universität wien

Rhetoric of visuals

The art of communicating data

Laura Koesten & Verena Prantl

12. Jänner 2023

universität wien

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18. April 2023

Schedule

Lecture on 10th of Jan:

Ethics

TODAY:

Rhetoric of visuals

Lecture on 17th of Jan:

Collection Visualization

Week	Date	Tuesday (13:15 - 14:45)	Thursday (13:15 - 14:45)
1	Oct 04/06	Introduction (TM) pdf [Munzner Ch. 1] Rosling at TED 2006; Krulwich at RadioLab	D3 Tutorial (BJ) zip browser
2	Oct 11/13	Design Principles (LK) pdf [Tufte, The Visual Display of Quantitative Information]	Vis Process + D3 Q&A (AC + BJ) pdf [d3 paper]
	Oct 16	Due: A1 (23:55)	
3	Oct 18/20	Data Types, Semantics (LK) pdf Dataset + Dataset Description [Munzner Ch. 2+3] Task Typology	Visual Encoding Principles (LK) pdf [Munzner Ch. 5] Learning perceptual kernels for vis design Livingstone: What Art can tell us about the brain (Vis 2008 keynote);
4	Oct 25/27	Tasks (FW) pdf [Munzner Ch. 2+3] Task Typology	D3 Tutorial (BJ) zip browser
5	Nov 01/03	All Saints Day	Arrange Tables + Spatial Data (SR) pdf [Munzner Ch. 7+8]
	Nov 06	Due: A2 (23:55)	
6	Nov 08/10	Arrange Tables + Spatial Data (SR) pdf [Munzner Ch. 7+8]	Arrange Networks/Trees (CK) pdf [Munzner Ch. 9+10] Example: GraphDiaries by Bach et al.
7	Nov 15/17	Arrange Networks / Trees (CK) pdf [Munzner Ch. 9+10] Example: GraphDiaries by Bach et al.	Q&A and Vue/D3 Tutorial (AC, BJ)
8	Nov 22/24	Facet into Multiple Views (AC) pdf [Munzner Ch. 12] Improvise	Design Studies (FW) + A4 Q&A (LK, CK) pdf [Munzner Ch. 4] Design Study Methodology
	Nov 27	Due: A3 (23:55)	
9	Nov 29 / Dec 01	Midterm (LK, CK)	Reduce: Items and Attributes (LK) pdf [Munzner Ch. 13] DimStiller
10	Dec 06/08	Embed: Focus + Context (LK) pdf [Munzner Ch. 14]	Mary conception
	Dec 11	Due: A4 (23:55)	
11	Dec 13/	Evaluation (TM) pdf R. - Evaluation	TextVis (TM) pdf
	Dec 20/22	[illegible]	Holiday
	Dec 27/29	Holiday	Holiday
	Jan 03/05	Holiday	Holiday
12	[illegible] 10/12	Ethics (TM) pdf IEEE 7000 Standard Correll paper	Rhetoric of visuals (LK)
13	[illegible] 17/19	Collection Visualization (FW) pdf [Survey paper]	Explainability (TS)
	Jan 22	Due: A5 (23:55)	
14	Jan 24/26	Final (TM, CK)	Data behind Vis (LK)
15	Jan 31/Feb 02	Presentations	Presentations

Schedule

Lecture on 31st of March:

Arrange Tables + Spatial Data

TODAY:

Rhetoric of visuals

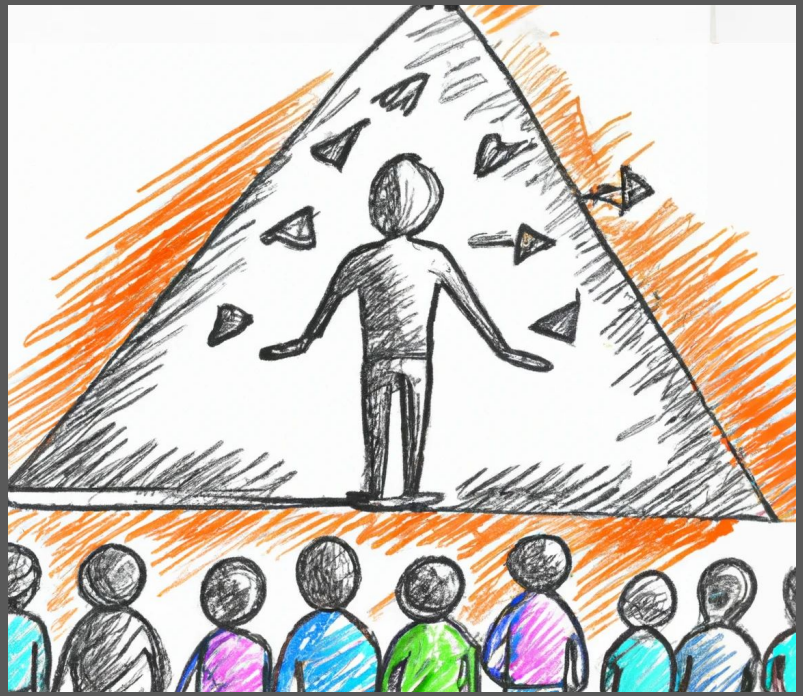
Lecture on 25th of April:

