

**beautiful data**

lecture 5

*overview*

**what makes data clear and beautiful?  
why should we be skeptical of  
beauty?**

- 1. Charles Minard**
- 2. Du Bois**
- 3. Meander Belt Maps**
- 4. LIDAR maps**

what makes a beautiful image?

what makes a compelling data visualization?

how do aesthetics augment communication?

## Tufte: 6 principles

1. comparisons (contrast)
2. causality, mechanism, structure, explanation
3. multivariate analysis (3+ variables)
4. integration of evidence
5. documentation
6. content counts most of all

### examples to analyze:

- Minard (various)
- DuBois
- Meander maps
- LIDAR meander maps
- imaginary meander maps
- storymap

Tufte, "The Fundamental Principles of Analytic Design", #4:

"More generally, the principle of information integration points to a philosophy of inquiry: a broad, pluralistic, problem-directed view of what constitutes the scope of relevant evidence. Too often in scholarly research, in social science at least, there is a certain narrowness in the choice and use of evidence. Thus many investigations of, say, political economy rely exclusively on a single mode of evidence: statistical data, or wordy memoirs of policy-makers, or anecdotes, or mathematical models, or metaphor, or economic or political ideology, or newspaper clippings. Research questions are framed along the lines of 'How can one type of information or one particular approach be used to explain something?' rather than 'How can something be explained?'

"Pre-specifying the mode of relevant information or the explanatory method may produce a tendentious misalignment of evidence in relation to substantive matters under investigation. The world to be explained is indifferent to scholarly specialization by type of evidence, methodology, or disciplinary field. A deeper understanding of human behavior may well result from integrating a diversity of evidence, whatever it takes to explain something. Like good information displays, explanatory investigations, if they are to be honest and genuine, must seek out and present all relevant evidence regardless of mode."

GIS for Designers  
VT | A+D | SU22

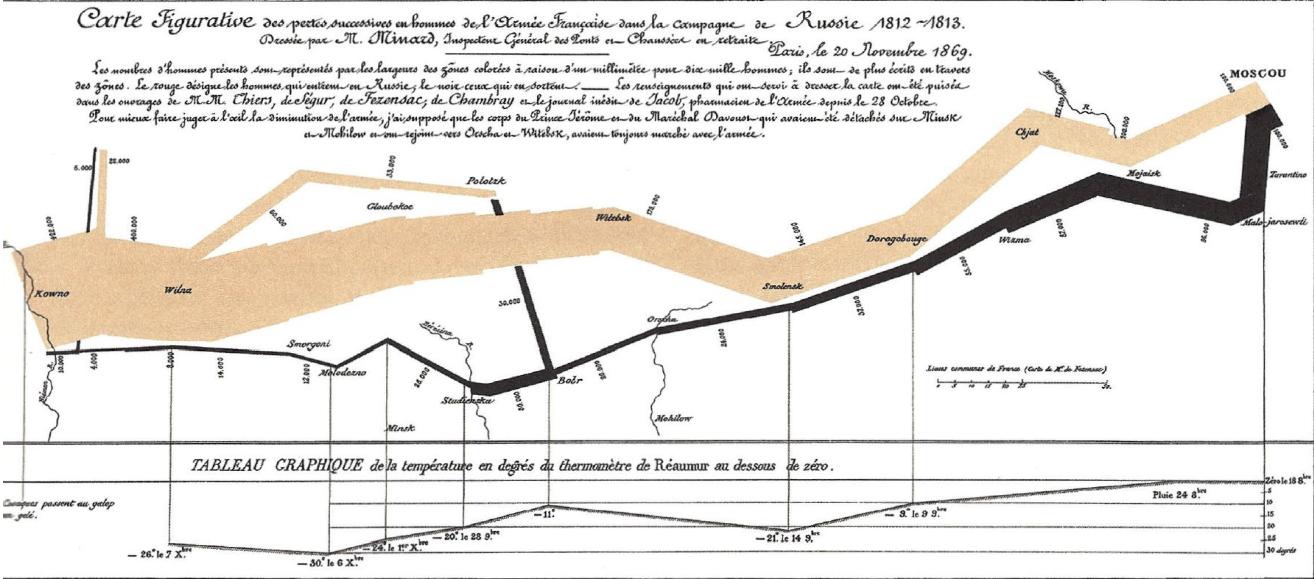
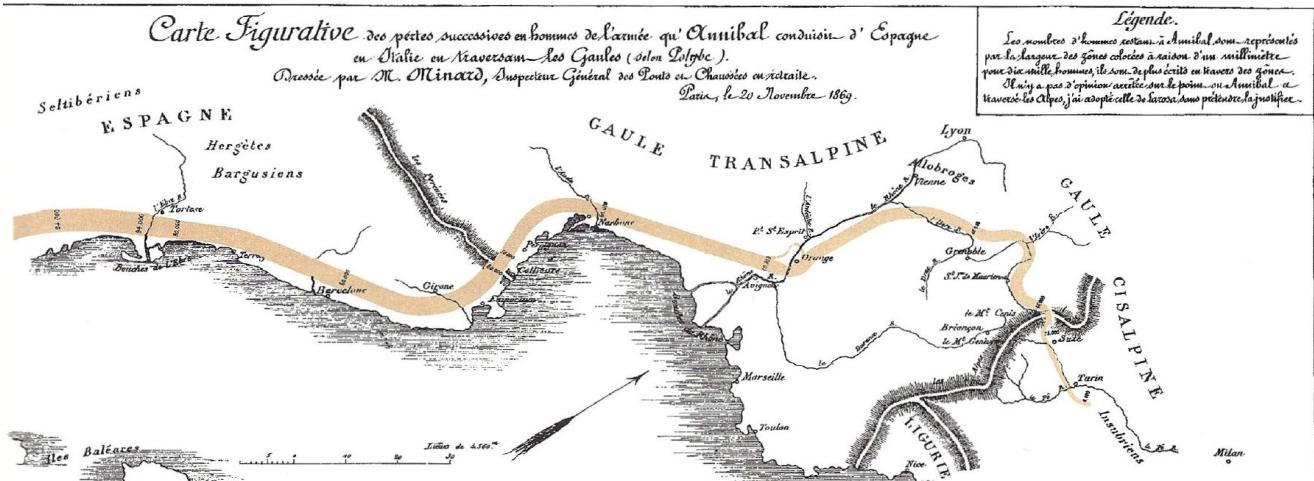
## Maps of the marches of Hannibal (top) and Napoleon (1869)

Charles Minard, Inspector General of Bridges and Roads, Paris

source: Tufte, Beautiful Evidence (2006)

Tufte: 6 principles

1. comparisons
2. causality
3. multivariate analysis
4. integration of evidence
5. documentation
6. content

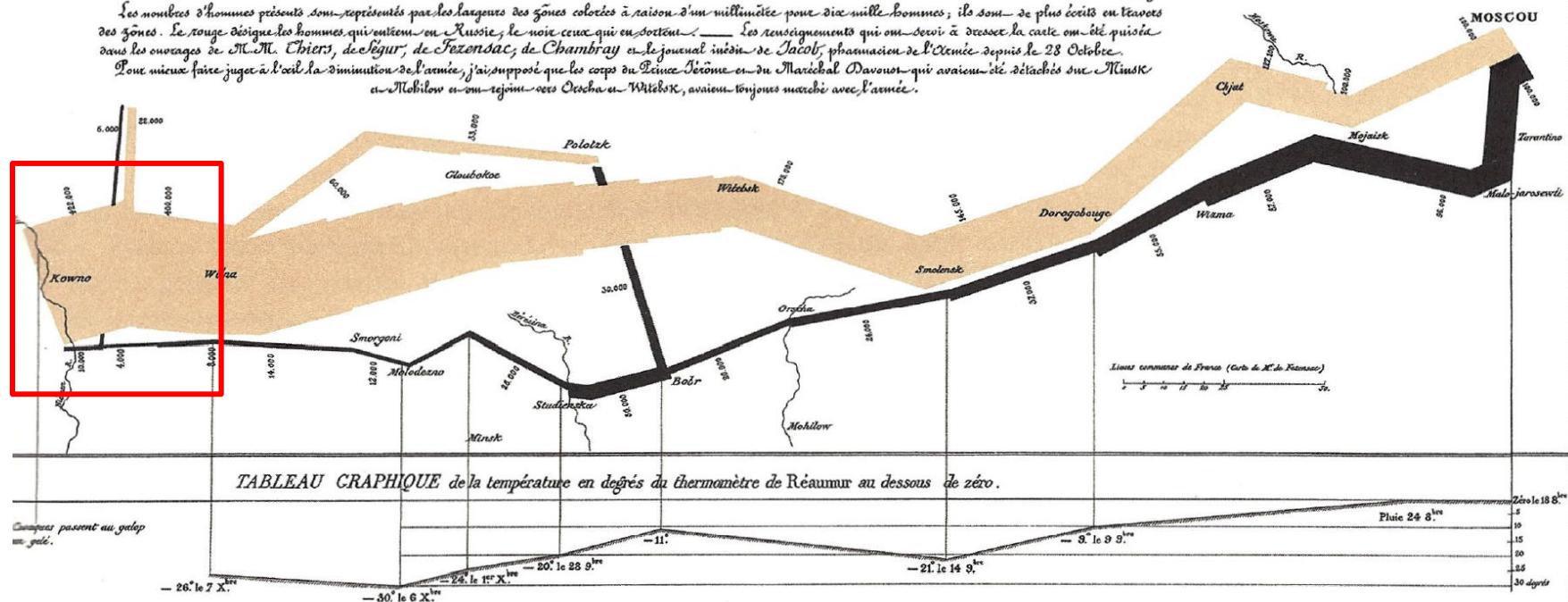


1. comparisons - number of troops leaving vs. returning (contrast)
2. causality
3. multivariate analysis
4. integration of evidence
5. documentation
6. content

