

Visualization (Vis)

**Storytelling with
Interactive Data Visualizations**



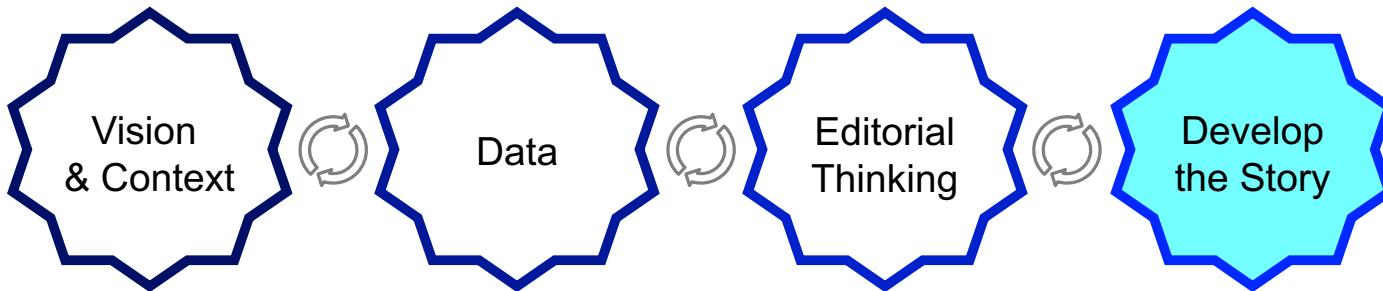
Lecture 7
—
**Interactivity
& Storytelling**



Image by Arhnue Tan from Pixabay



Develop the Story: Visual Encoding – Interactivity & Storytelling



- ◆ Visual Encoding and Charts
- ◆ Rules of Thumb
- ◆ **Interactivity and Storytelling**
- ◆ Annotation, Colour and Composition



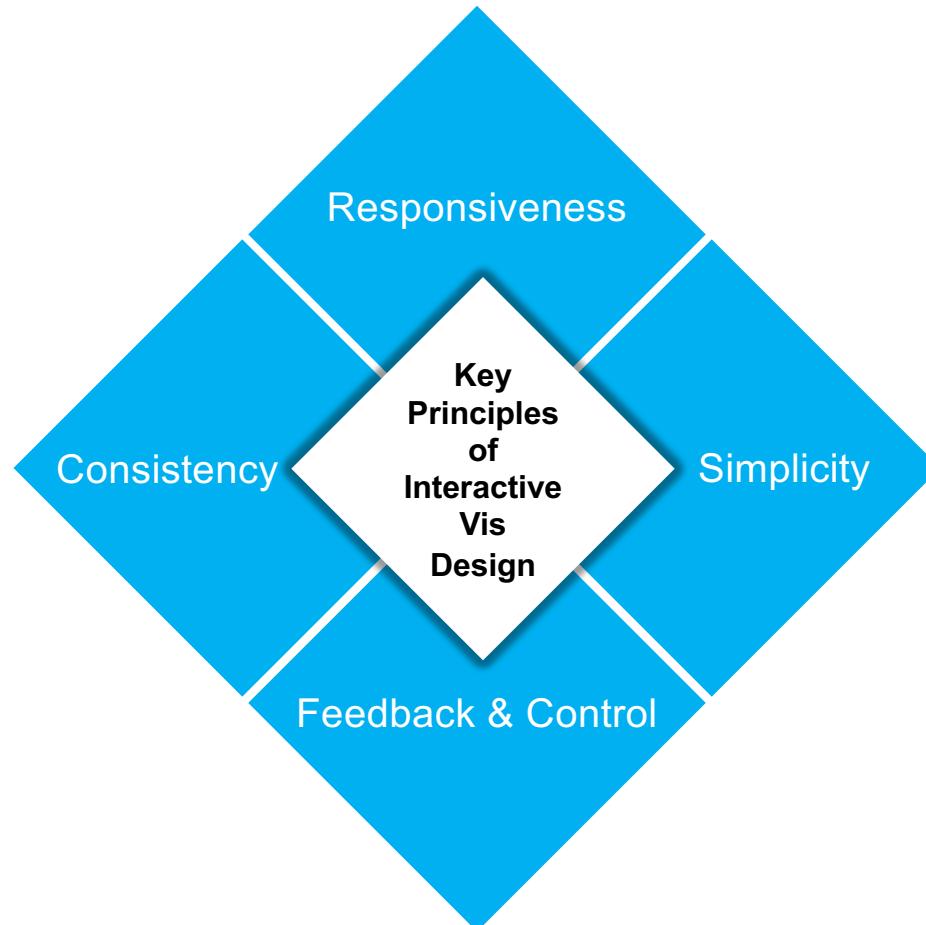
Visualization

Interactivity & Storytelling

1.  Interactivity - Functions, Events, Controls
2. Interactivity – Motivation and Summary
3. Traditional Storytelling
4. Storytelling applied to Data Visualizations
5. Interactivity in Data Visualizations Stories



Key Principles of Interactive Visualization Design





Functions, Events, Controls

- ◆ **Function:** Operation, that is performed
 - Example: Select a Category
- ◆ **Event:** User action
 - Example: Mouseclick
- ◆ **Control:** UI Element, to which the event/action is applied
 - Example: Dropdown Menu
- ◆ **Caveat:** controls differ between desktop/mouse and mobile/touch devices
 - hover + click vs. double tap
 - right-click vs. long-press



Filtering

- ◆ **Filtering: include/exclude data to/from chart**
 - Modifies “Editorial Framing”

Filtering: example functions

- Apply categorial data filter: one or several combinations
- Apply quantitative filter: one value or range of values
- Reset all filters

