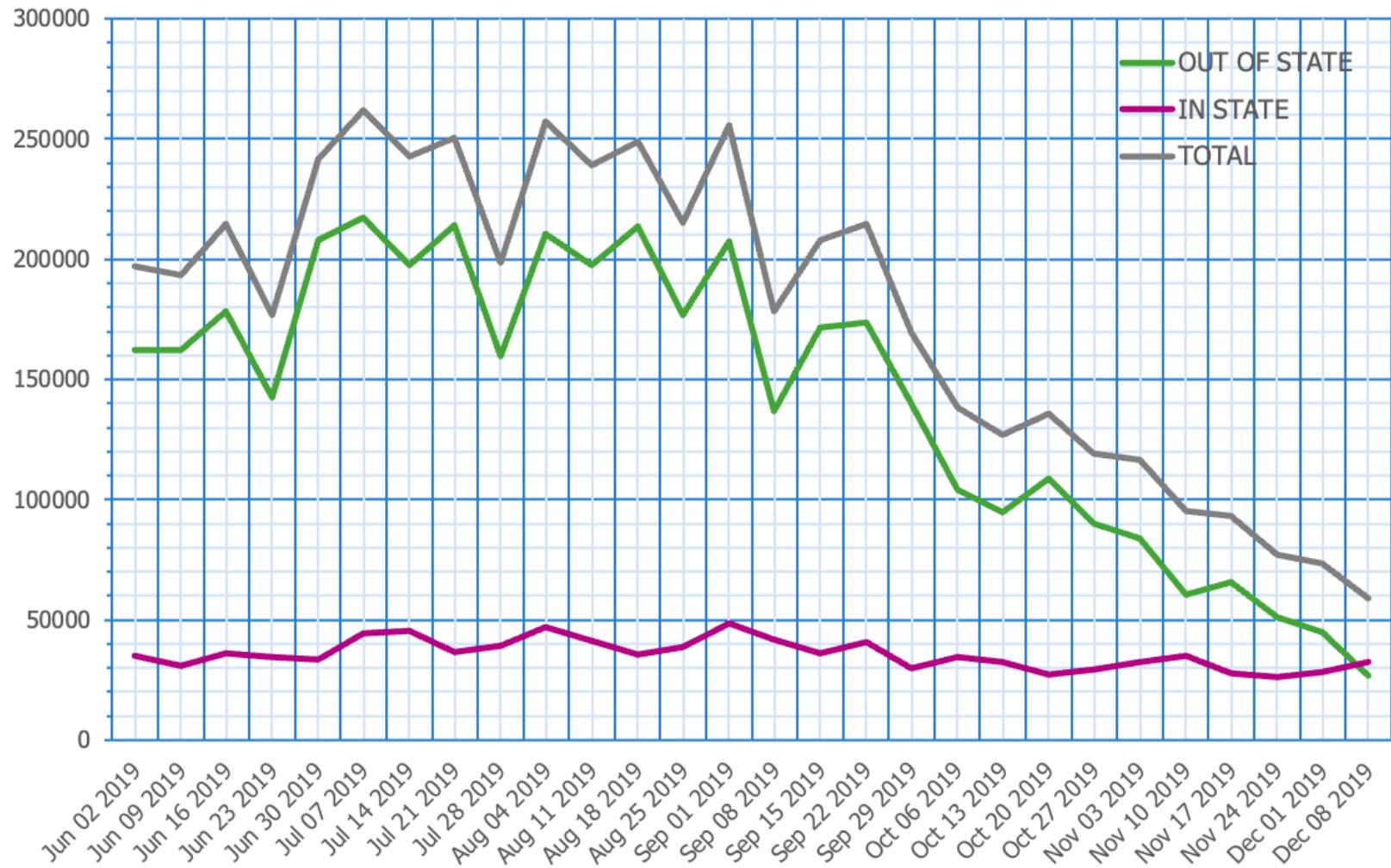


**PRIMARY PRODUCT: unit sales exceed plan by nearly 20% year to date**

Millions of Units

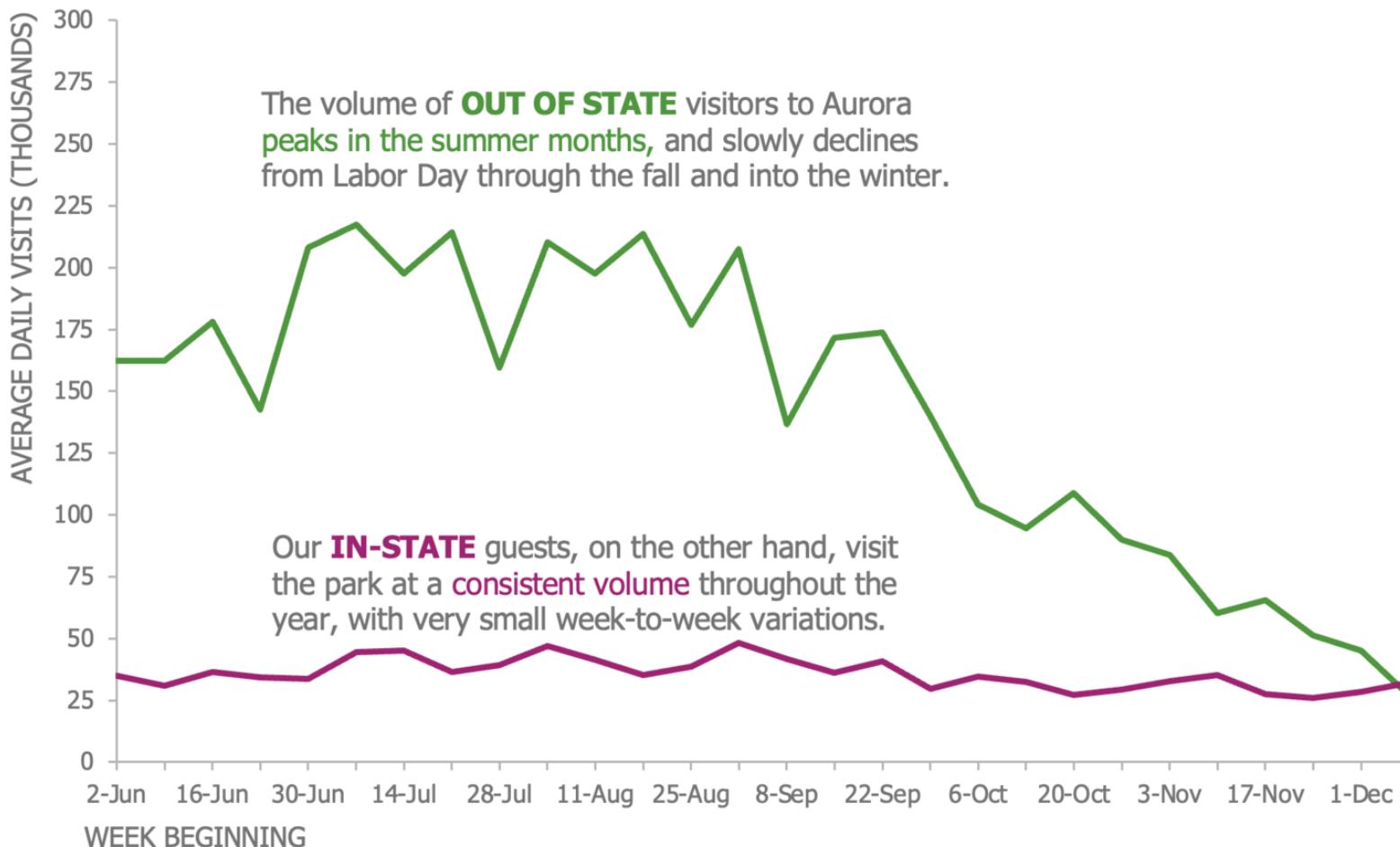


## Daily Average Park Visitors By Week



# Daily visitors to Aurora Park in summer/fall 2019

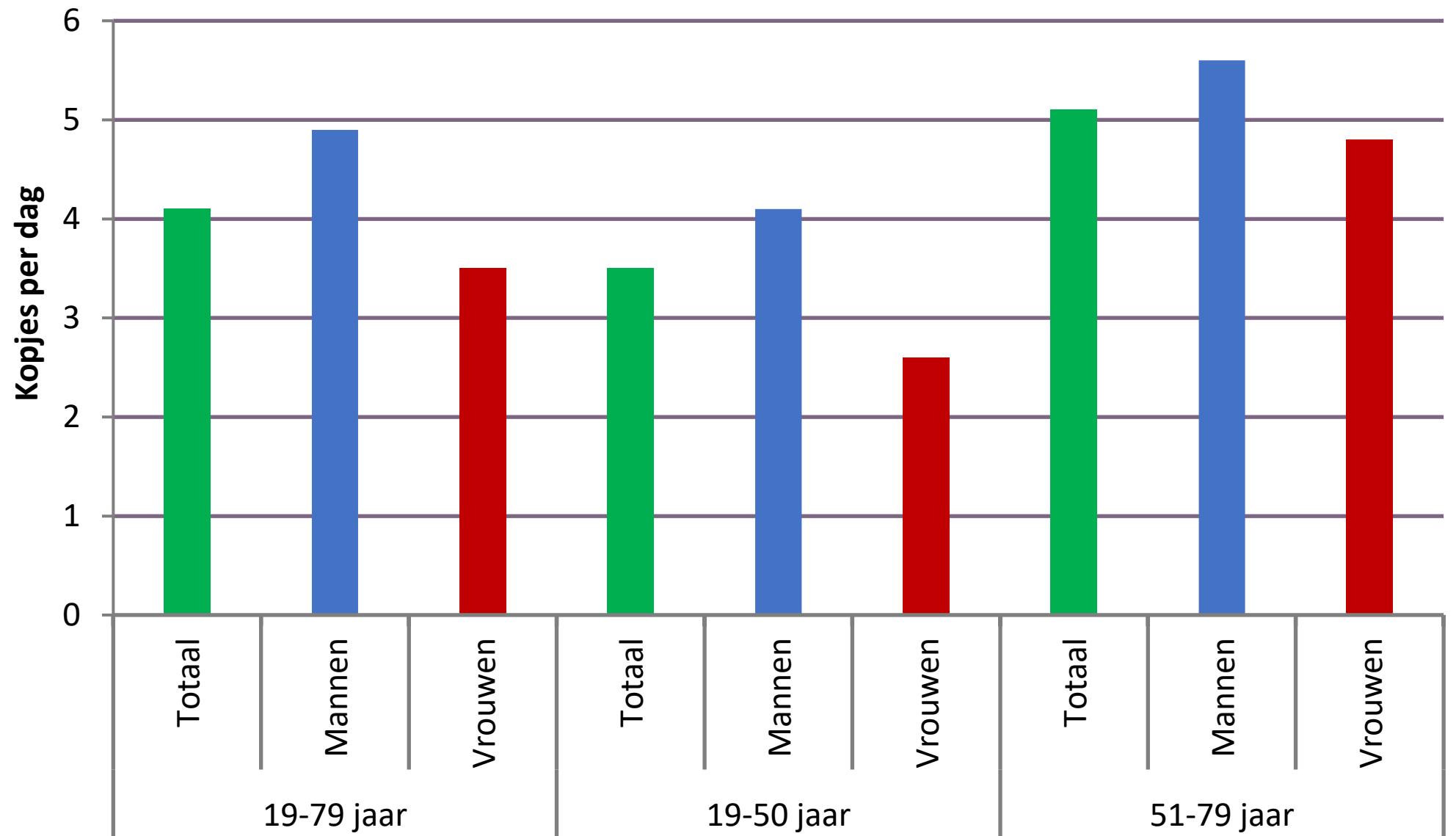
VALUES ARE CALCULATED WEEKLY AS A 7-DAY AVERAGE



The volume of **OUT OF STATE** visitors to Aurora peaks in the summer months, and slowly declines from Labor Day through the fall and into the winter.

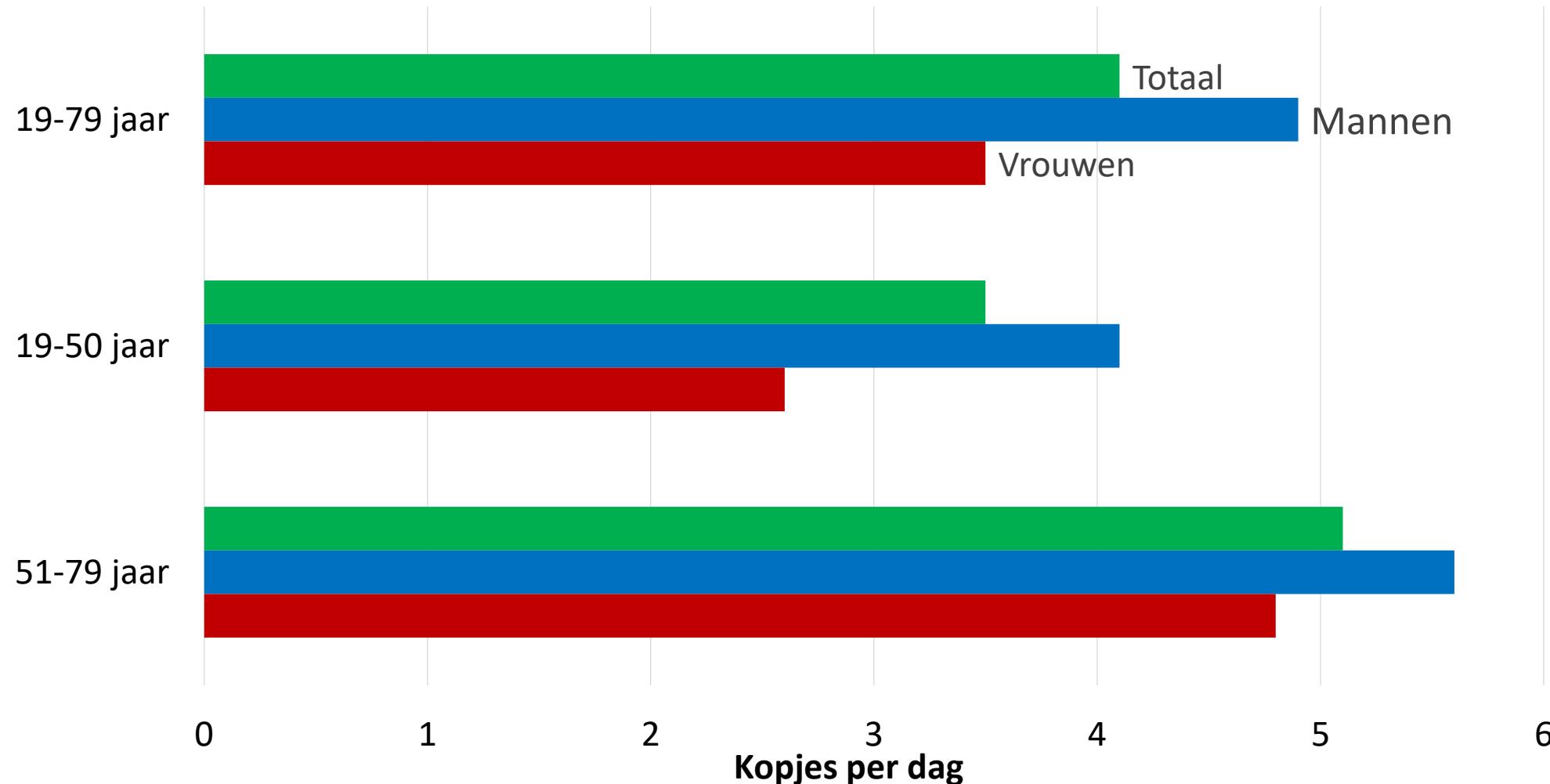
Our **IN-STATE** guests, on the other hand, visit the park at a **consistent volume** throughout the year, with very small week-to-week variations.

## Koffieconsumptie, 19-79 jaar, VCP 2012-2014



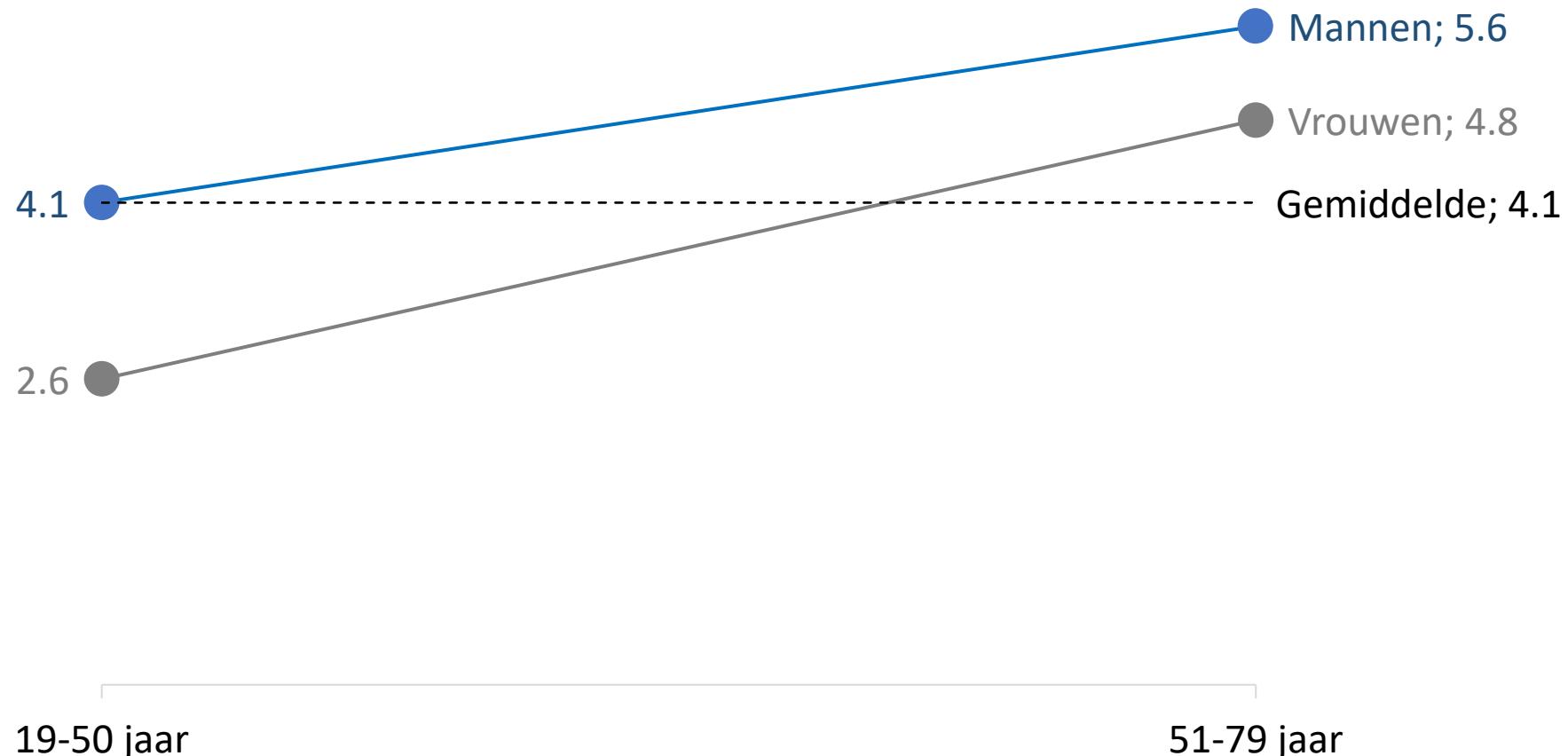
# Vergelijk per leeftijdsgroep?

Koffieconsumptie, 19-79 jaar, VCP 2012-2014



# De koffieconsumptie voor volwassenen tussen 19-79 jaar (in aantal kopjes per dag)

Mannen drinken meer koffie dan vrouwen en het drinken van koffie neemt toe met de leeftijd





De kracht van het verhaal

# Data, beeld én verhaal

*“Maybe stories are just data with a soul.”* – Brené Brown.

# “Maybe stories are just data with a soul.”

DATA



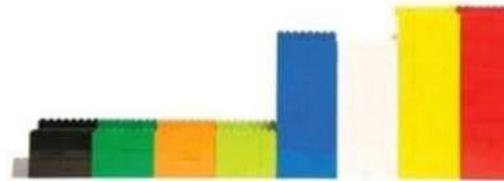
SORTED



ARRANGED



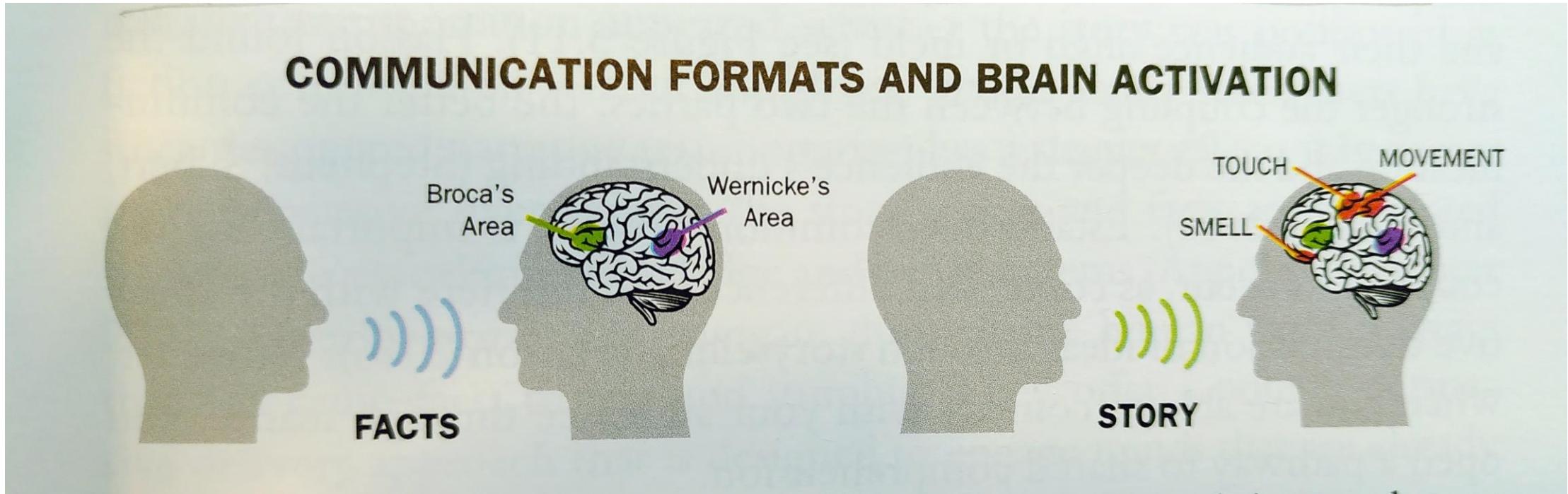
PRESENTED VISUALLY



EXPLAINED WITH A STORY



# We horen feiten, maar we voelen verhalen



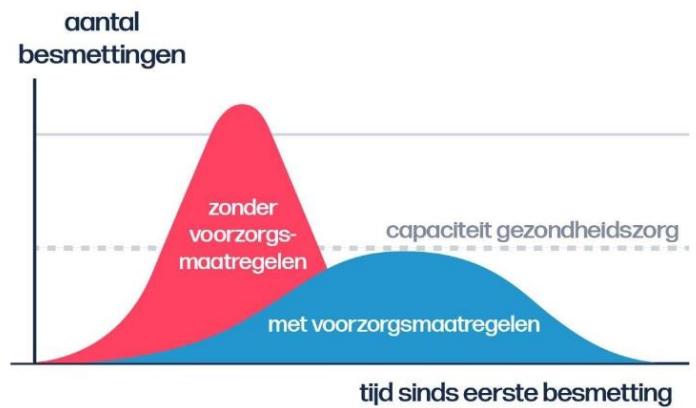
Lieke schopte tegen de bal

De huid van zijn handen voelde *als leer*

Ik opende een *vers pak koffie*

# De vier soorten visualisaties...

## Idea illustration

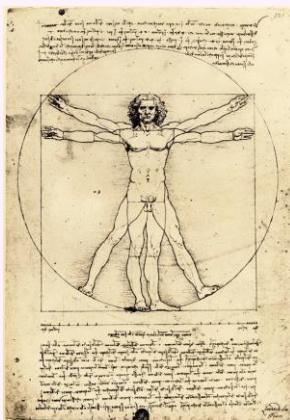


# BEWEREN

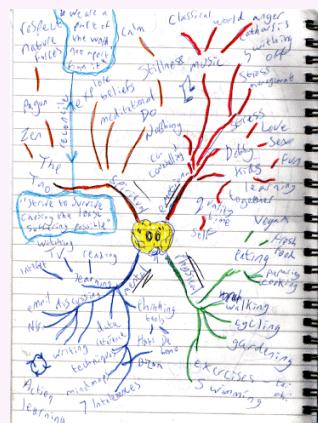


# *'Everyday' DataViz*

## Idea generation



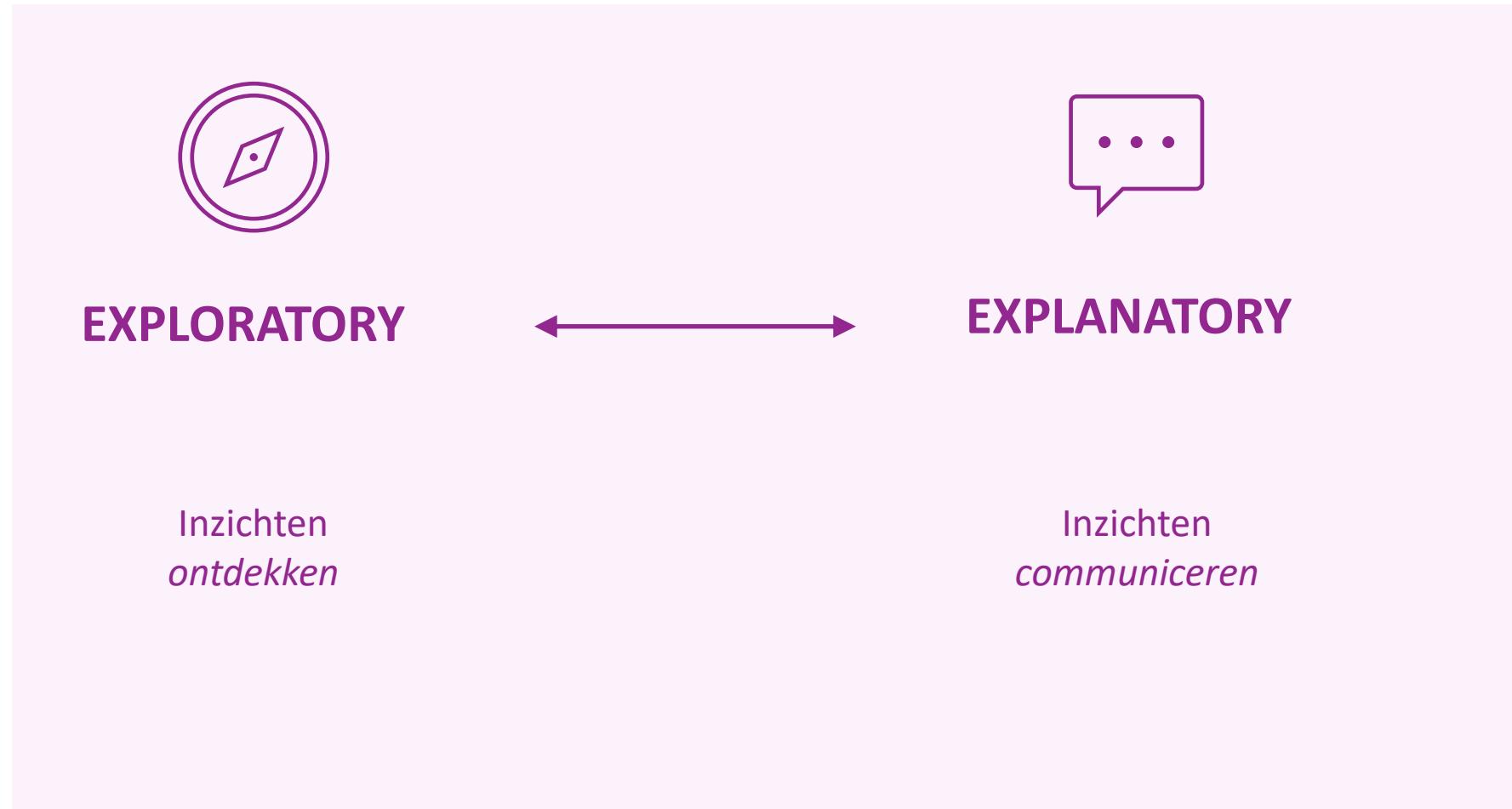
# CONCEPTUEEL



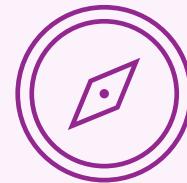
# ONTDEKKEN

## *Visual discovery*

# Visualisaties voor ontdekken en communiceren zijn *niet* hetzelfde!



# Visualisaties voor ontdekken en communiceren zijn *niet* hetzelfde!



**EXPLORATORY**



**EXPLANATORY**

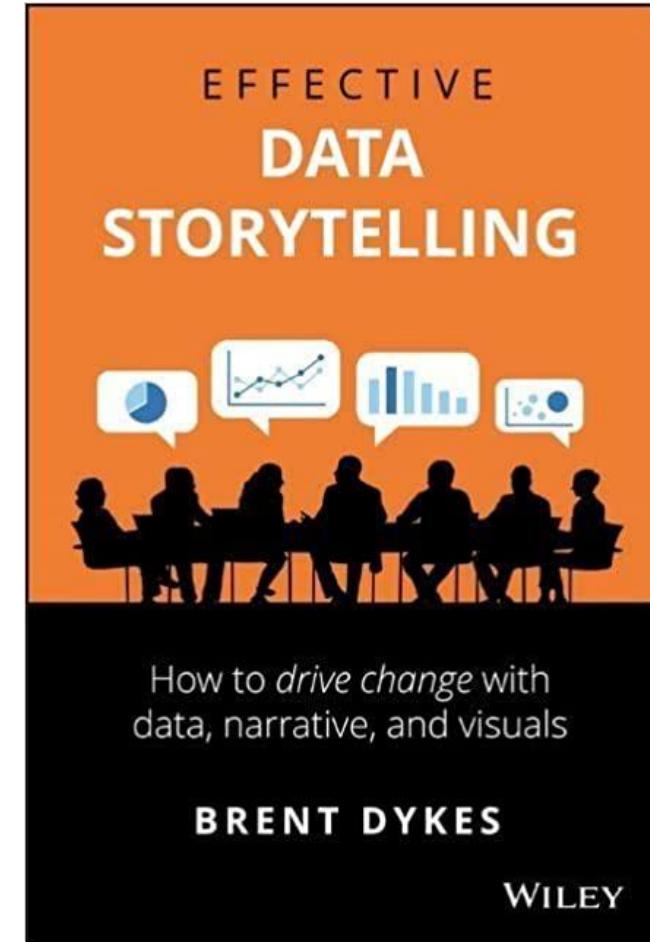
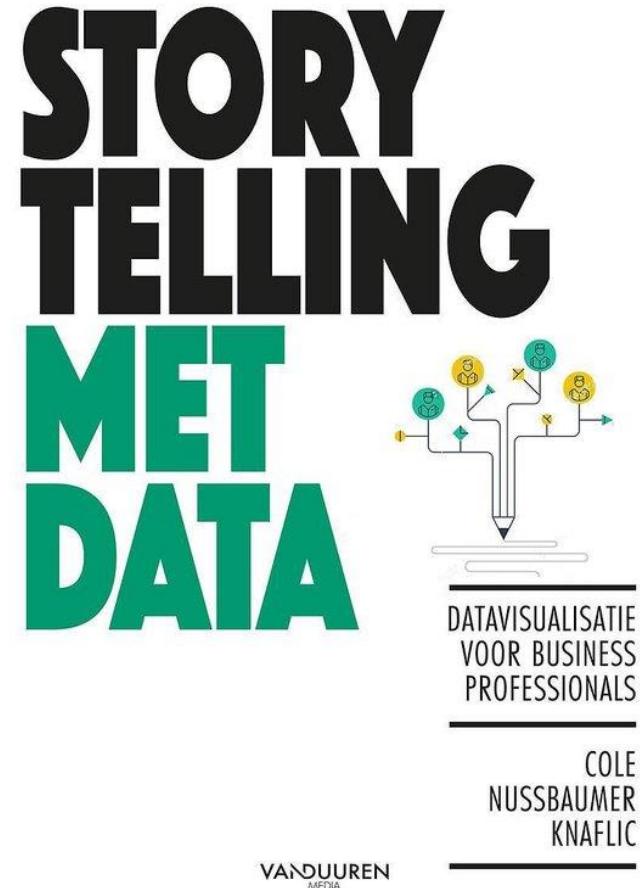
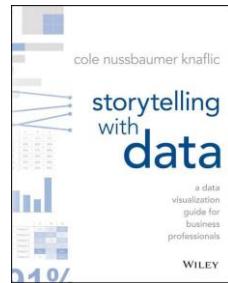
<b>Doel:</b>	Begrijpen
<b>Publiek:</b>	Jij
<b>Bekendheid:</b>	Heel bekend
<b>Visualisatie focus:</b>	Flexibel en snel
<b>Verhaal:</b>	Onbekend
<b>Uitkomst:</b>	Inzicht