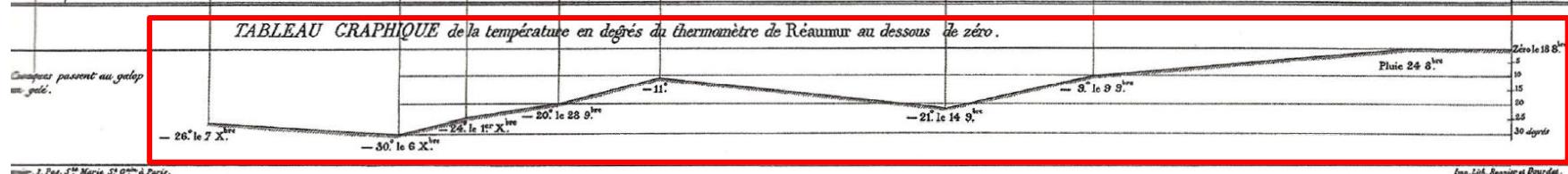
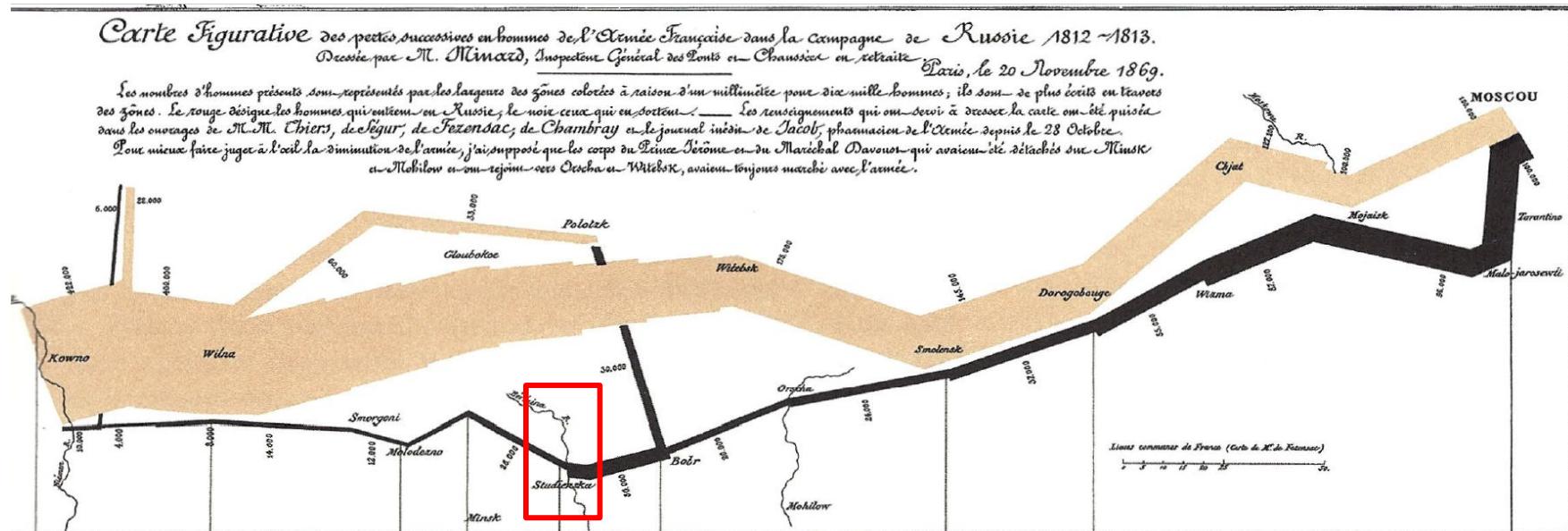
*Carte Figurative des pertes successives en hommes de l'Armée Française dans la Campagne de Russie 1812-1813.*

Dessiné par M. Minard, Inspecteur Général des Ponts et Chaussées en retraite Paris, le 20 Novembre 1869.

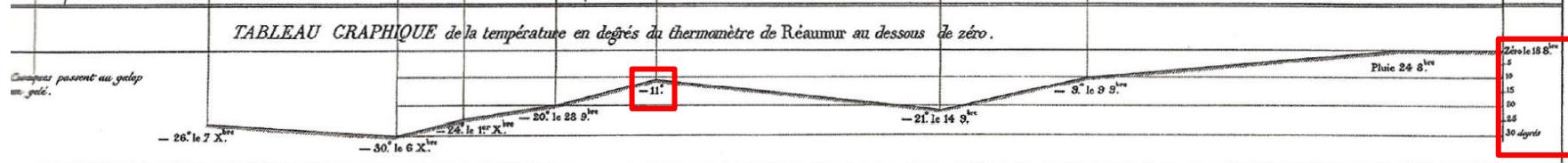
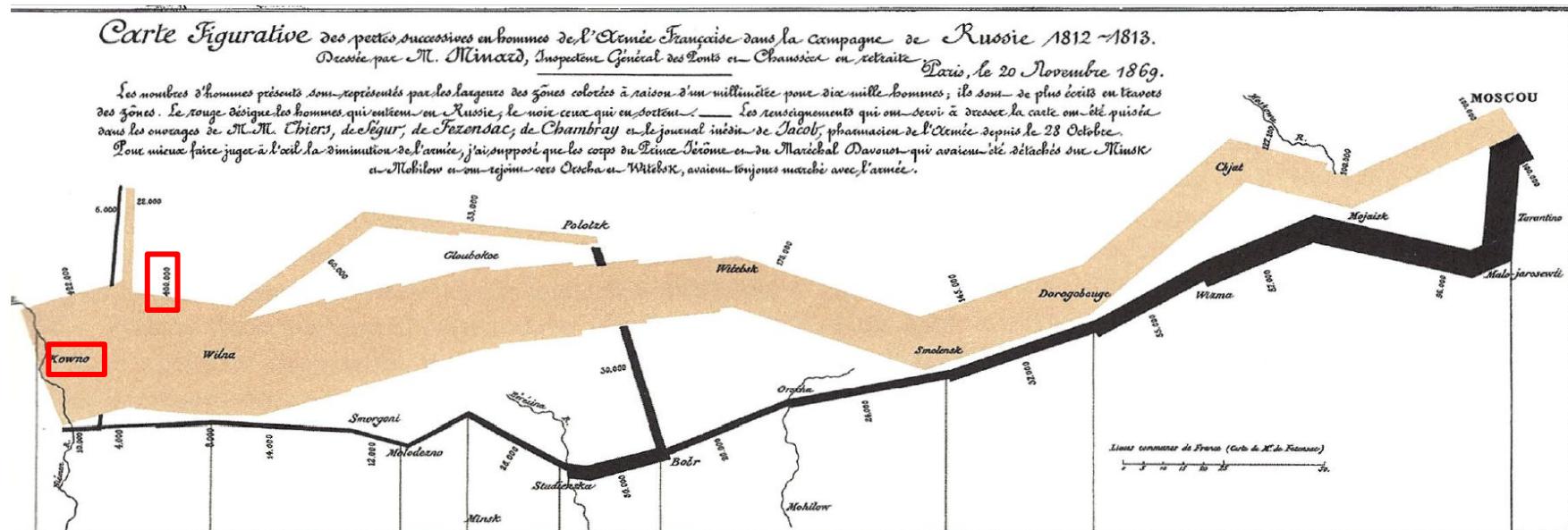
Les nombres d'hommes perdus sont représentés par les largeurs des zones colorées à raison d'un millimètre pour dix mille hommes; ils sont de plus écrits en lettres des zones. Le rouge désigne les hommes qui entrent en Russie; le noir ceux qui en sortent. — Les renseignements qui ont servi à dresser la carte ont été pris dans les ouvrages de M. M. Chiers, de Séguir, de Tocozac, de Chambray et le journal médical de Jacob, pharmacien de l'Armée depuis le 28 Octobre. Pour mieux faire juger à l'œil la diminution de l'armée, j'ai supposé que les corps de l'ence-Jérôme et du Maréchal Davout qui avaient été détachés sur Minsk et Mohilow se sont rejoints vers Orsha en Witebsk, avoient toujours marché avec l'armée.



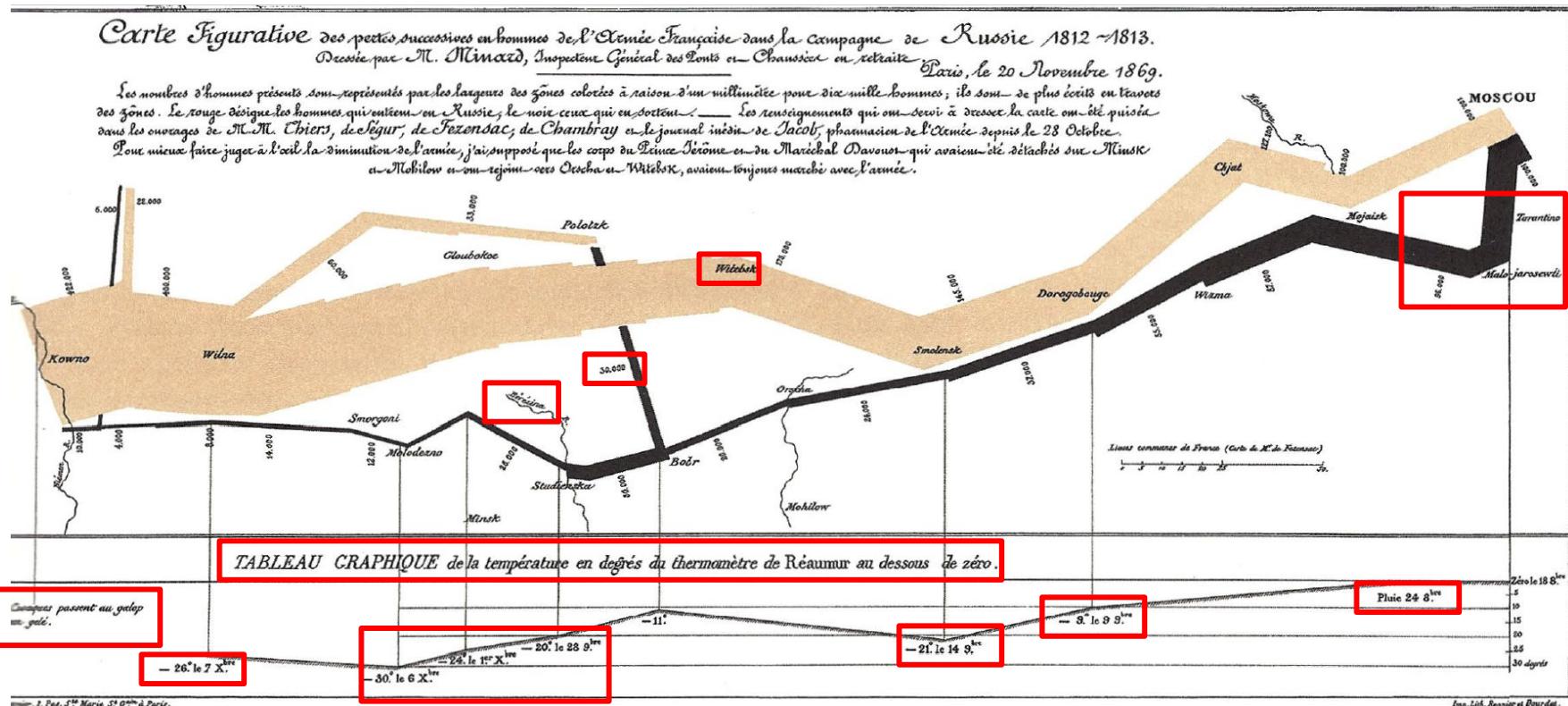
1. comparisons
2. causality - freezing temperatures
3. multivariate analysis
4. integration of evidence
5. documentation
6. content