Filtering: example events and controls

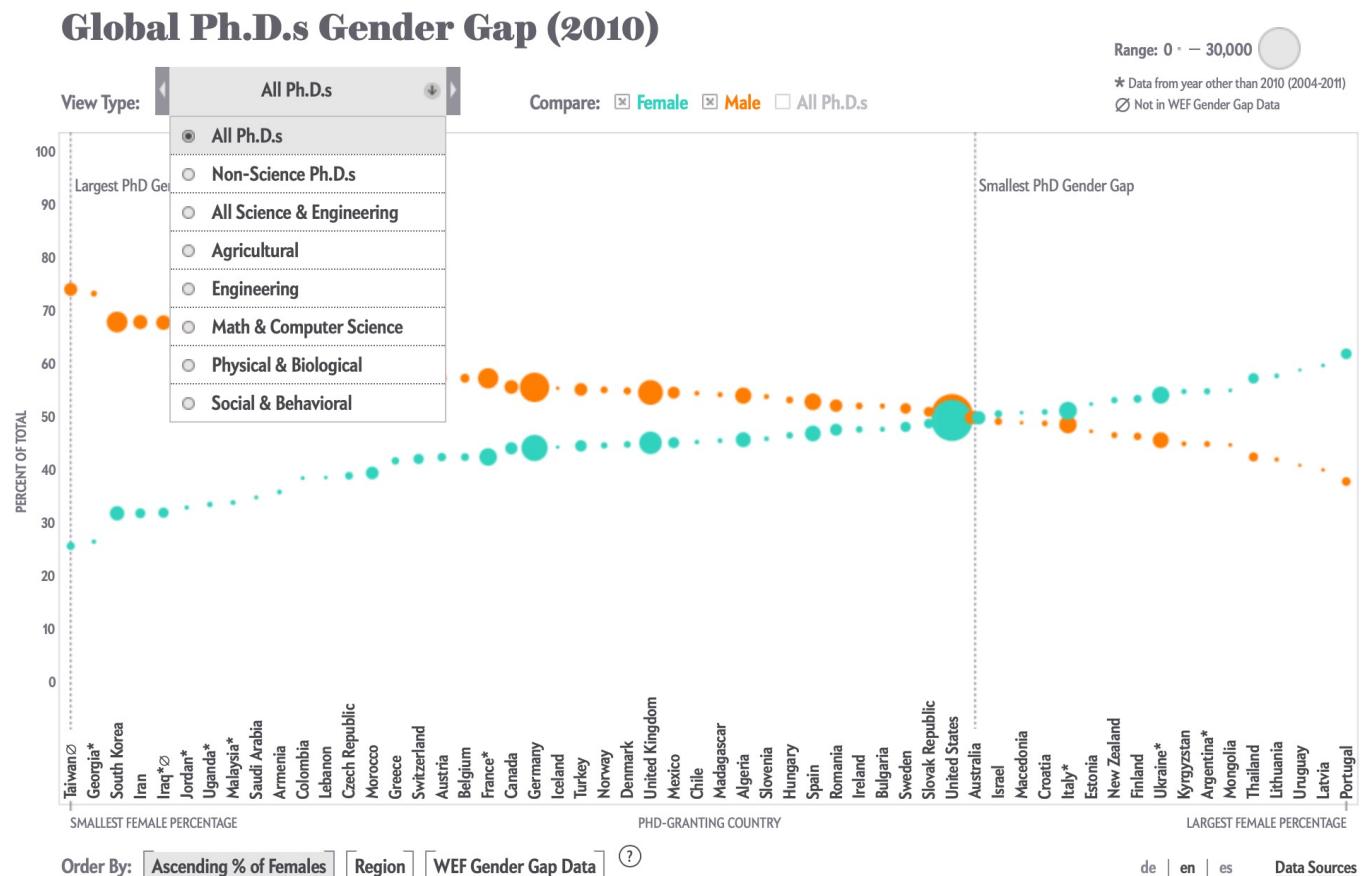
- Select a button or link
- Select an item from a menu list
- Select multiple items from a check-box or menu list
- Alter state of a toggle or radio button
- Alter position of a handle along a scale slider
- Alter position of two handles along a scale slider (to create a range)
- Enter a value into an input box

Filtering – Examples 1: How Nations Fare in PhDs by Sex

- Example
Scientific American:
[How Nations Fare in PhDs by Sex](#)

([Chart only](#))

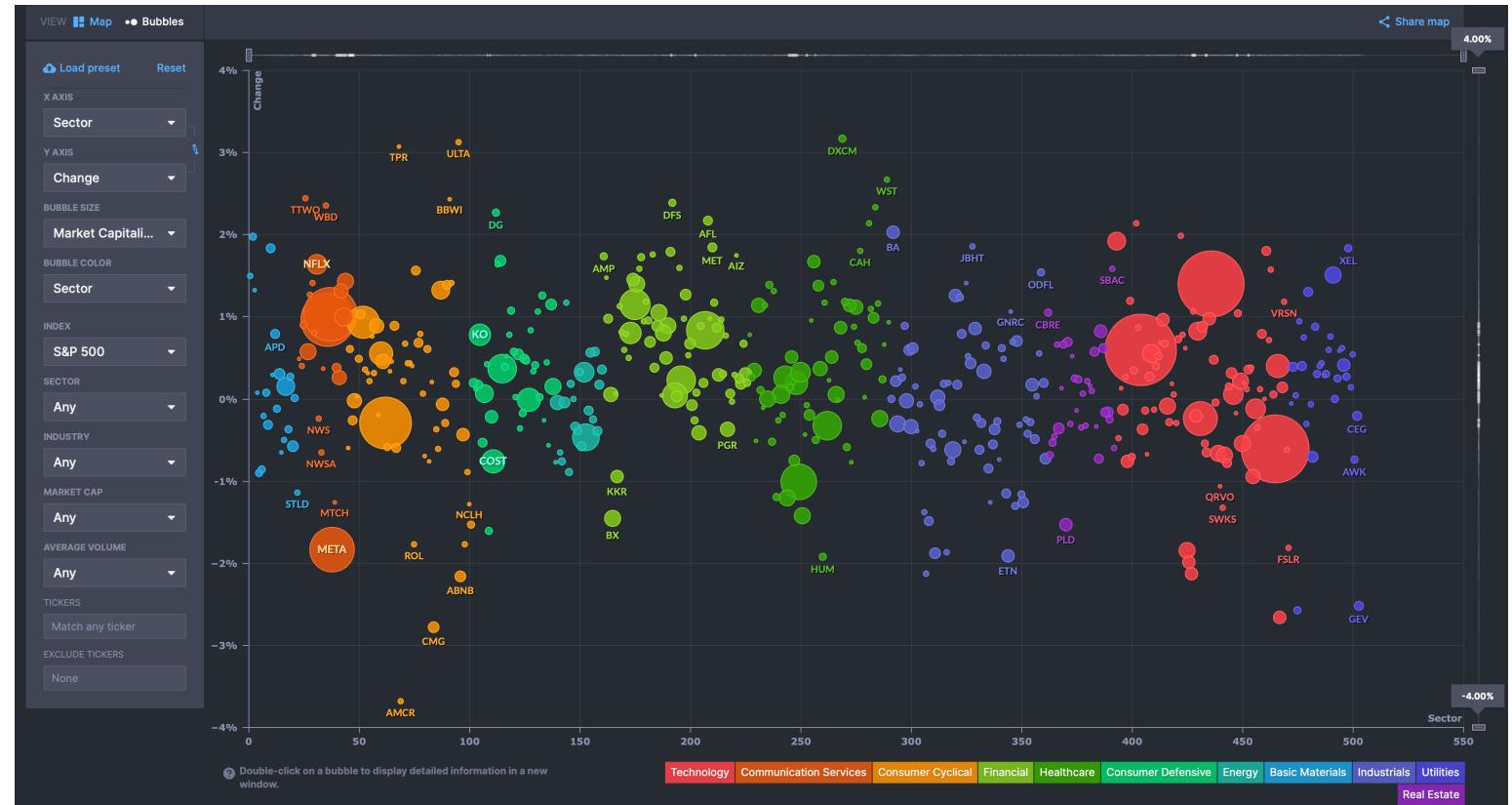
- Example shows
 - Apply quantitative filter: range of values