Communiceren
Anderen
Minder bekend
Simpel, helder, samenhang
Bekend
Actie

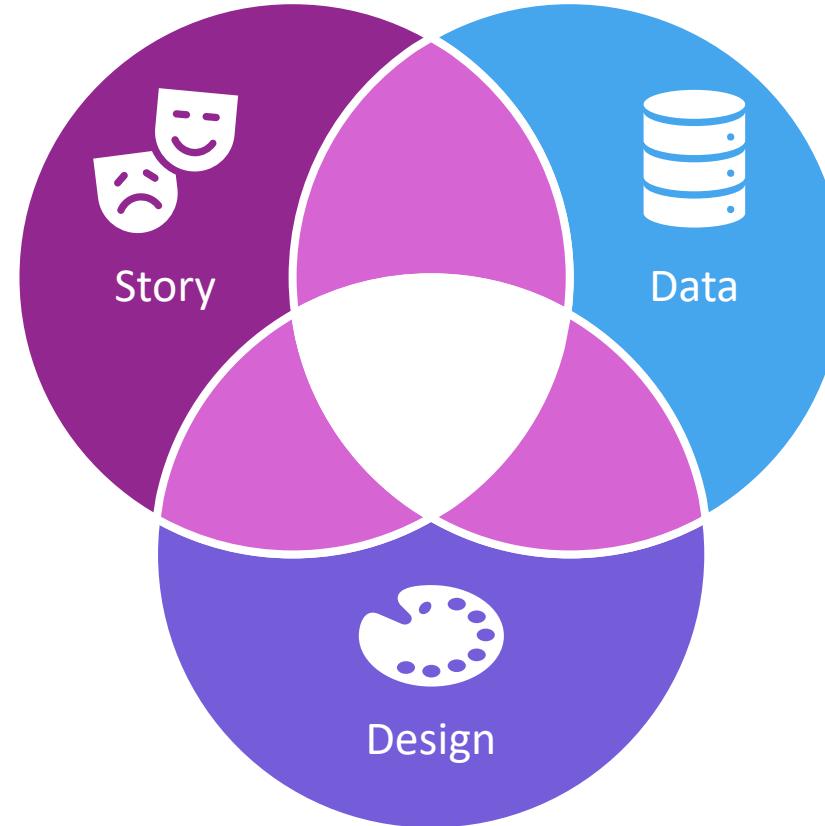
# Een effectieve (data-)visualisatie vertelt een verhaal



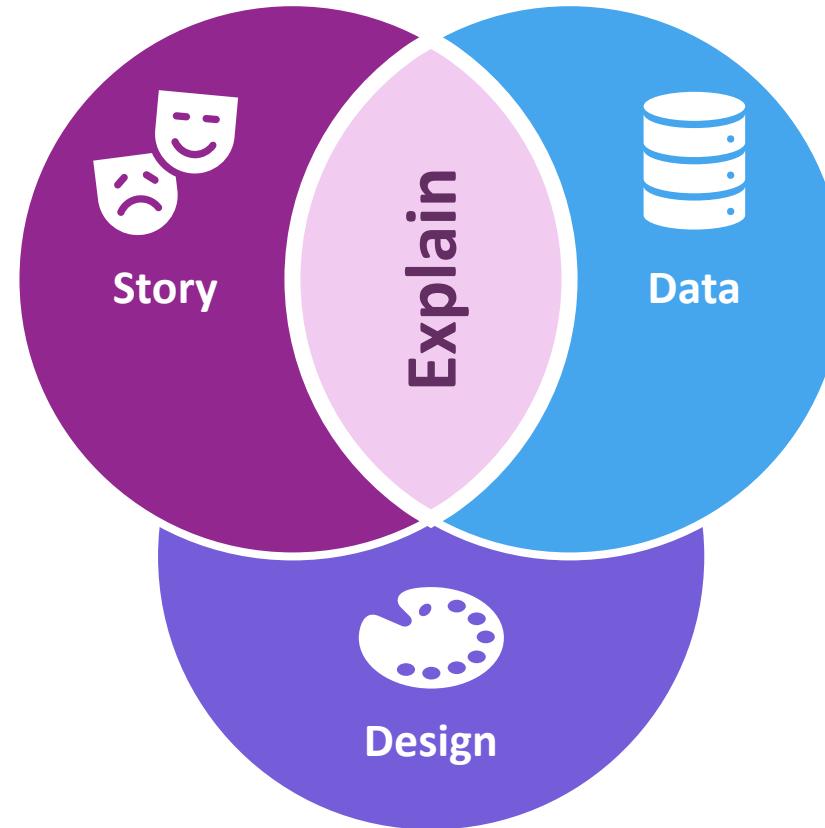
# Een effectieve (data-)visualisatie vertelt een verhaal



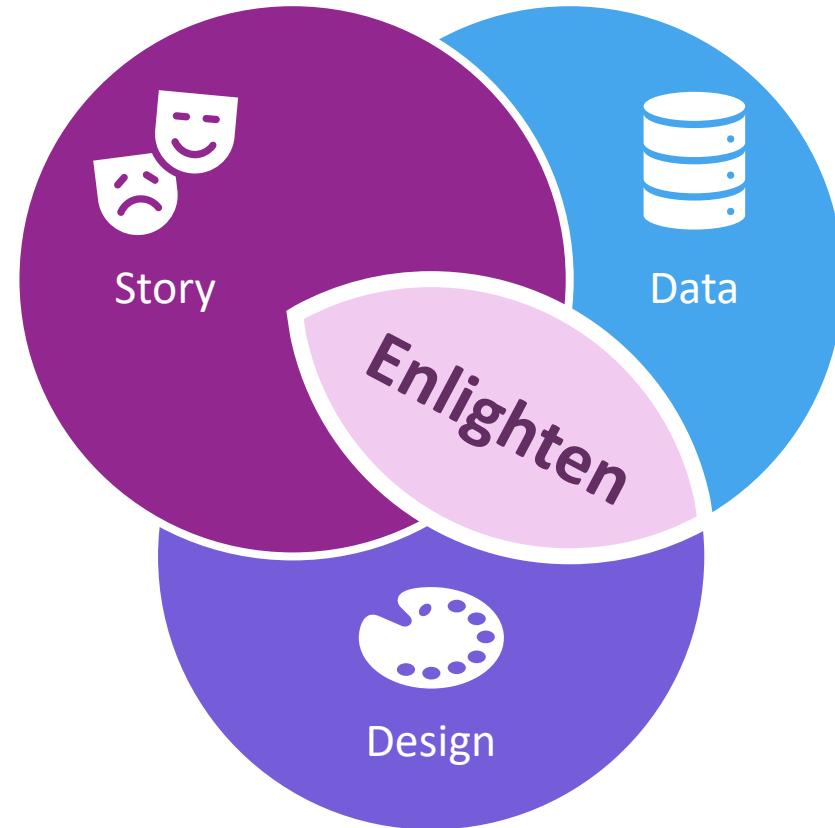
# De drie componenten van een effectieve datavisualisatie:



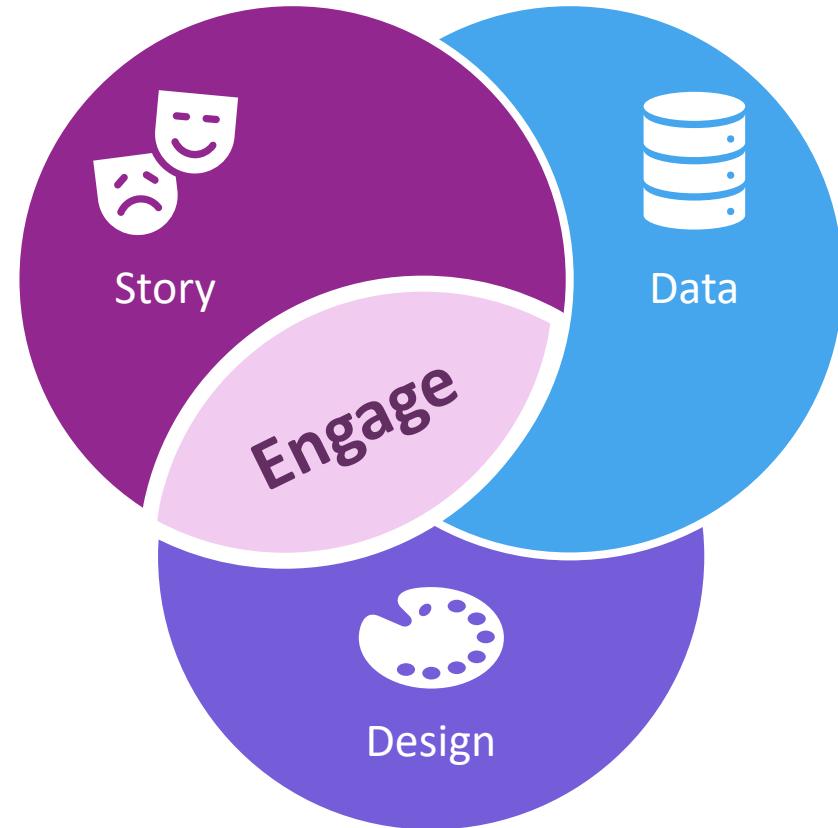
# Je kunt data *uitleggen* met een verhaal...



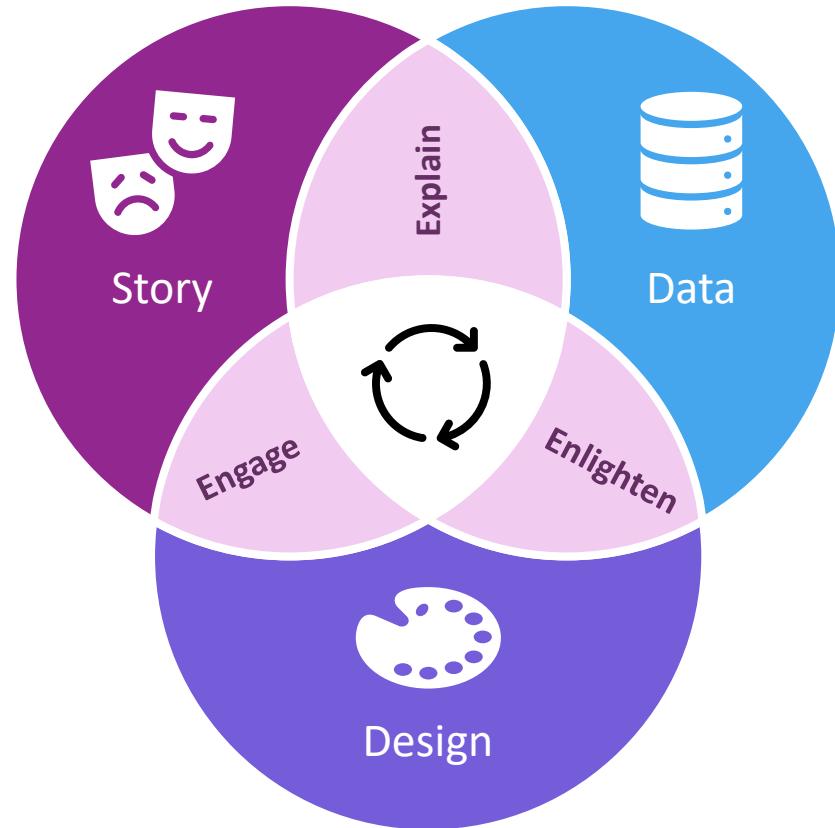
# Je maakt data *inzichtelijk* met beeld...



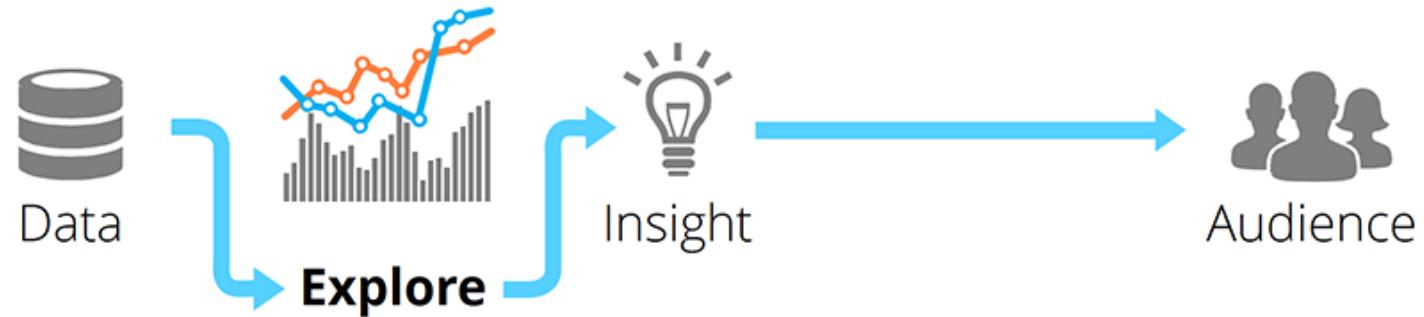
# De combinatie beeld en verhaal boeit...



# Data, beeld en verhaal stimuleren ACTIE!

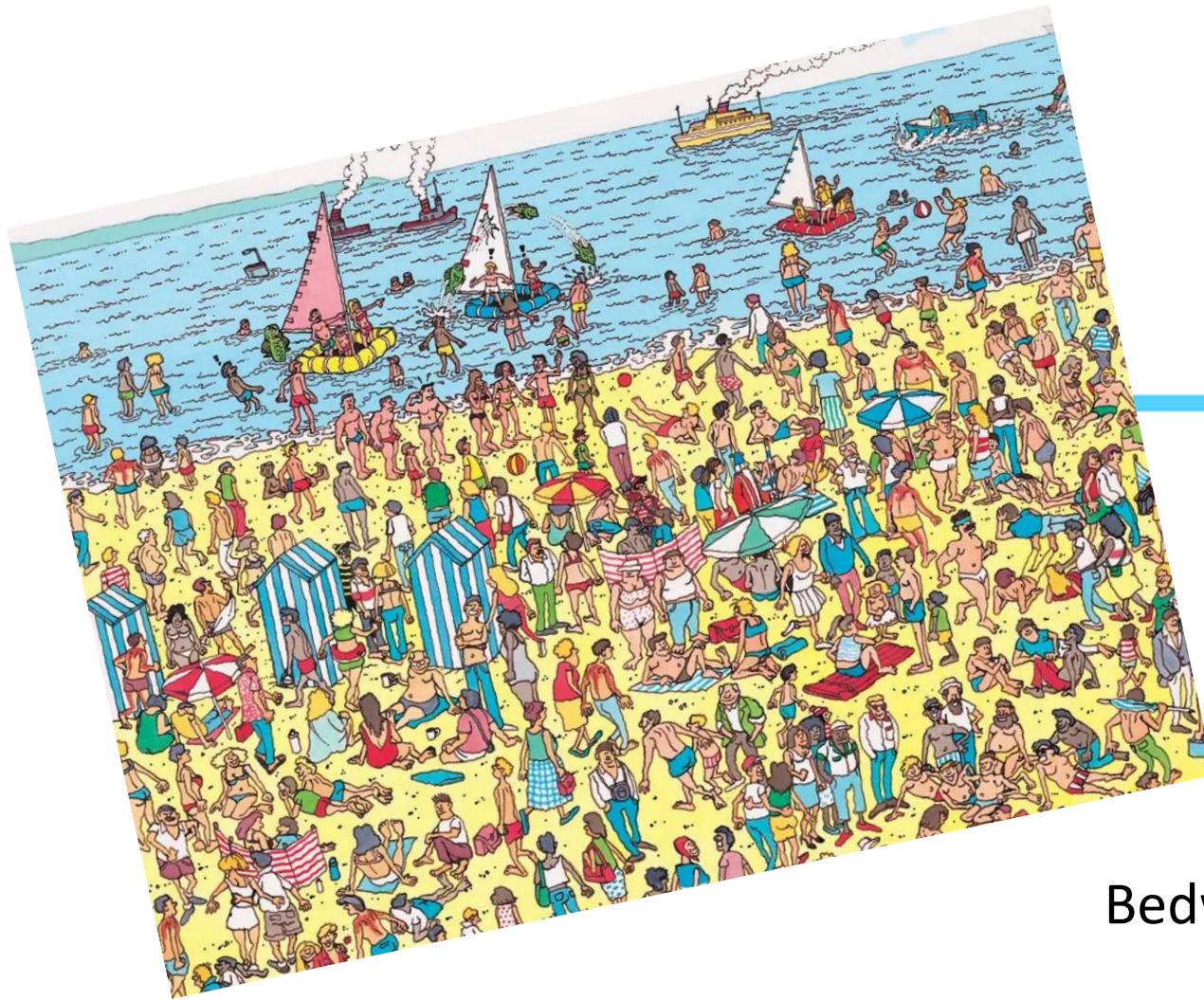


# Let op: 3 valkuilen voor een data-verhaal



Bedwing de drang om *alles* te laten zien!

# Let op: 3 valkuilen voor een data-verhaal

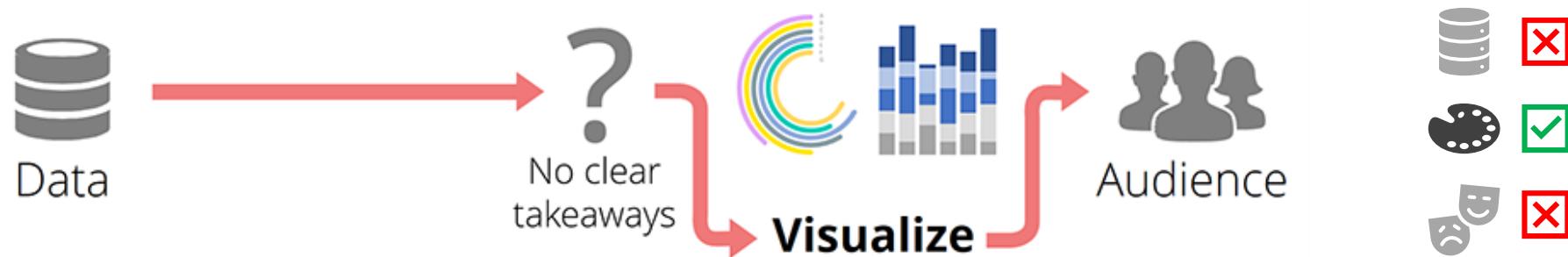


Audience

- 
- 
- 

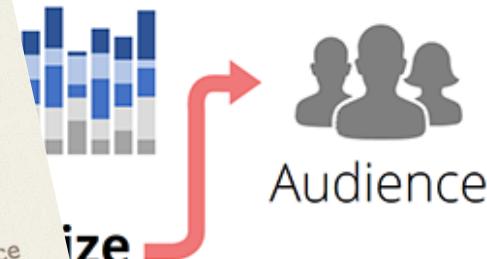
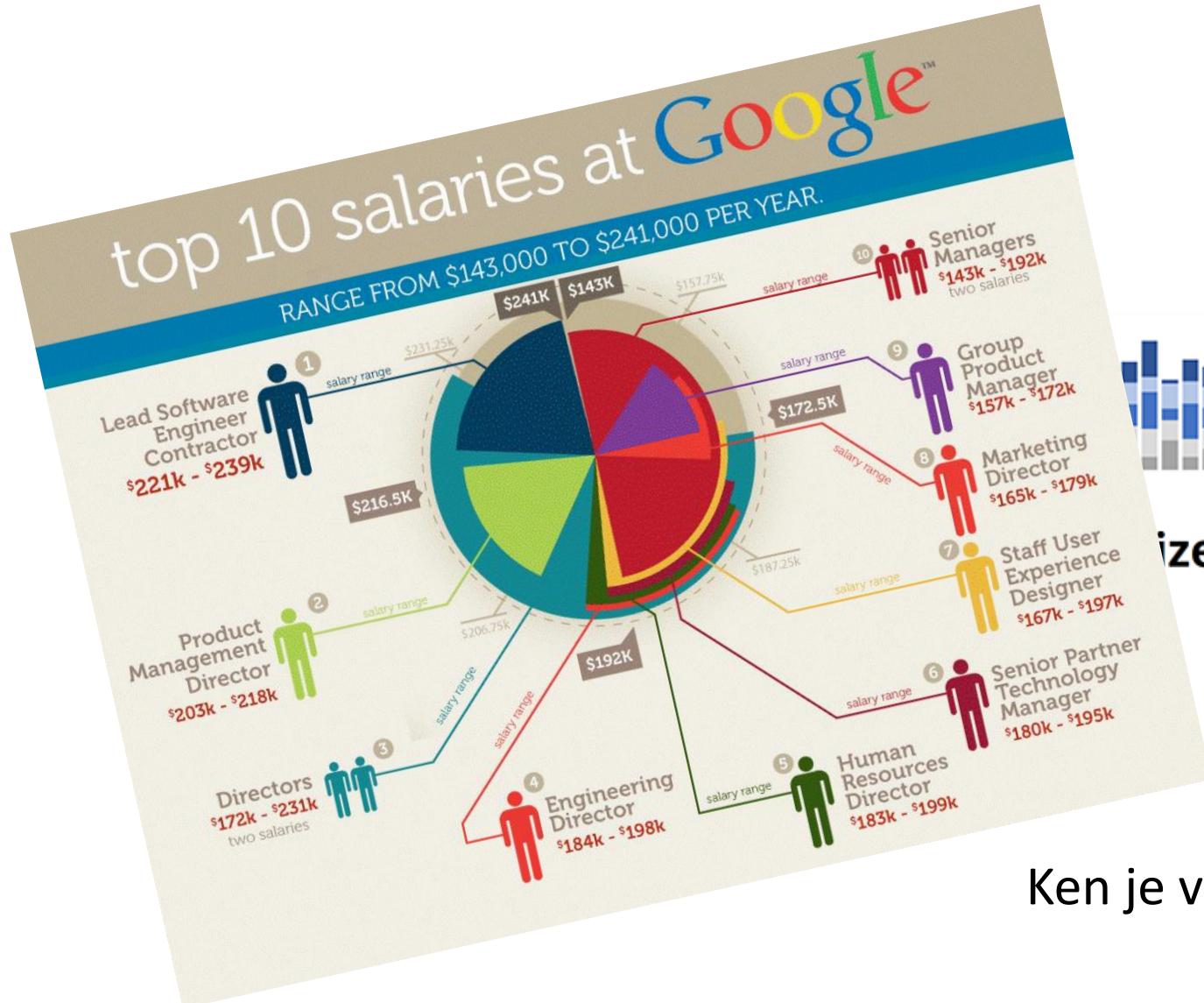
Bedwing de drang om *alles* te laten zien!

# Let op: 3 valkuilen voor een data-verhaal



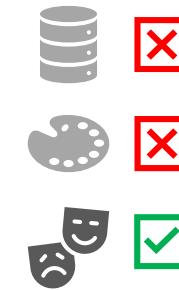
Ken je verhaal voordat je gaat visualiseren!

# Let op: 3 valkuilen voor een data-verhaal



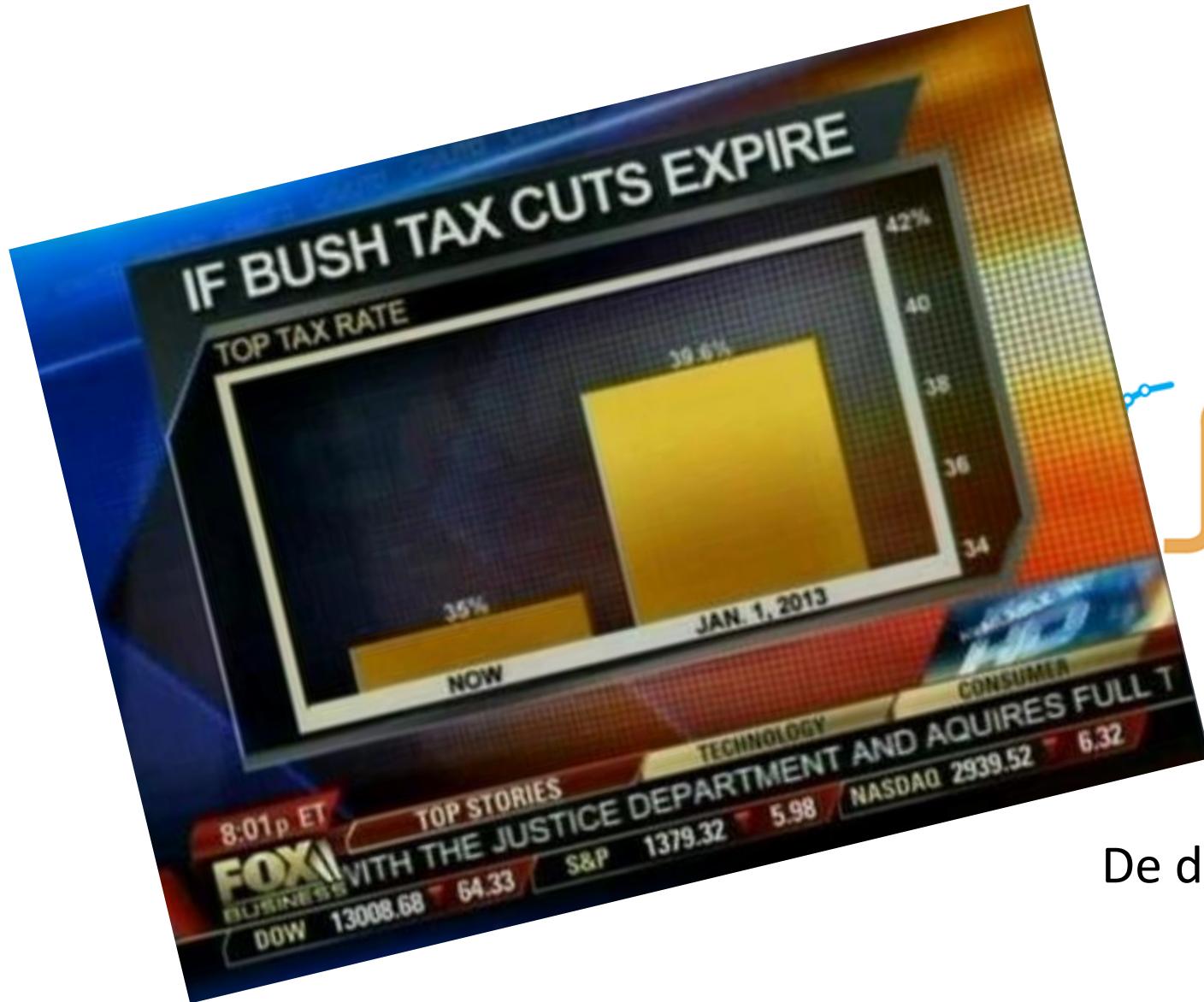
Ken je verhaal voordat je gaat visualiseren!

# Let op: 3 valkuilen voor een data-verhaal



De data is de basis voor het verhaal!

# Let op: 3 valkuilen voor een data-verhaal



Audience

- 
- 
- 

De data is de basis voor het verhaal!