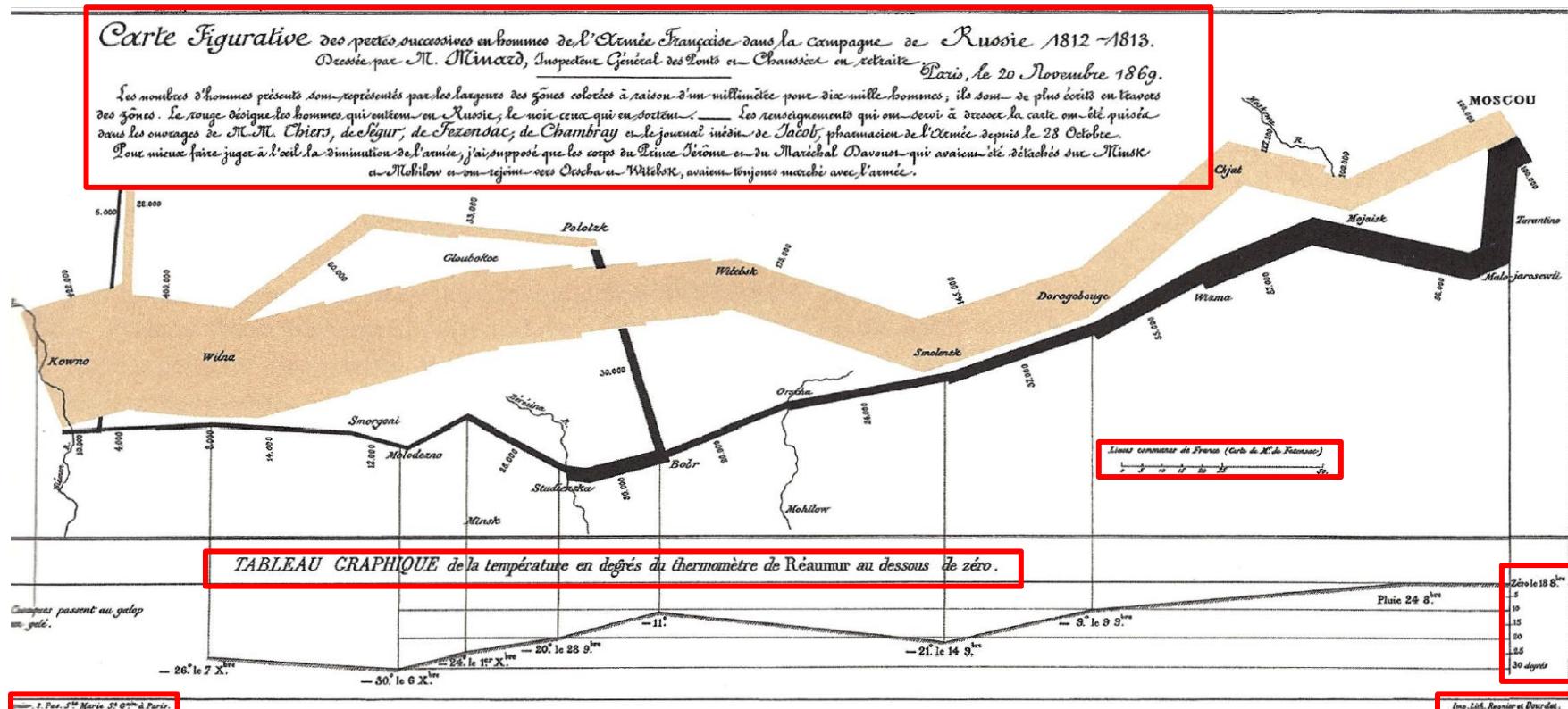
1. comparisons
2. causality
3. multivariate analysis - geography (location, direction), number of troops (size), temperature, date
4. integration of evidence
5. documentation
6. content



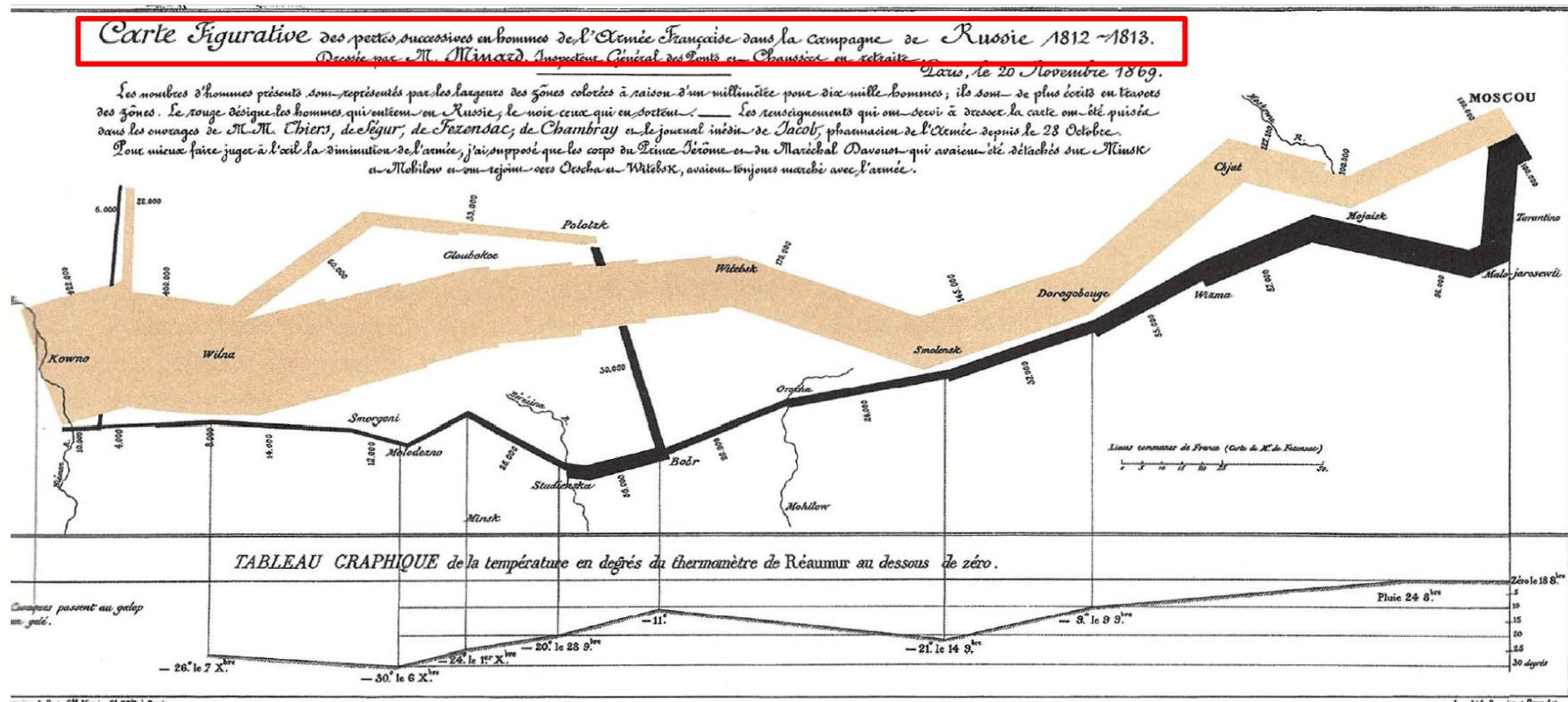
1. comparisons
2. causality
3. multivariate analysis
4. **integration of evidence - anecdotes from certain dates, certain river crossings and cities, certain periods of reinforcement**
5. documentation
6. content



1. comparisons
2. causality
3. multivariate analysis
4. integration of evidence
- 5. documentation - sources of evidence, date, time, and author of graph, and context of story being told**
6. content



1. comparisons
2. causality
3. multivariate analysis
4. integration of evidence
5. documentation
6. content - point of the map - the futility and lethality of Napoleon's quixotic march



## Map of Raw Cotton Imports to Europe (1866)

Charles Minard, Inspector General of Bridges and Roads, Paris

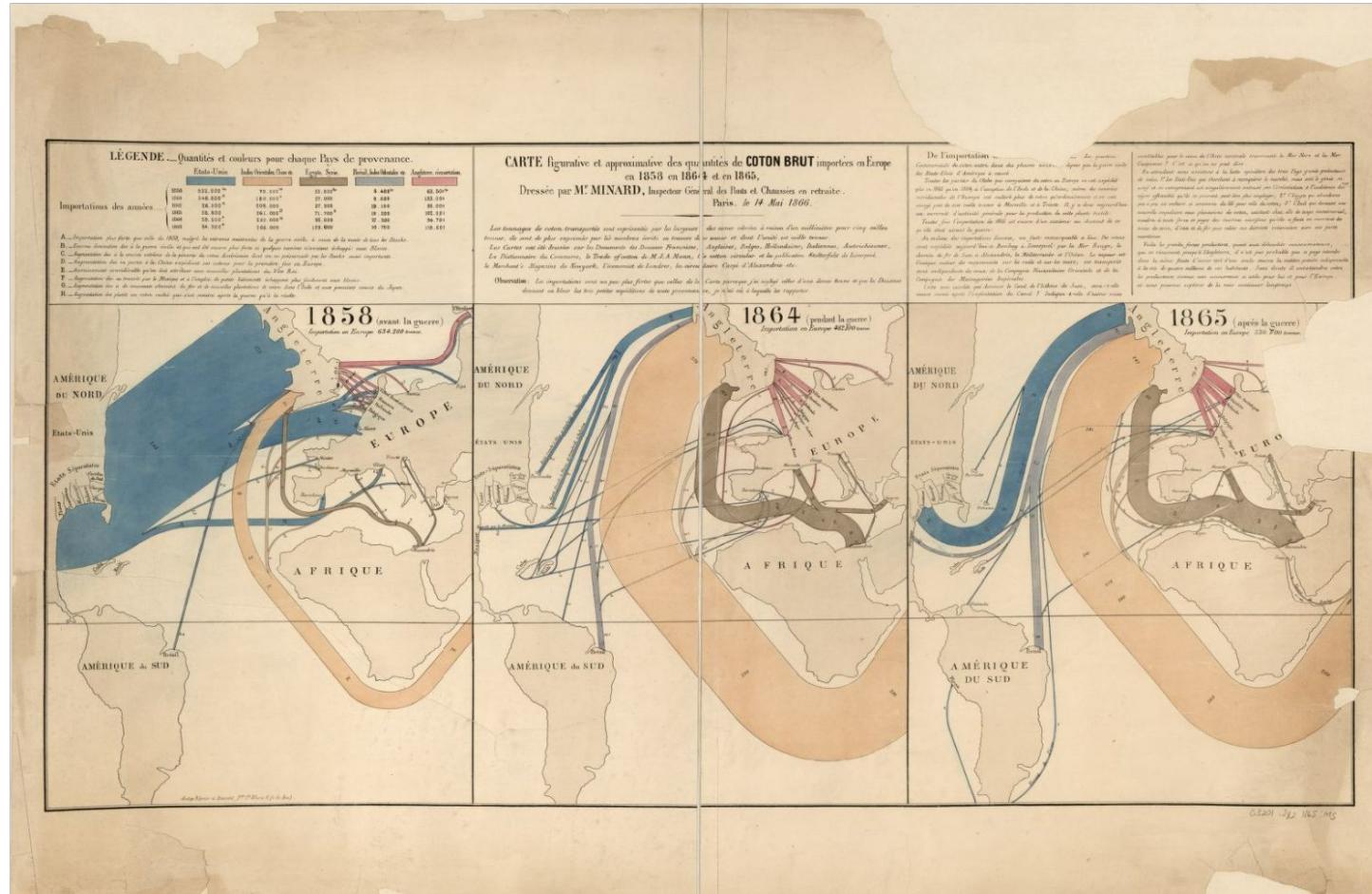
global cotton trade before, during, and after the American Civil War

what can you tell about the impact of the Civil War on global trade?