Filtering – Examples 2: Stock Analysis

- ◆ Example
finviz: [Stock Visualizations](#)
- ◆ Example shows
 - Apply categorial data filter: one combination



Source: <https://finviz.com/bubbles.ashx>



Highligthing

- ◆ **Highlighting:** visually emphasize data items or data values of interest
 - Modifies “Editorial Focus”

Highlighting: example functions

- Highlight selection
- Highlight values based on selection
- Highlight associations between selected values
- Linking: Highlight associated items in another chart based on selection
- Rearrange the order of the data
- Form calculations based on selection

Highlighting: example events and controls

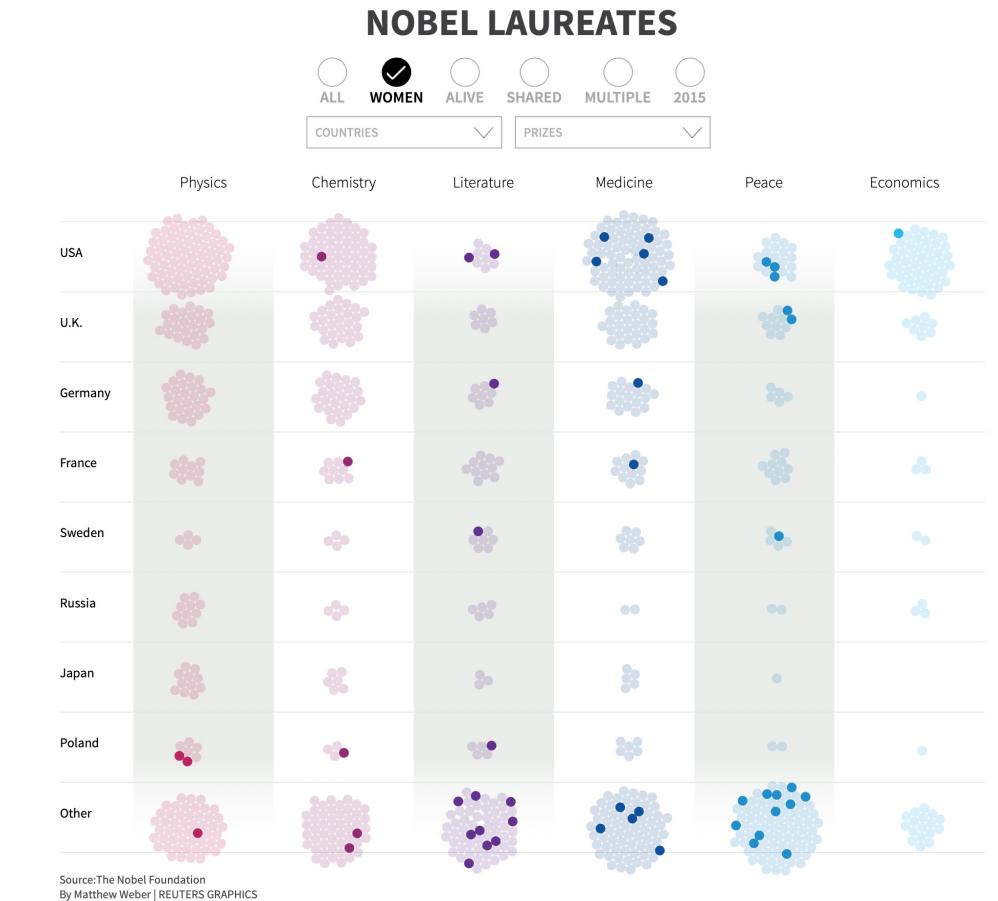
- Select a button or link
- Select an item from a menu list
- Select multiple items from a check-box or menu list
- Alter state of a toggle or radio button
- Alter position of a handle along a scale slider
- Alter position of two handles along a scale slider (to create a range)
- Enter a value into an input box
- Select a mark in a chart
- Hover of a mark in a chart
- Select range of marks in a chart (“brushing”)

Based on: Andy Kirk, Data Visualisation



Highlighting – Examples 1: Nobel Laureates

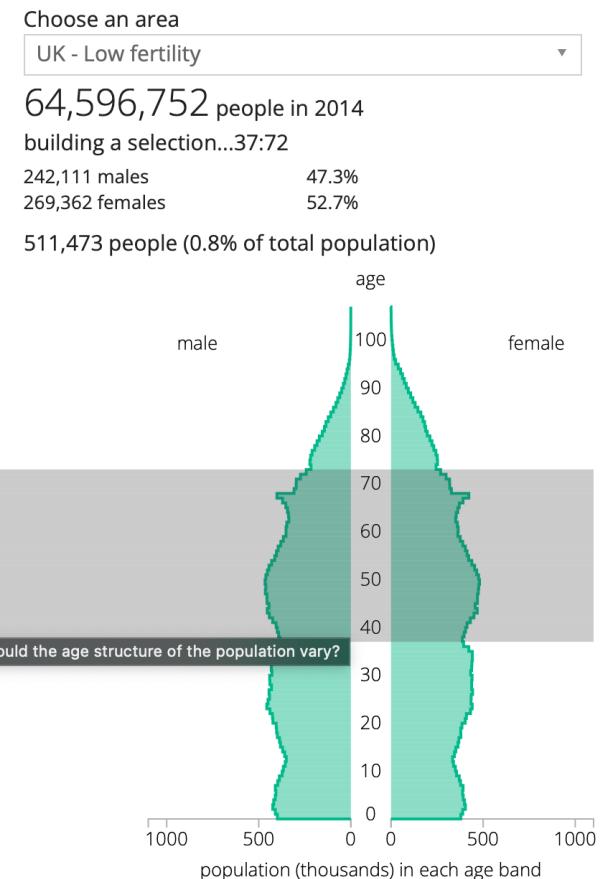
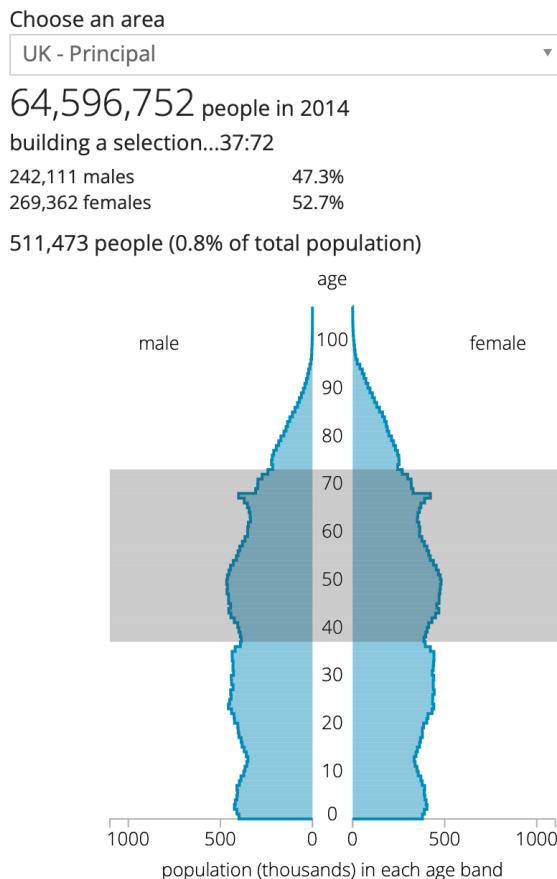
- ◆ Example
Reuters: [Nobel Laureates](#) (up to 2015)
- ◆ Example shows
 - Color-Highlighting