Facet into Multiple Views

Week	Date	Tuesday	Friday
1	Feb 28/Mar 03	No lecture	Introduction (TM,FW) pdf [Munzner Ch. 1] Rosling at TED 2006; Krulwich at RadioLab
2	Mar 07/10	Design Principles (AC) pdf	D3 Tutorial (BJ) zip browser
3	Mar 14/17	Data(set) Types and Semantics (LK) pdf Task Typology	No lecture
	Mar 19	Due: A1 (23:55)	
4	Mar 21/24	Visual Encoding Principles (LK) pdf [Munzner Ch. 5+10] Learning perceptual kernels for vis design Livingstone: What Art can tell us about the brain (Vis 2008 keynote);	Tableau Tutorial
5	Mar 28/31	Arrange Tables + Spatial Data (SR) pdf [Munzner Ch. ...]	Arrange Tables + Spatial Data (SR) pdf [Munzner Ch. 7+8]
	Apr 02	Due: A2 (23:55)	
	Apr 04/07	Easter	Easter
	Apr 11/14	Easter	Easter
6	Apr 18/21	Rhetorics (LK)	D3 Tutorial (BJ)
7	Apr 25/28	Facet into Multiple Views (AC) pdf [Munzner Ch. 12] Improvise	Q&A - D3 Tutorial
	Apr 30	Due: A3 (23:55)	
8	May 02/05	Tasks (FW) pdf [Munzner Ch. 2+3] Task Typology	Q&A Design Assignment
9	May 09/12	Design Studies (FW) pdf [Munzner Ch. 4] (MizBee) An example of a design study	VIS in Digital Humanities I (FW) pdf
	May 14	Due: A4 (23:55)	
10	May 16/19	Arrange Networks / Trees (CK) pdf [Munzner Ch. 9+10] Example: GraphDiaries by Bach et al.	VIS in Digital Humanities II (FW) pdf [Collection Visualization Survey] Survey
11	May 23/26	Arrange Networks / Trees (CK) pdf [Munzner Ch. 9+10]	No lecture
	May 30 / Jun 02	No Lecture	No Lecture
12	Jun 06/09	Reduce Items & Attributes (TM) pdf [Munzner Ch. 13] DimStiller	No Lecture
13	Jun 13/16	Manipulate View, Embed: Focus+Context (TS) pdf [Munzner Ch. 11+14]	TextVis for DH (AC, FW) pdf
	Jun 18	Due: A5 (23:55)	
14	Jun 20/23	TextVis (TM) pdf	Final
15	Jun 27/30	A5 Presentations	A5 Presentations

Outline

1. **The art of persuasion**
2. **Logos**
3. **Ethos**
4. **Pathos**
5. **Storytelling**



Main reference

- Charles Kostelnick. 2008. The visual rhetoric of data displays: The conundrum of clarity. IEEE Transactions on Professional Communication 51, 1 (2008), 116–130.

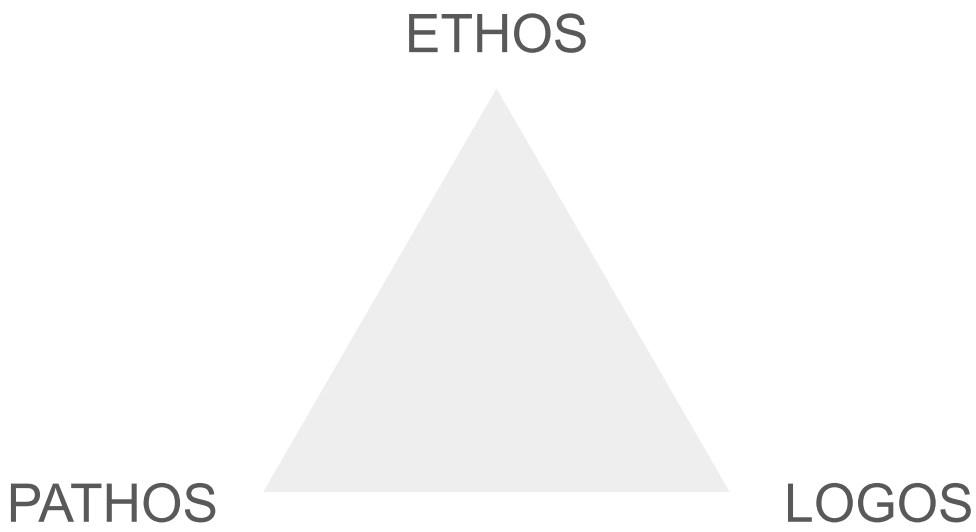
The art of persuasion

The Art of Persuasion

Aristotle has considered the art of communication (rhetoric) as a balance of:

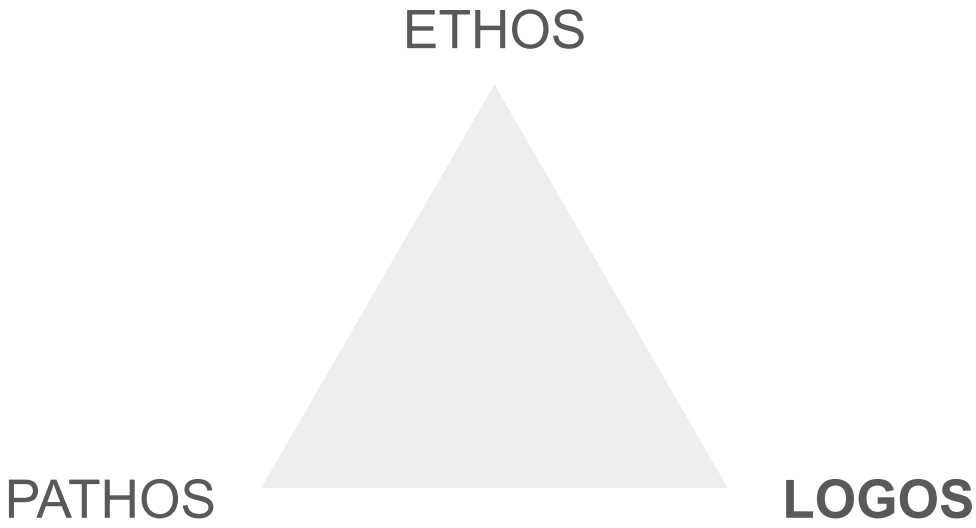
- Logos -> reason
- Ethos -> morality
- Pathos -> feeling

The rhetorical triangle



Aristoteles. 1995. Rhetorik (5th ed.). Fink Verl., Munich.