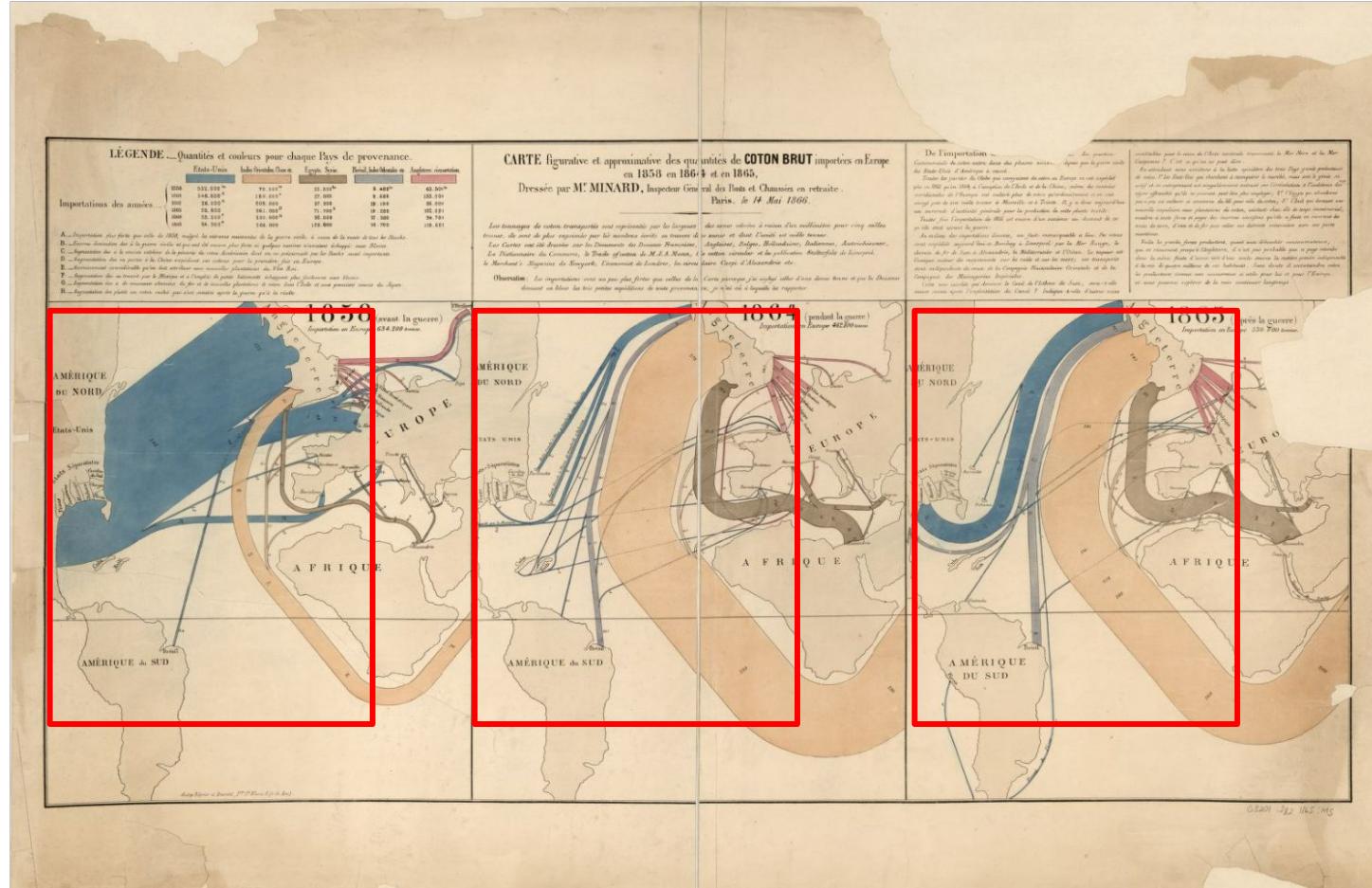
source: Library of Congress

Tufte: 6 principles

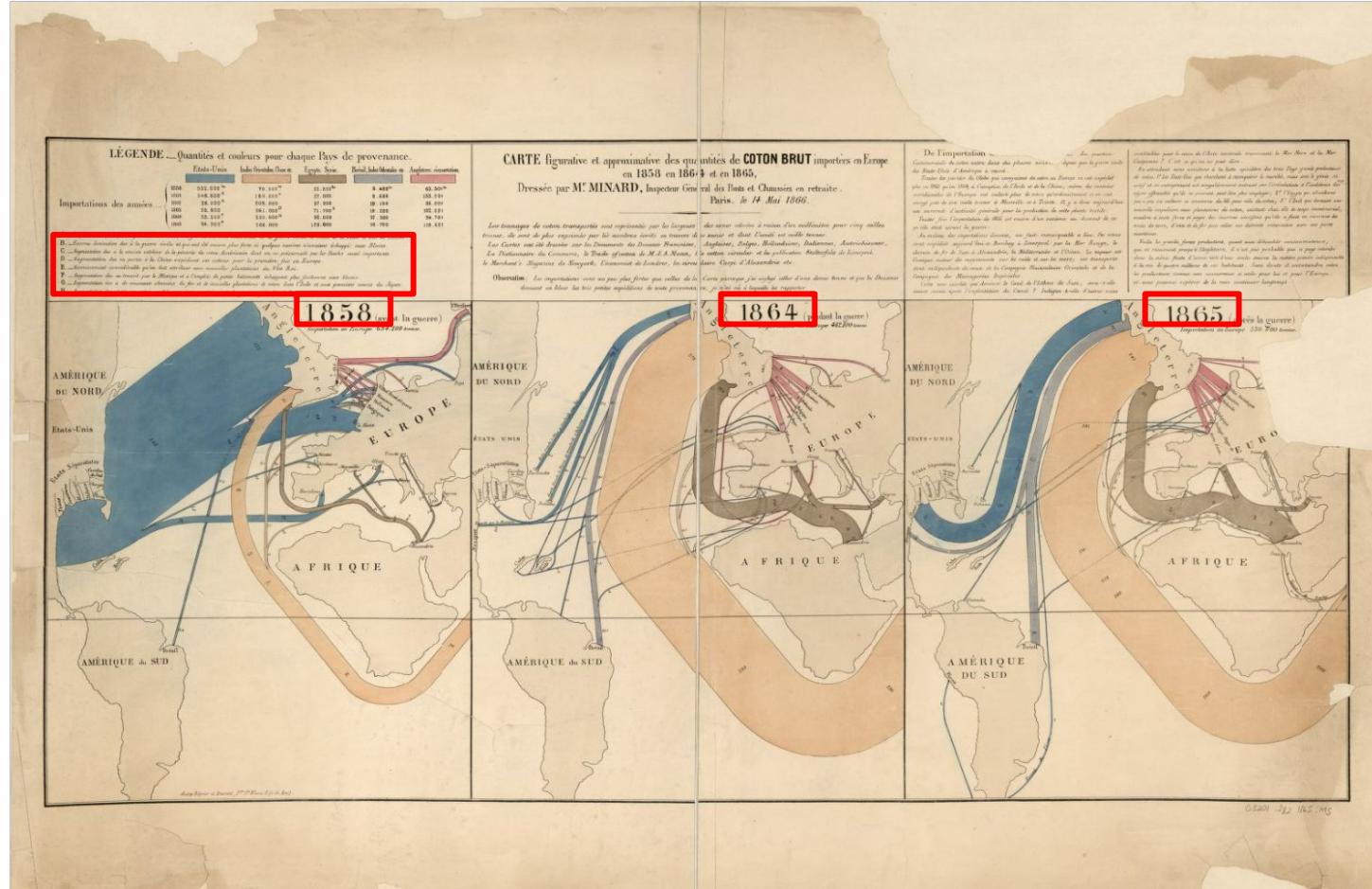
1. comparisons
2. causality
3. multivariate analysis
4. integration of evidence
5. documentation
6. content



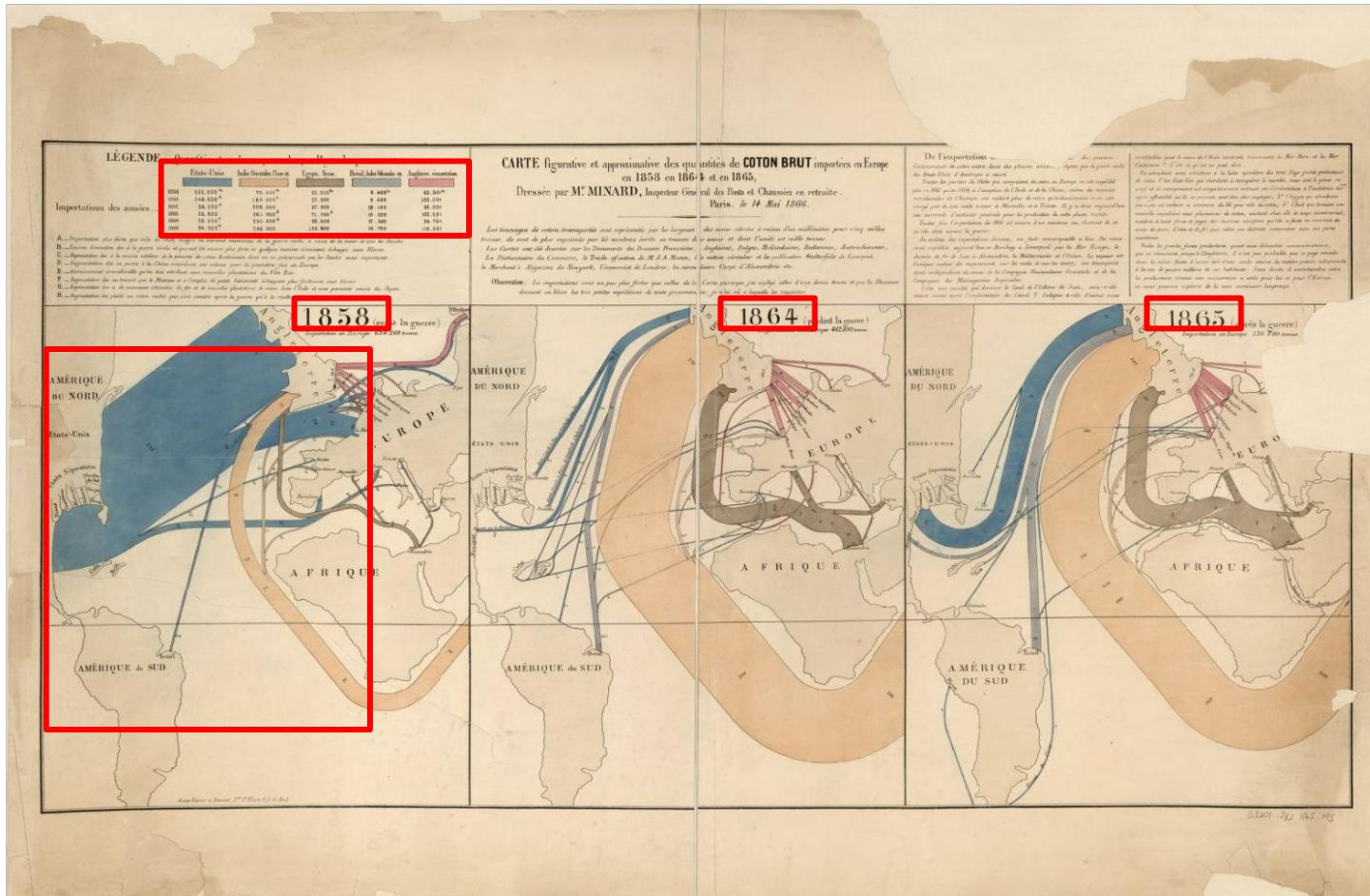
1. comparisons - between years and amount of cotton
  2. causality
  3. multivariate analysis
  4. integration of evidence
  5. documentation
  6. content