Highlighting – Examples 2: UK Population

- ◆ Example
ONS: How could the age structure of the population vary?
 - ◆ Example shows
 - Brushing
 - Linking
 - Calculations



Source: <https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/articles/howbigwilltheukpopulationbein25yearstime/2015-10-29>



Participating

- ◆ **Participating:** the user of the vis actively contributes data

Participating: example functions

- Submit data to initiate feedback (e.g., a quiz)
- Submit data to customize a view

Participating: example events and controls

- Select a button or link
- Select an item from a menu list
- Select multiple items from a check-box or menu list
- Alter state of a toggle or radio button
- Alter position of a handle along a scale slider
- Alter position of two handles along a scale slider (to create a range)
- Enter a value into an input box



Participating – Examples 1: Sugar quiz

- ◆ Example

abc.net: [Sugar Quiz](#)

- ◆ Example shows

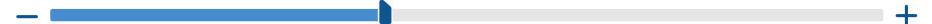
- Submit data to initiate feedback: a quiz

How many tubs of
strawberry yoghurt
can you eat before you
reach six teaspoons
of sugar?



[Check answer](#)

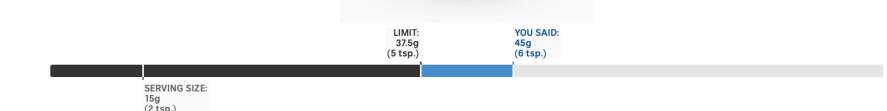
262.5g (1½ tubs)



How many heaped
teaspoons of **jam** can
you eat before you
reach six teaspoons
of sugar?



Almost right!
That's worth
5 points



Source: <https://www.abc.net.au/news/2016-03-18/quiz-what-does-six-teaspoons-of-sugar-look-like/7086790>



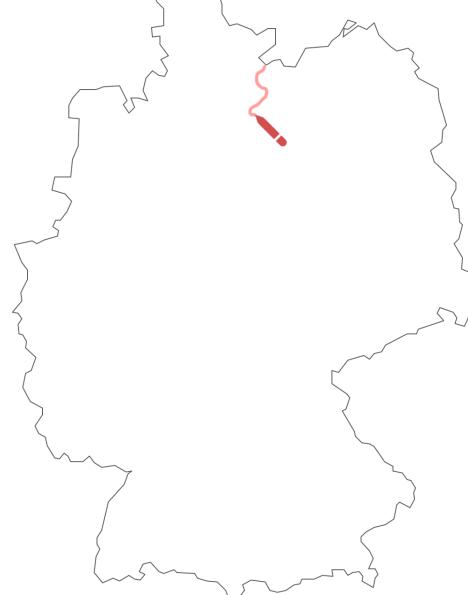
Participating – Examples 2: German Division

- ◆ Example
Berliner Morgenpost:
[Wissen Sie noch, wo Deutschland geteilt war?](#)
- ◆ Example shows
 - Submit data to customize a view

Wissen Sie noch, wo Deutschland geteilt war?

Auf knapp 1400 Kilometern Länge zerschnitt die innerdeutsche Grenze Jahrzehntelang das Land. Können Sie zeigen, wo sie verlief?

Zeichnen Sie den Verlauf der innerdeutschen Grenze



Wissen Sie noch, wo Deutschland geteilt war?

Auf knapp 1400 Kilometern Länge zerschnitt die innerdeutsche Grenze Jahrzehntelang das Land. Können Sie zeigen, wo sie verlief?



Source: <https://interaktiv.morgenpost.de/innerdeutsche-grenze/>



Annotating

- ◆ Annotating: provide more details on demand

Annotating: example functions

- Reveal annotations in a local tooltip/pop-up
- Reveal annotations in a separate panel

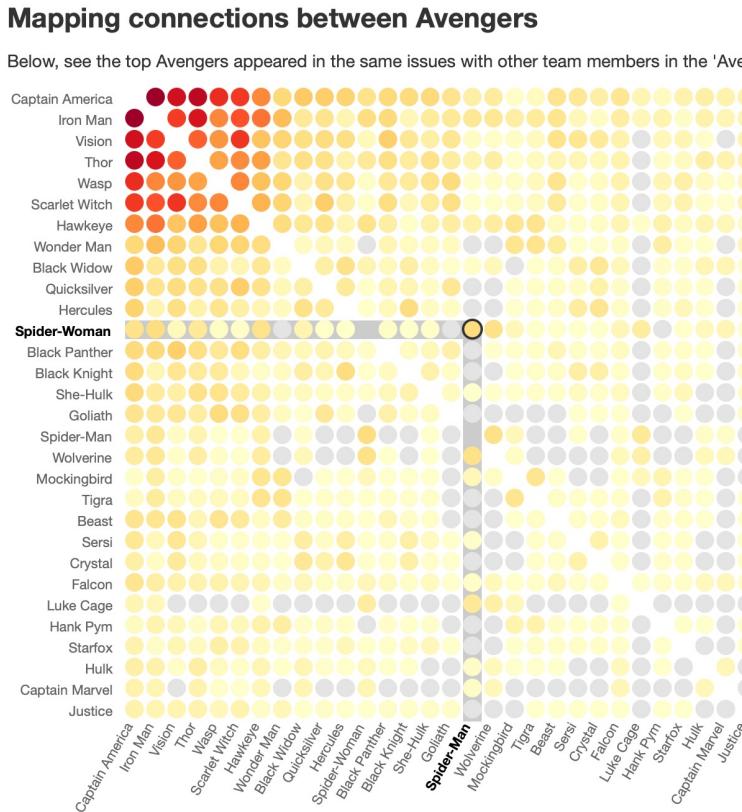
Annotating: example events and controls

- Select a button or link
- Select a mark in a chart
- Hover over a mark in a chart