The rhetorical triangle



Logic/Reason

- sound argument
- scientific evidence

Aristoteles. 1995. Rhetorik (5th ed.). Fink Verl., Munich.

The rhetorical triangle

ETHOS

Ethics/Credibility
- trustworthiness
- authority

PATHOS

LOGOS

Logic/Reason
- sound argument
- scientific evidence

Aristoteles. 1995. Rhetorik (5th ed.). Fink Verl., Munich.

The rhetorical triangle

ETHOS

Ethics/Credibility
- trustworthiness
- authority

PATHOS

Feelings of the audience
- emotional appeal
- personal connection

LOGOS

Logic/Reason
- sound argument
- scientific evidence

Aristoteles. 1995. Rhetorik (5th ed.). Fink Verl., Munich.

The rhetorical triangle

ETHOS

Ethics/Credibility
- trustworthiness
- authority

PATHOS

Feelings of the audience
- emotional appeal
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LOGOS

Logic/Reason
- sound argument
- scientific evidence

Aristoteles. 1995. Rhetorik (5th ed.). Fink Verl., Munich.

Why Persuasion?

Why Persuasion?

Isn’t this a bad thing?

Persuasive communication

Persuasion is not deception.

Persuasion is any message that is intended to shape, reinforce, or change the responses of others.

Convincing or persuading versus deception or manipulation.

Demand for objectivity → are data visualizations really objective?

Raises the question: should datavis really aim to persuade?

Stiff, J. B., & Mongeau, P. A. 2016. Persuasive communication. Guilford Publications.

Rhetoric of visuals
The art of persuasion
Logos
Ethos
Pathos
Storytelling

Logos

Logos

- Rhetoric of science
- Appeals to logic and reason (and clarity)

-> What does this mean for data visualization?

Logos

- Rhetoric of science
- Appeals to logic and reason (and clarity)

-> What does this mean for data visualization?

- “Perceptual cognitive-based school of thought” (Brasseur, 2003)
- Principles of design optimised for perception and task

L. E. Brasseur, Visualizing Technical Information: A Cultural Critique. Amityville, NY: Baywood Publishing, 2003.

Perspective: Rhetoric of clarity

Perceptual science of data vis design

The vis is there to facilitate the readers comprehension of data

Transmission of fact and truth (Rhetoric of neutrality)

Graphical excellence (Tufte)

Utilitarian nature of data displays *vs. design approach (e.g. Don Norman)?*

“if the numbers are boring, then you've got the wrong number's. [...] who would trust a chart that looks like a videogame?"

Edward R Tufte. 1990. Envisioning Information. Graphic Press, Cheshire, Connecticut.