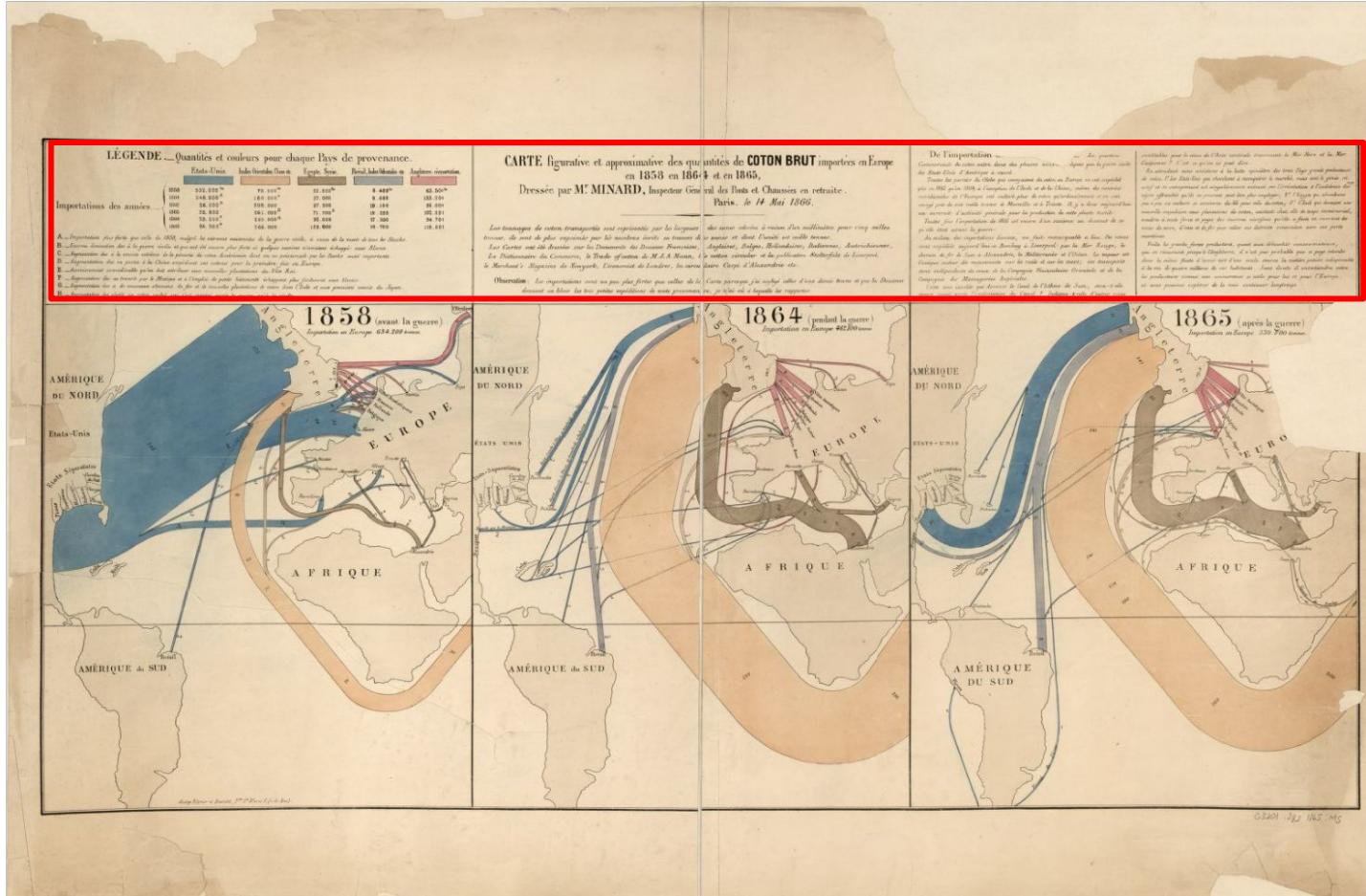
1. comparisons
  2. **causality - implied by the dates (American Civil War), but explicitly stated in the side notes**
  3. multivariate analysis
  4. integration of evidence
  5. documentation
  6. content



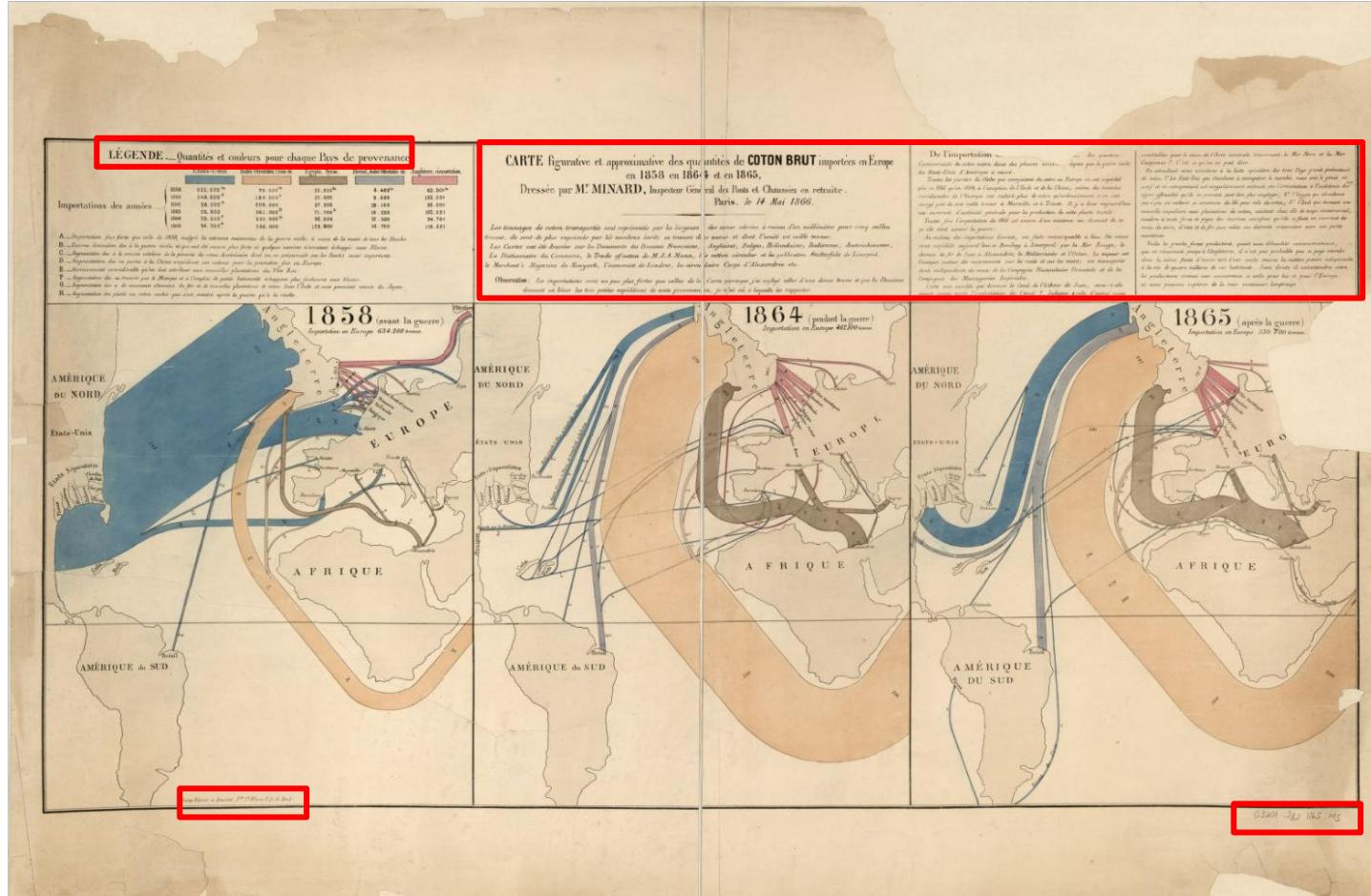
1. comparisons
  2. causality
  3. **multivariate analysis - dates, amount of cotton, location of trade**
  4. integration of evidence
  5. documentation
  6. content



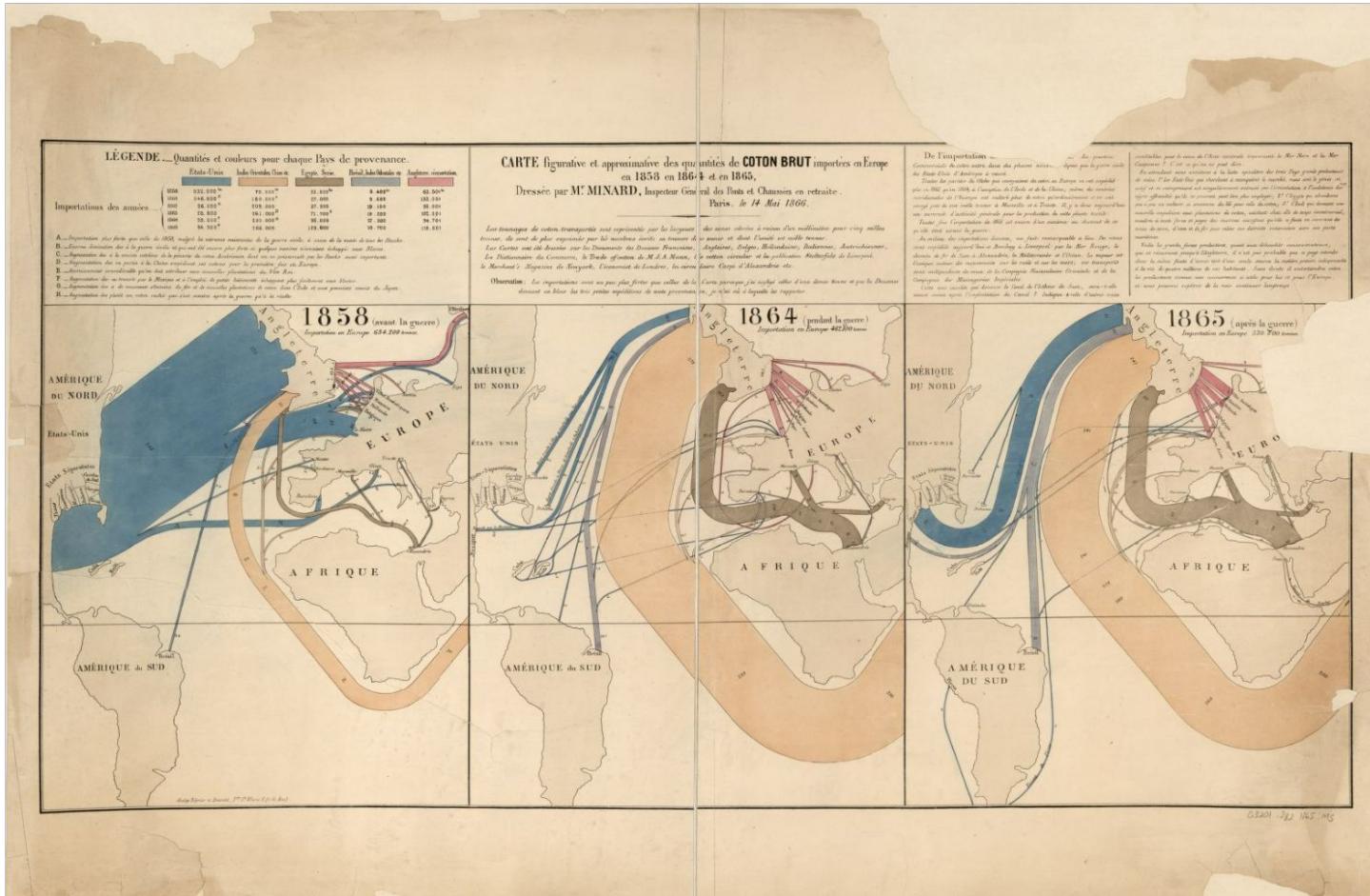
1. comparisons
  2. causality
  3. multivariate analysis
  4. **integration of evidence - commentary at top, change in trade routes, amount of cotton visualized in scale**
  5. documentation
  6. content