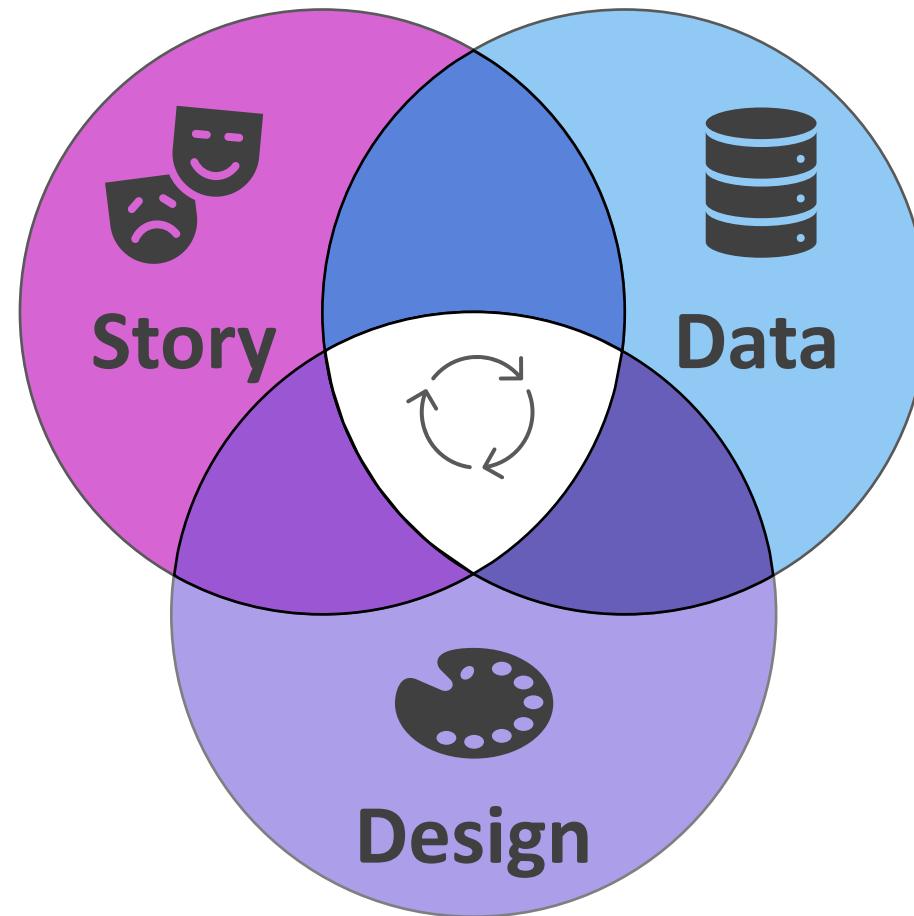


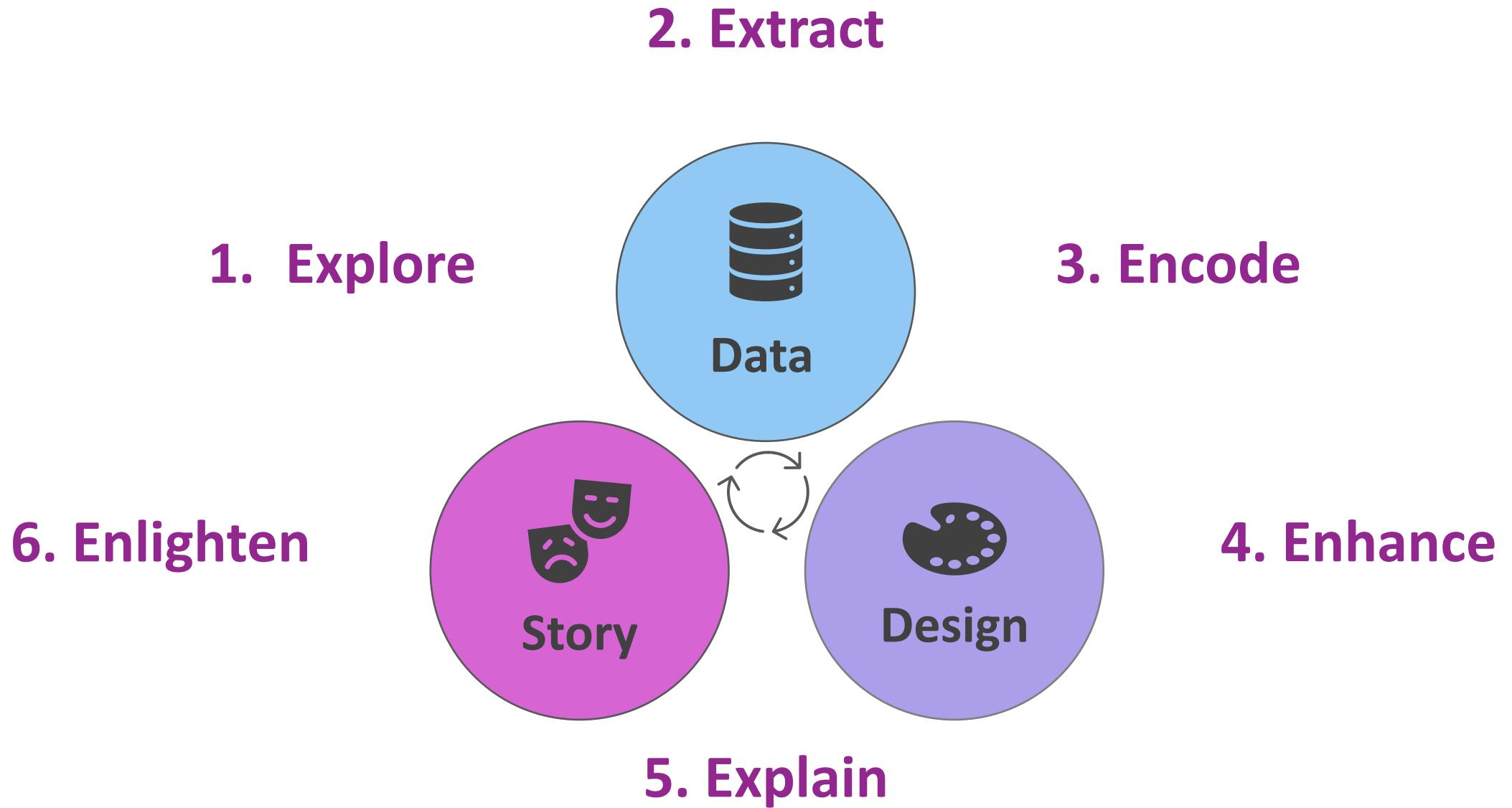
De kracht van het verhaal

# Vorm volgt verhaal

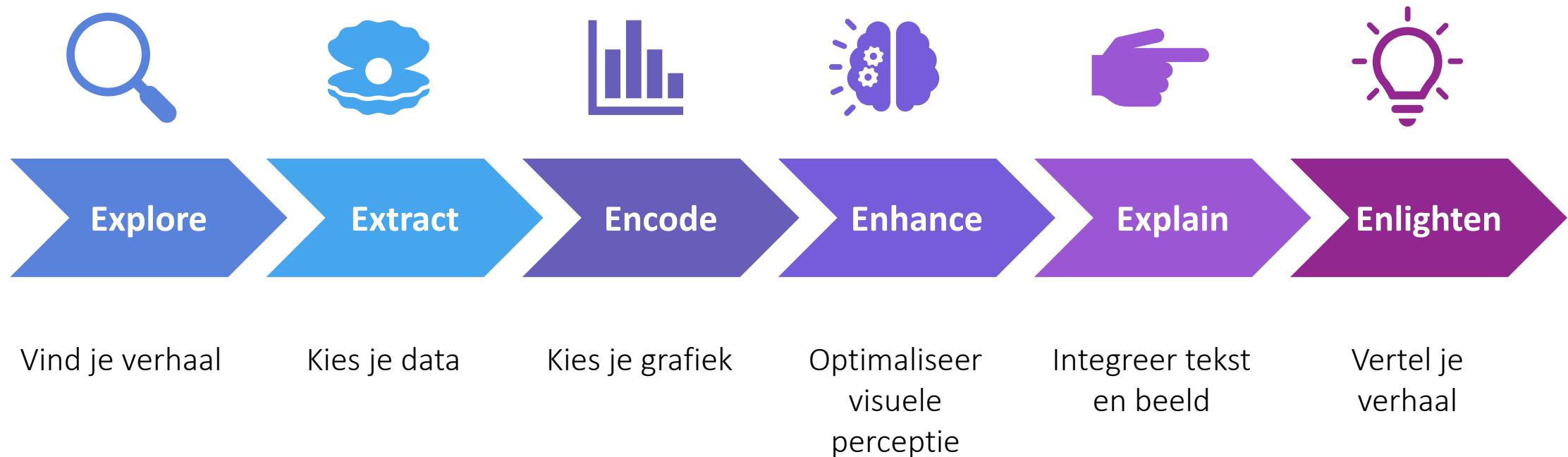
*“Words are how we think. Stories are how we link.”*

# De 6 stappen naar een krachtig dataverhaal

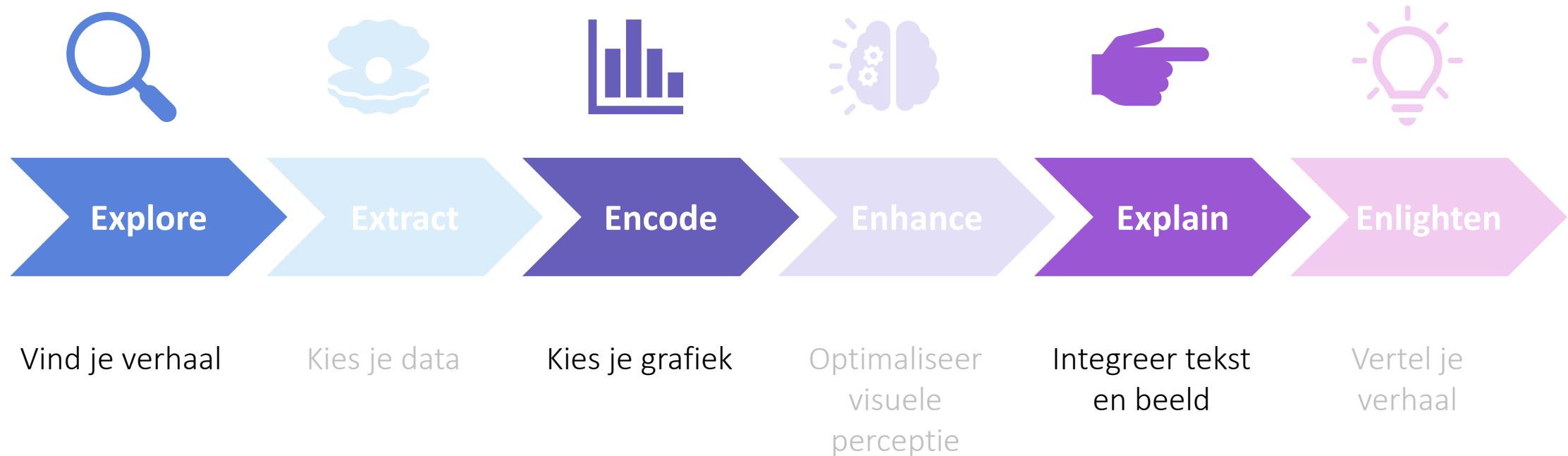




# De 6 stappen naar een krachtig dataverhaal



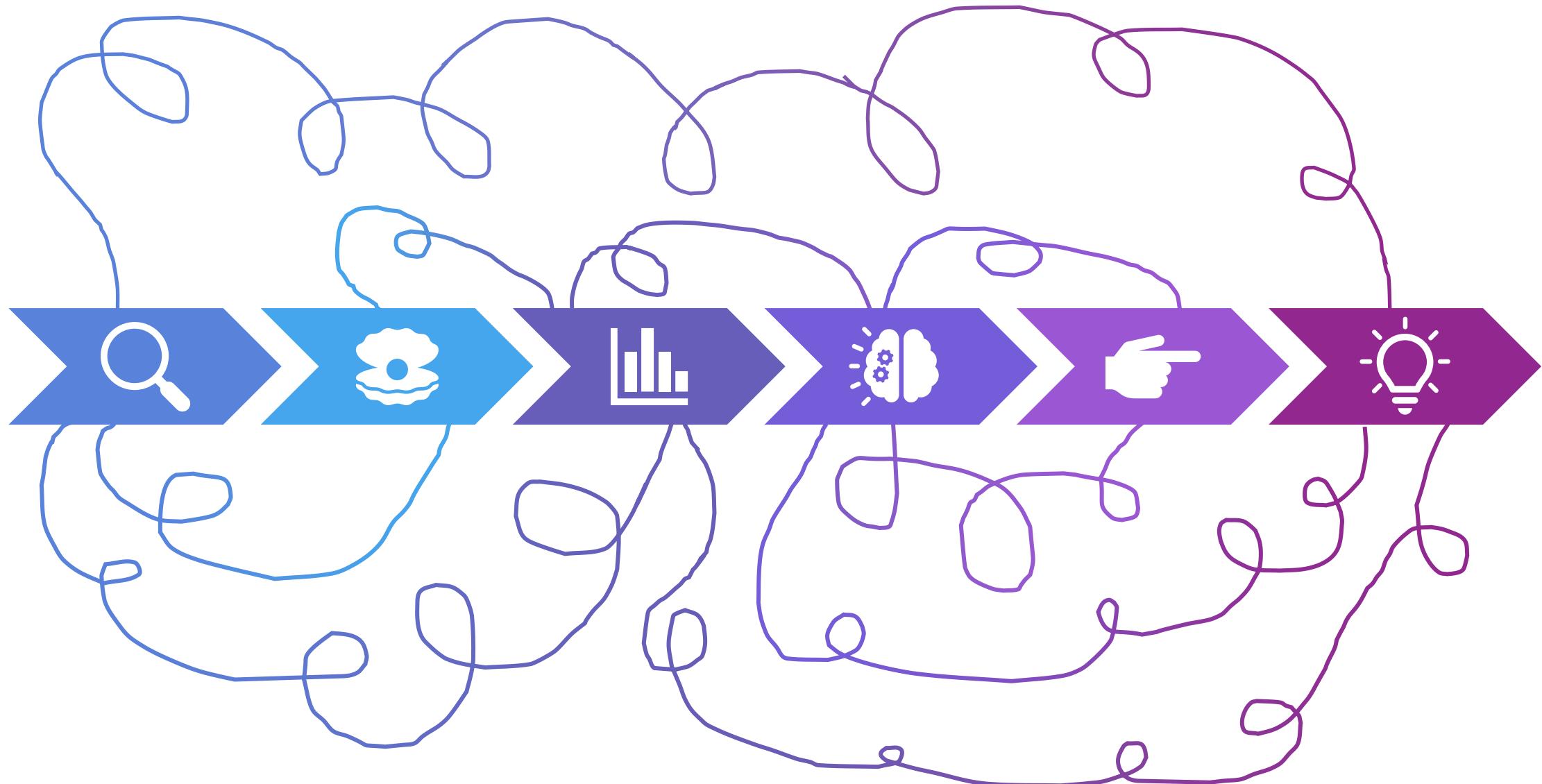
# De 6 stappen naar een krachtig dataverhaal



# De ideale situatie...



...de realiteit!



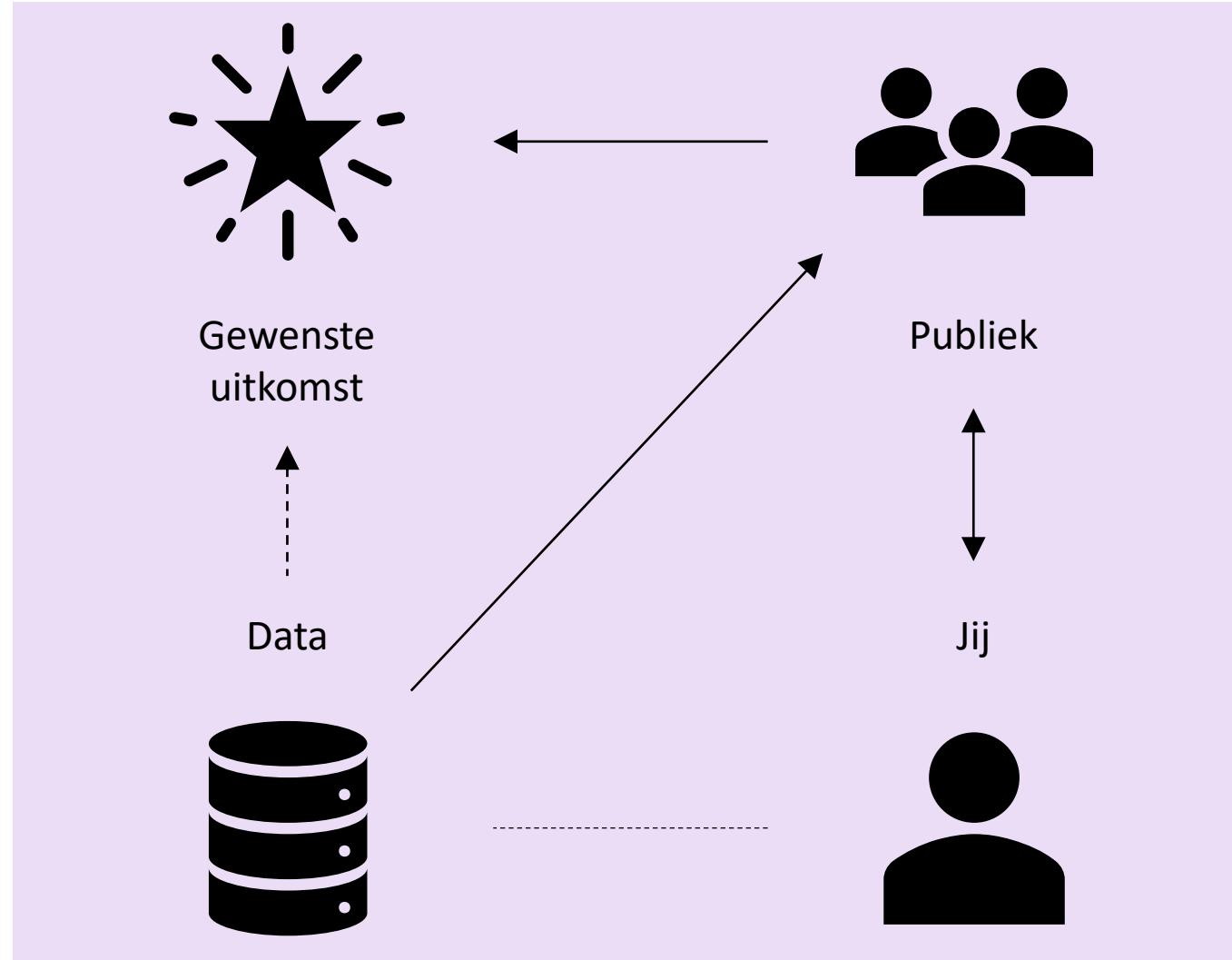


# Explore: vind je verhaal

Begin with the end in mind.

# De context: begin with the end in mind

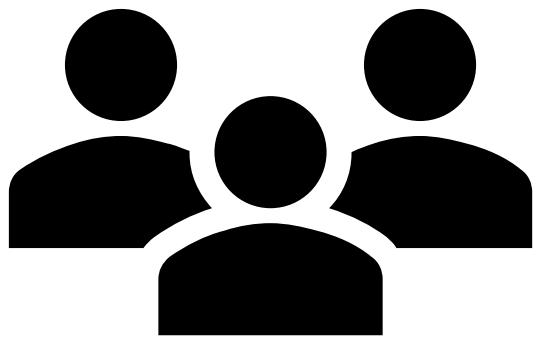
Waarom?



Wie?

Wat?

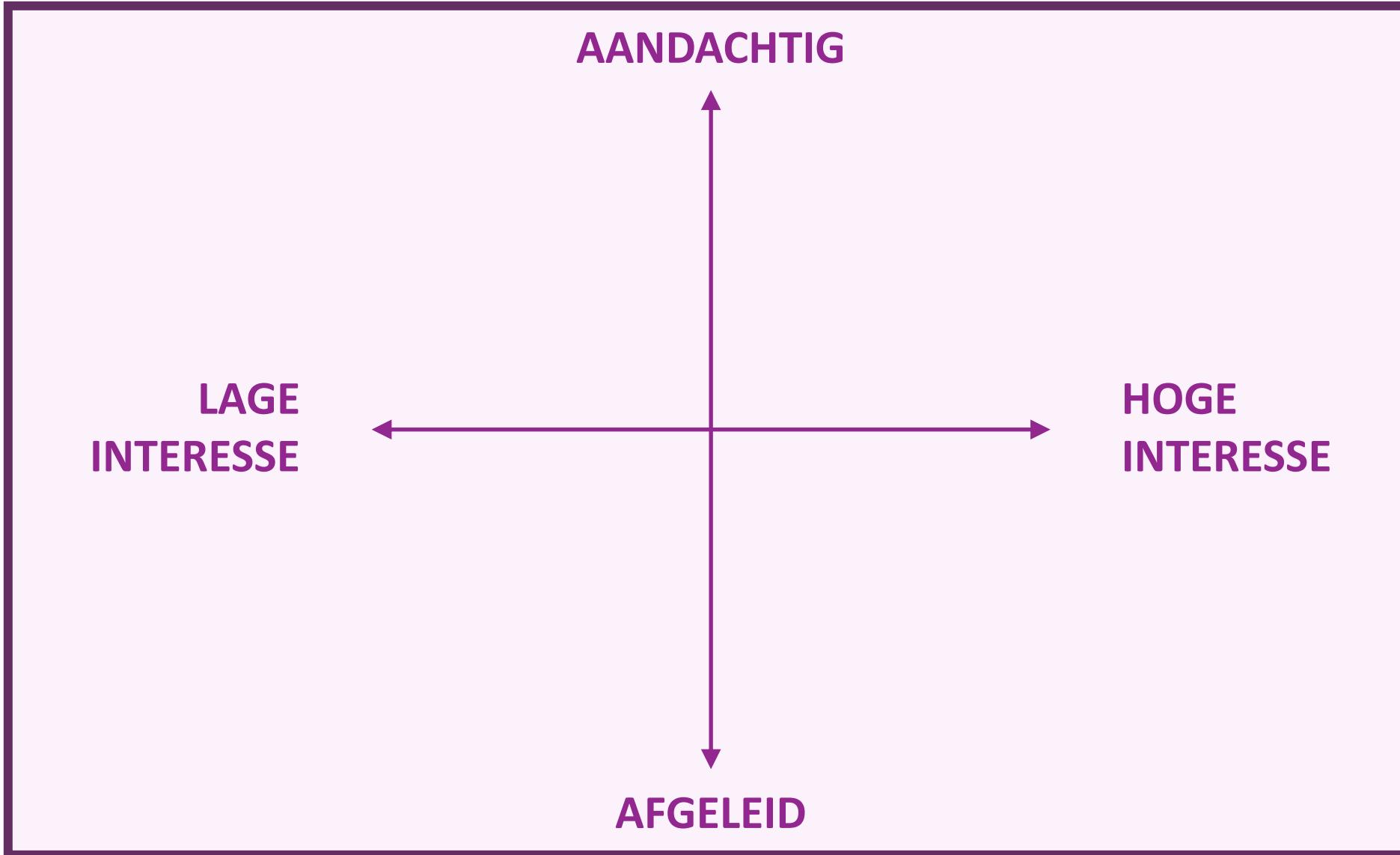
Waar?



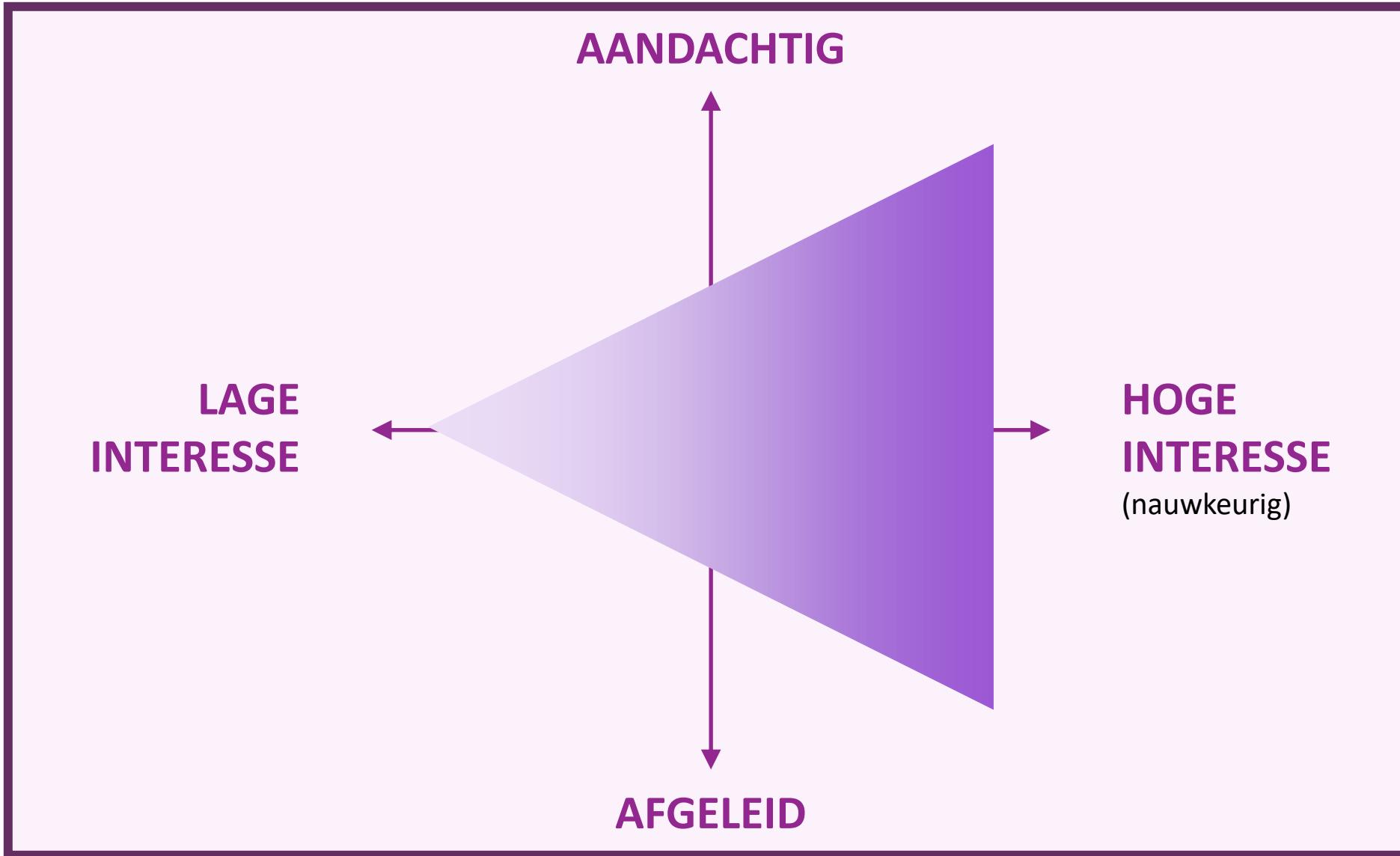
Publiek

Wie?

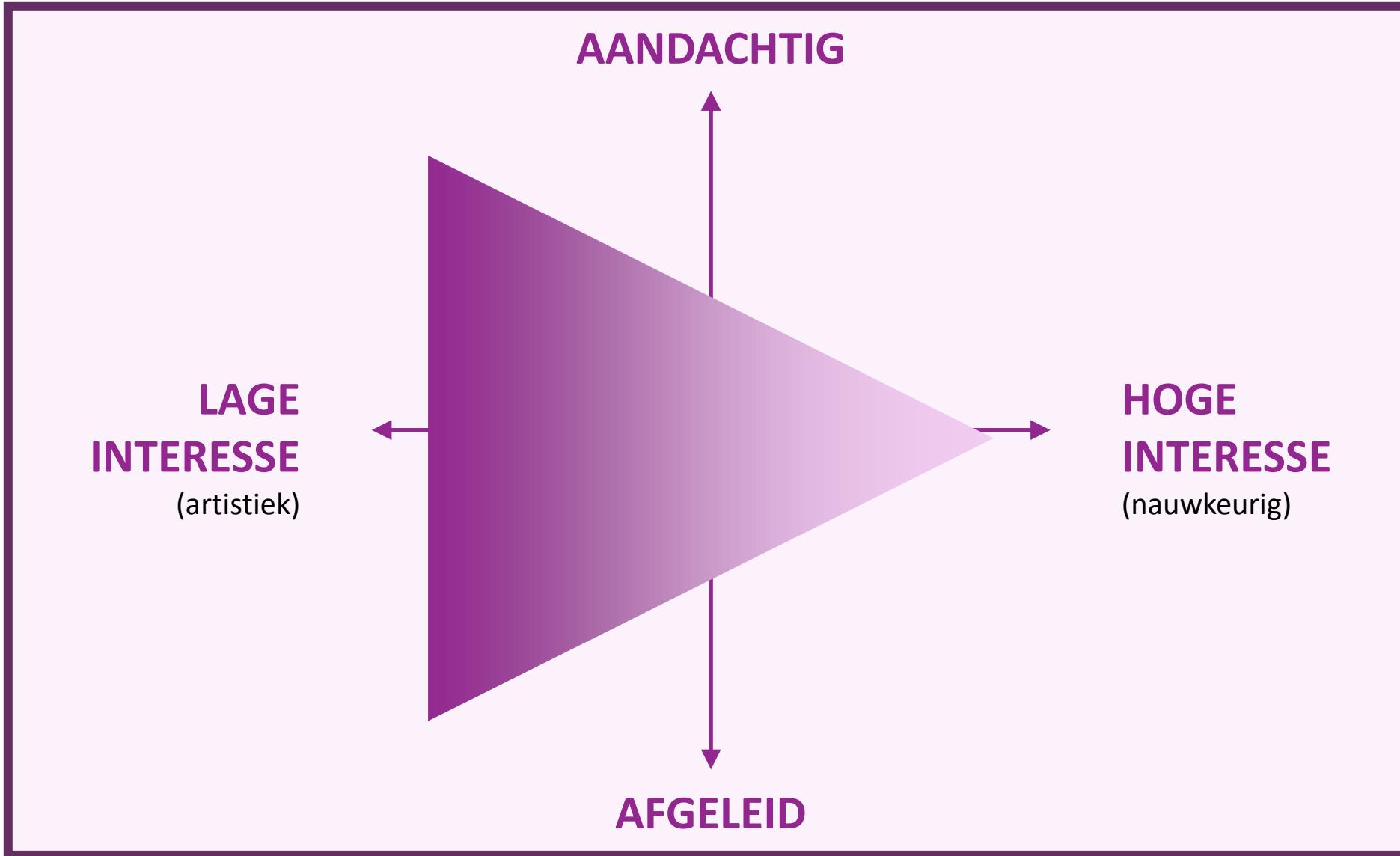
# Datavisualisaties zijn er voor ieder publiek



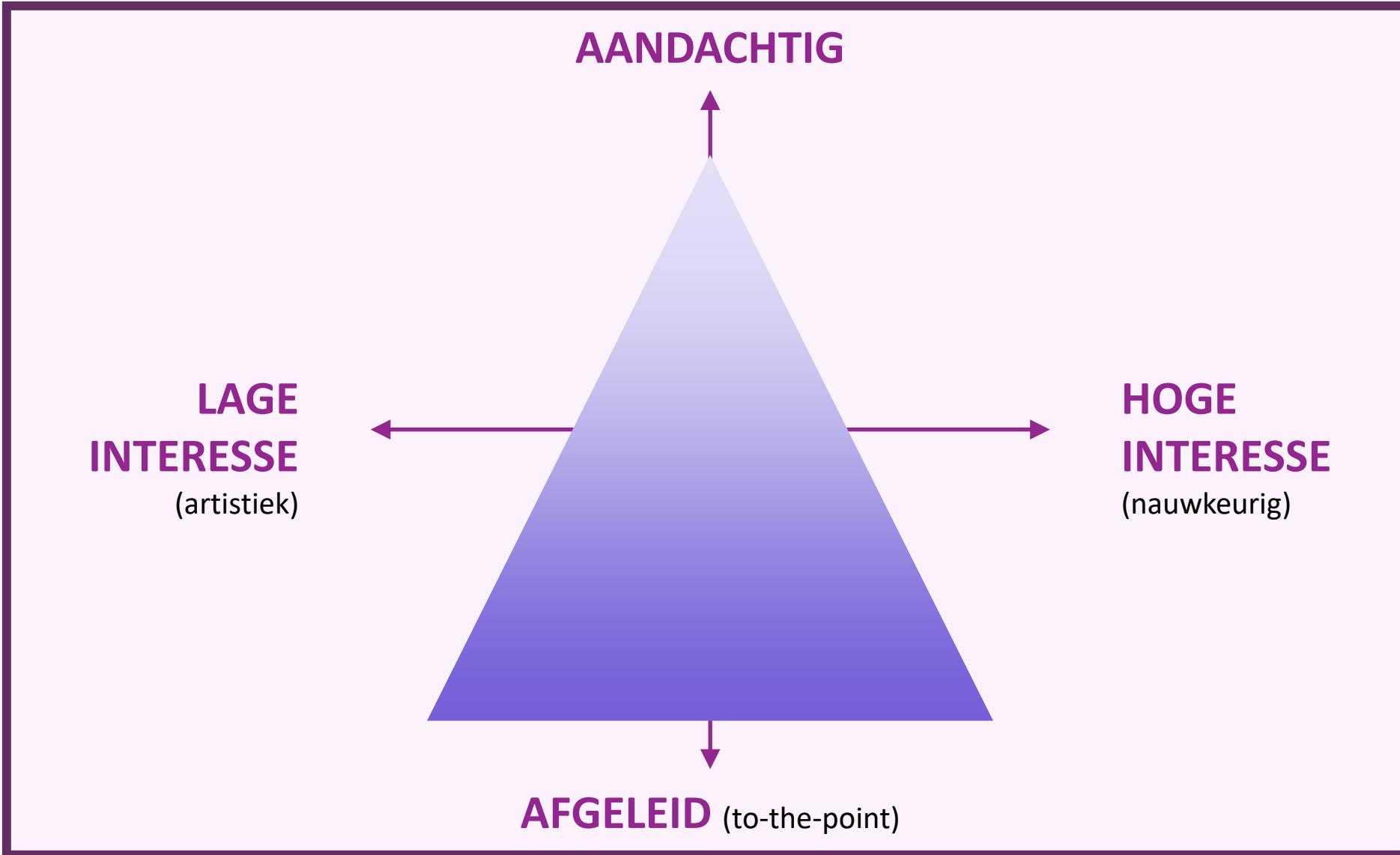
# Wetenschap...?