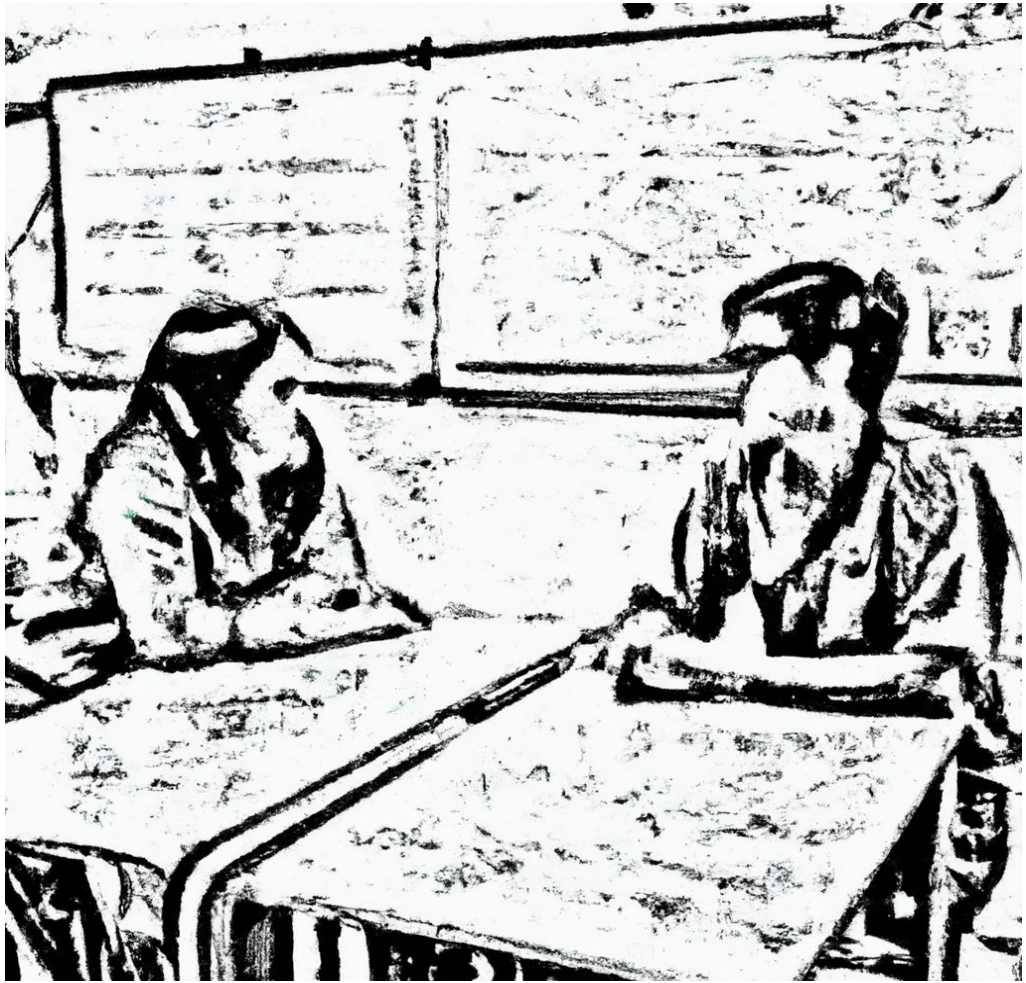
Critique Tufte

- Memorability
- Engagement
- Support cognitive processes through repetition?

Manifesto for Putting 'Chartjunk' in the Trash 2021!

Akbaba, D., Wilburn, J., Nance, M.T. and Meyer, M., 2021. Manifesto for Putting'Chartjunk'in the Trash 2021!. arXiv preprint arXiv:2109.10132.

Takeaways ?



Takeaways: Logos

- Maximise logos
  - Sound argument
  - Good evidence
  - Reasonable connection between claim and evidence
- There is a visual rhetoric (an aesthetic) connected to this perspective -> rhetoric of neutrality
- Ethical issues need to be considered
- Communicative interactions complicate this perspective

Rhetoric of visuals
The art of persuasion
Logos
Ethos
Pathos
Storytelling

Ethos

Ethos in Data Vis

Clarity

- Aesthetics vs. functionality

Social rhetoric

- Data vis design is a process
- Readers interpret through collective learning, experience and values

Rhetoric of participation

- Readers actively manipulate displays to explore
- Personal interest and interpretative preference in the foreground

Objectivity of data

- Ethical dimensions of data displays

Charles Kostelnick. 2008. The visual rhetoric of data displays: The conundrum of clarity. IEEE Transactions on Professional Communication 51, 1 (2008), 116–130.

Clarity

- Enabling optimal interpretation
- Design principles to ensure optimal transmission of data from designer to user
- Emphasis on universal principles of design (Tufte)
- Purpose and context of the visualization

Rationale: protect readers from the excesses, malpractice, and duplicity of designers

Charles Kostelnick. 2008. The visual rhetoric of data displays: The conundrum of clarity. IEEE Transactions on Professional Communication 51, 1 (2008), 116–130.

“By undermining the clarity of the display, these perceptual faux pas also weaken the ethos, or credibility, of the designer”

Charles Kostelnick. 2008. The visual rhetoric of data displays: The conundrum of clarity. IEEE Transactions on Professional Communication 51, 1 (2008), 116–130.

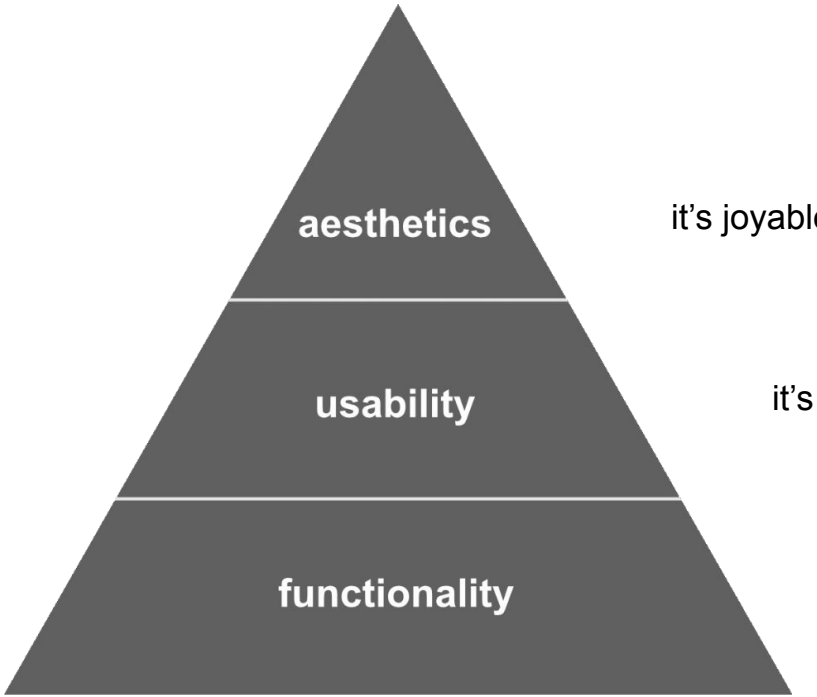
Aesthetics vs. Functionality

- Beautiful things are also more functional (Norman), **but**:

  it can negatively impact the integrity of the data

- Function comes first, aesthetics second

Aesthetics vs. Functionality



it’s joyable

it’s easy to use

it works, no bugs

UX hierarchy of needs

Aesthetics vs. Functionality

- Beautiful things are also more functional (Norman), **but**:

  it can negatively impact the integrity of the data

- Function comes first, aesthetic second
- Well-designed displays create a subjective response from the viewer
- Why is aesthetics important?
  - it makes displays more inviting to readers because readers are naturally drawn to elegant displays
  - it bolsters their credibility because beauty and truth are cognate qualities

Charles Kostelnick. 2008. The visual rhetoric of data displays: The conundrum of clarity. IEEE Transactions on Professional Communication 51, 1 (2008), 116–130.