1. comparisons
  2. causality
  3. multivariate analysis
  4. integration of evidence
  5. **documentation - of sources, author, date, location, context**
  6. content



1. comparisons
  2. causality
  3. multivariate analysis
  4. integration of evidence
  5. documentation
  6. **content - stark visualization of the impact of war on the location of cotton production – permanent change to importing from India / China**



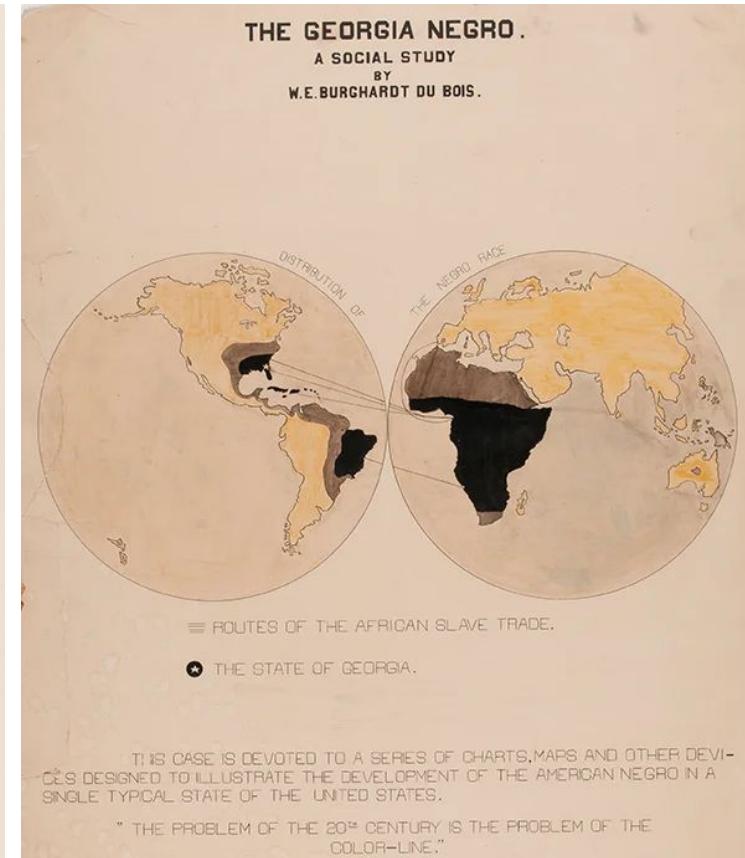
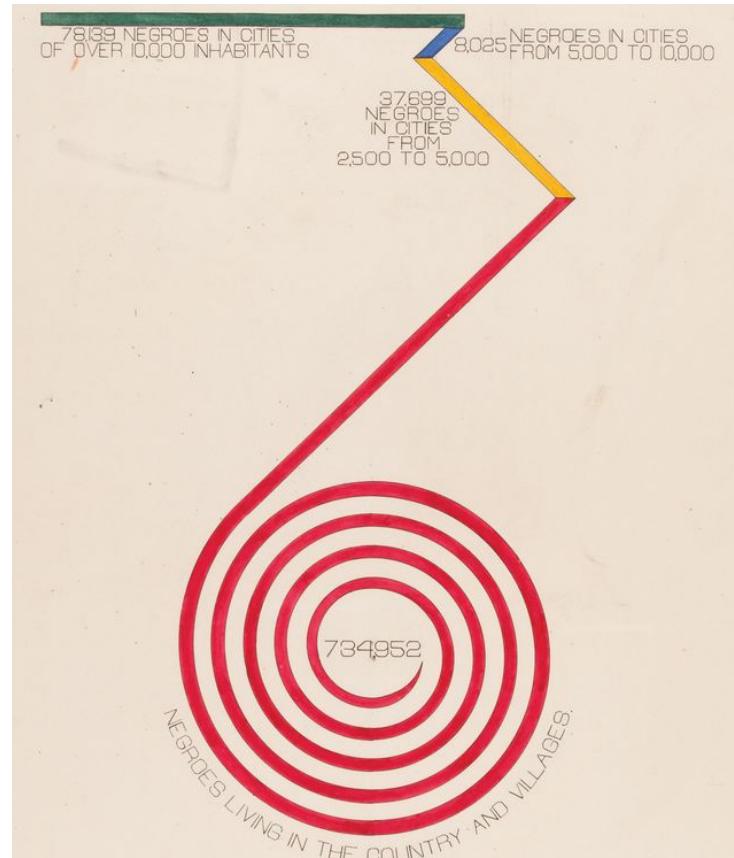
W.E.B. DuBois  
(1900)

Left: urban vs. rural population; Right: introductory image, African diaspora to Americas

image source: *W.E.B. Du Bois's Data Portraits Visualizing Black America* (2018)

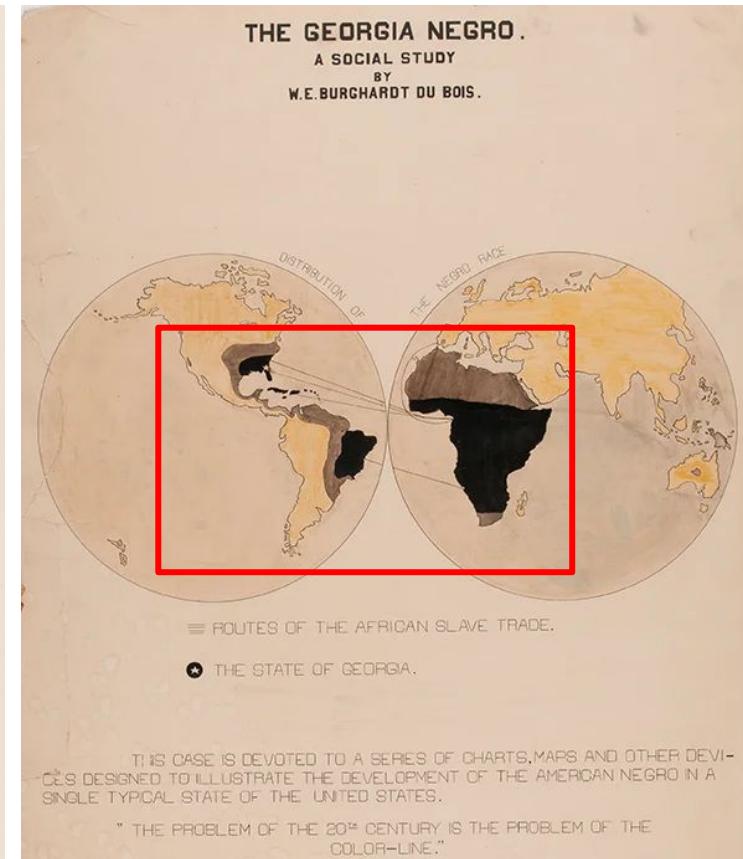
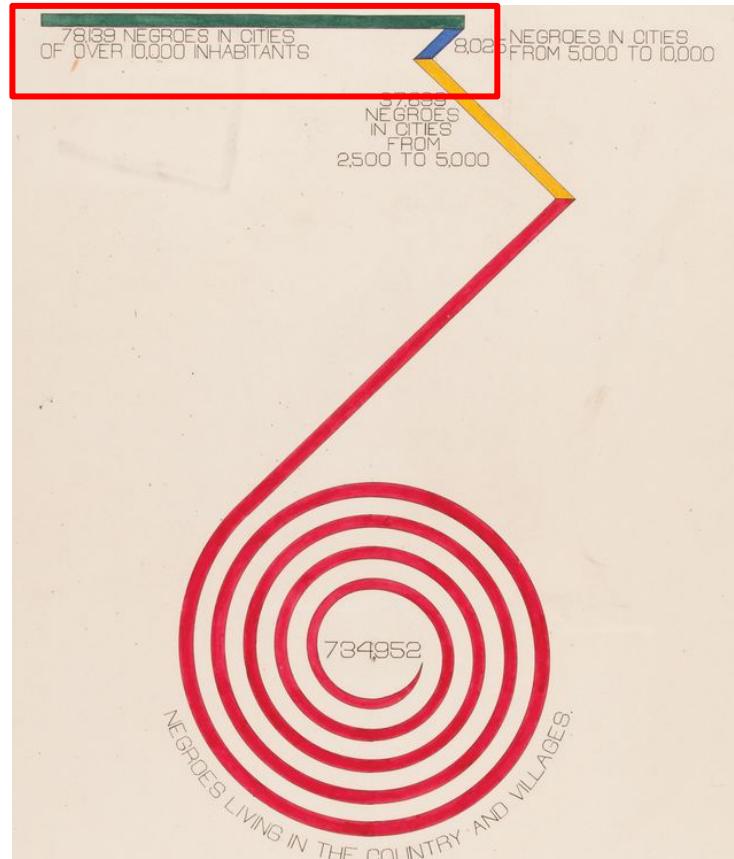
Tufte: 6 principles (as applied to entire 1901 collection - presented as a whole)

1. comparisons
2. causality
3. multivariate analysis
4. integration of evidence
5. documentation
6. content