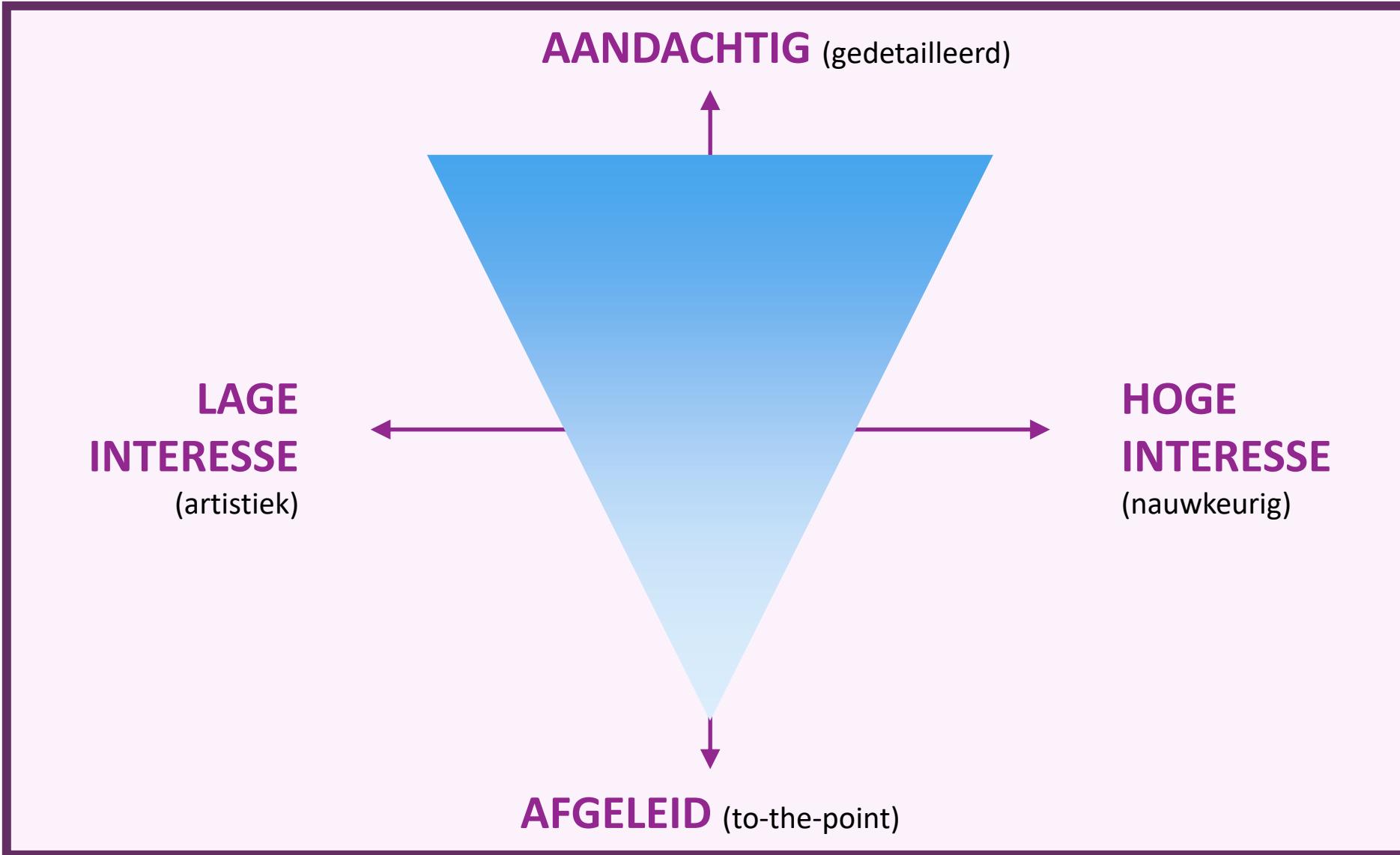
# ...of kunst?



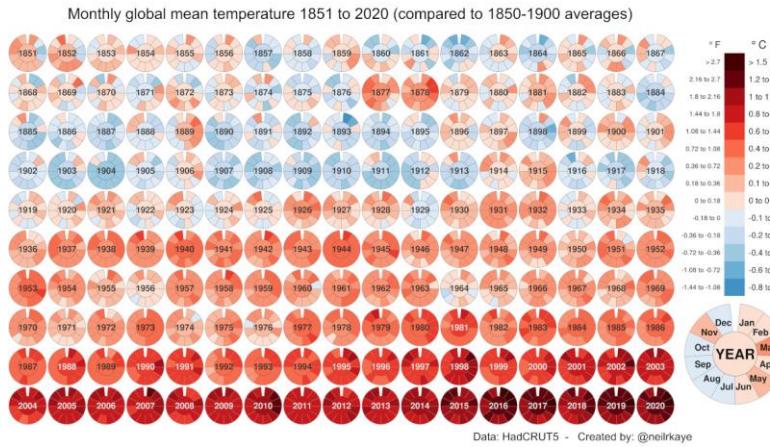
# Focus...?



# ...of details?

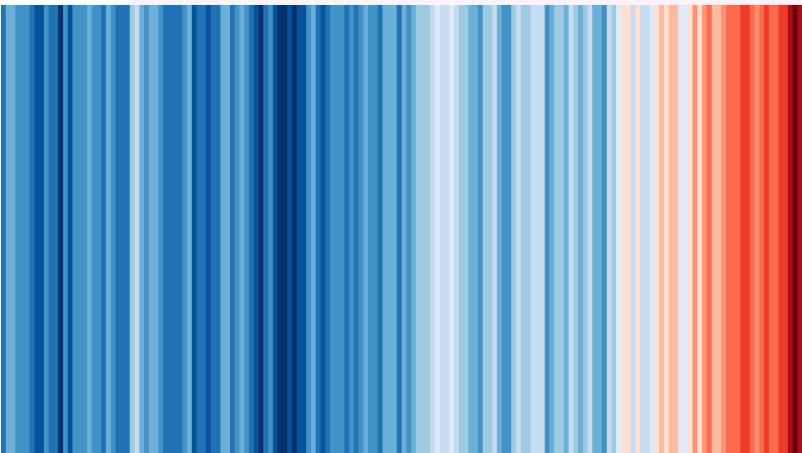


# Een grafiek voor ieder publiek



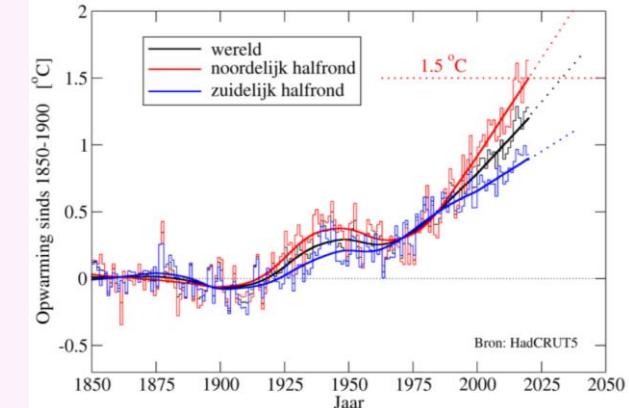
AANDACHTIG

LAGE  
INTERESSE



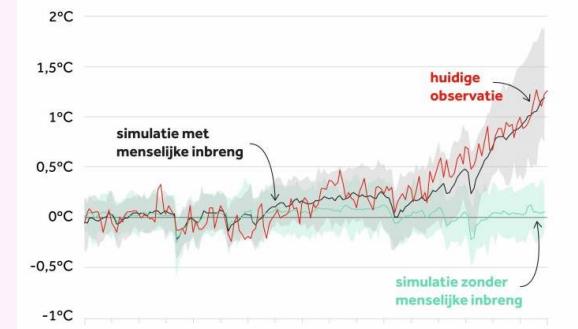
AFGELEID

Waargenomen veranderingen in temperatuur 1850-2020

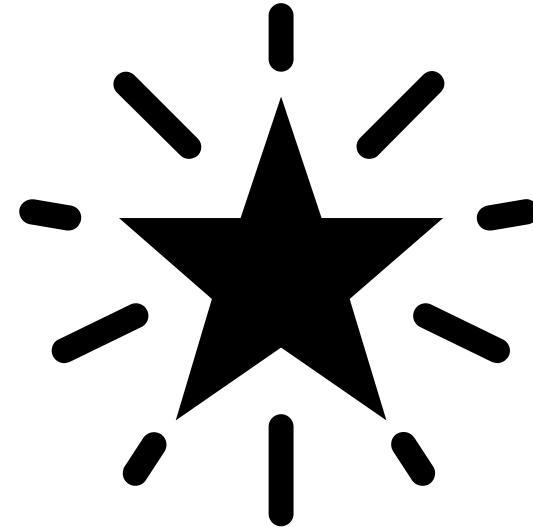


HOGE  
INTERESSE

Menselijke factor duidelijke oorzaak opwarming  
Verandering in wereldwijde temperatuur (1850-2020)

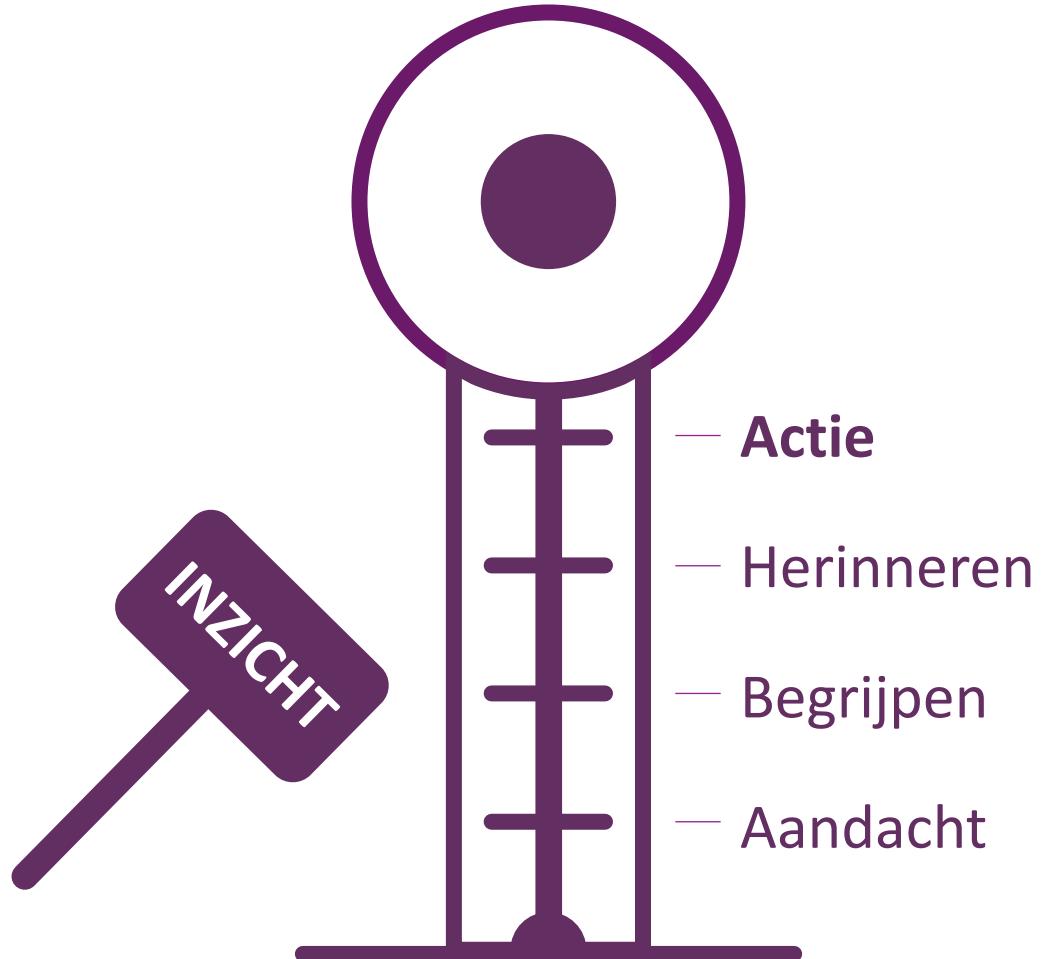


# Waarom?



Gewenste  
uitkomst

# Waarom zou jouw publiek dit interesseren?



Wat is je **doel**?  
Welke **actie** wil je dat je publiek onderneemt??

← **Waarom?**

← **Waarom?**

← **Waarom?**

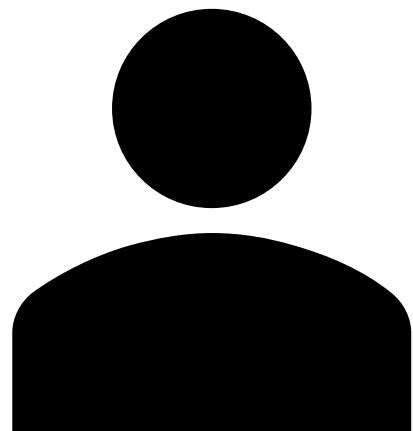
# Wat is jouw **actieplan**?



Wat wil je dat jouw publiek weet of nooit meer vergeet?

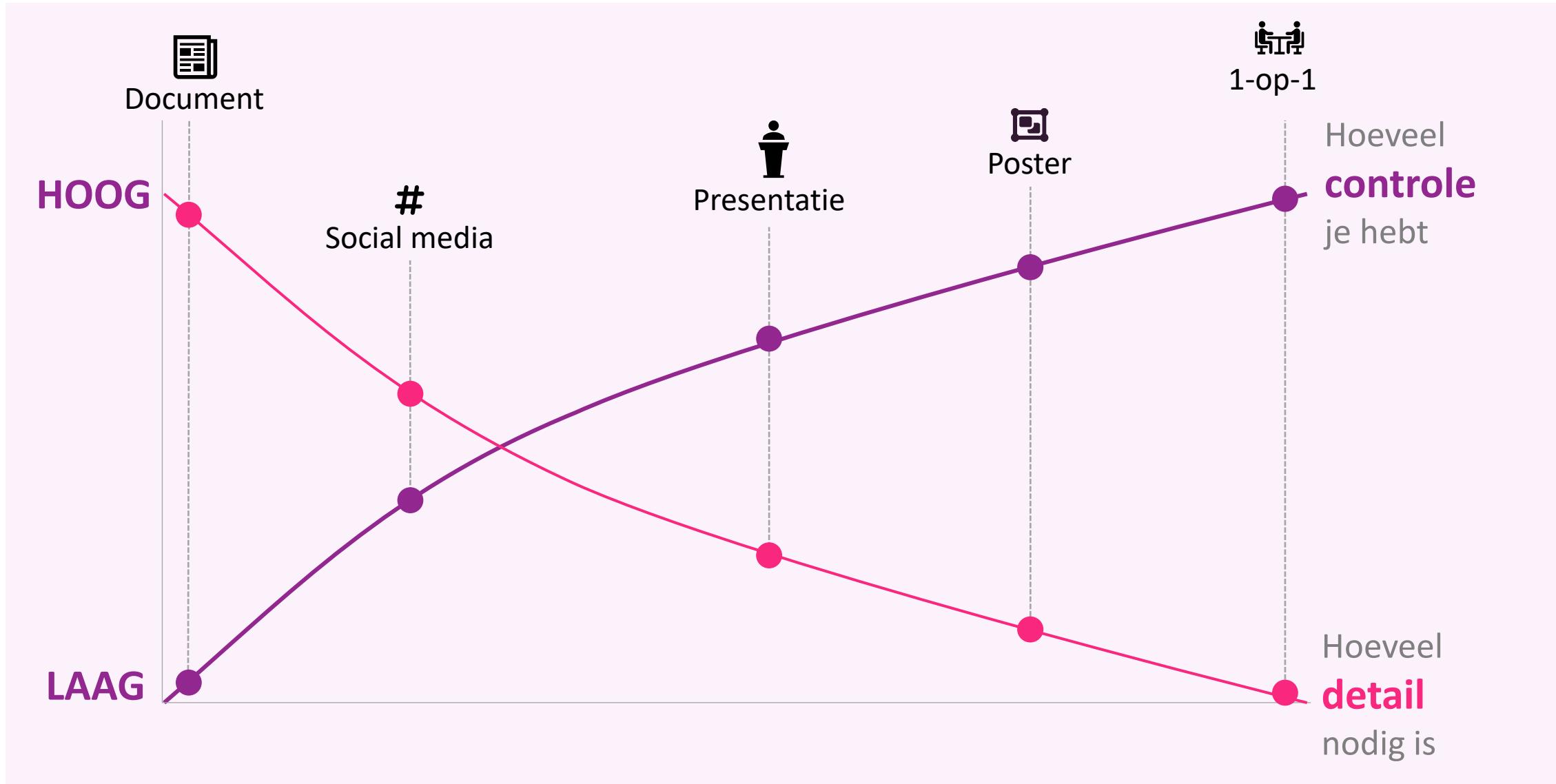
accepteren | instemmen | beginnen | geloven | veranderen | samenwerken | initiëren | creëren | verdedigen | wensen | onderscheiden | doen | benadrukken | motiveren | stimuleren | interesseren | bepalen | onderzoeken | faciliteren | vertrouwd raken | vormen | implementeren | toevoegen | beïnvloeden | investeren | verhelderen | weten | leren | leuk vinden | overtuigen | plannen | promoten | nastreven | aanbevelen | ontvangen | herinneren | rapporteren | beantwoorden | verzekeren | vereenvoudigen | starten | proberen | begrijpen | valideren

Jij



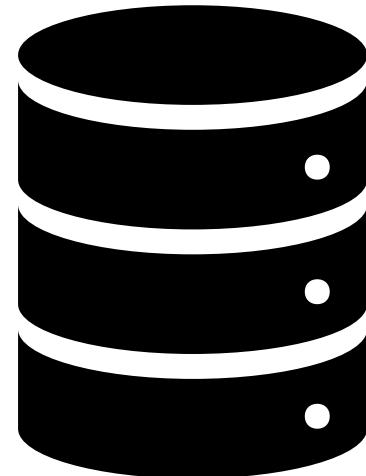
Waar?

# *Waar* bepaalt hoe



# Wat?

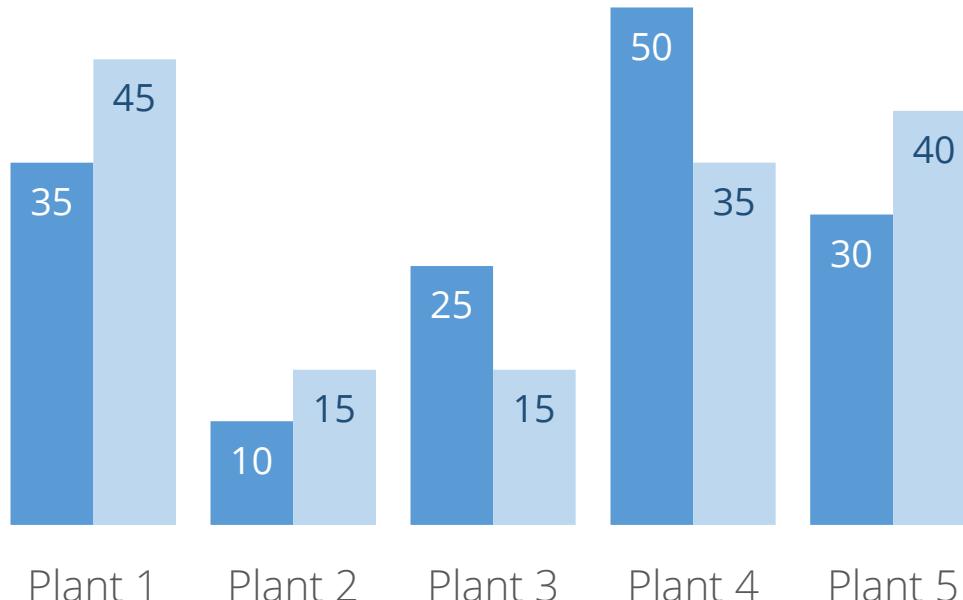
Data



# Maak een **keuze**: vermijd hoofdrekenen

Safety Incidents by Plant

■ 2017 ■ 2018

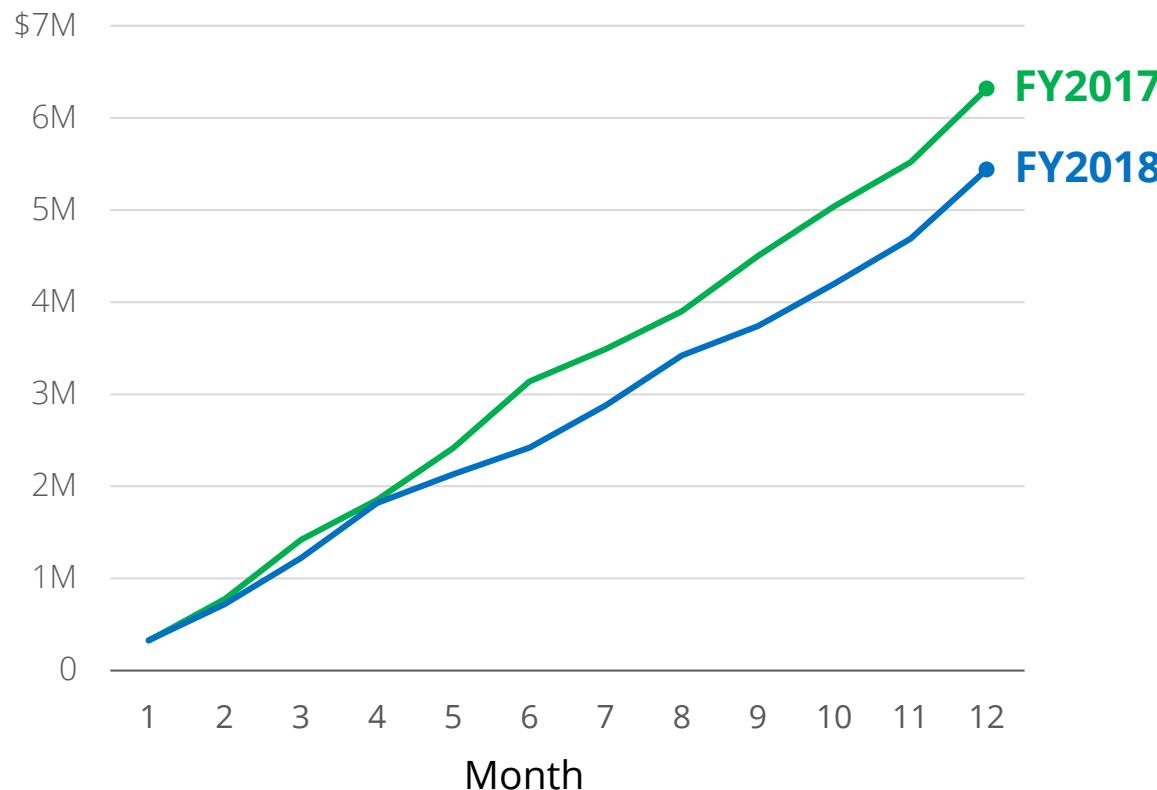


Year-to-Year Variance in Safety Incidents by Plant (2017-2018)

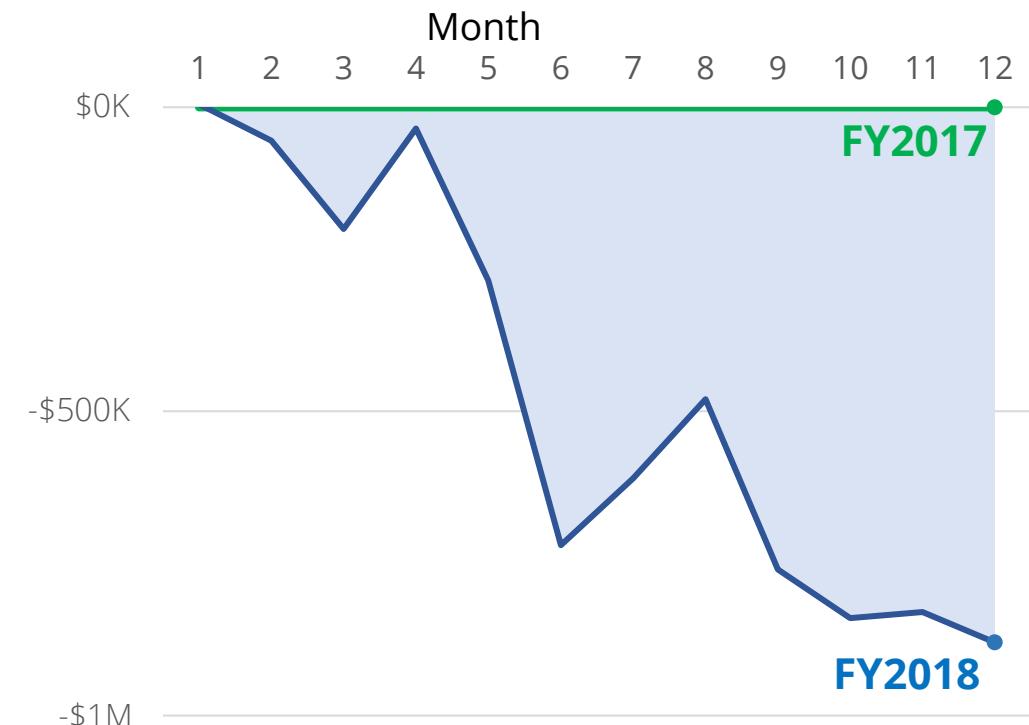


# Maak een **keuze**: overweeg data variaties

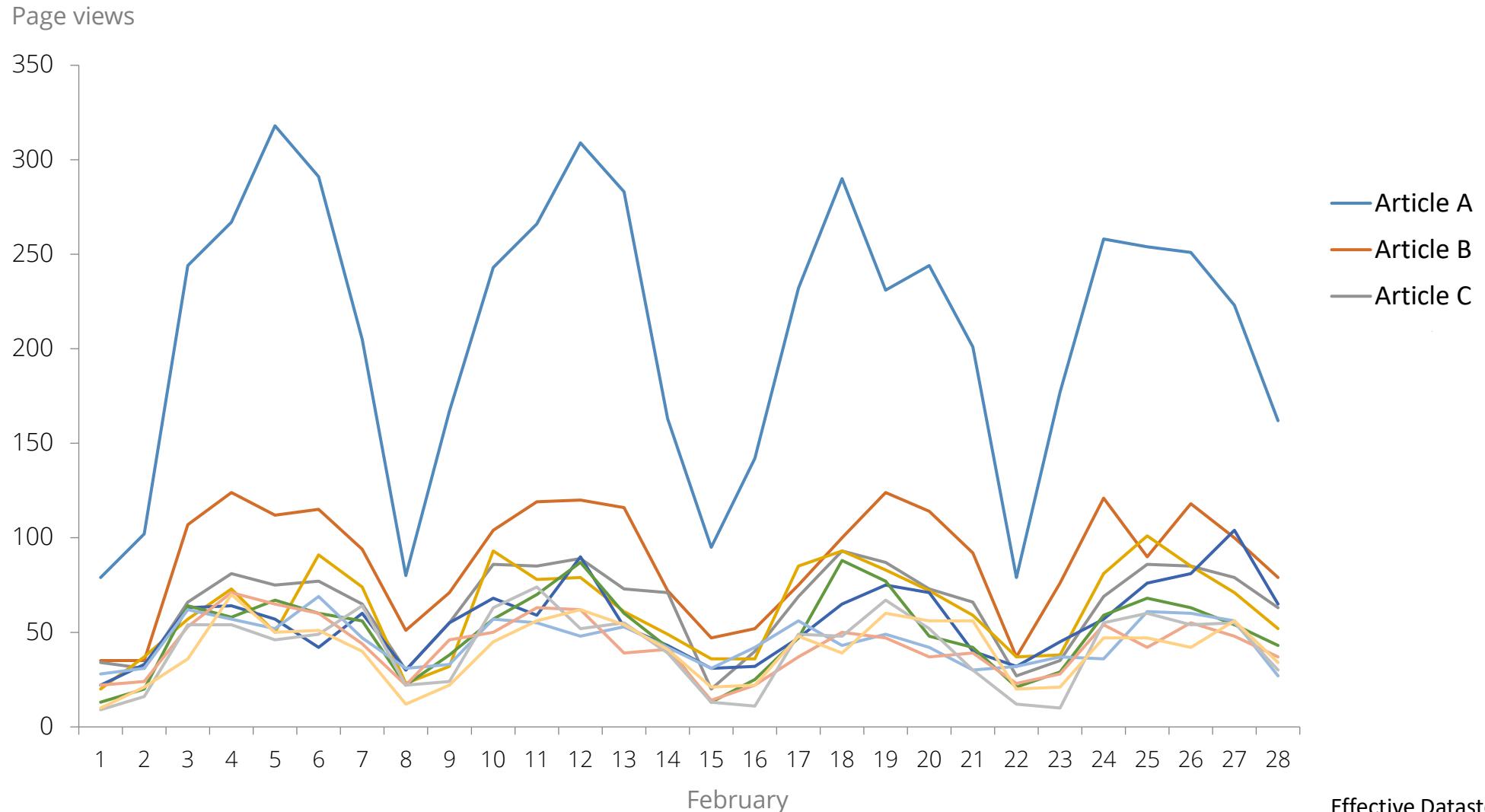
Running Total Revenues



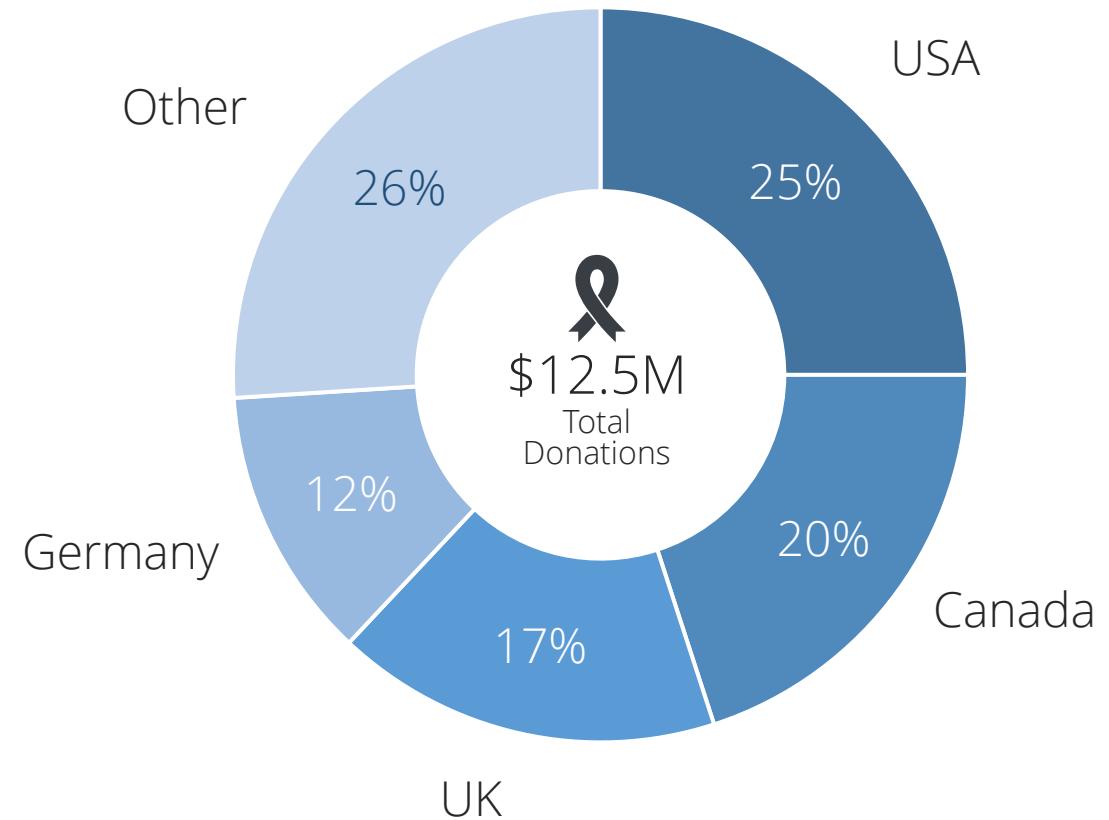
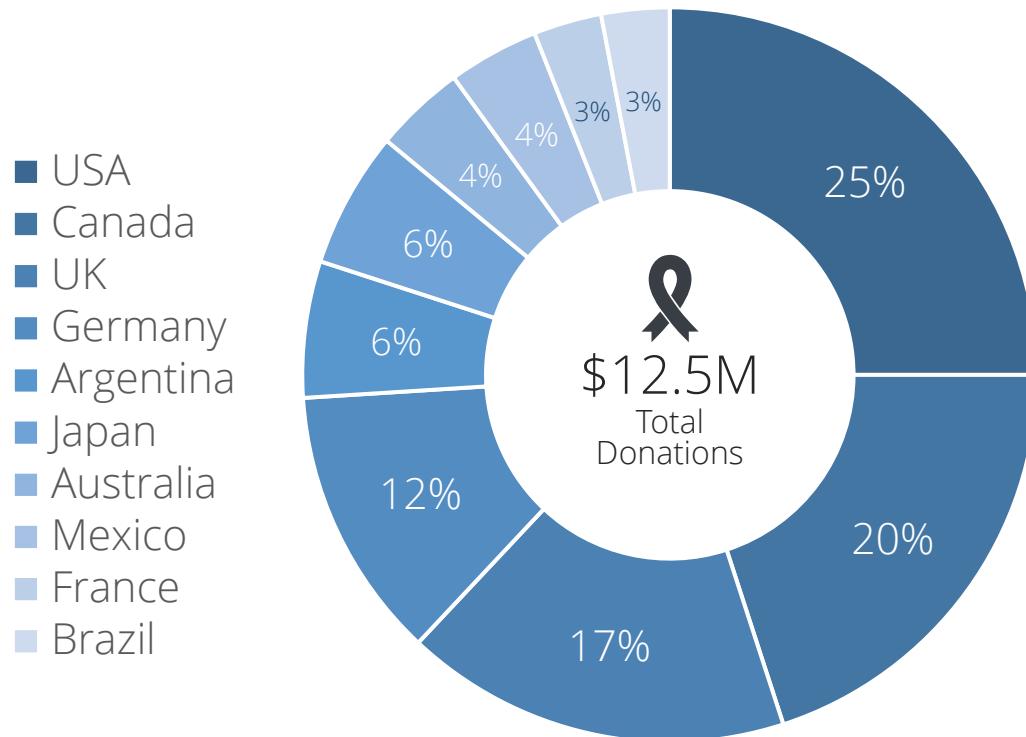
Revenue Variance between  
FY2018 and FY2017