Alberto Cairo. 2013. The functional art: an introduction to information graphics and visualization. New Riders, Berkeley.

Social rhetoric

- Readers interpret displays through their collective learning, experience, and values
  - Interpretation of data design is a highly social act
- Data displays as socially constructed conventions
  - Achieving clarity is a collective effort
- We need to tailor communication to specific situations:
  - Audience
  - Purpose
  - Context

Charles Kostelnick. 2008. The visual rhetoric of data displays: The conundrum of clarity. IEEE Transactions on Professional Communication 51, 1 (2008), 116–130.

“Readers are not naïve noble savages who gaze innocently; rather, they are members of discourse communities - large and small, public and specialized - that foster their interpretive skills”

Charles Kostelnick. 2008. The visual rhetoric of data displays: The conundrum of clarity. IEEE Transactions on Professional Communication 51, 1 (2008), 116–130.

Interactivity & Participation

- Shift from *speech* to print to screen
- Interactive displays can enhance clarity ?
- Shift from a passive to an active, participatory role of the user → user participates in adapting the display
- Micro- and macro view

Charles Kostelnick. 2008. The visual rhetoric of data displays: The conundrum of clarity. IEEE Transactions on Professional Communication 51, 1 (2008), 116–130.
Edward R Tufte. 1990. Envisioning Information. Graphic Press, Cheshire, Connecticut.
Firat, E.E., Joshi, A. and Laramee, R.S., 2022. Interactive visualization literacy: The state-of-the-art. Information Visualization, 21(3), pp.285-310.

Interactive example:

http://manpopex.us/

Ethical aspects

“The world does not spontaneously quantify, curate, or data-mine itself. Rather, the process of observing the world and quantifying it is a political act, and deserves ethical consideration”

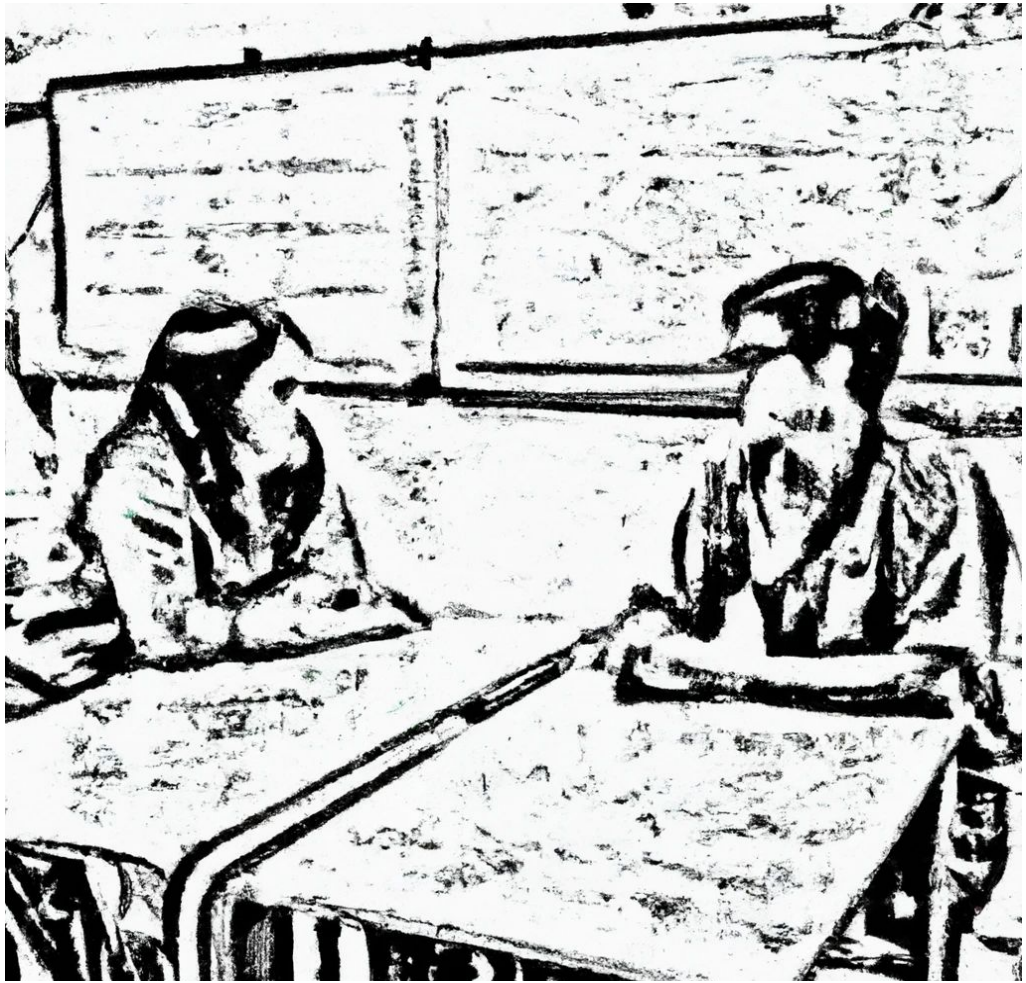
Michael Correll. 2019. Ethical Dimensions of Visualization Research. In CHI Conference on Human Factors in Computing Systems. ACM, New York, 1–19.

How to create ethical visualizations

- Make the Invisible Visible
  - visualize hidden labor
  - visualize hidden uncertainty
  - visualize hidden impacts
- Collect Data With Empathy
  - encourage “small data”
  - anthropomorphize data
  - obfuscate data to protect privacy
- Challenge Structures of Power
  - support data “due process”
  - act as data advocates
  - pressure or slow unethical analytical behavior

Michael Correll. 2019. Ethical Dimensions of Visualization Research. In CHI Conference on Human Factors in Computing Systems. ACM, New York, 1–19.