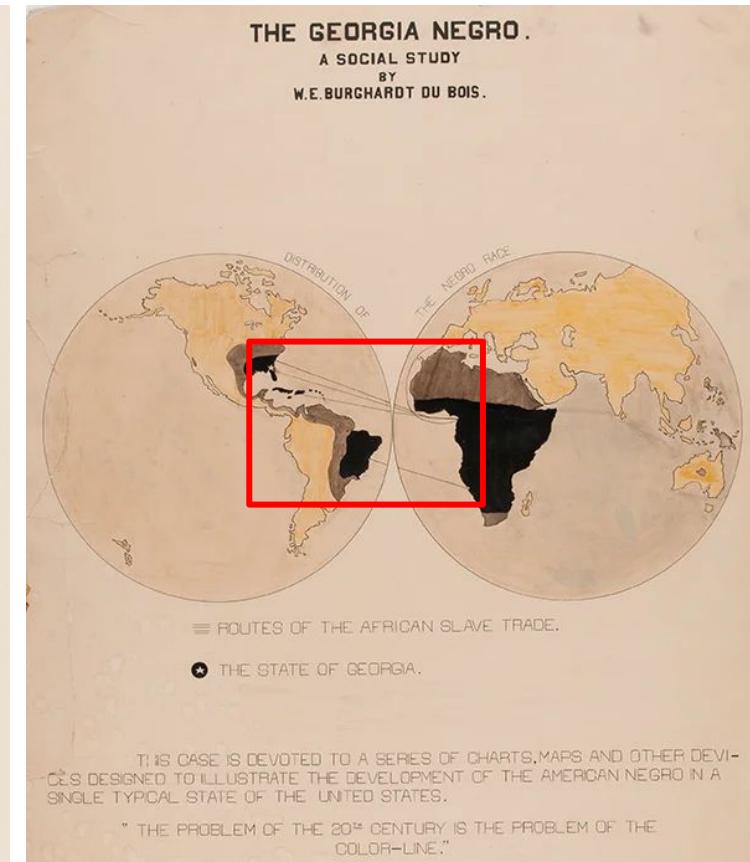
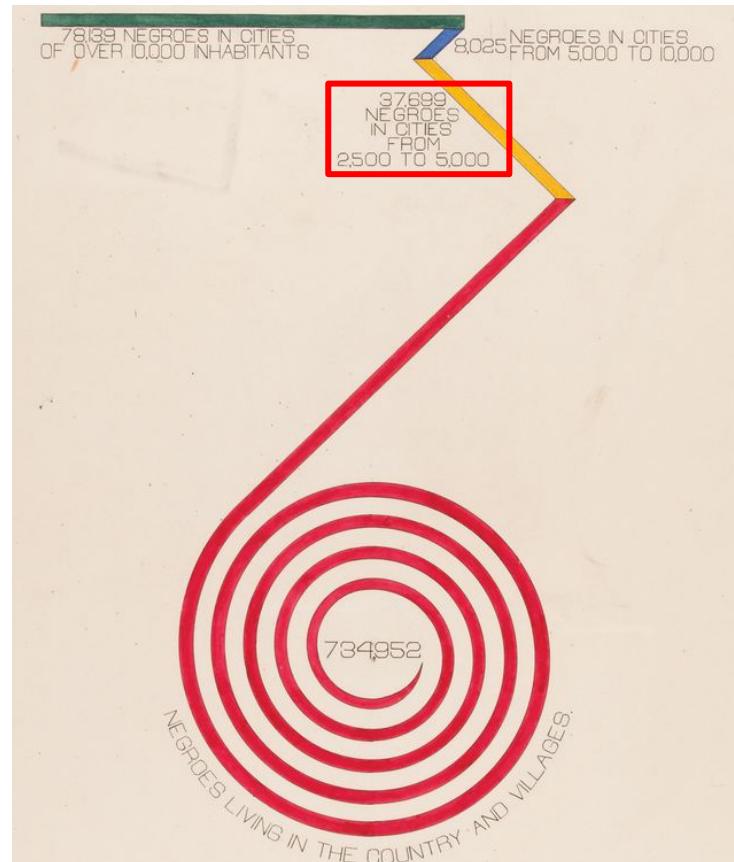
1. **comparisons - number of AfAm in cities vs. rural**
2. causality
3. multivariate analysis
4. integration of evidence
5. documentation
6. content

1. **comparisons - Af migration from point of origin**
2. causality
3. multivariate analysis
4. integration of evidence
5. documentation
6. content



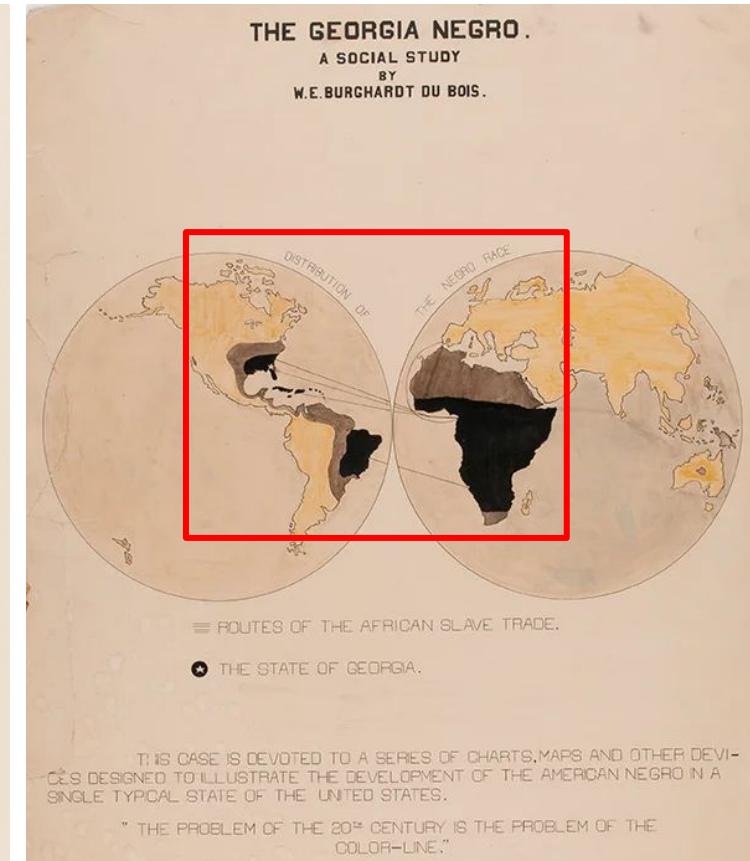
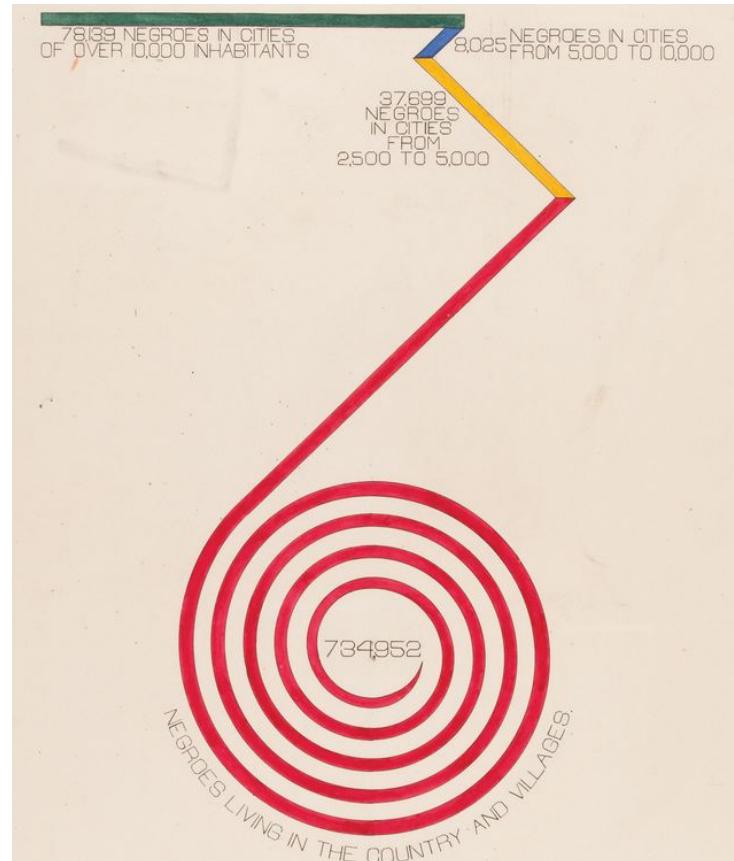
1. comparisons
2. causality
3. multivariate analysis
4. integration of evidence
5. documentation
6. content

1. comparisons
- causality - lines of slave trade**
3. multivariate analysis
4. integration of evidence
5. documentation
6. content

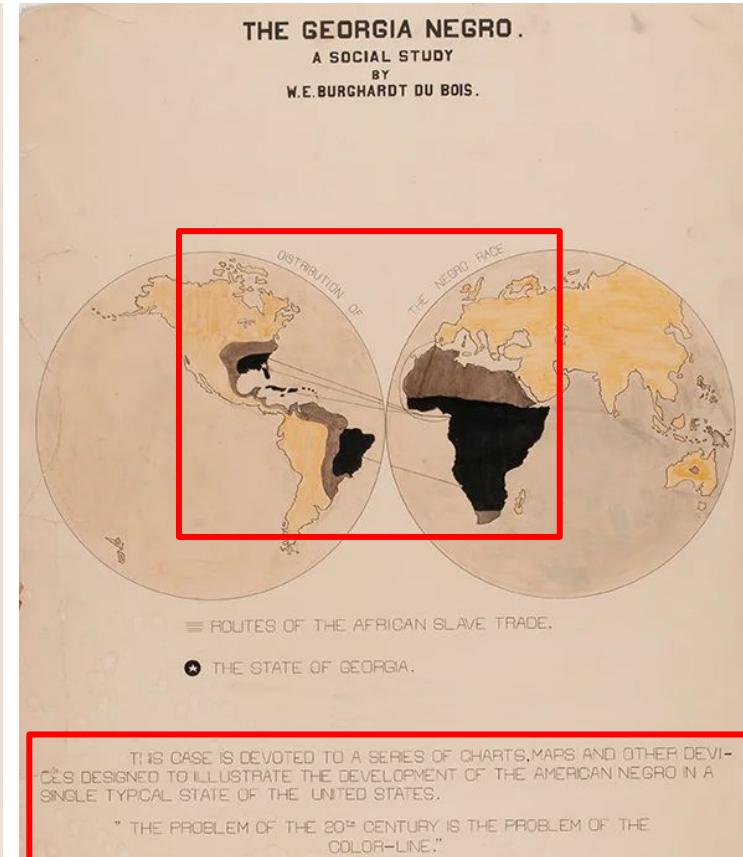


1. comparisons
2. causality
- 3. multivariate analysis**
4. integration of evidence
5. documentation
6. content