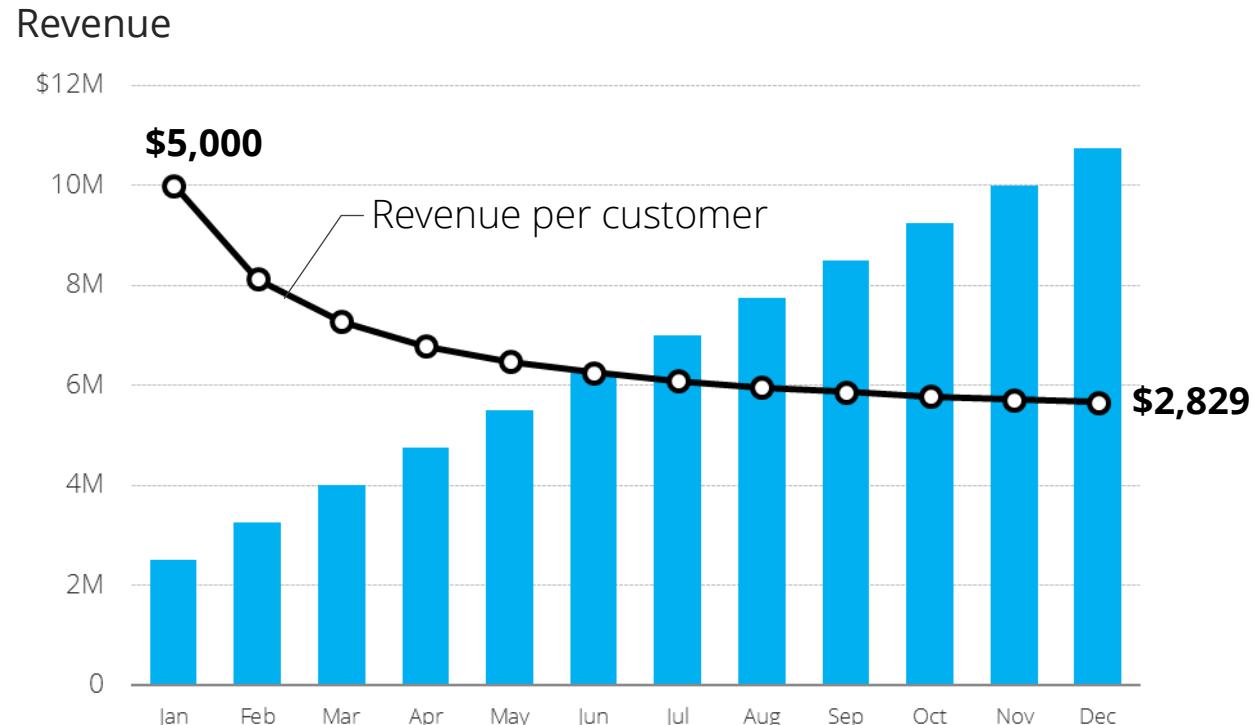
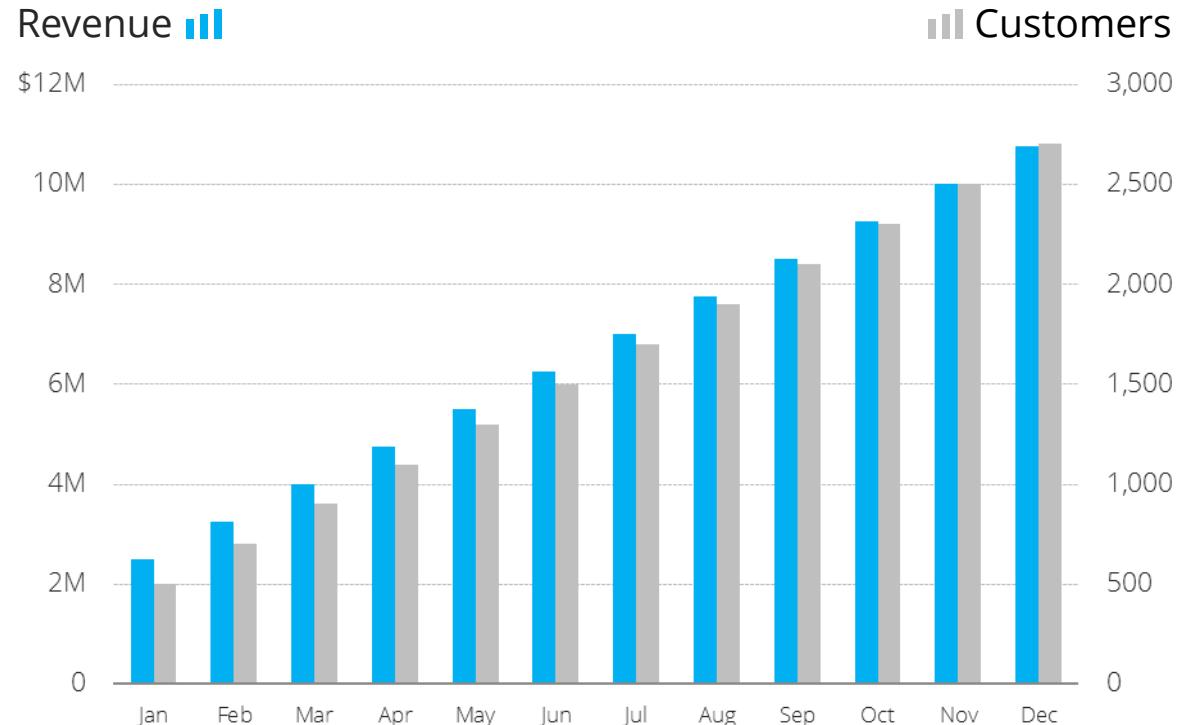
# Maak een **keuze**: is alle data van belang?



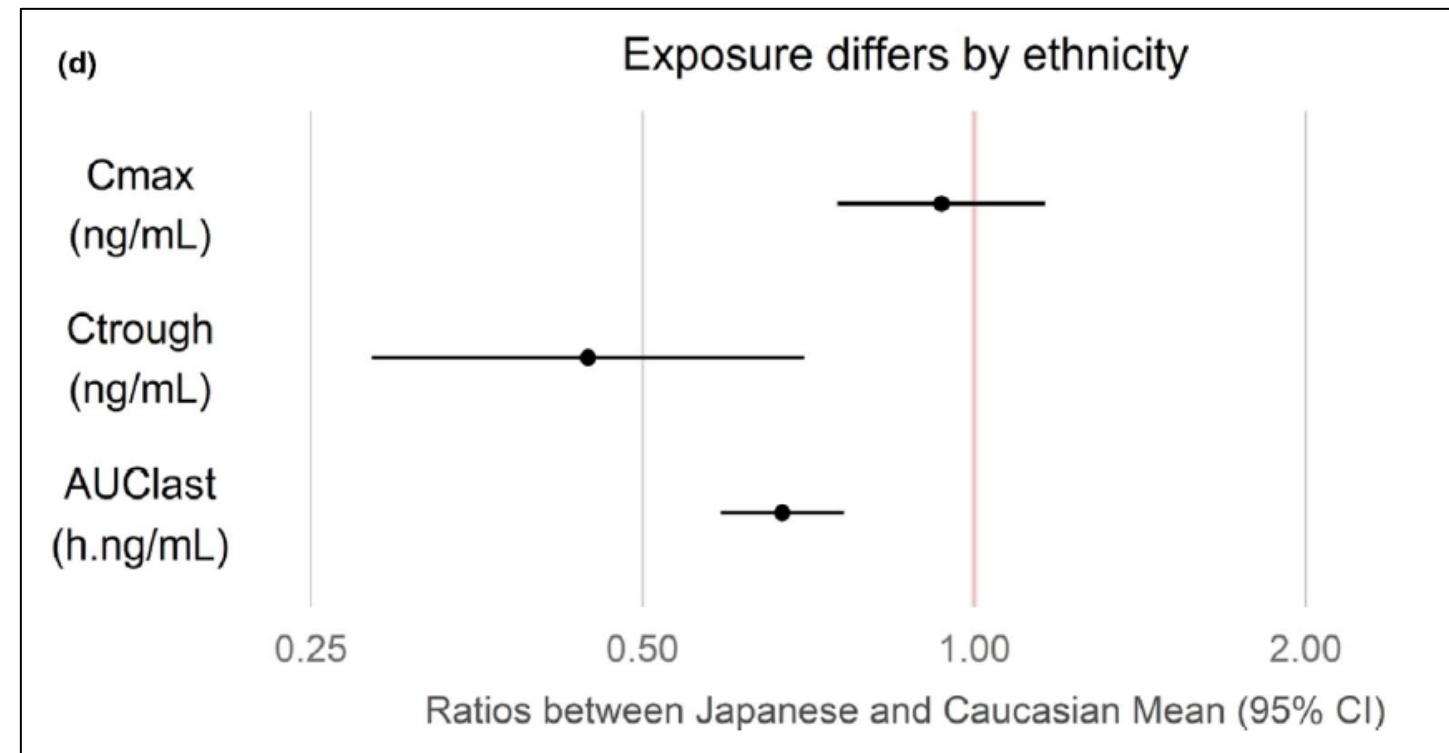
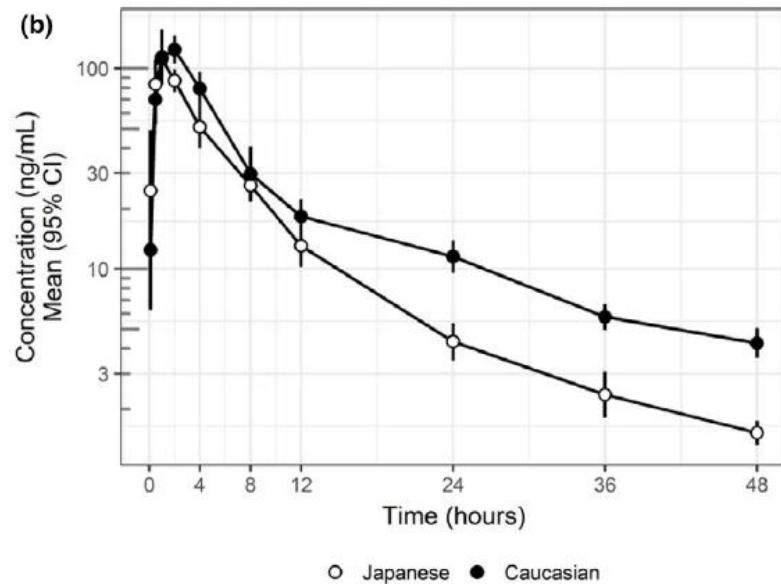
# Maak een **keuze**: kun je data groeperen?



# Maak een **keuze**: welke waarde is relevant?



# Maak een **keuze**: welke waarde is relevant?





# Encode: kies je grafiek

Form follows function

# Zoveel mogelijkheden, hoe kies je?



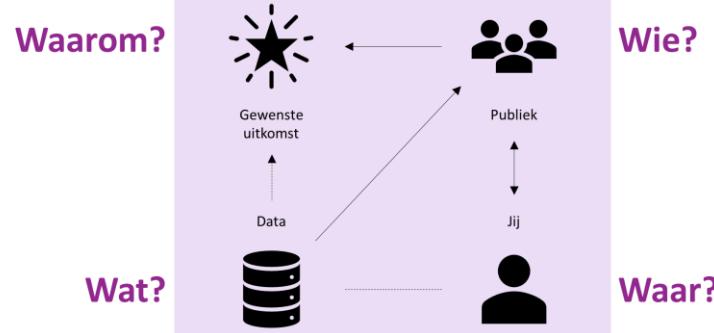
# Zoveel mogelijkheden, hoe kies je?



# Zoveel mogelijkheden, hoe kies je?

1.

Wat is de context?



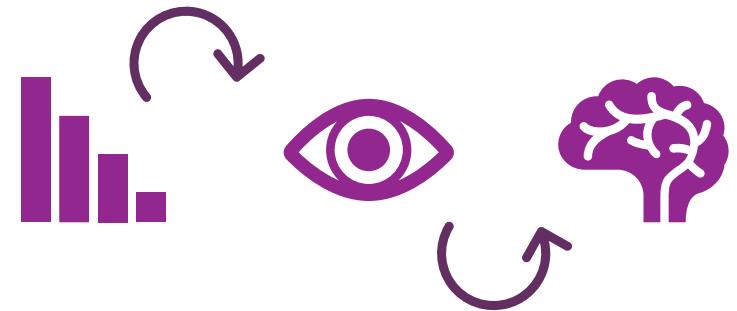
2.

Wat wil je laten zien?



3.

Hoe verwerkt ons brein visuele informatie?



*STORY*

*DATA*

*DESIGN*

# Oefening:

## Een dataset, meerdere verhalen

# Eén dataset, meerdere verhalen

Aantal besmettingen	Stad
250	Amsterdam
110	Rotterdam
125	Den Haag
23	Utrecht
125	Eindhoven
55	Groningen
155	Leeuwarden
85	Enschede
120	Maastricht
15	Bilthoven

5 min



## 5 Scenarios:

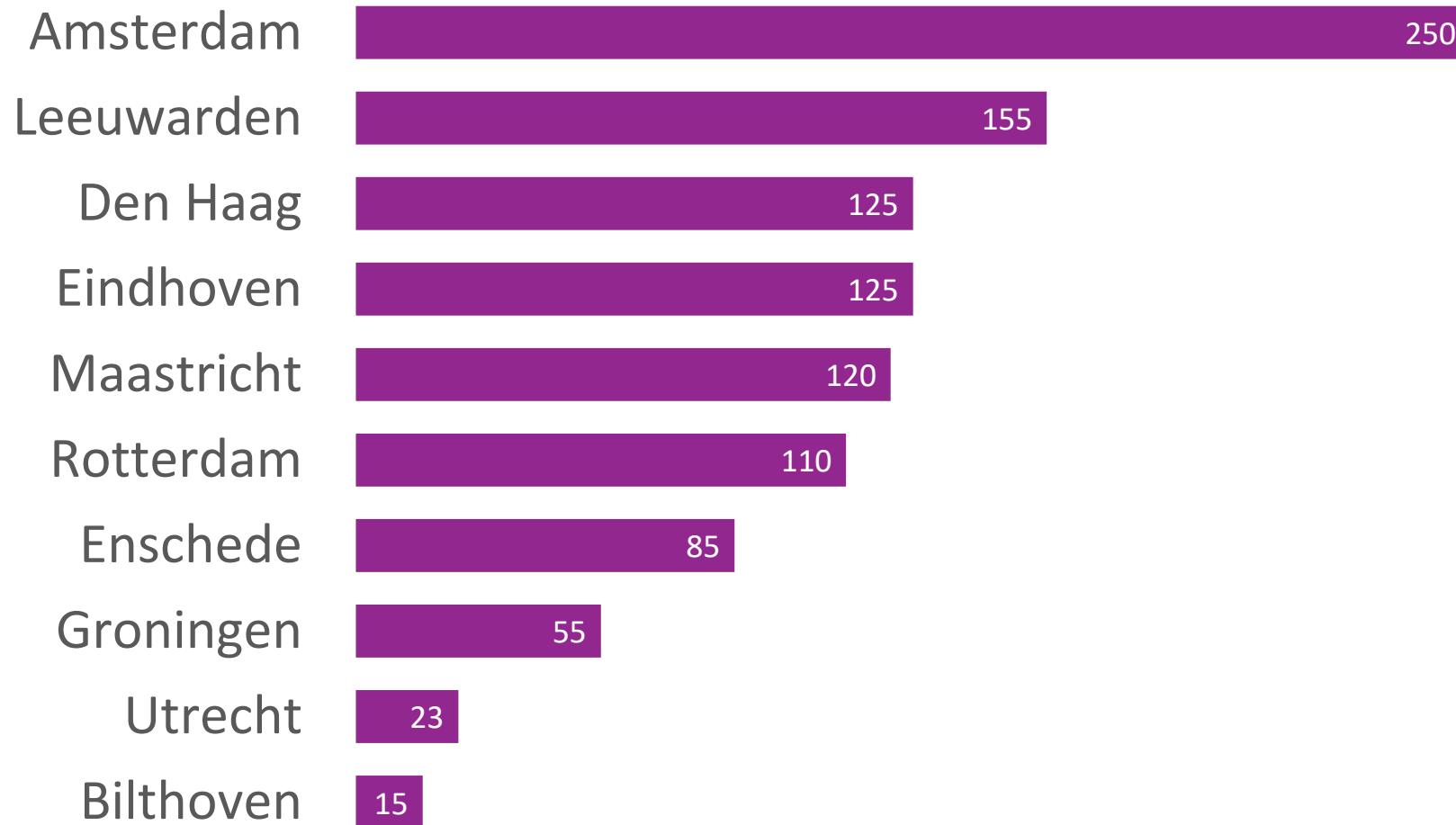
Lezer wil weten:

1. Hoeveel besmette personen zijn er per stad?
2. Op welke plaats staat Maastricht?
3. Hoe verhoudt het aantal in Amsterdam zich tot de andere steden?
4. Welke steden hebben meer dan 100 besmettingen?
5. Heeft de afstand tussen de steden invloed op het aantal besmettingen?

# Hoeveel besmette personen zijn er per stad?

Stad	Aantal besmettingen	Stad	Aantal besmettingen
Amsterdam	250	Amsterdam	250
Leeuwarden	155	Bilthoven	15
Den Haag	125	Den Haag	125
Eindhoven	125	Eindhoven	125
Maastricht	120	Enschede	85
Rotterdam	110	Groningen	55
Enschede	85	Leeuwarden	155
Groningen	55	Maastricht	55
Utrecht	23	Rotterdam	110
Bilthoven	15	Utrecht	23

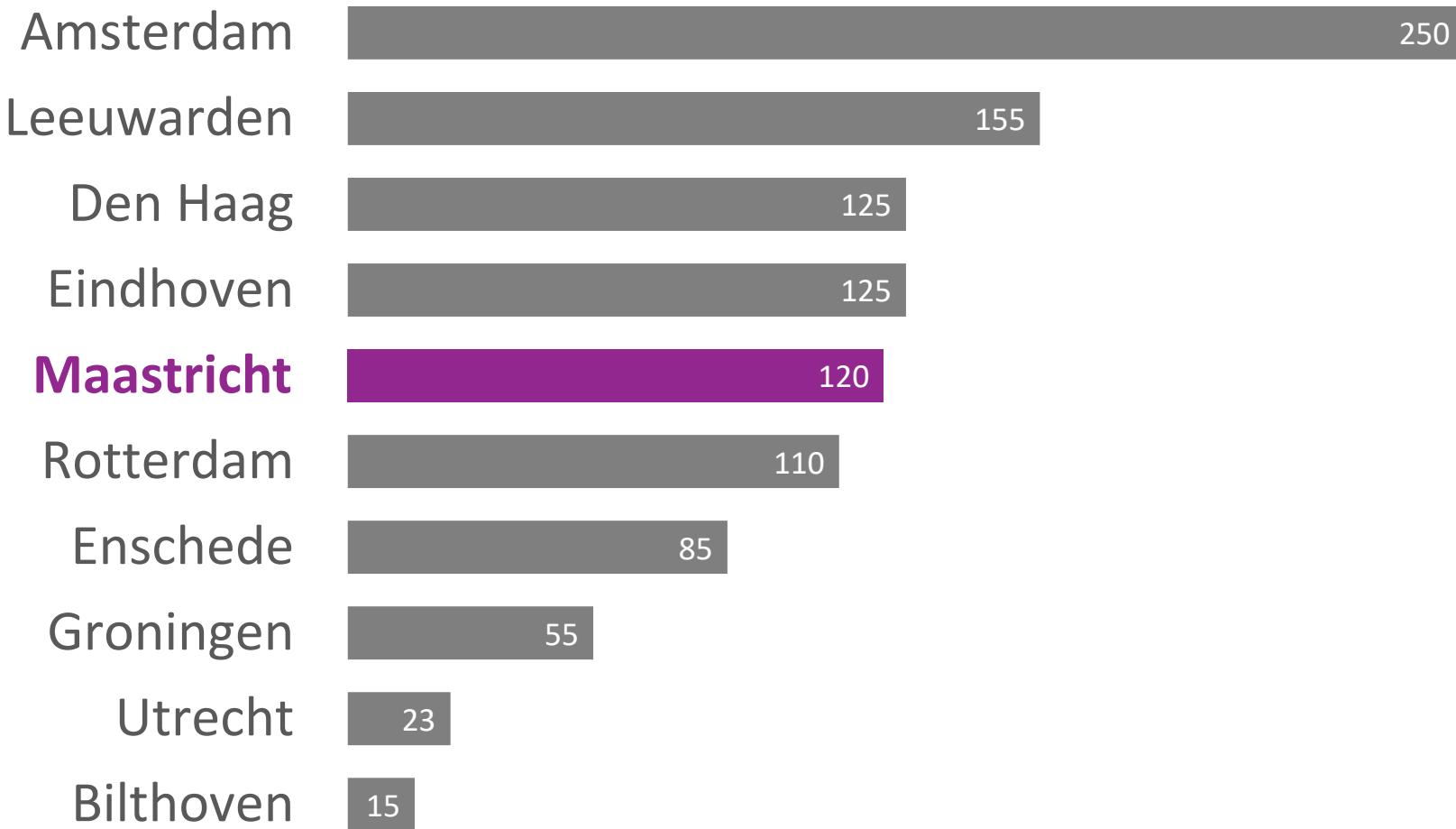
# Hoeveel besmette personen zijn er per stad?



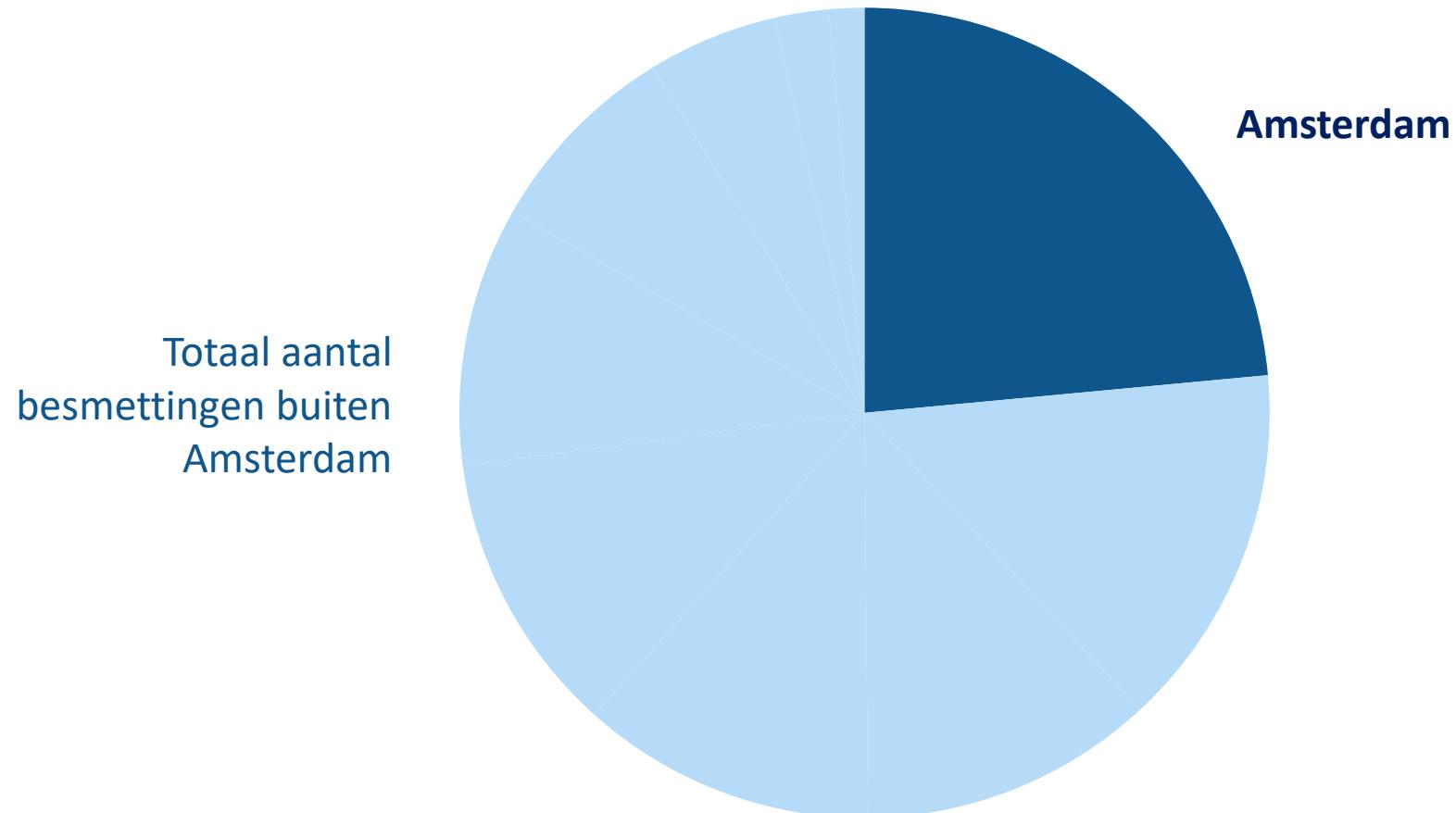
# Op welke plaats staat Maastricht?

	<b>Stad</b>	<b>Aantal besmettingen</b>
1.	Amsterdam	250
2.	Leeuwarden	155
3.	Den Haag	125
4.	Eindhoven	125
5.	<b>Maastricht</b>	<b>120</b>
6.	Rotterdam	110
7.	Enschede	85
8.	Groningen	55
9.	Utrecht	23
10.	Bilthoven	15

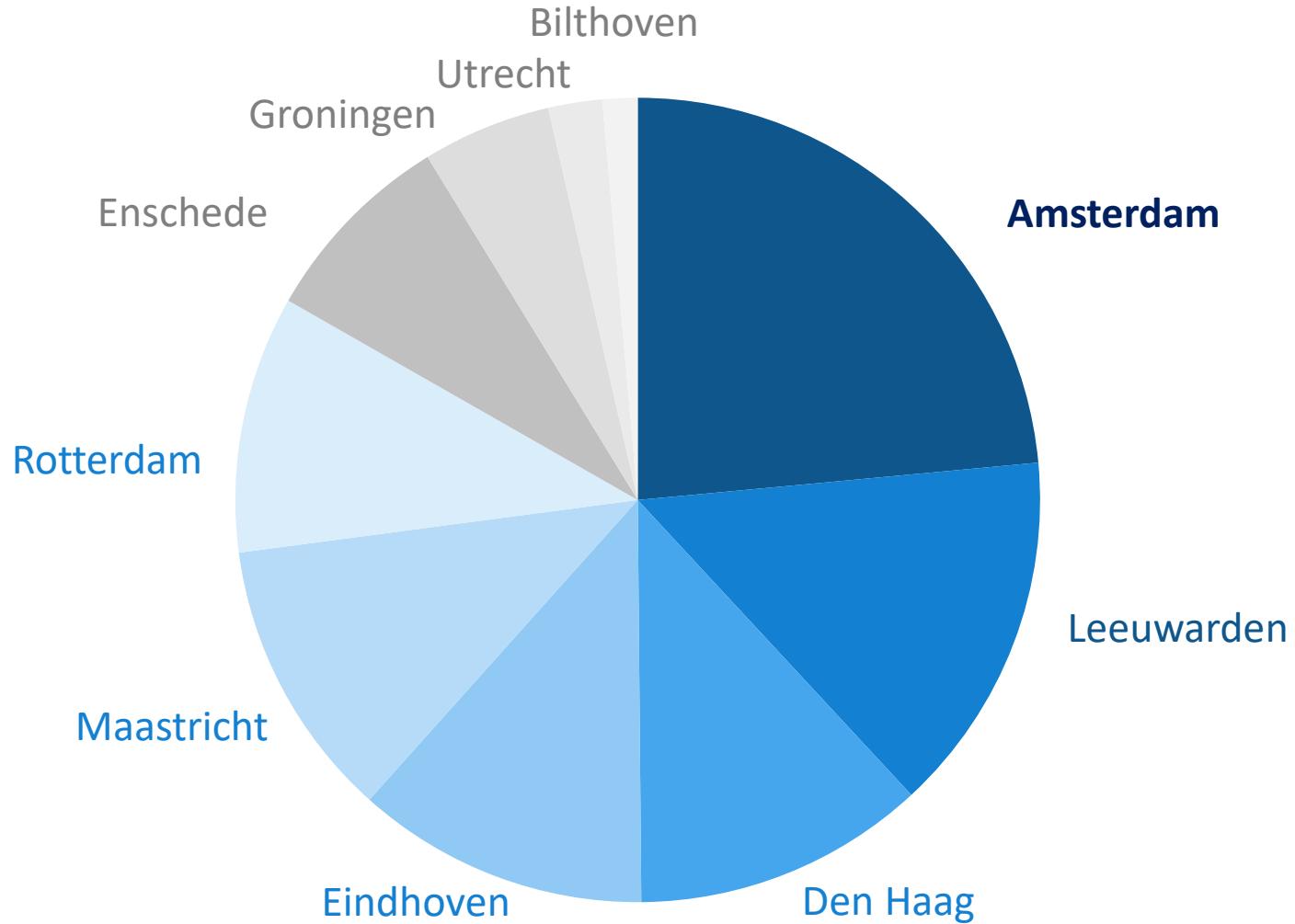
# Op welke plaats staat Maastricht?