Annotating – Examples 1: Sugar quiz

- ◆ Example
WSJ: How the 'Avengers' Line-up Has Changed Over the Years
 - ◆ Example shows
 - Reveal annotations in a separate panel



Spider-Woman



Spider-Man

66

Spider-Woman and Spider-Man appeared together **66** times between 1963-2015

Source: <http://graphics.wsj.com/avengers-team/>



Animating

- ◆ **Animating:** Present temporal data as animated sequence

Animating: example functions

- Automatically initiated animation
- Manually initiated animation
- Manually controlled animation

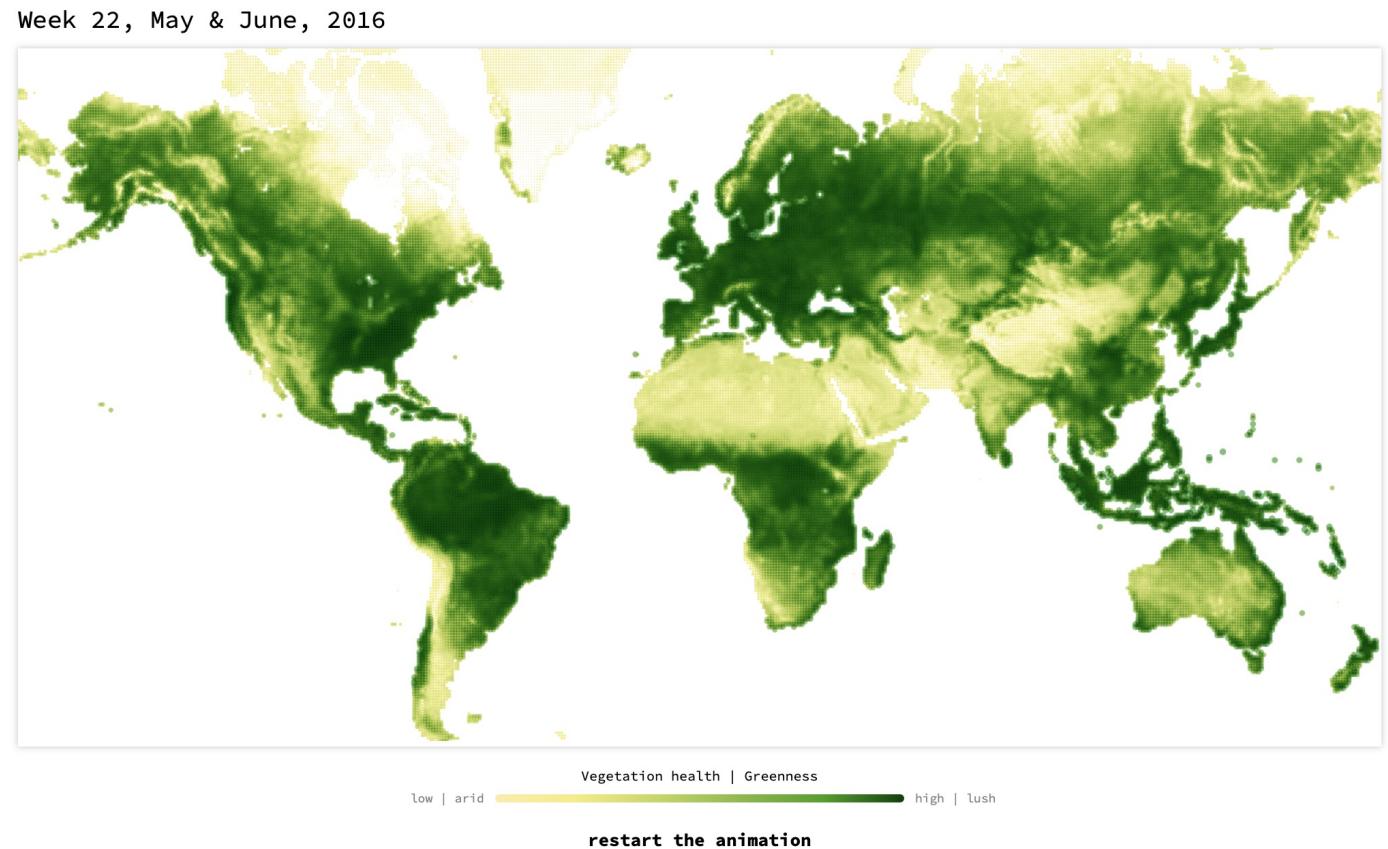
Animating: example events and controls

- Load a website
- Select a button (play, pause, stop, ...)
- Alter the position of a handle along a scale slider



Animating – Examples 1: Breathing Earth

- ◆ Example
Visual Cinnamon:
[Breathing Earth](https://breathingearth.visualcinnamon.com)
- ◆ Example shows
 - Automatically initiated animation
(uncontrollable)