Takeaways ?



Takeaways (ethos)

- Data displays need to be functional but also well-designed in order to elicit a subjective response
- Communication via data displays is a social act
- Different target audiences have different interpretive frameworks that profoundly influence what they find clear and credible in data displays
- Data visualizations are political: they influence representation, delegation, interpretation, as well as marginalization

“We control the curation, presentation, rhetorical content of the visualizations we create”

Michael Correll. 2019. Ethical Dimensions of Visualization Research. In CHI Conference on Human Factors in Computing Systems. ACM, New York, 1–19.

Rhetoric of visuals
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Logos
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Pathos

What is Pathos and why is it a good thing?

- Aesthetic-rhetorical concept
- No universal definition of the term pathos
- Appeal to the audiences emotions → those that affect a person's soul
- Pathos originally was used to (in theaters):
  - persuade the audience
  - enhance their catharsis
- Emotions tie to experiences → part of the sensemaking process

Aristoteles. 1995. Rhetorik (5th ed.). Fink Verl., Munich

Yun Wang, Adrien Segal, Roberta Klatzky, Daniel F. Keefe, Petra Isenberg, Jörn Hurtienne, Eva Hornecker, Tim Dwyer, Stephen Barrass, and Theresa Marie Rhyne. 2019. An Emotional Response to the Value of Visualization. IEEE Computer Graphics and Applications 39, 5 (2019), 8–17

“The world cannot be understood without numbers. And it cannot be understood with numbers alone”

Hans Rosling. 2019. Factfulness. Ten reasons we’re wrong about the world - and why things are better than you think. Sceptre, London.

Techniques to create Pathos in Data Vis

- Proximity techniques
  - Time
  - Place
  - People
- Color & Design
- (Personal) Interest

Proximity Techniques

- **Time**
  - Assumption: Temporal proximity creates a higher emotional resonance in the viewer
  - How? Prediction
  - Con: Not always possible

Sarah Campbell. 2018. The Rhetoric of Pathos in Visualization. Northeastern University Boston.
George Campbell. 2008. The Philosophy of Rhetoric. Southern Illinois University Press.

Proximity Techniques

- **Time**
  - Assumption: Temporal proximity creates a higher emotional resonance in the viewer
  - How? Prediction
  - Con: Not always possible
- **Place**
  - Assumption: Data with a local proximity to the viewer cause that individual to feel more strongly about them
  - How? Let people choose/appeal to imagination
  - Con: Subsets of data need to be generated → can create completely different datasets (not comparable anymore)

Sarah Campbell. 2018. The Rhetoric of Pathos in Visualization. Northeastern University Boston.
George Campbell. 2008. The Philosophy of Rhetoric. Southern Illinois University Press.

Proximity of time / place: AI generating future scenarios

Alexandra Luccioni, Victor Schmidt, Vahe Vardanyan, and Yoshua Bengio. 2021. Using Artificial Intelligence to Visualize the Impacts of Climate Change. IEEE Computer Graphics and Applications 41, 1 (2021), 8–14.

Proximity Techniques

- **People → humanizing data**
  - Assumption: When the data concerns people connected to the target-audience, people care more
  - How? Show people behind the data, Anthropographics
  - Con: similarity bias/ individual differences (e.g. skin color)

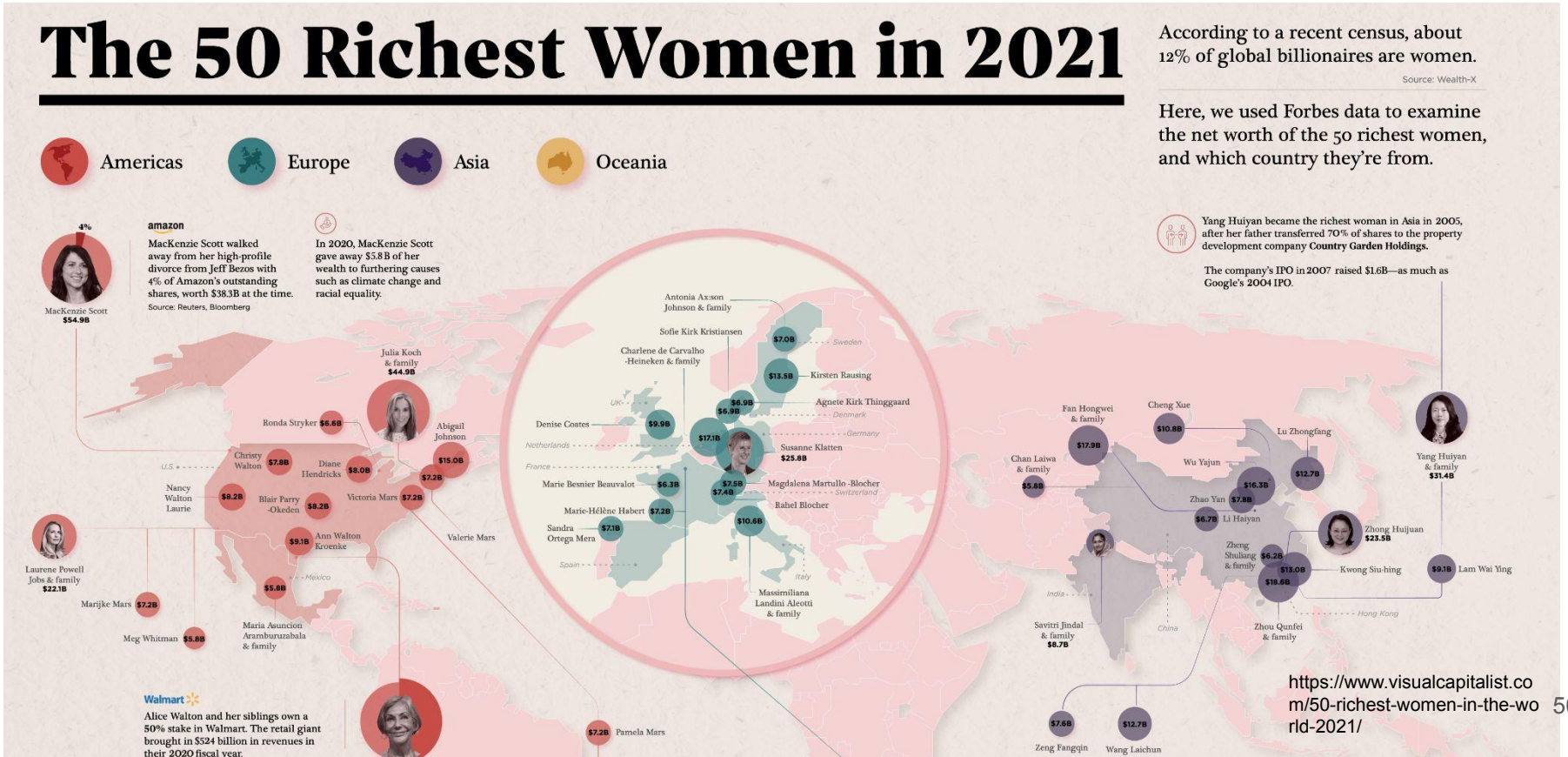
Xingyu Lan, Yanqiu Wu, Yang Shi, Qing Chen, and Nan Cao. 2022. Negative Emotions, Positive Outcomes? Exploring the Communication of Negativity in Serious Data Stories. In CHI Conference on Human Factors in Computing Systems. 1–14.