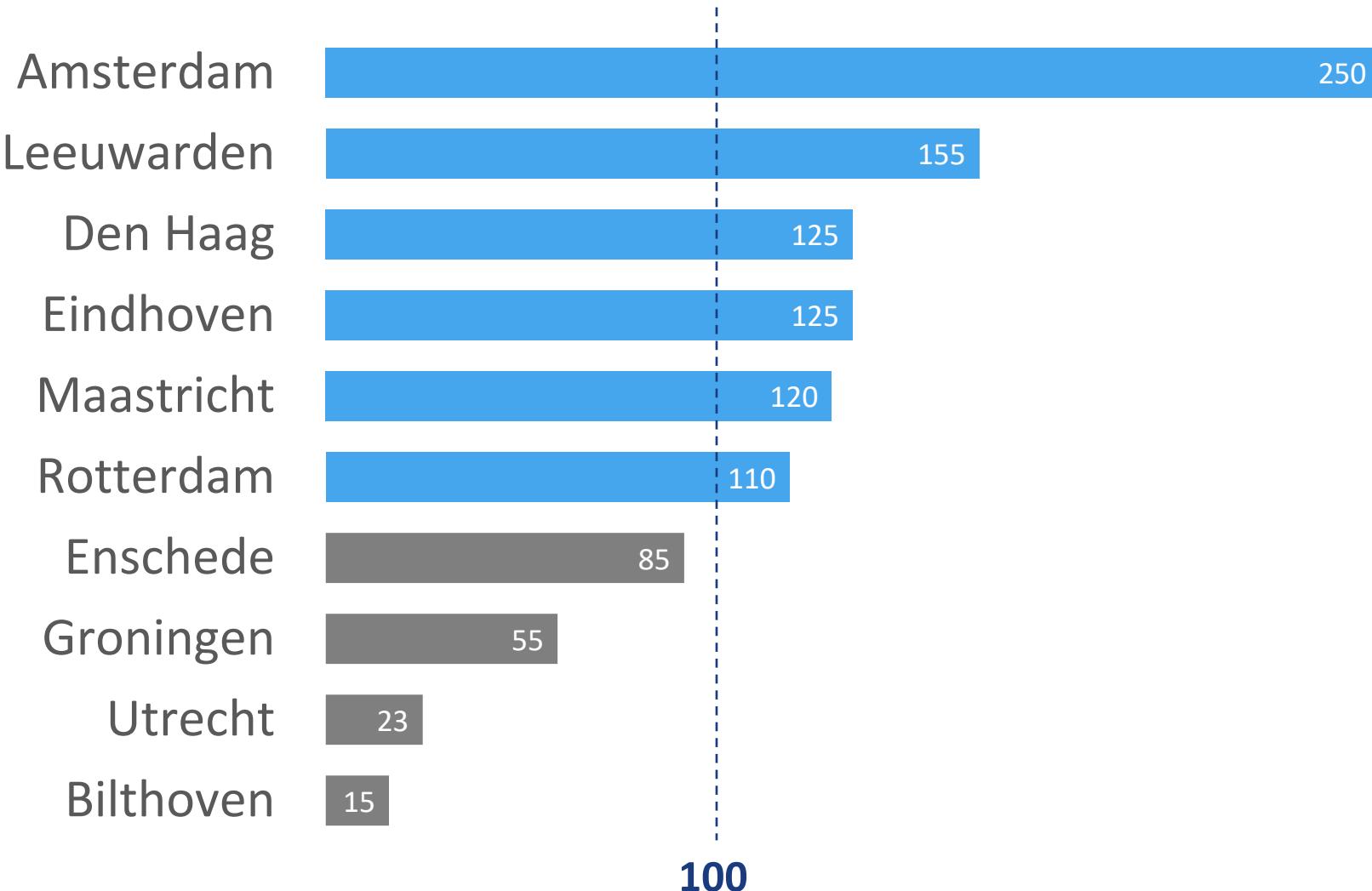
# Hoe verhoudt het aantal besmettingen in Amsterdam zich tot de andere steden?



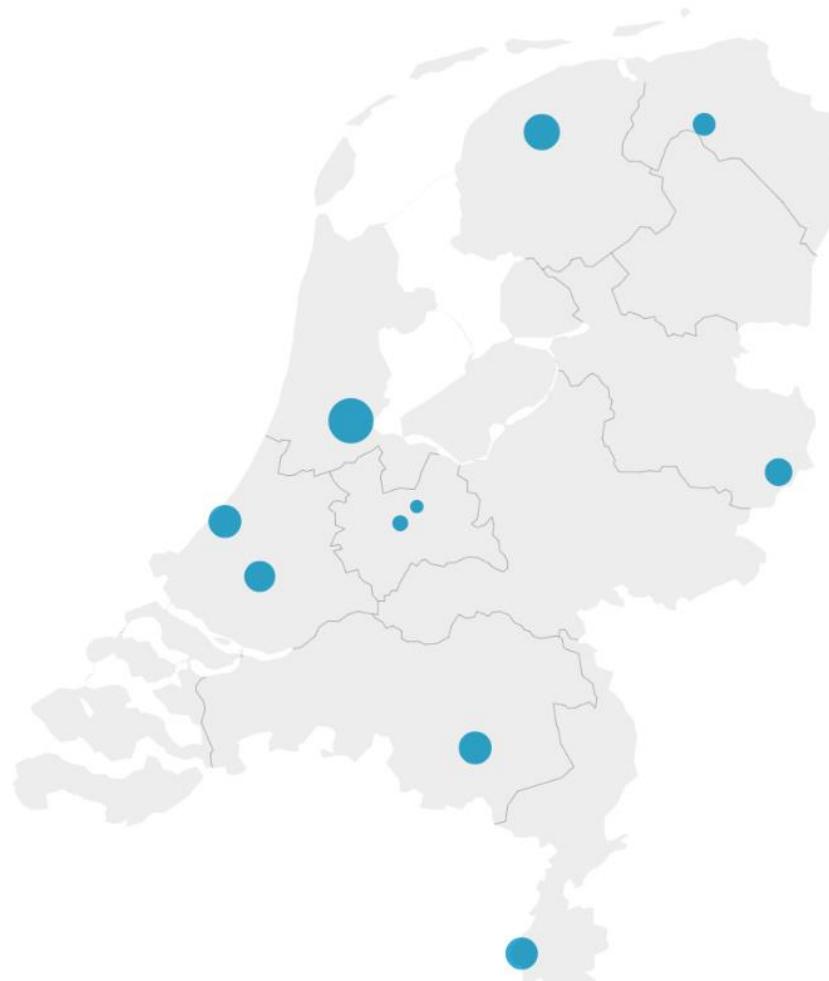
# Hoe verhoudt het aantal besmettingen in Amsterdam zich tot de andere steden?

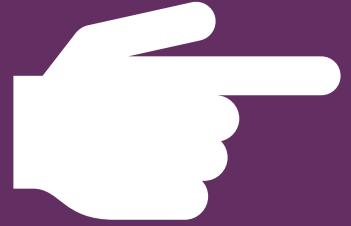


# Welke steden hebben meer dan 100 besmettingen?



Heeft de afstand tussen de steden invloed op het aantal besmettingen?



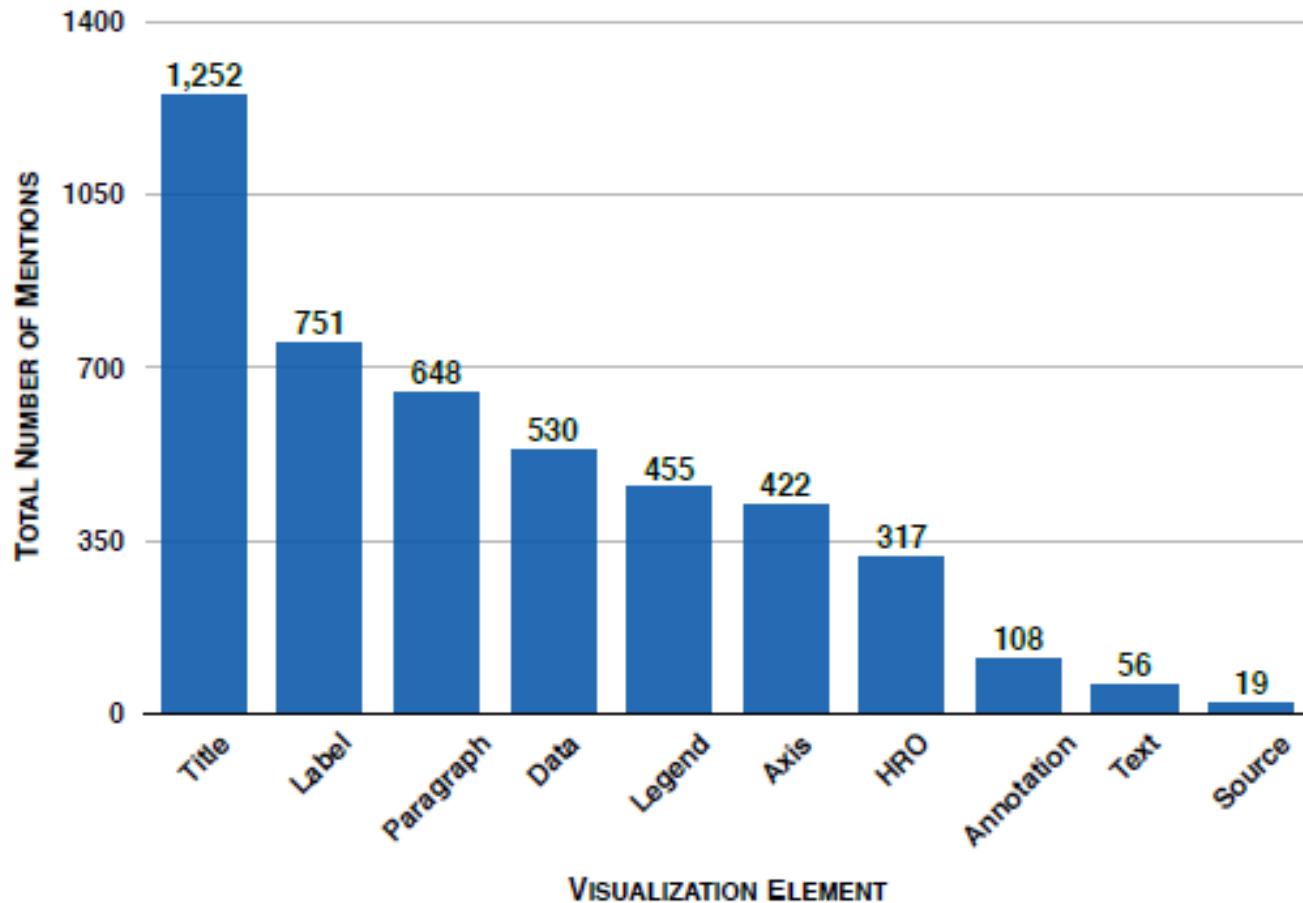


# Explain: integreer tekst en beeld

Show and Tell.

# Wat maakt een visualisatie memorabel?

Wat wordt het meest onthouden?



Rank:	1st	2nd	3rd
Overall	Title (46%)		
Infographics	Title (72%)	Label (27%)	Paragraph (24%)
News	Paragraph (45%)	Title (43%)	Paragraph (24%)
Government	Title (55%)	Legend (26%)	Label (33%)
Science	Label (27%)	Axis (14%)	Data (21%)
			Legend (13%)

# De titel is de lezers eerste indruk

Zwakke titel



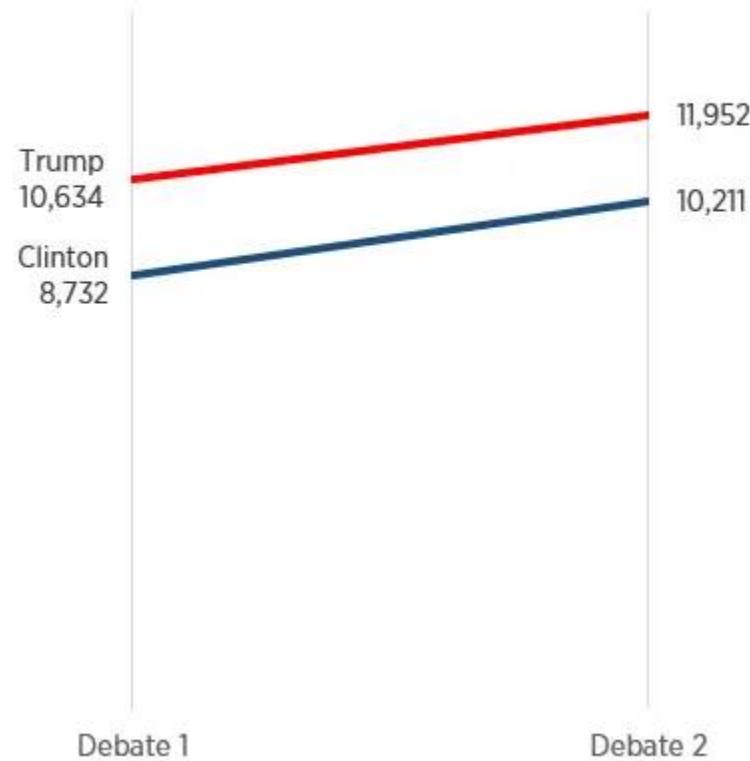
Sterke titel

Average **pretest** & **posttest** scores show the parenting program made the biggest impact on helping participants handle their own stress.  
Scale was 0-5, with 5 representing "Excellent."

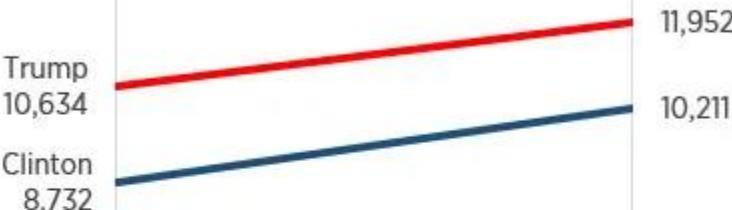


# Beschrijven ≠ Oordelen

Words Spoken at Debate

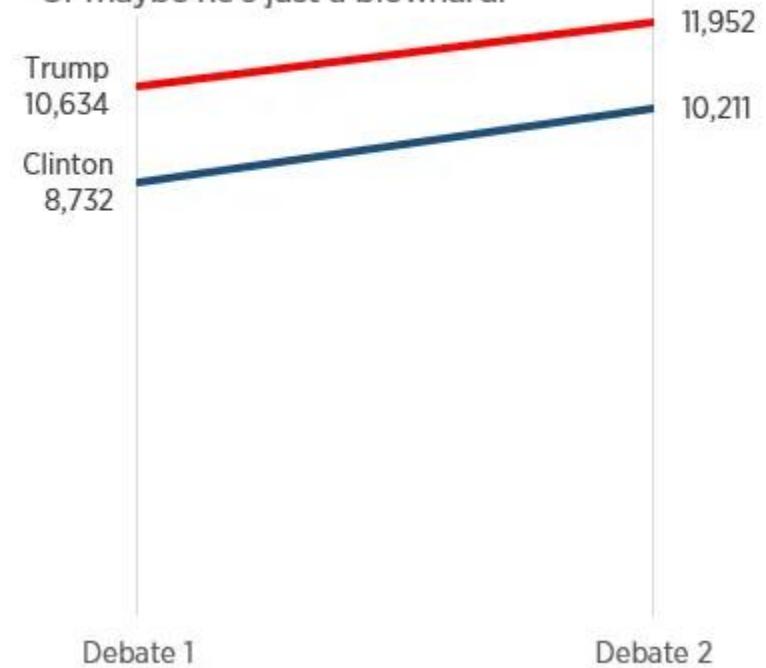


**Trump** spoke more words during both debates.



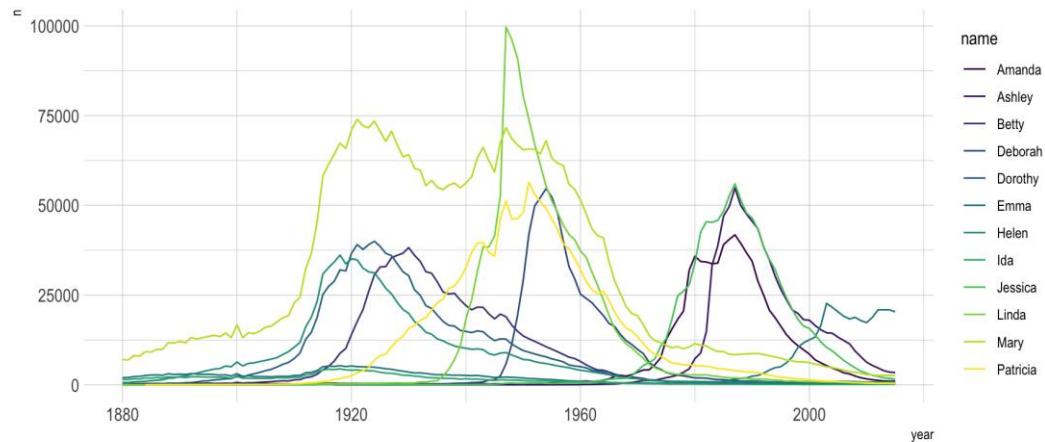
**Trump** spoke more words during both debates.

Therefore he deserves to be president.  
Or maybe he's just a blowhard.

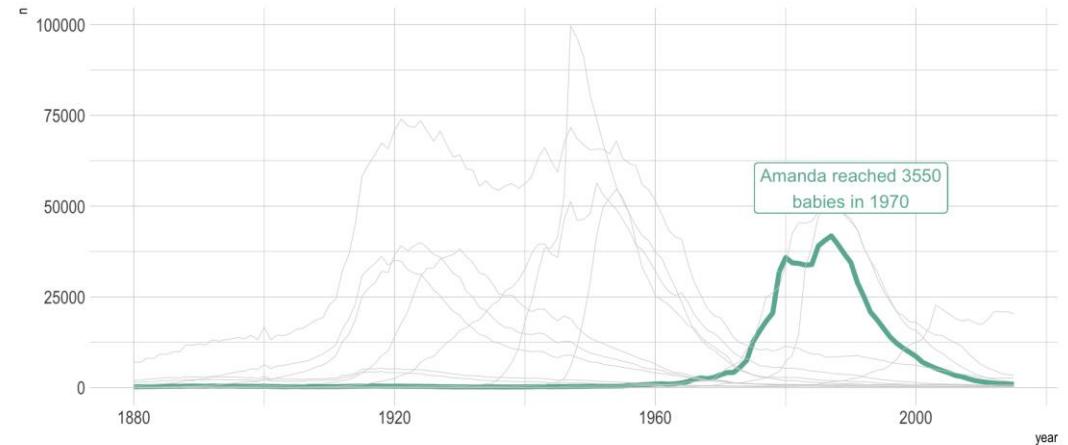


# Beschrijf wat belangrijk is

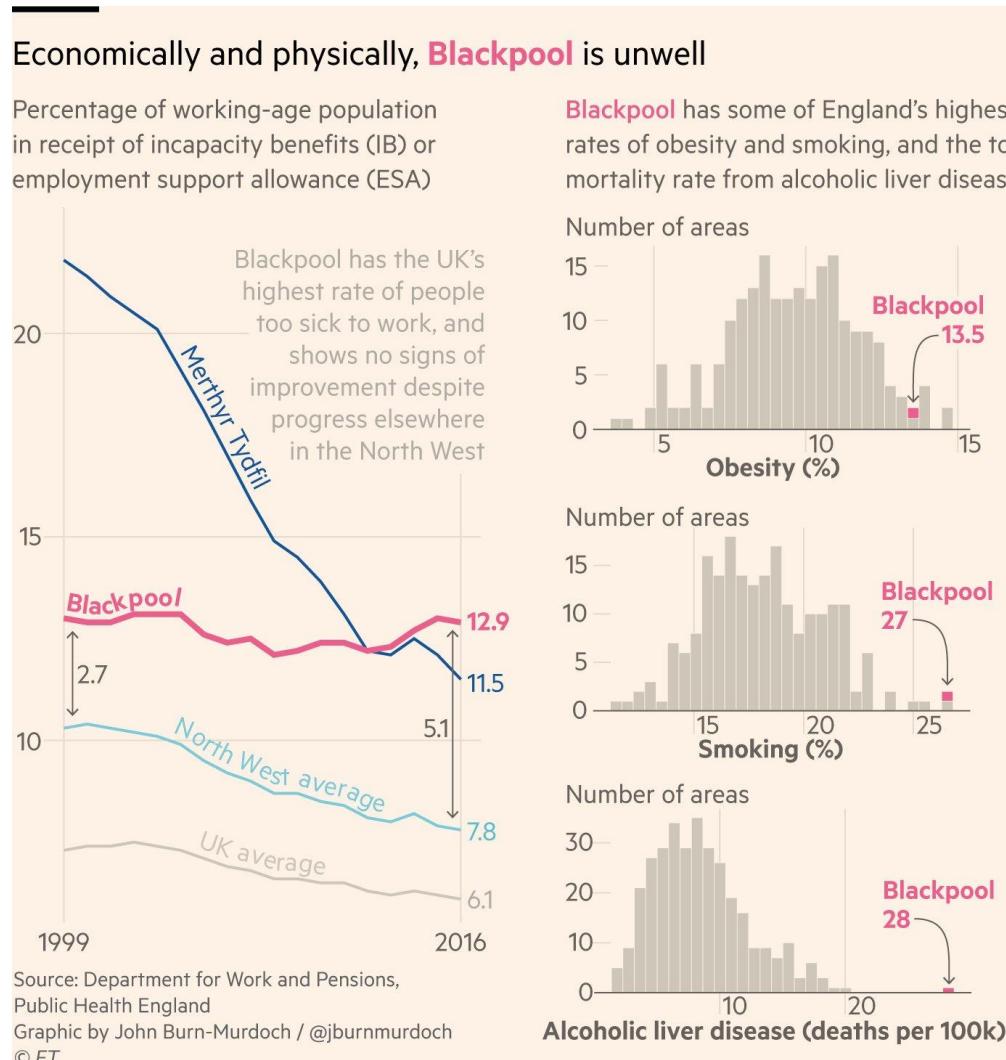
A spaghetti chart of baby names popularity