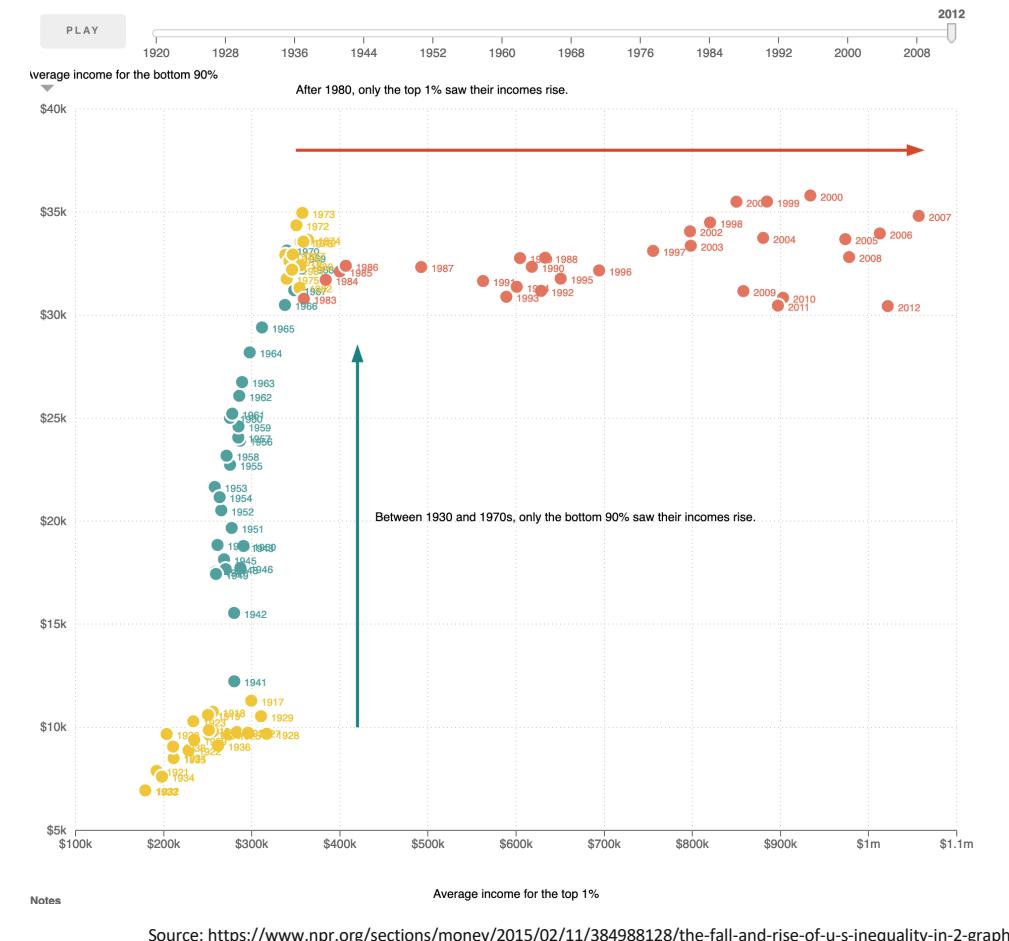
Animating – Examples 2: Fall and Rise of US Inequality

- ◆ Example

npr: [The Fall and Rise of US Inequality, in 2 Graphs](#)

- ◆ Example shows

- Manually initiated animation
- Manually controlled animation





Navigating

◆ Navigating: access multiple views

Navigating: example functions

- Panning
- Geometric Zooming
- Semantic Zooming
- Navigate through a sequence of views (within the page)
- Navigate through a gradual unveiling of a vis
- Drill-Down to a lower hierarchical level

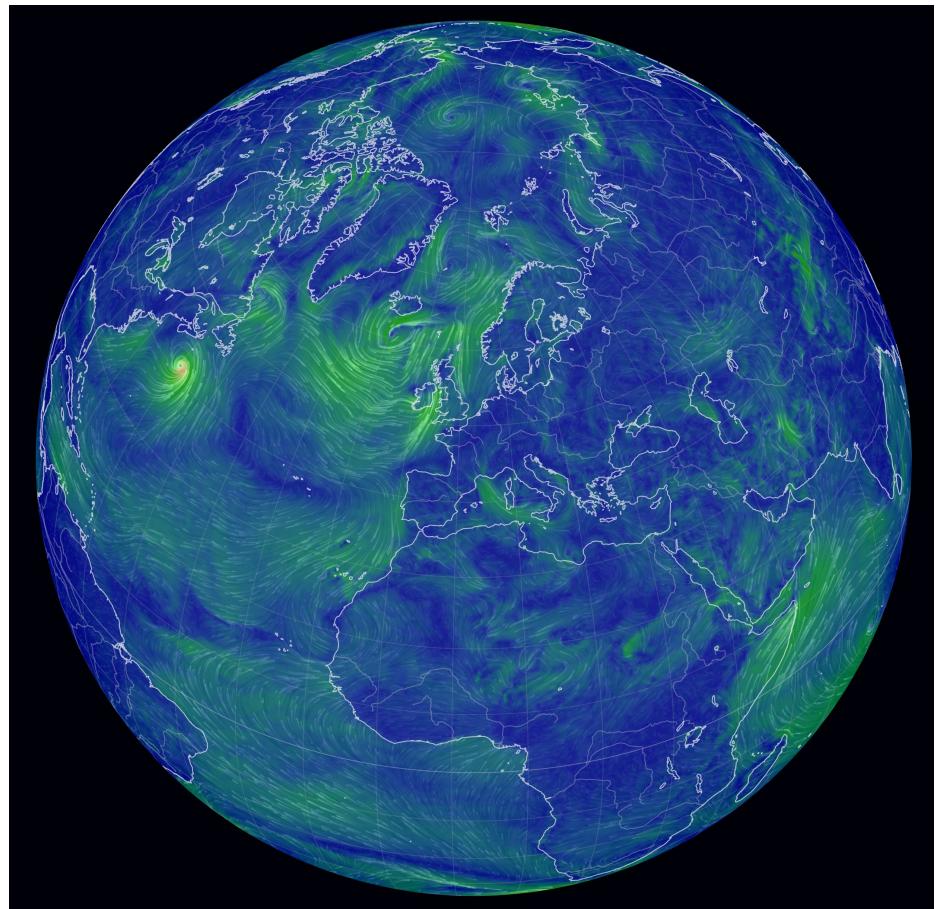
Navigating: example events and controls

- Select a region from a map or menu
- Select, hold and draw a region of interest
- Select, hold and move
- Alter the position of a handle along a scale slider
- Scroll (horizontally or vertically)



Navigating – Examples 1: Earth

- ◆ Example
nullschool.net: [Earth](https://earth.nullschool.net)
- ◆ Example shows
 - Panning
 - Geometric Zooming
 - (in addition:
automatically initiated,
manually controlled
animation)



Source: <https://earth.nullschool.net>



Navigating – Examples 2: Killing the Colorado

- ◆ Example

ProPublica: [Killing the Colorado](#)