Jeremy Boy, Anshul Vikram Pandey, John Emerson, Margaret Satterthwaite, Oded Nov, and Enrico Bertini. 2017. Showing People Behind Data: Does Anthropomorphizing Visualizations Elicit More Empathy for Human Rights Data?. In Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems (CHI '17). Association for Computing Machinery, New York, NY, USA, 5462–5474.

Anthropographics

Luiz Morais, Yvonne Jansen, Nazareno Andrade, Pierre Dragicevic. Showing Data about People: A Design Space of Anthropographics. IEEE Transactions on Visualization and Computer Graphics, 2022, 28 (3), pp.1661-1679

Proximity to people (similarity)



https://www.visualcapitalist.com/50-richest-women-in-the-world-2021/

Color & Design

- Assumption: A deliberate choice of design can address the emotional side of the viewer
- How? Make use of colors / Emotional Design (2004) by Donald A. Norman
- Con: Trust / credibility / Tufte

Francesca Samsel, Lyn Bartram, and Annie Bares. 2018. Art, Affect and Color: Creating Engaging Expressive Scientific Visualization. In 2018 IEEE VIS Arts Program (VISAP). 1–9.

Lisa Charlotte Muth. 2016. A Data Point Walks Into a Bar. https://lisacharlottemuth.com/2016/12/27/datapoint-in-bar/

Color & Design: “Iraq’s bloody toll” by Simon Scarr

http://www.simonscarr.com/iraqs-bloody-toll

Color & Design: Example

https://guns.periscopic.com/

Interest

- Assumption: The greater the interest people feel toward something, the higher the engagement with the visualization
- How? Subject matter
- Con: Very individual

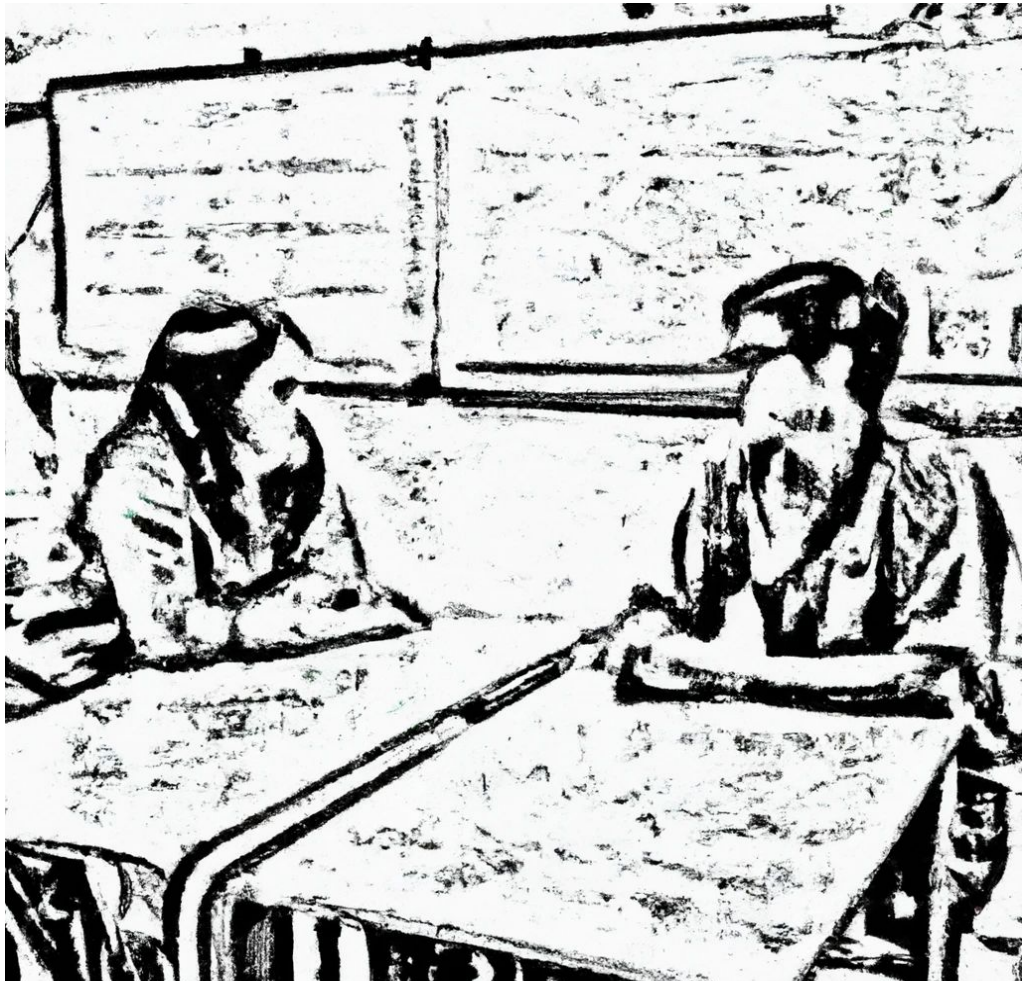
Helen Kennedy and Rosemary Lucy Hill. 2018. The Feeling of Numbers: Emotions in Everyday Engagements with Data and Their Visualisation. Sociology 52, 4 (2018), 830–848.