Popularity of American names in the previous 30 years

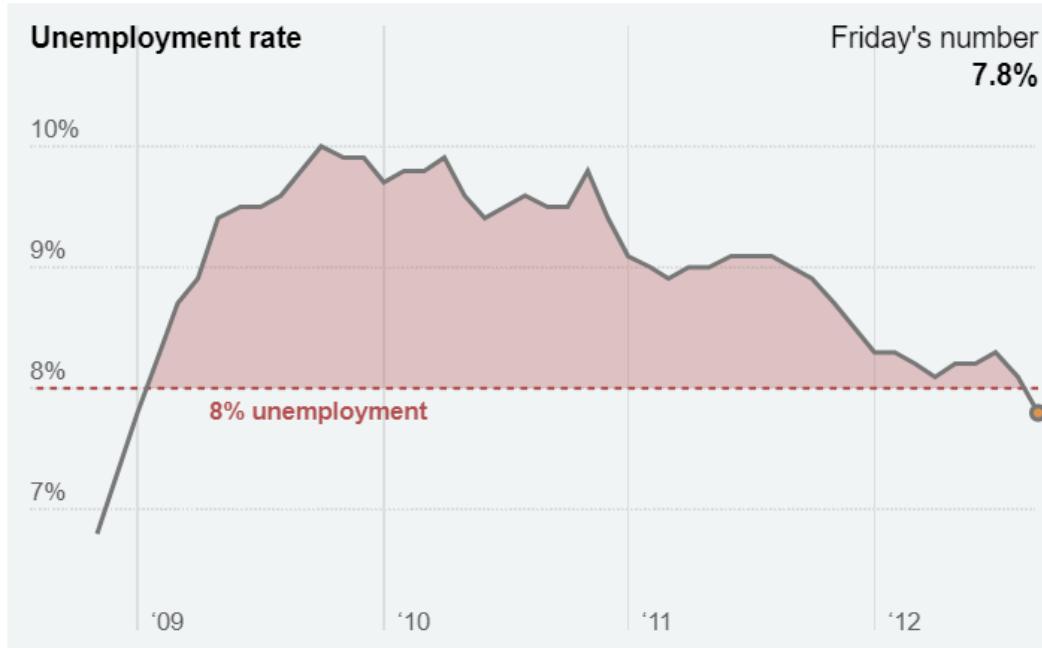


# Beschrijf en verhelder wat belangrijk is

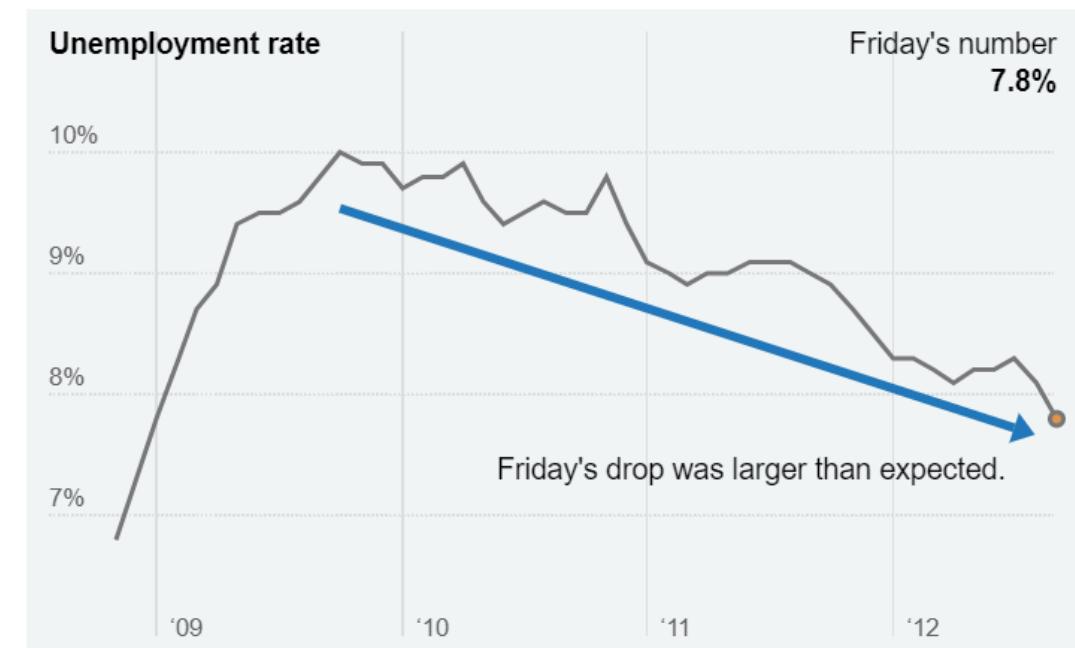


# Perceptie is gevoelig voor stijl...

*The rate was above 8 percent for 43 months.*

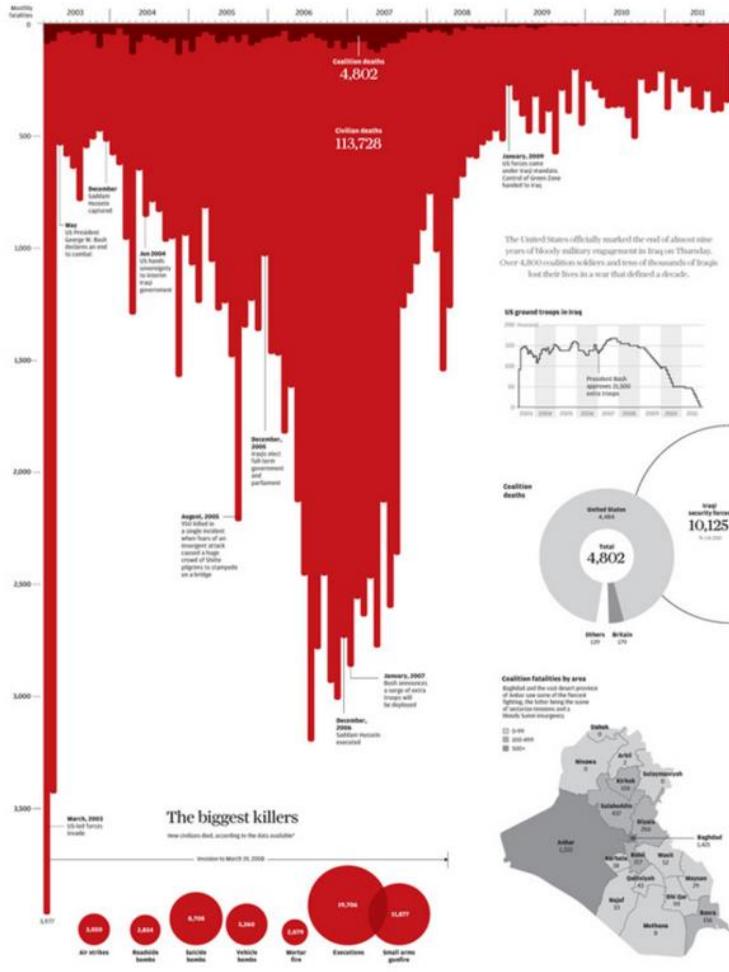


*The rate has fallen more than 2 points since its recent peak.*

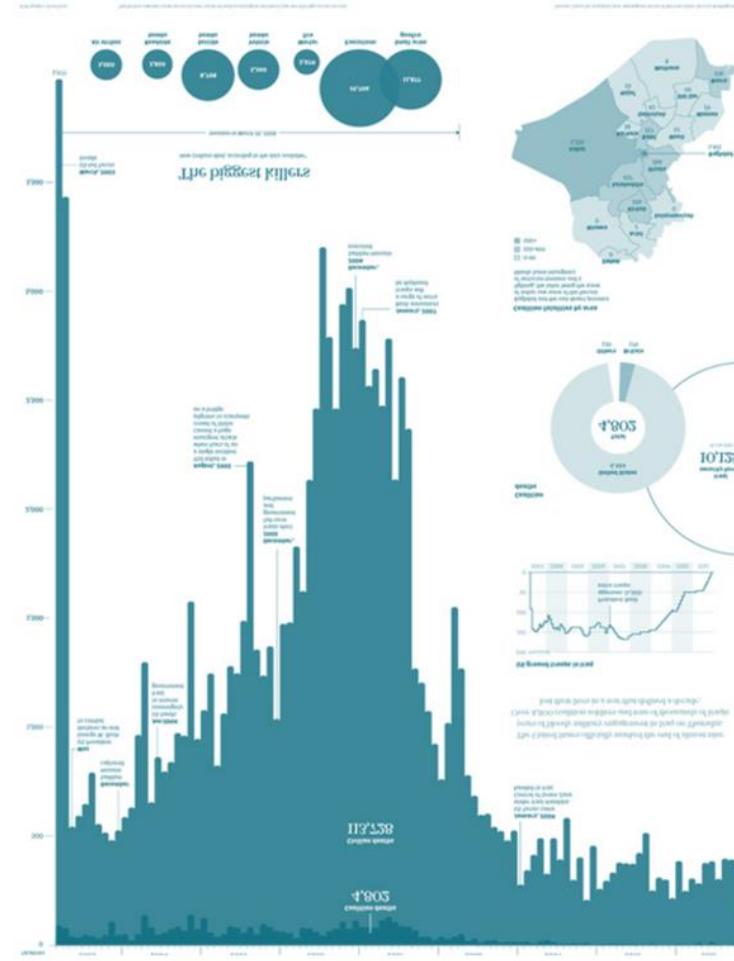


# Perceptie is gevoelig voor stijl...

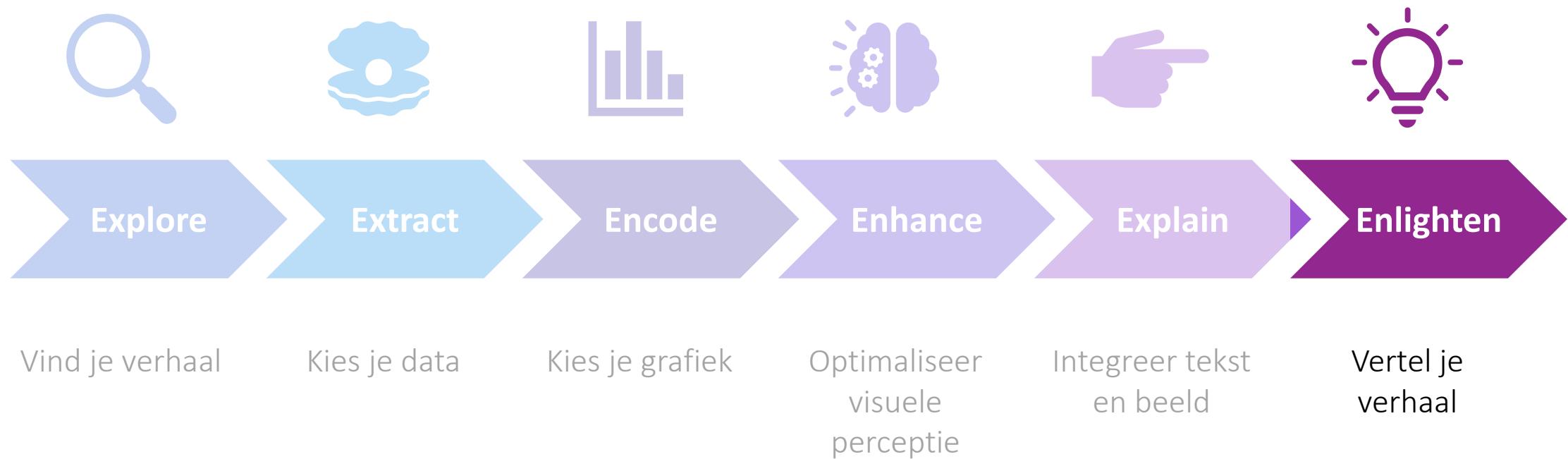
## Iraq's bloody toll



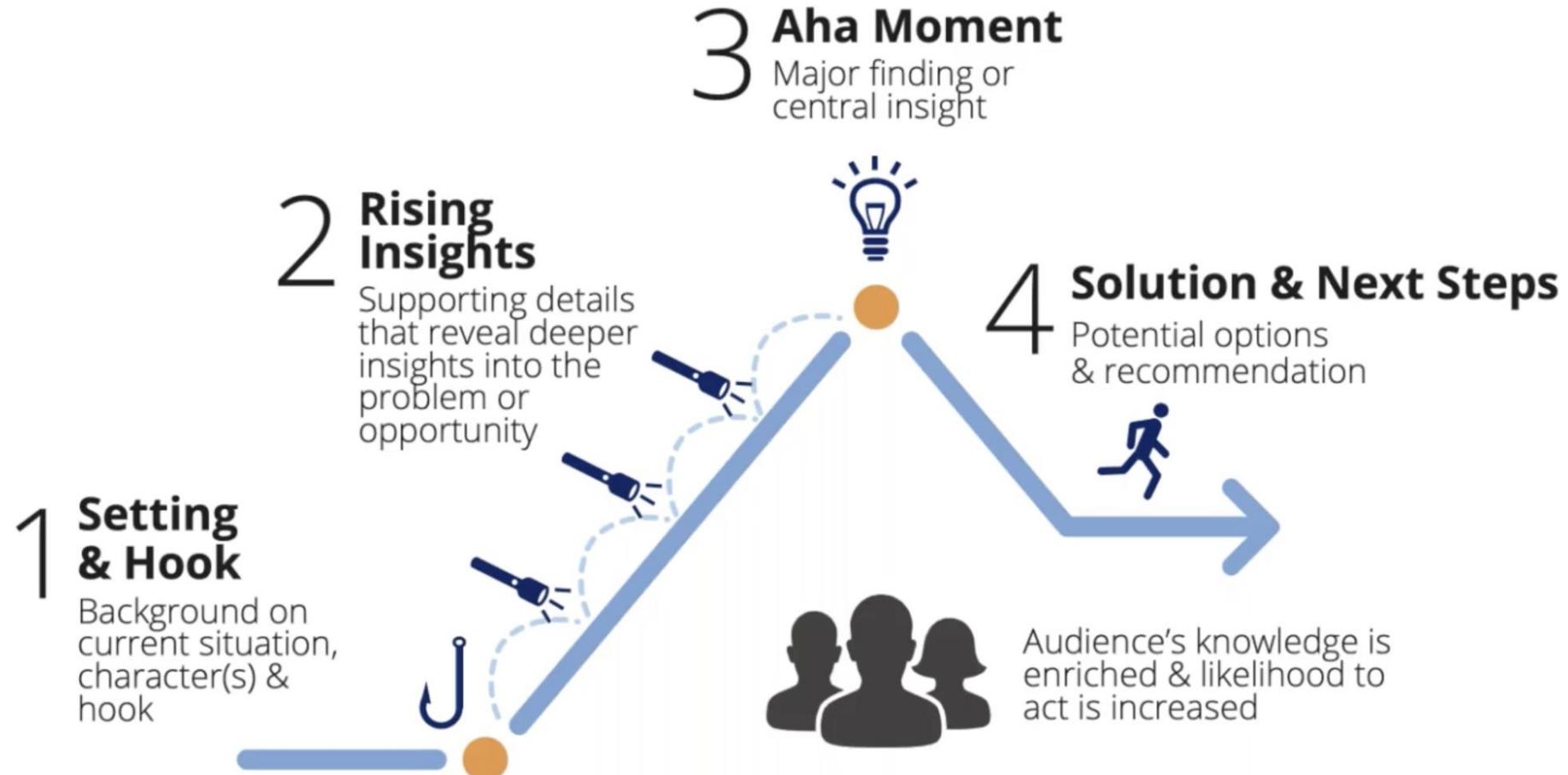
## Iraq: Deaths on the decline



# De 6 stappen naar een krachtig dataverhaal



# Enlighten: Inspireer met data, beeld en verhaal!



# Cooling down!

Pulling it all together: oefeningen met ‘eigen’ werk

# Zien, verwonderen, verbeteren



## Zien: (<10 sec)

*Wat is het eerste dat je opvalt?*



## Verwonderen: (< 1 min)

*Wat vraag je je af?*



## Verbeteren (max. 5 min) :

*Wat zou je anders doen?*

**Eenvoudig, Helder, Duidelijk, Intuïtief, Toegankelijk**

# Storyboarding

De context

**Wie?**

Voor wie is de visualisatie bedoeld?  
Wat motiveert hen?

**Waarom?**

Wat wil je dat je publiek gaat doen?  
Specificeer in 1 zin..

**Wat?**

Welke data ondersteunt de boodschap?

Het verhaal  
(3 zinnen)

**Begin**

Wat is het probleem?  
Waarom zal dit het publiek interesseren?

**Midden**

Wat is de oplossing?  
Hoe overtuigt de data?

**Einde**

Wat is de aanbeveling  
(call-to-action) waar het publiek mee aan de slag moet?

# Maak een grafiek en vertel je verhaal!



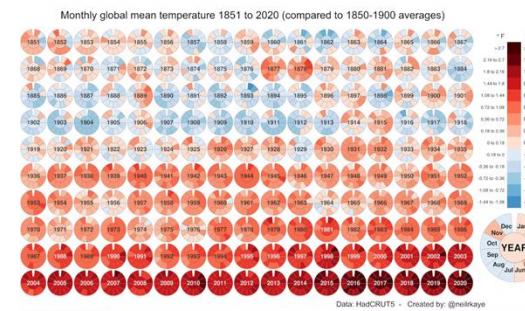
## From **data** to **story**



# En nu...een total ander publiek!



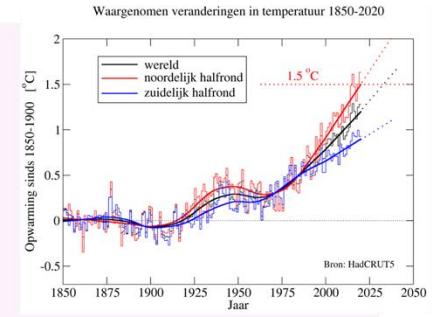
## From data to story



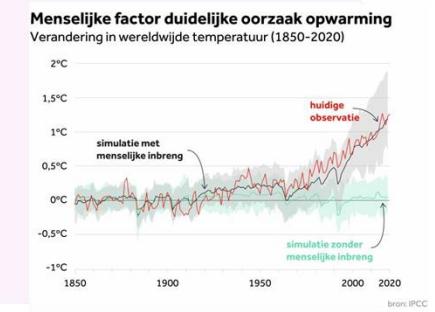
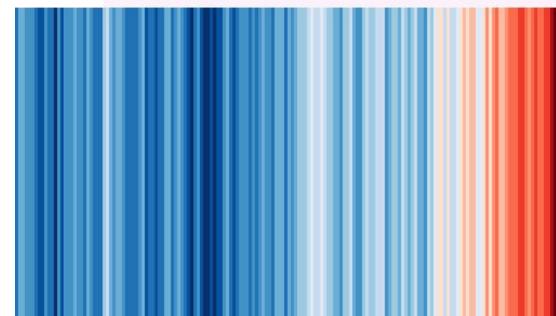
**LAGE  
INTERESSE**

**AANDACHTIG**

**AFGELEID**



**HOGE  
INTERESSE**

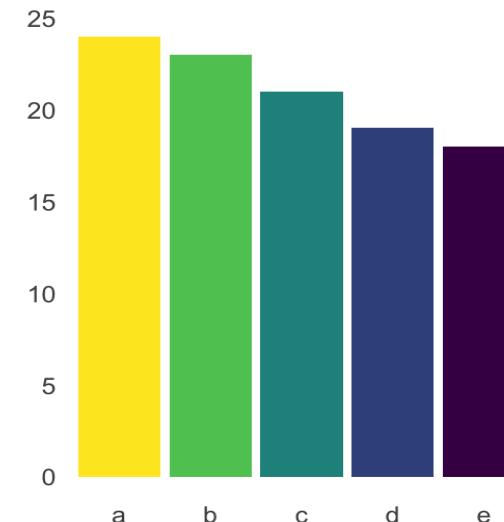
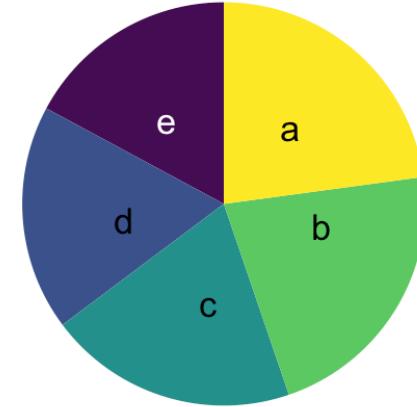
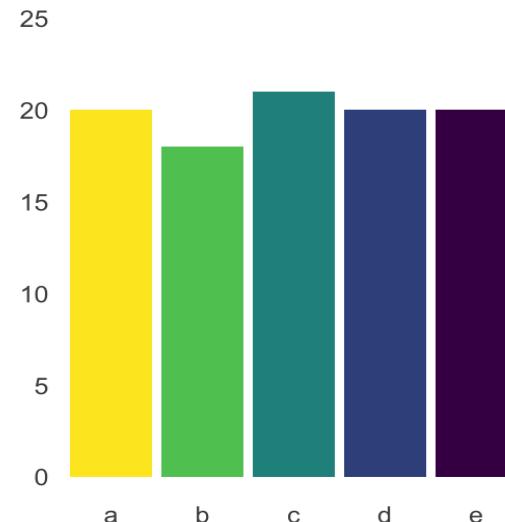
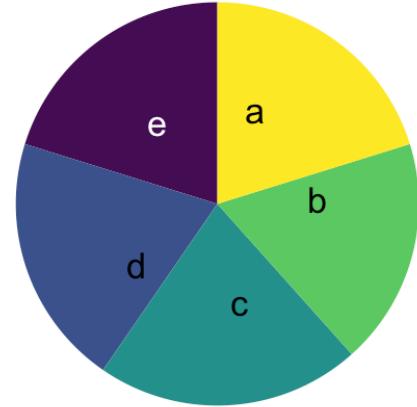
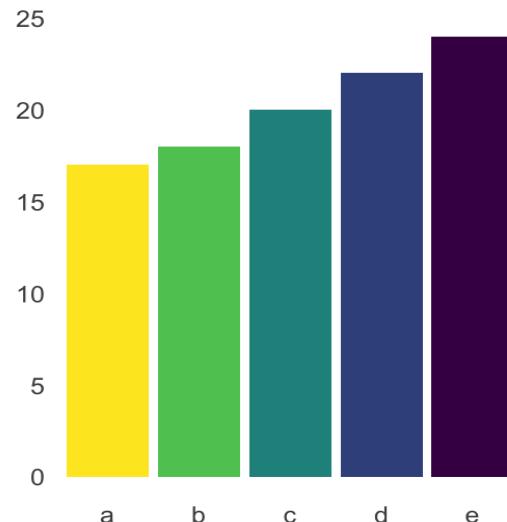
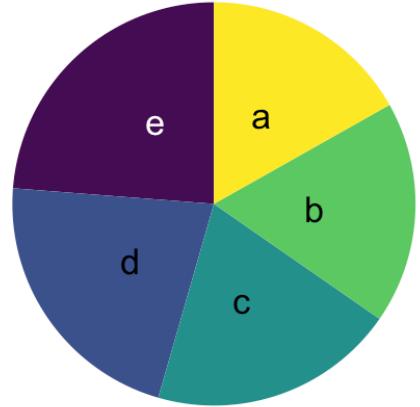




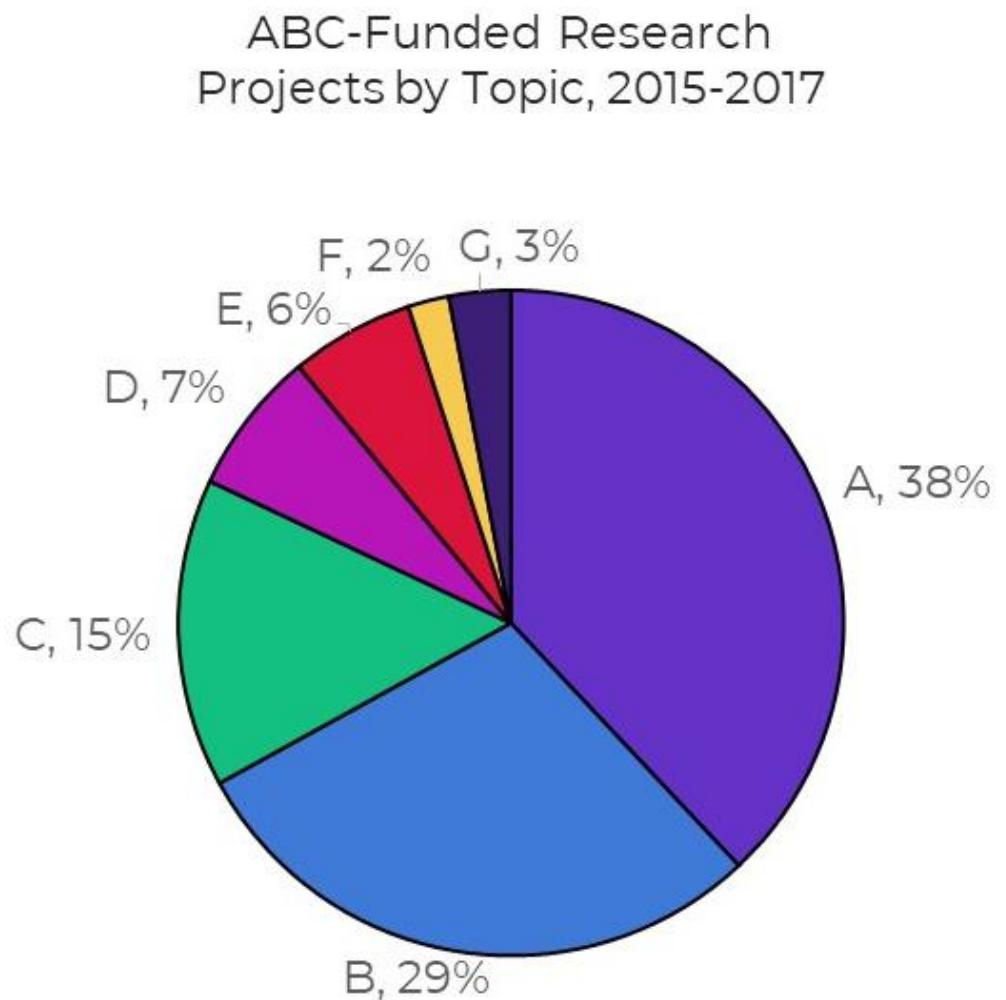
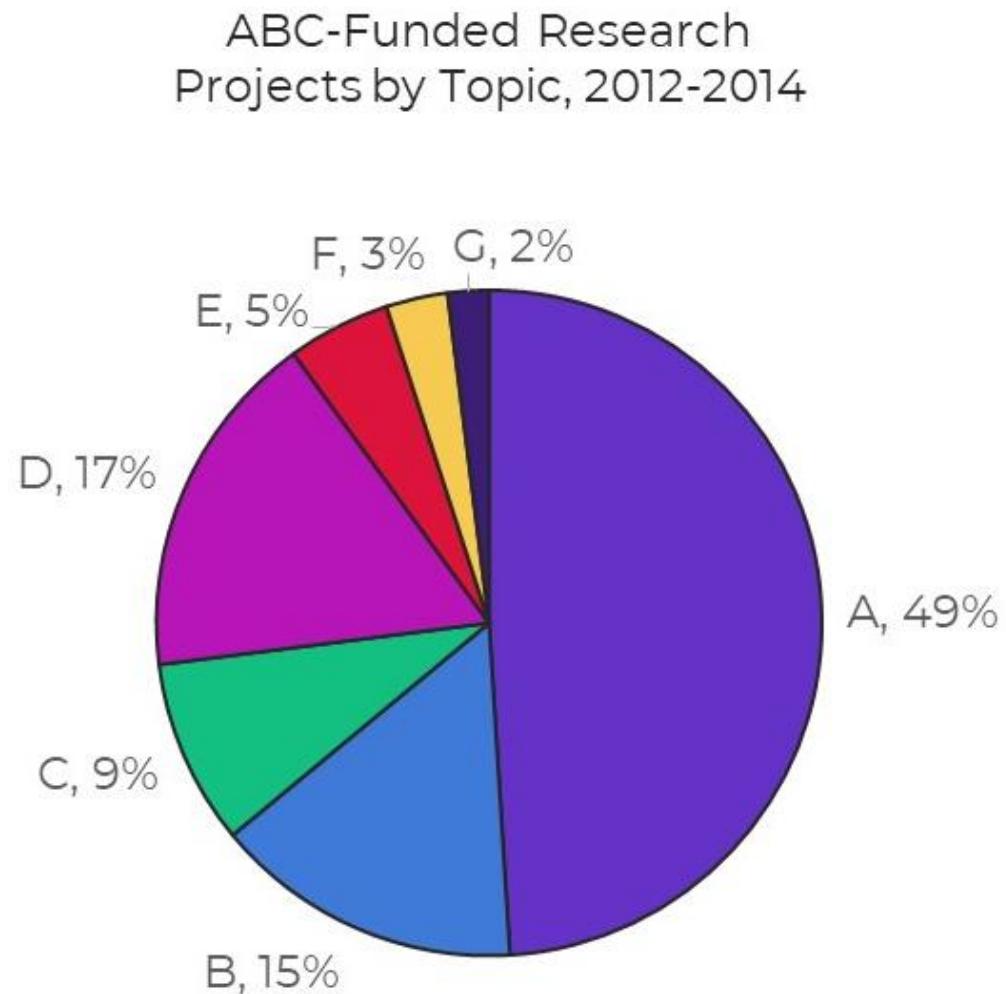
# Tot slot: Taartdiagrammen

*“There is no data that can be displayed in a pie chart, that cannot be displayed BETTER in some other type of chart.”* – John Tukey

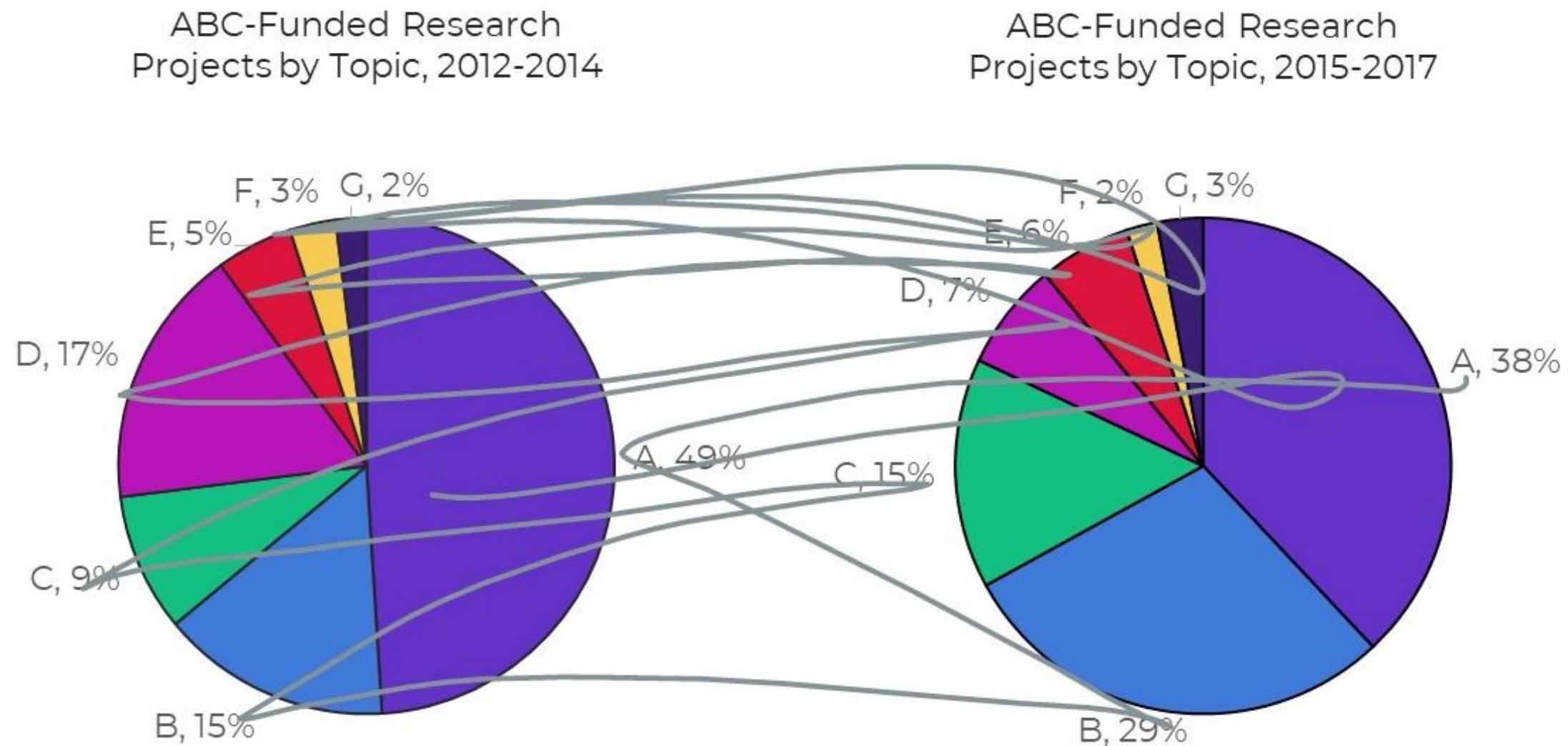
# Het probleem met taartdiagrammen...



# Het probleem met taartdiagrammen...

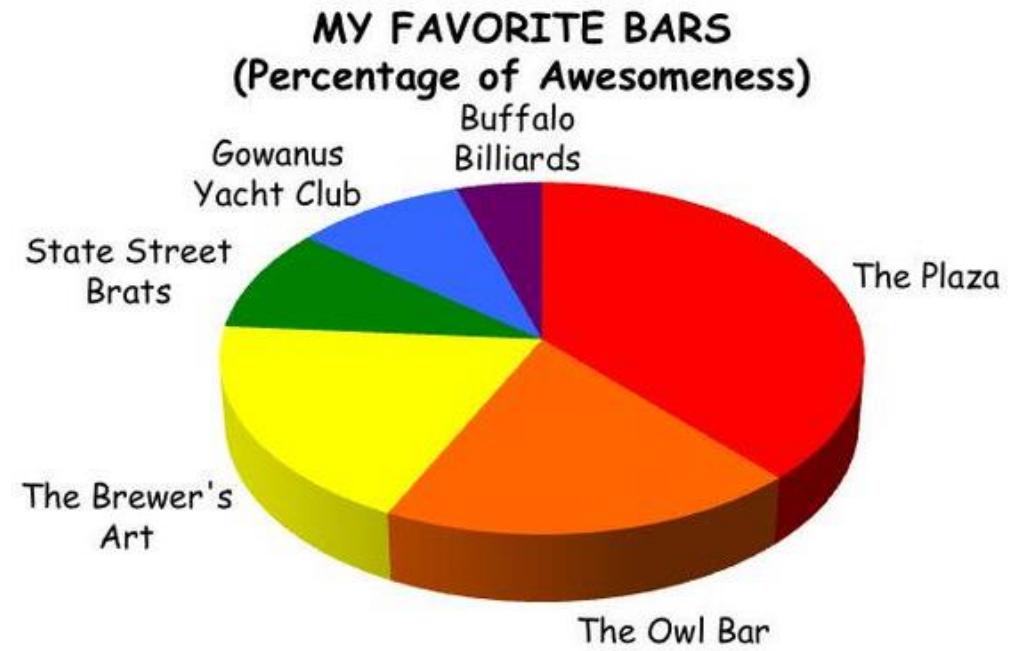
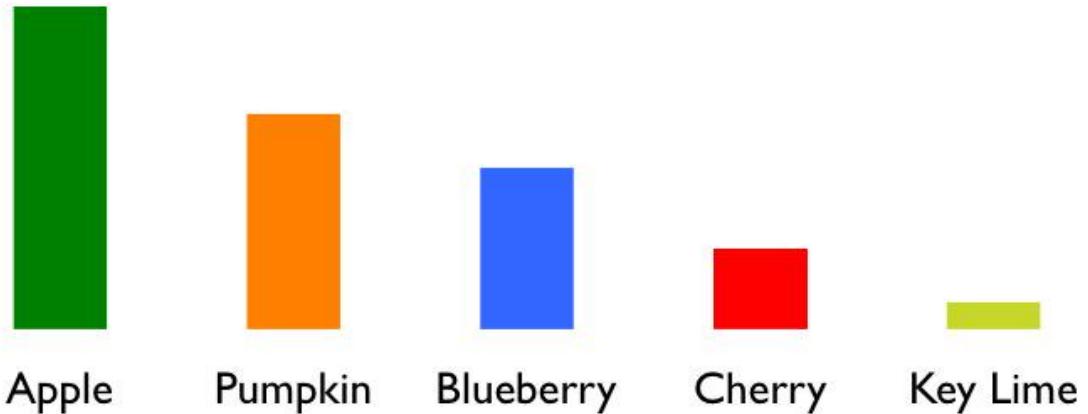