- ◆ Example shows

- Navigate through a gradual unveiling of a vis

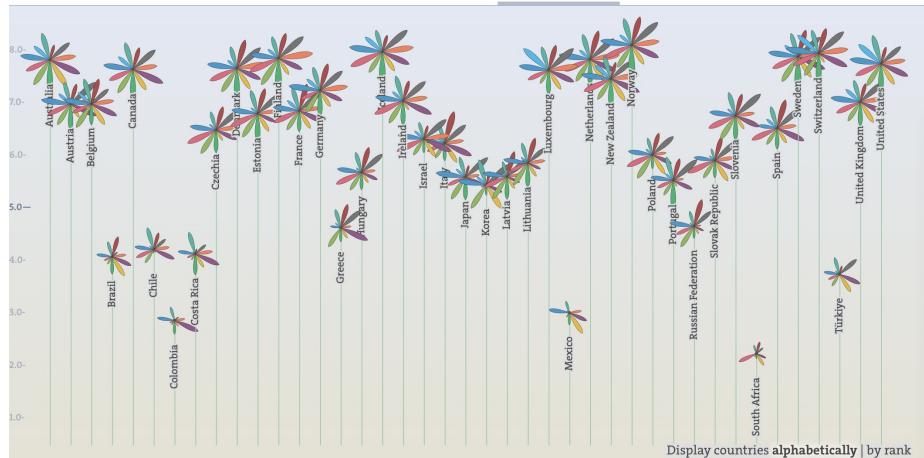


Source: <https://projects.propublica.org/killing-the-colorado/explore-the-river/#navajo-generating-station>



Navigating – Examples 3: OECD better live index

- ◆ Example
OECD: [Better Live Index](#)
- ◆ Example shows
 - Drill-Down to a lower hierarchical level

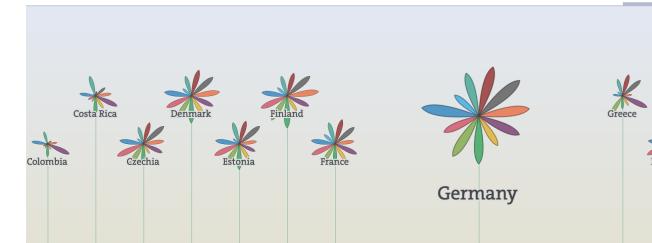


Create Your Better Life Index

Rate the topics according to their importance to you:

Housing	— +
Income	— +
Jobs	— +
Community	— +
Education	— +
Environment	— +
Civic Engagement	— +
Health	— +
Life Satisfaction	— +
Safety	— +
Work-Life Balance	— +

Reset Help



Germany

→ Learn even more about Germany at oecd.org

How's Life?

Germany performs well in many dimensions of well-being relative to other countries in the Better Life Index. Germany outperforms the average in jobs, work-life balance, education, environmental quality, safety, civic engagement and life satisfaction. These assessments are based on available selected data.

Money, while it cannot buy happiness, is an important means to achieving higher living standards. In Germany, the **average household net-adjusted disposable income per capita is USD 38 971 a year**, more than the OECD average of USD 30 490 a year.

In terms of employment, **about 77% of people aged 15 to 64 in Germany have a paid job**, above the OECD employment average of 66%. Some 80% of men are in paid work, compared with 73% of women. In Germany, **4% of employees work very long hours in paid work**, below the OECD average of 10%, with 6% of men working very long hours in paid work compared with 2% of women.

Good education and skills are important requisites for finding a job. In Germany, **86% of adults aged 25-64 have completed upper secondary education**, higher than the OECD average of 79%. However, completion varies between men and women, as 87% of men have successfully completed upper secondary education.





Visualization

Interactivity & Storytelling

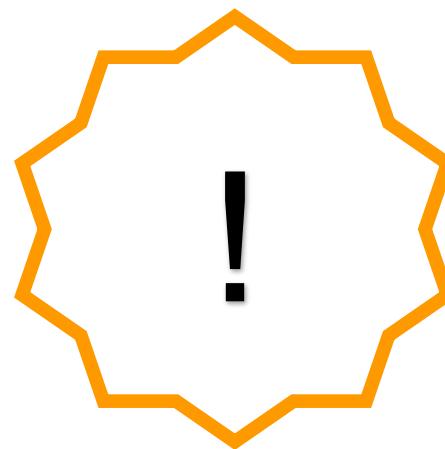
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Your Turn !

Exercise 1

Benefits of Interactivity





Common Pitfalls

♦ Editorial Pitfalls

- Reward for the user to become (inter-)active need to be sufficiently high!
- Interactivity needs to be fundamentally justified
 - Enhance understanding, do not obstruct understanding!
 - Not everything that can be interactive, should be interactive!
- Interactivity != Abdication of Responsibility
 - Do not pass task of discovering insights to the user for explanatory visualizations!

♦ Technical Pitfalls

- Poor responsiveness
- Over-complicated interfaces
- Inconsistent design patterns
- Misleading interactions



Three Quotes

Data want's to be interactive []
Focus on analysis and storytelling.
Tune out the rest.

Thiago Teixeira
Co-Founder Streamlit
Streamlit Quarterly Showcase, 2024

A picture is worth a thousand words.
An interface is worth a thousand pictures.

Ben Shneiderman
Professor and Author

I tell you and you forget.
I show you and you remember.
I involve you and you understand.

Confucius
Chinese philosopher
500 BC



Visualization

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The Power of Storytelling

- ◆ The Power of Storytelling
 - Captures attention and engages audiences
 - Makes information memorable
 - Helps convey complex ideas simply





Storytelling for Communication in Different Fields

- ◆ Why Stories Matter in Communication: Stories
 - ... connect with emotions
 - ... simplify complex information
 - ... are more likely to be remembered
- ◆ Storytelling Across **Different Fields**
 - **Marketing:** Building brand narratives
 - **Journalism:** Crafting compelling news stories
 - **Education:** Enhancing learning through stories
 - **Data Visualization:** Turning data into engaging narratives