Sarah Campbell and Dietmar Offenhuber. 2019. Feeling numbers. The emotional impact of proximity techniques in visualization. Information design journal 25 (2019), 71–86.

*“In fact, **emotion could be thought of as a byproduct of** a **learning** outcome. [...] If an advocacy group is trying to get their audience fired up and emotionally charged, it’s because they want them to take an action”*

Elsie Lee-Robbins and Eytan Adar. 2022. Affective Learning Objectives for Communicative Visualizations. IEEE Transactions on Visualization and Computer Graphics (2022), 1–11. https://doi.org/10.1109/TVCG.2022.3209500

Takeaways ?



Takeaways (pathos)

- Pathos is the appeal to the audience's emotion
- The use of proximity techniques can create pathos
- Show the people behind the data (Humanize your data)
- Make use of color and design
- Let people choose → appeal to their interests

Rhetoric of visuals
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Storytelling

Storytelling with data

“Datastories are intentional communicative artefacts that present data in an interesting, evocative and informative way”

Feigenbaum, A. and Alamalhodaei, A., 2020. The Data Storytelling Workbook. Routledge.

Science is a form of storytelling

- When data and stories are used together they resonate with audiences on both an intellectual and emotional level [Jennifer L Aaker, 2013]
- Potential to focus on the human elements.
- A dataset likely contains multiple possible stories.
- A great story needs to surprise (then it sticks).
- The discovery process has the potential to create great narratives.

“It is naïve to expect that simply by rendering multiple data streams visually, a teacher or learner will be able to make sense of them”

Roberto Martinez-Maldonado, V Echeverria, Gloria Fernandez Nieto, and Simon Buckingham Shum. 2020. From Data to Insights: A Layered Storytelling Approach for Multimodal Learning Analytics. In CHI Conference on Human Factors in Computing Systems. CHI ’20, Honolulu, 1–15.

Principles of Data Storytelling

- Data Storytelling is goal oriented
- The data story should rely on a fitting chart type
- The data story should be stripped down first
- The data story should guide attention

Narrative Design Patterns

Martinez-Maldonado, R., Echeverria, V., Fernandez Nieto, G. and Buckingham Shum, S., 2020. From data to insights: A layered storytelling approach for multimodal learning analytics. In Proceedings of the 2020 chi conference on human factors in computing systems

Bach, B., Stefaner, M., Boy, J., Drucker, S., Bartram, L., Wood, J., Ciuccarelli, P., Engelhardt, Y., Koeppen, U. and Tversky, B., 2018. Narrative design patterns for data-driven storytelling. In Data-driven storytelling, AK Peters/CRC Press.

Sea depth

https://neal.fun/deep-sea/

The collapse of insects

https://www.reuters.com/graphics/GLOBAL-ENVIRONMENT/INSECT-APOCALYPSE/egpbykdxjvq/

Resources & Literature

1. Aristoteles. 1995. Rhetorik (5th ed.). Fink Verl., Munich
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4. Sarah Campbell. 2018. The Rhetoric of Pathos in Visualization. Master's thesis. Northeastern University Boston.
5. Sarah Campbell and Dietmar Offenhuber. 2019. Feeling numbers. The emotional impact of proximity techniques in visualization. Information design journal 25 (2019), 71–86. https://doi.org/10.1075/idj.25.1.06cam
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14. Periscopic. 2018. U.S. Gun Killings in 2018. https://guns.periscopic.com/
15. Hans Rosling. 2019. Factfulness. Ten reasons we're wrong about the world - and why things are better than you think. Sceptre, London.
16. Simon Scarr. [n.d.]. Iraq's bloody toll. http://www.simonscarr.com/iraqs-bloody-toll
17. Francesca Samsel, Lyn Bartram, and Annie Bares. 2018. Art, Affect and Color: Creating Engaging Expressive Scientific Visualization. In 2018 IEEE VIS Arts Program (VISAP). 1–9. https://doi.org/10.1109/VISAP45312.2018.9046053
18. Edward R Tufte. 1990. Envisioning Information. Graphic Press, Cheshire, Connecticut.