# Het probleem met taartdiagrammen...

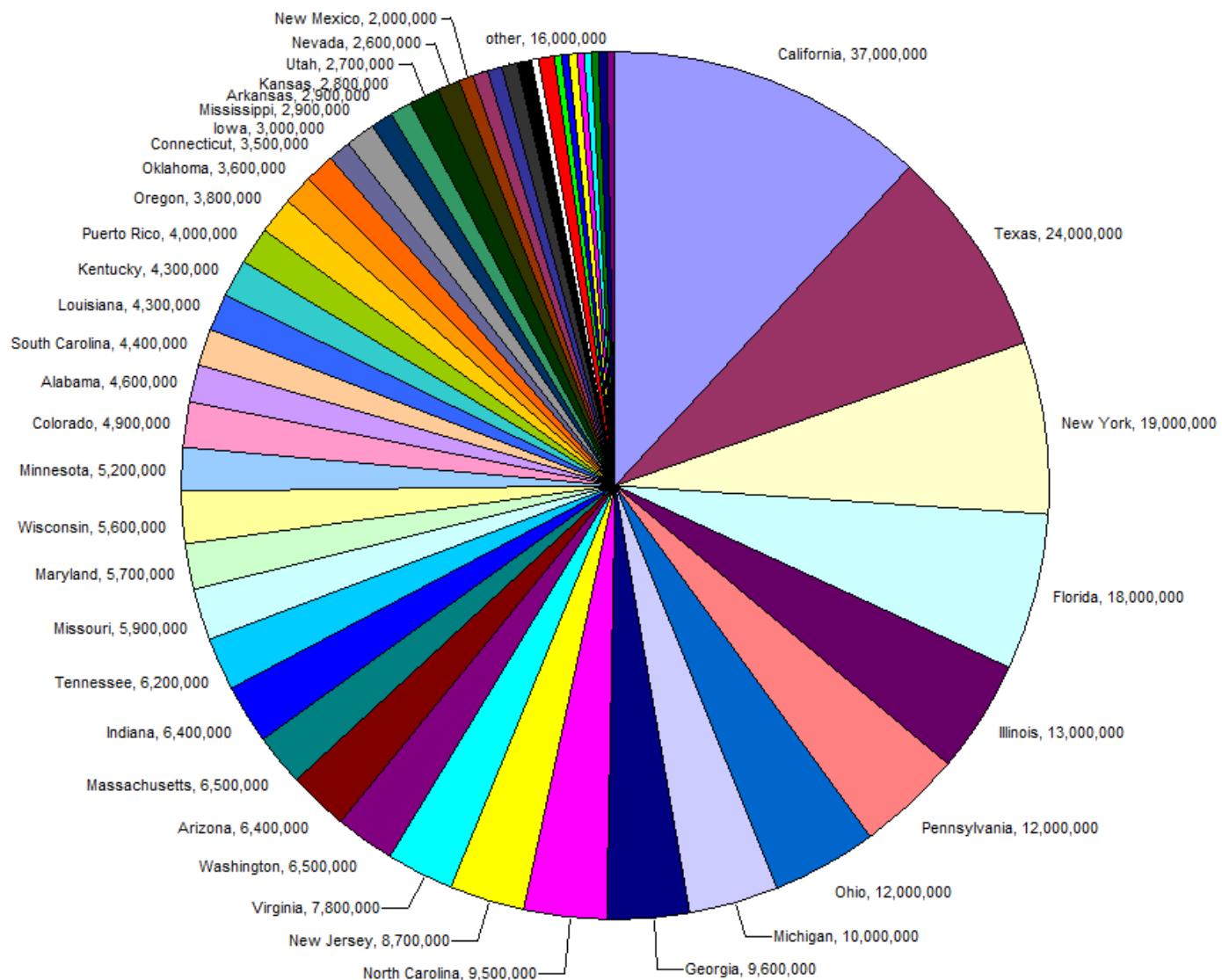


# Wanneer kies je voor een *pie* of *bar* chart?

**My Favorite Pies**  
(Percentage of Tastiness)

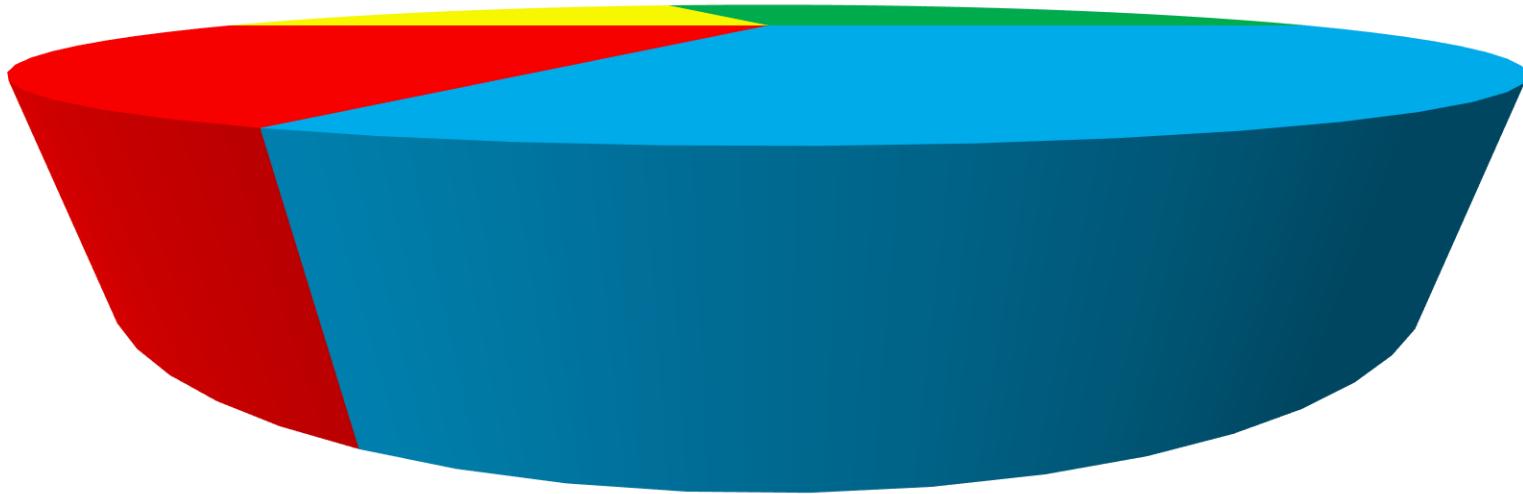


# Gebruik geen taartdiagram bij >5 categorieën



# Gebruik ook geen 3D taartdiagram

Perceptie van een 3D taartdiagram



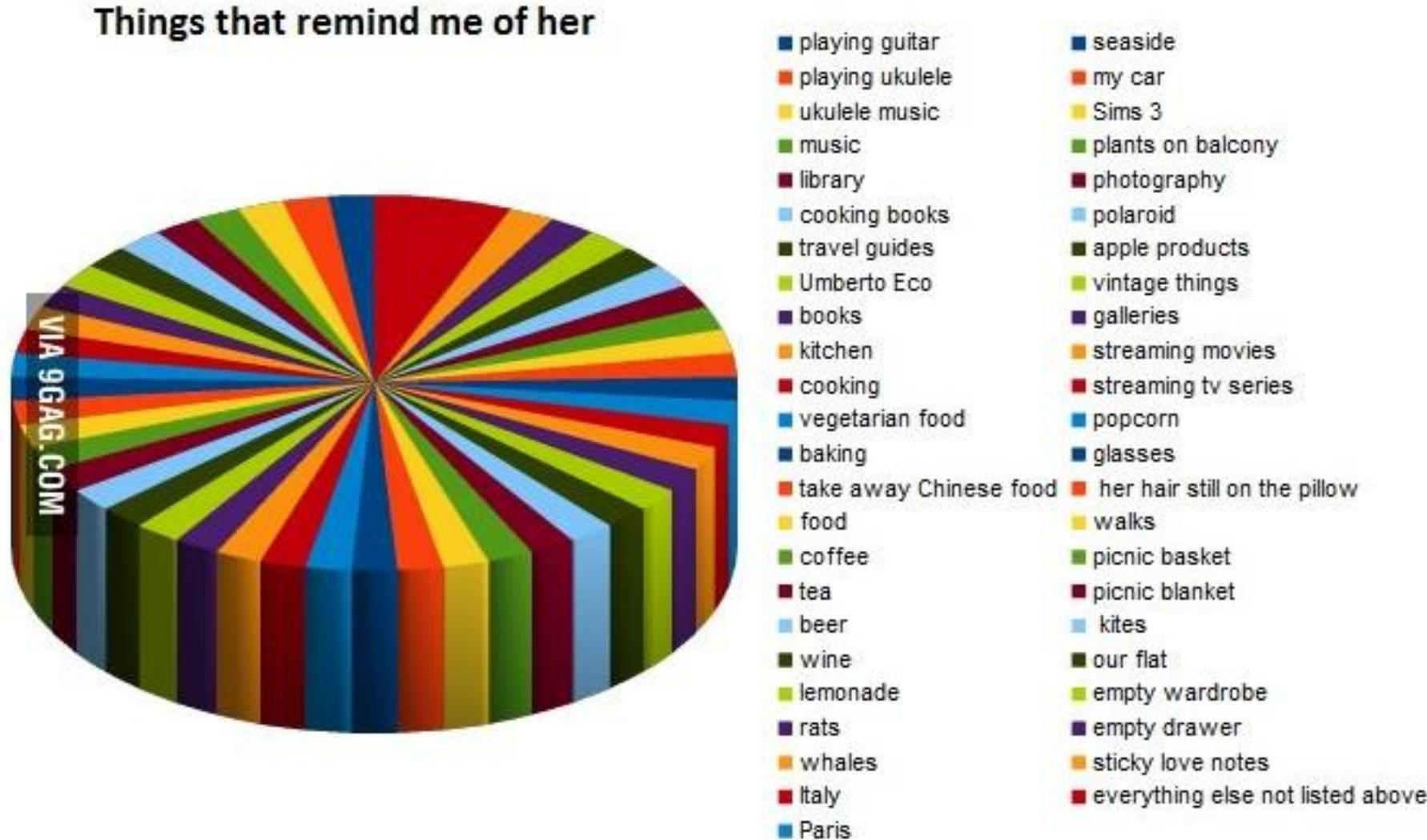
■ Gaaf (30%)

■ Misleidend (20%)

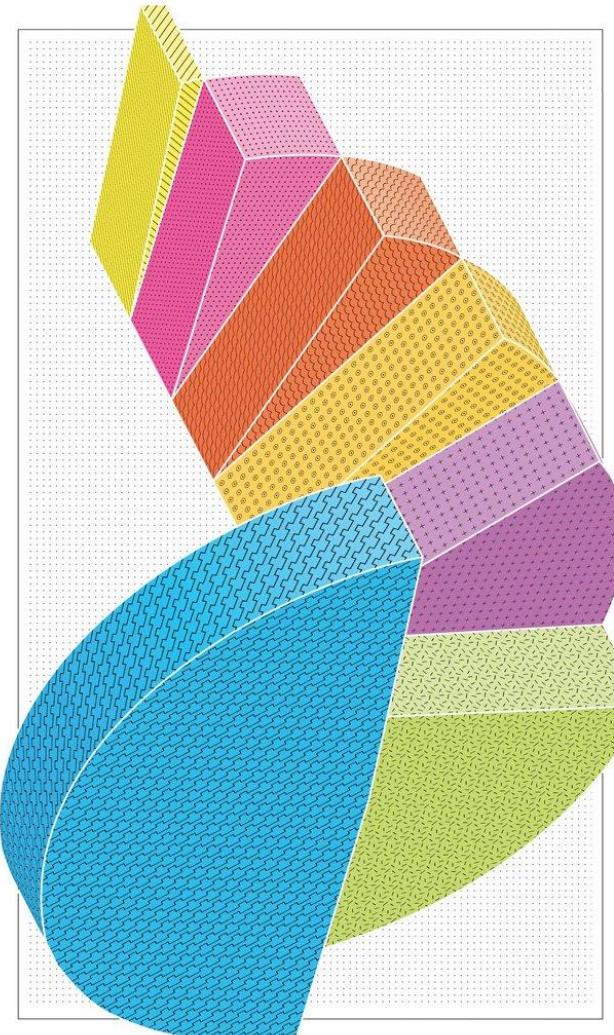
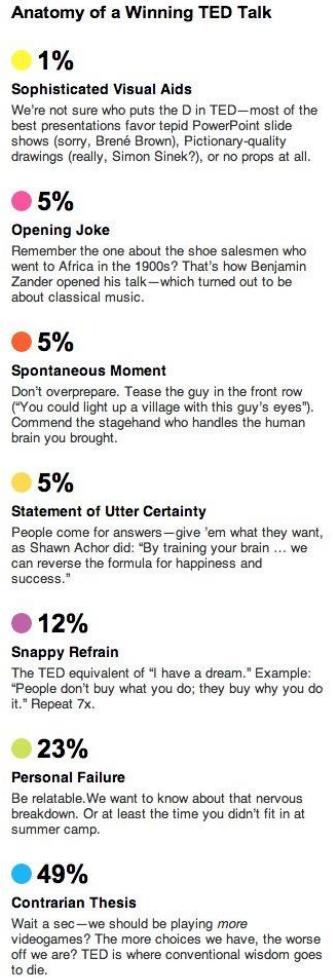
■ Verwarrend (20%)

■ Onleesbaar (30%)

# Of een 3D taartdiagram met >5 categorieën...

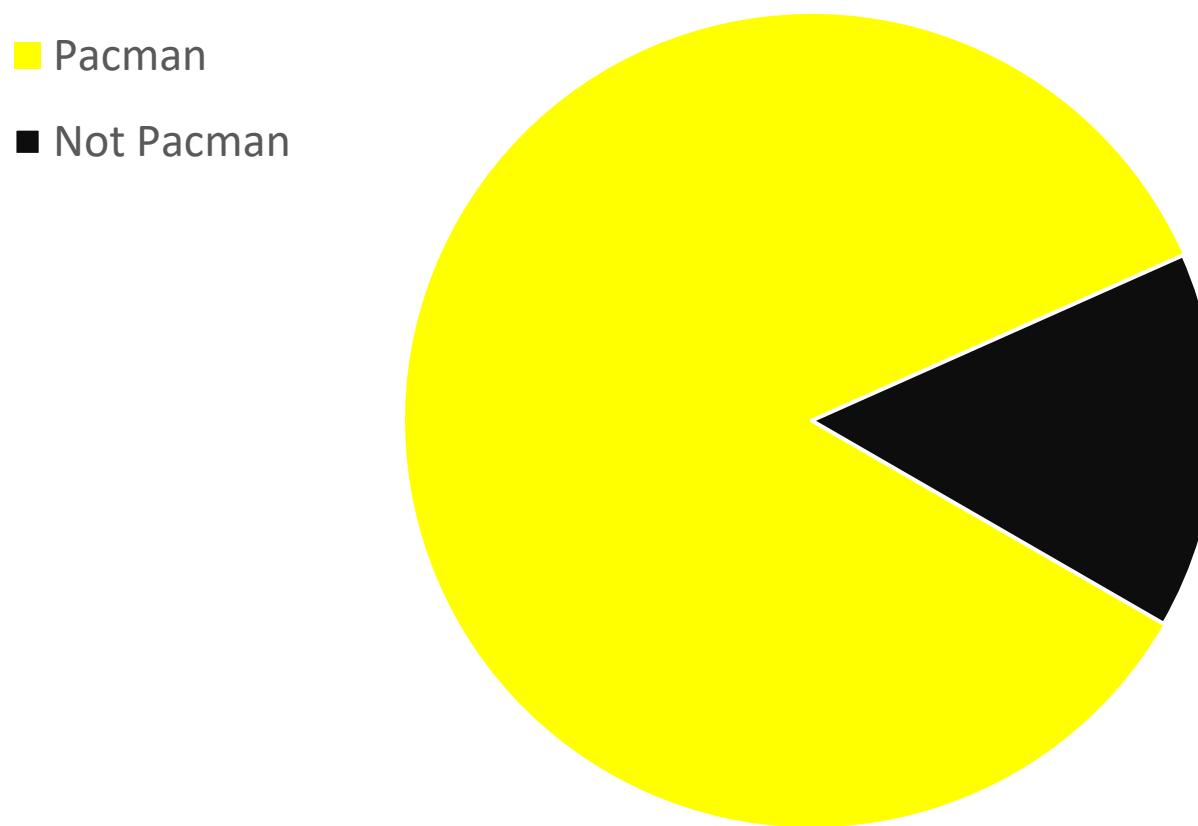


# En zeker geen 3D op-z'n-zij-liggende wenteltrap taartdiagram met > 5 categorieen...!



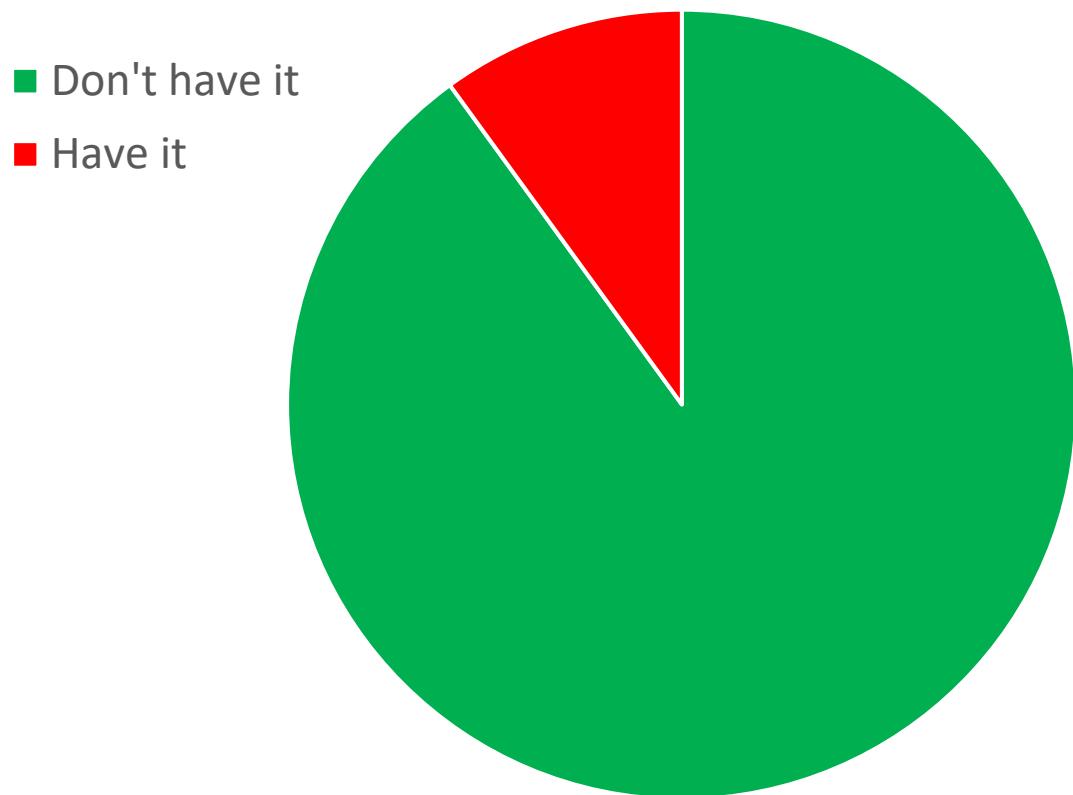
# Een taartdiagram werkt goed bij 2 groepen

Percentage of chart that looks like Pacman

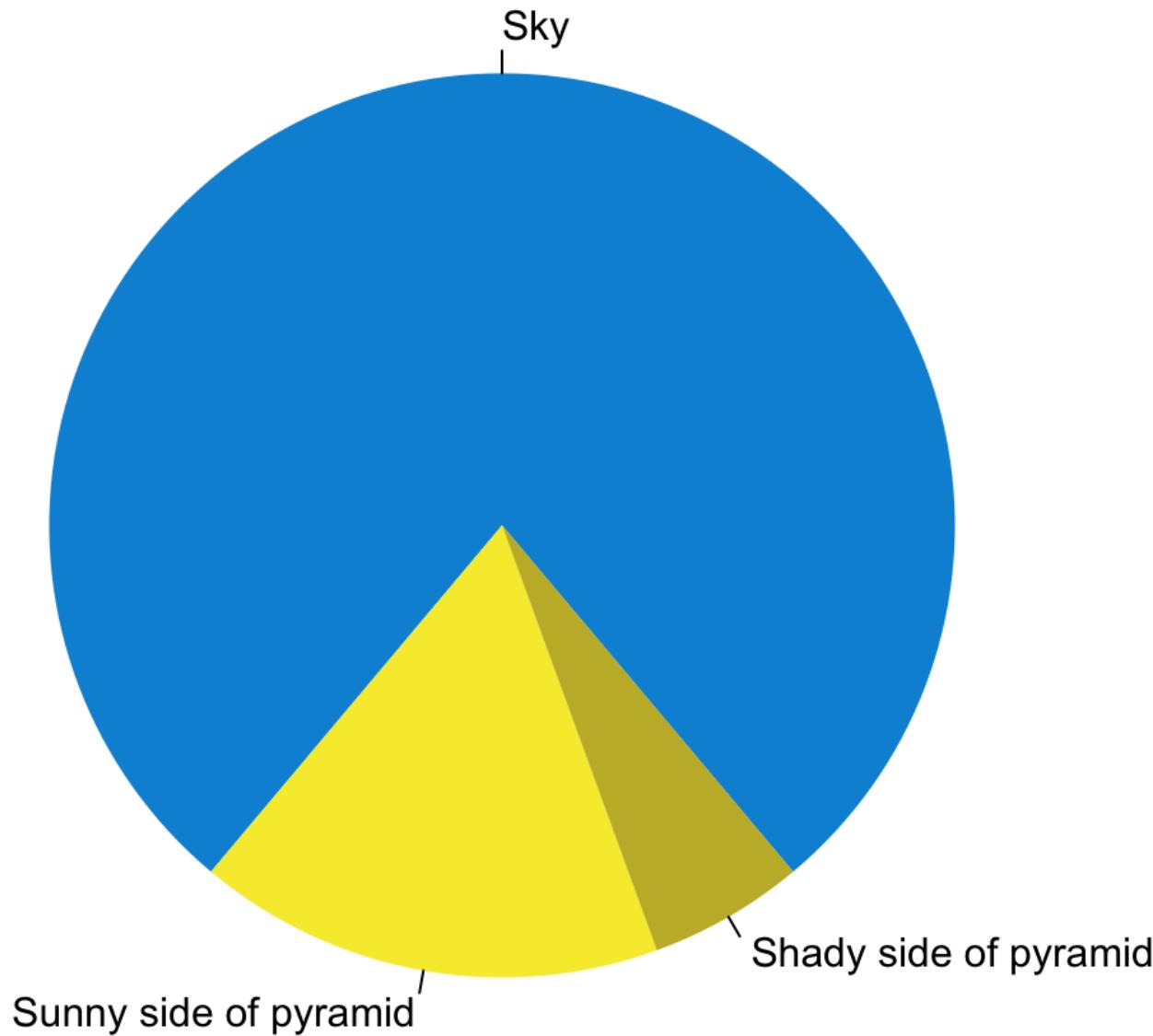


# Maar niet altijd...

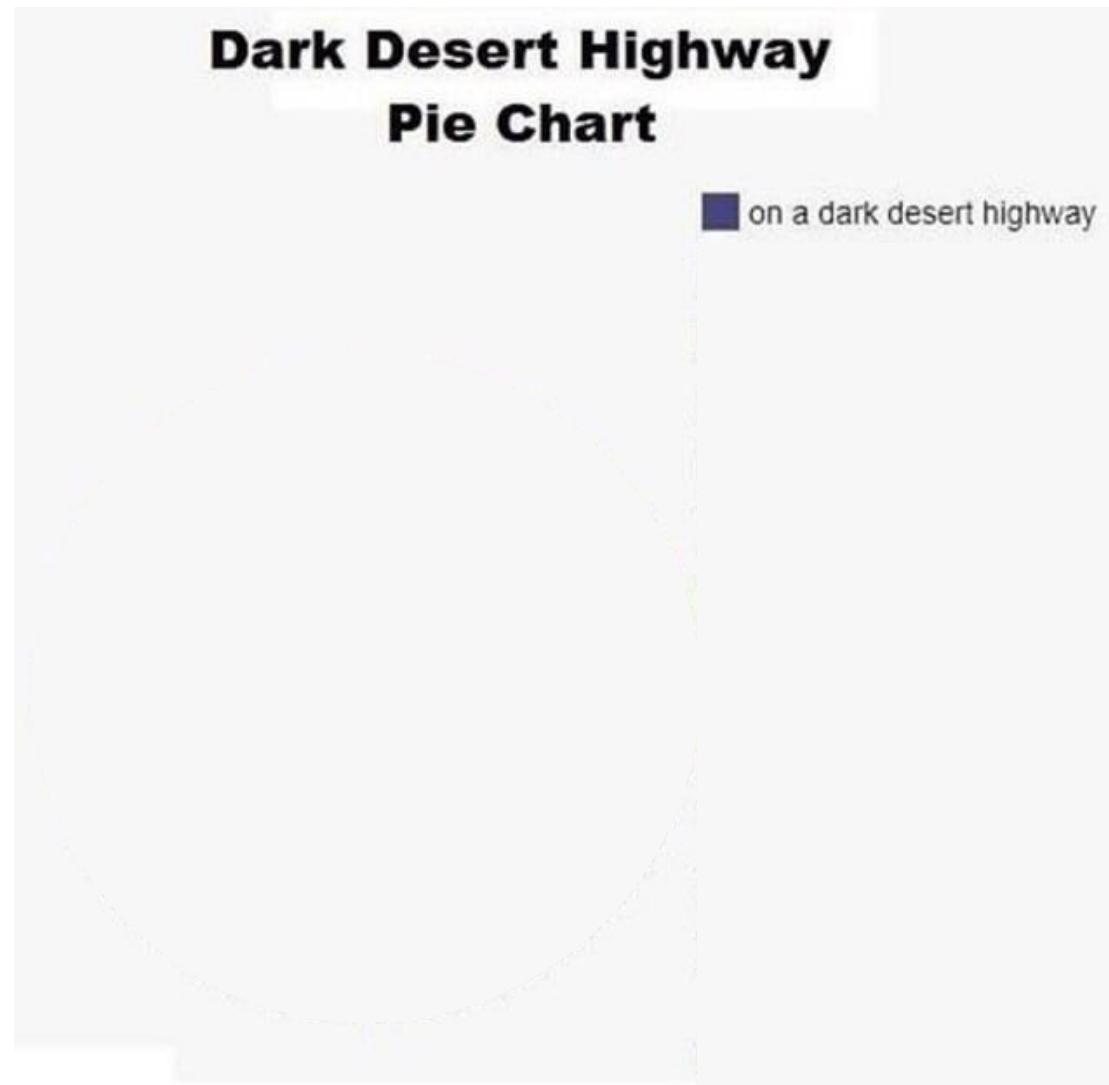
Rood-groenkleurenblindheid bij mannen



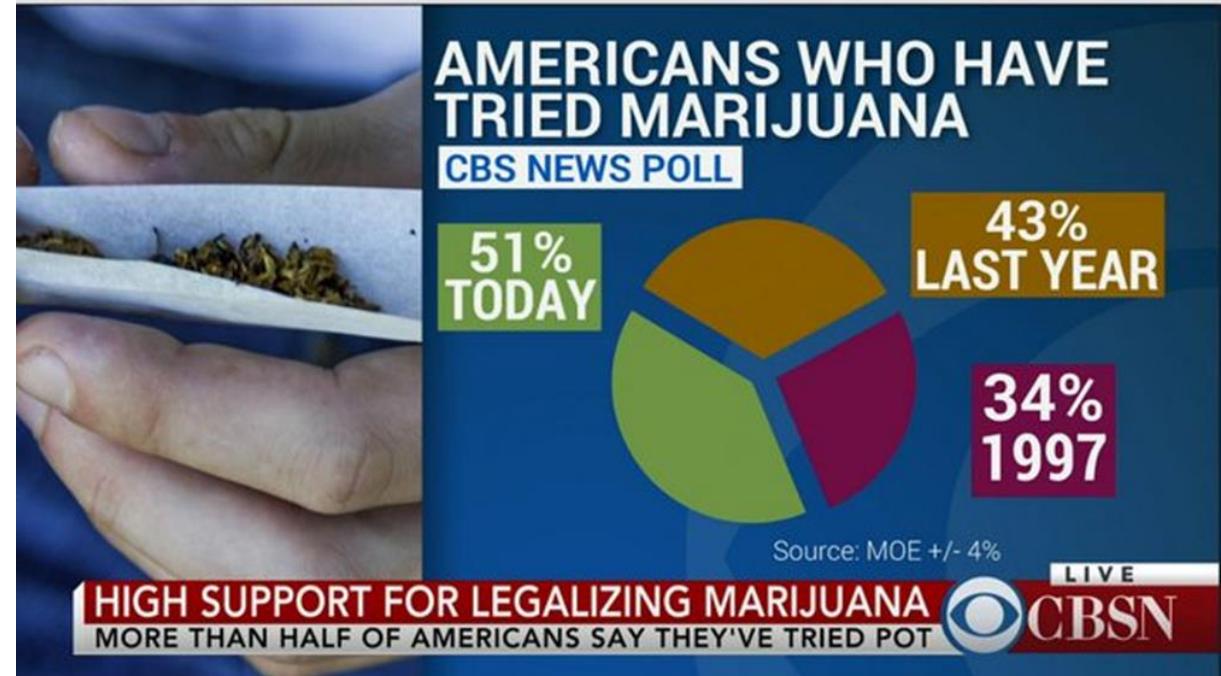
# Een taartdiagram werkt goed bij 3 groepen



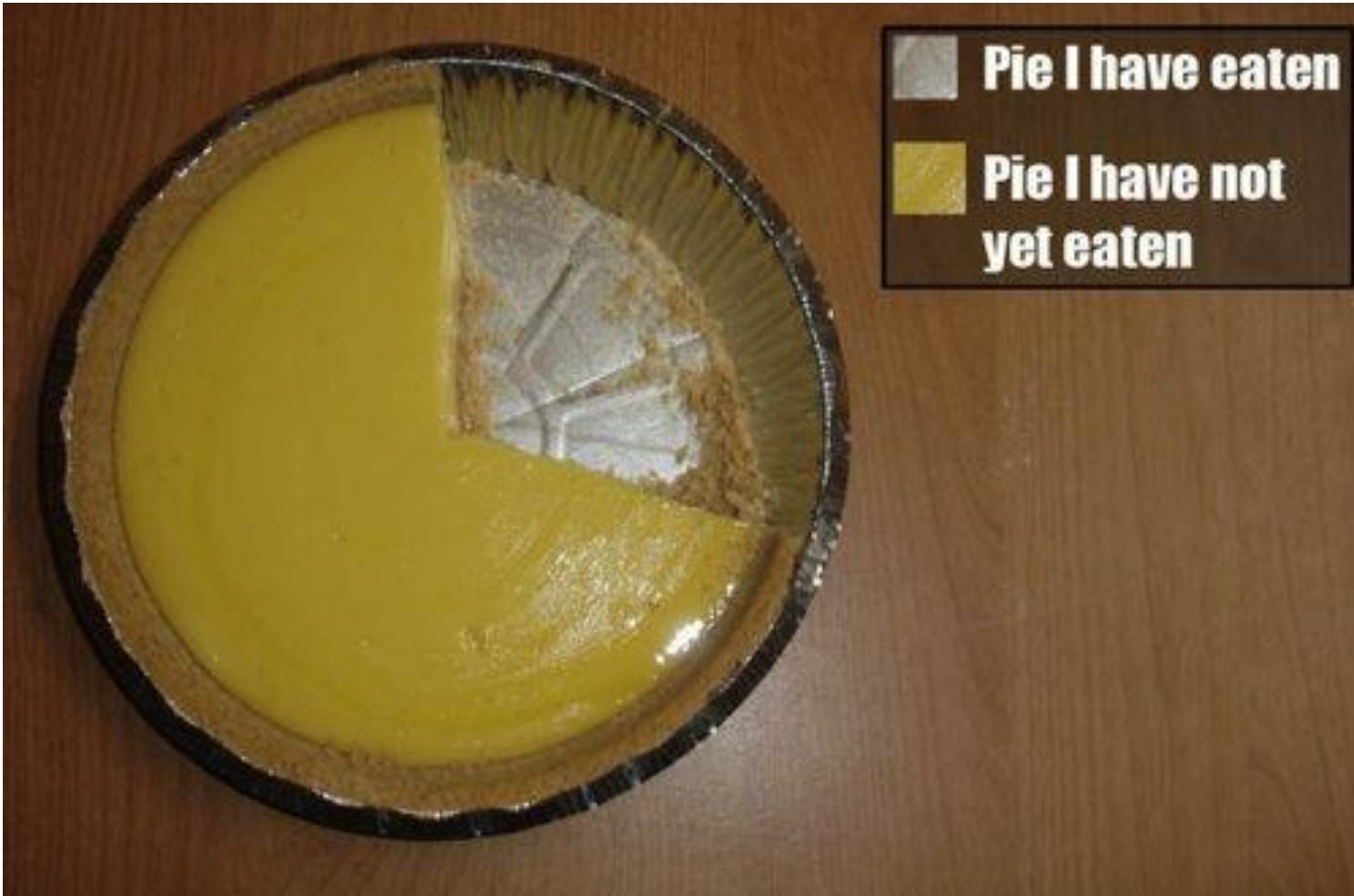
# En soms zelfs bij >5 groepen



# Het slechtste taartdiagram ever...?



# Het beste taartdiagram ever...?



# Dankjewel!



Happy  
Viz-ing!

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