Key Elements of Storytelling

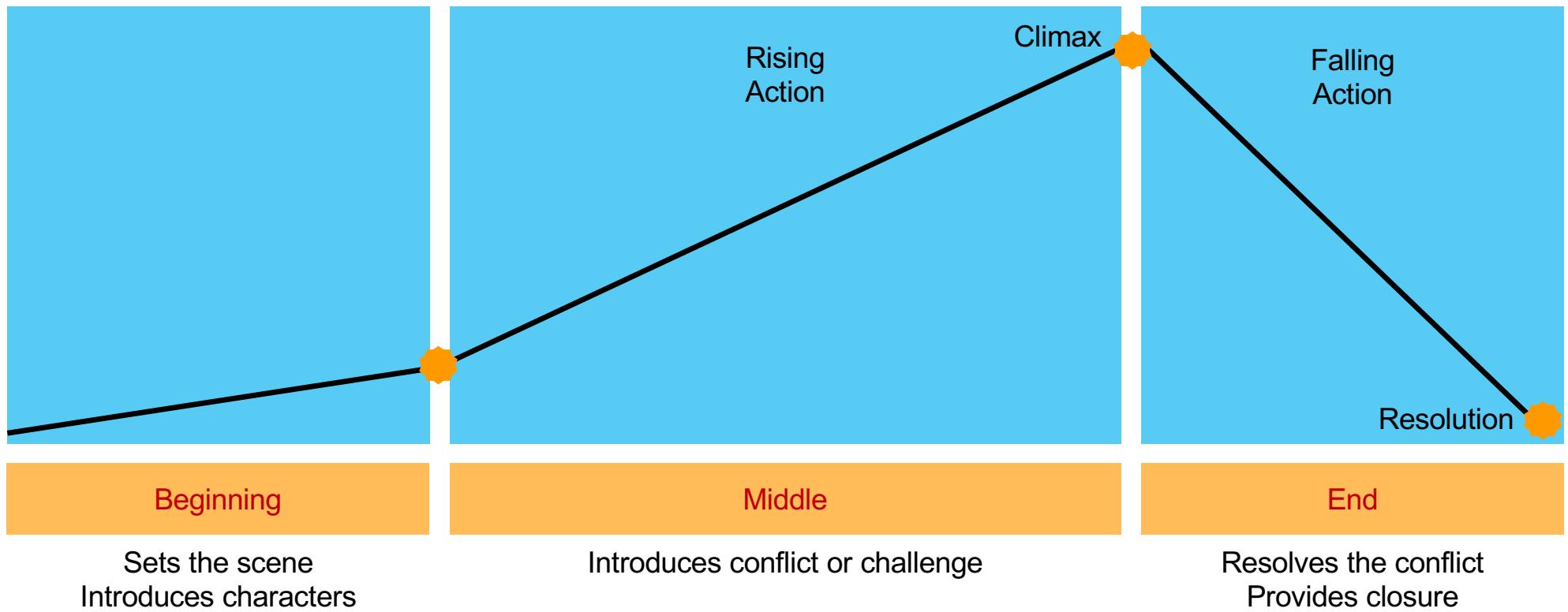
Key Elements of Storytelling

- ◆ Narrative Structure
- ◆ Characters
- ◆ Conflict
- ◆ Resolution
- ◆ Theme





Narrative Structure – Backbone of the Story





Characters

- ◆ **Protagonist**

The main character or ‘hero’

- ◆ **Antagonist**

The character or force in conflict
with the protagonist

- ◆ **Supporting Characters**

Other characters who contribute to the story





Conflict and Resolution

Conflict

The challenge or problem the protagonist faces



Resolution

How the conflict is resolved



Theme

- ◆ **Theme:** The central idea or underlying message of the story
- Provides depth and meaning





Example Breakdown: A Simple Story



A village is
troubled by a
dragon

A hero emerges to
fight the dragon

The hero
defeats the
dragon, and the
village is saved

- ◆ Narrative Structure: Beginning, Middle, End
- ◆ Protagonist, Antagonist, Supporting Characters
- ◆ Conflict
- ◆ Rising Action
- ◆ Climax
- ◆ Falling Action
- ◆ Resolution
- ◆ Theme



Visualization

Interactivity & Storytelling

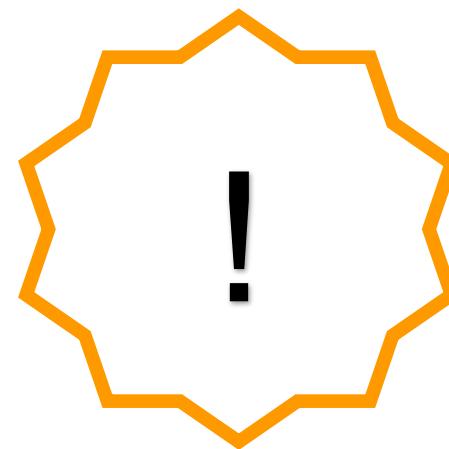
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Your Turn !

Exercise 2

Storytelling in Data Visualization





Visualization

Interactivity & Storytelling

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5.  Interactivity in Data Visualizations Stories



Interactivity in Data Storytelling

- ◆ **User-Driven Exploration:** Allow users to explore the data narrative at their own pace
→ make the story more engaging and personalized.
 - Example: A dashboard that lets users explore economic data by adjusting variables such as time periods or regions enables them to discover stories within the data on their own.
- ◆ **Exploration of Conflict:** Allow users to explore different facets of the conflict
→ e.g., filtering data to isolate variables, comparing scenarios, or simulating outcomes.
 - Example: An interactive visualization on budget allocation might allow users to adjust spending categories and see the immediate impact on deficit or surplus, highlighting the challenge of balancing a budget.
- ◆ **Real-Time Feedback Loops:** User actions generate immediate responses
→ e.g., updated graphs: keep users engaged and reinforce the narrative.
 - Example: In an educational visualization, users might answer questions that lead them down different narrative paths depending on their choices, making the learning experience more dynamic.



Putting It All Together: Example Data Storytelling Flow

- ◆ **Motivating Curiosity:** How does urbanization impact wildlife habitats?
- ◆ **Intended Effect:** not only inform but also inspire action
- ◆ Storytelling flow including interactivity
 1. **Beginning:** introductory visualization showing global urbanization trends over the past century, using an engaging visual to highlight the scale of urban growth
 2. **Middle:** Introduce the **conflict** by showing how urban expansion has encroached on wildlife habitats.
Interactivity: Allow users to zoom into different regions, revealing detailed data on species decline in specific areas.
 3. **Character:** Highlight specific “characters” such as endangered species or particular regions where the impact is most severe.
Interactivity: let users explore the stories of these characters.
 4. **End/Resolution:** visualization that shows ongoing conservation efforts and their impact.
Call to action: encourage users to explore ways they can contribute to wildlife conservation.
 5. **Theme:** delicate balance between urban growth and wildlife preservation, reinforced by the visual design and narrative structure.



Three Quotes

The purpose of visualization is insight, not pictures.

Ben Shneiderman
Professor and Author

No matter how clever the choice of the information, and no matter how technologically impressive the encoding, a visualization fails if the decoding fails.

William S. Cleveland
The Elements of Graphing Data

Visualizations act as a campfire around which we gather to tell stories.

Al Shalloway
Founder/CEO Net Objectives.



Key Takeaways

- ◆ **Interactivity**
 - Function, Event, Control
 - Filtering, Highlighting, Participating, Annotating, Animating, Navigating
 - Benefits of Interactivity
- ◆ **Traditional Storytelling**
 - Narrative Structure, Characters, Conflict, Resolution, Theme
- ◆ **Storytelling with Interactive Data Visualizations**



Photo by Dragonfly Ave on Unsplash