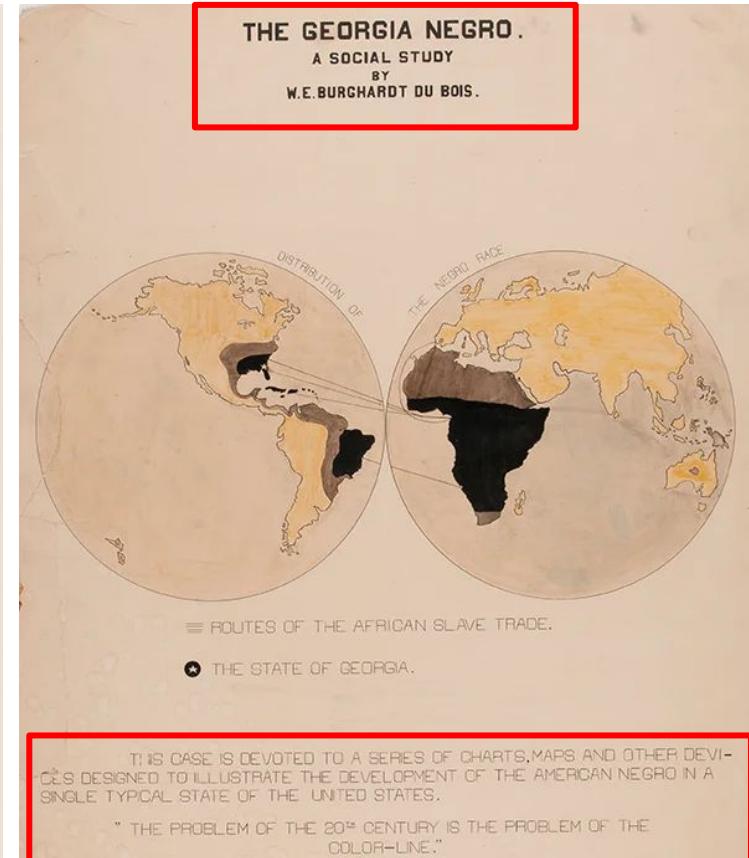
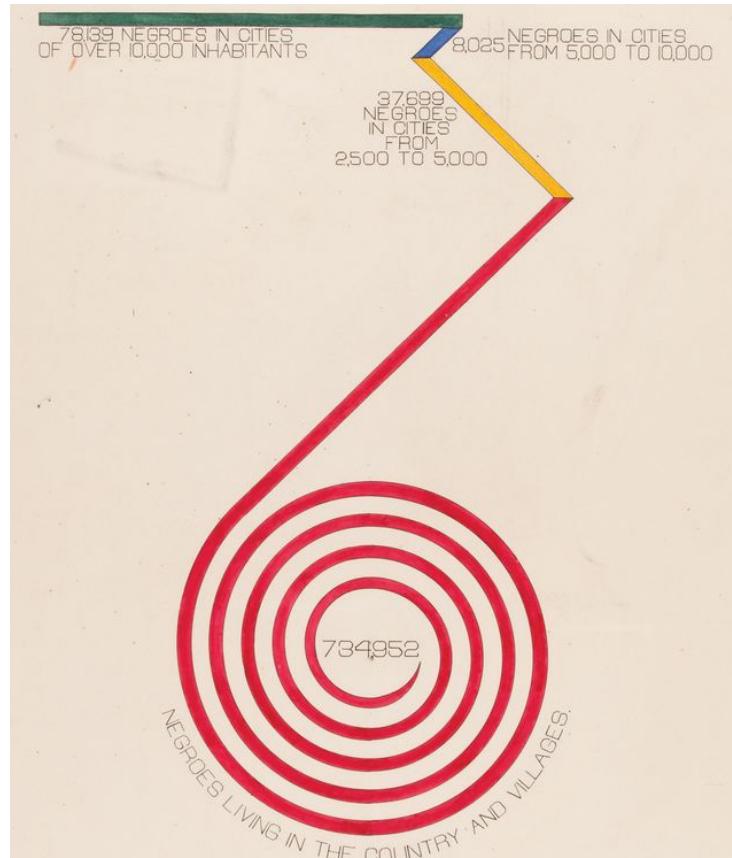
1. comparisons
2. causality
- 3. multivariate analysis - geography, spread, trade route (?)**
4. integration of evidence
5. documentation
6. content



1. comparisons
2. causality
3. multivariate analysis
- 4. integration of evidence**
5. documentation
6. content

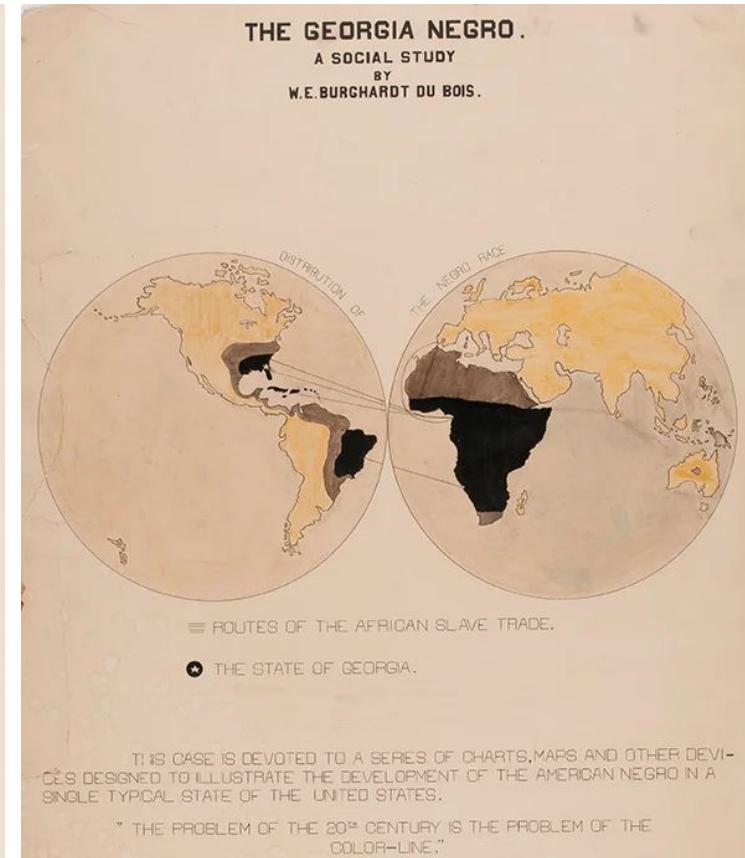
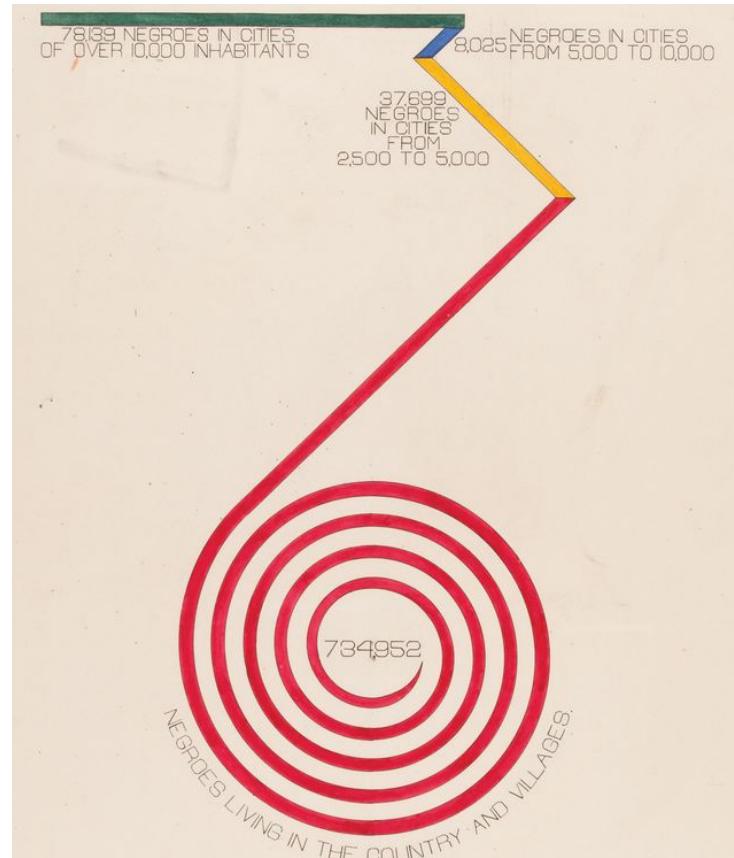


1. comparisons
2. causality
3. multivariate analysis
4. integration of evidence
- 5. documentation**
6. content



1. comparisons
2. causality
3. multivariate analysis
4. integration of evidence
5. documentation
- 6. content**

1. comparisons
2. causality
3. multivariate analysis
4. integration of evidence
5. documentation
- 6. content - argument for AfAm value, equality**



# Mississippi River Meander Belt maps (1944)

Harold Fisk - Louisiana State  
geology professor and  
cartographer

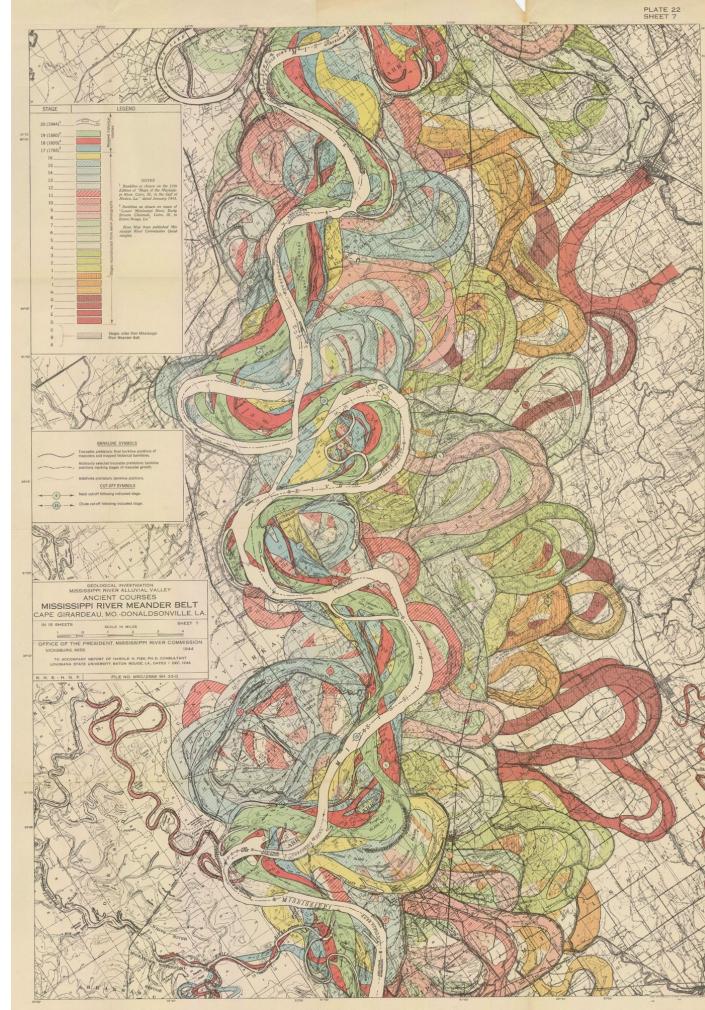
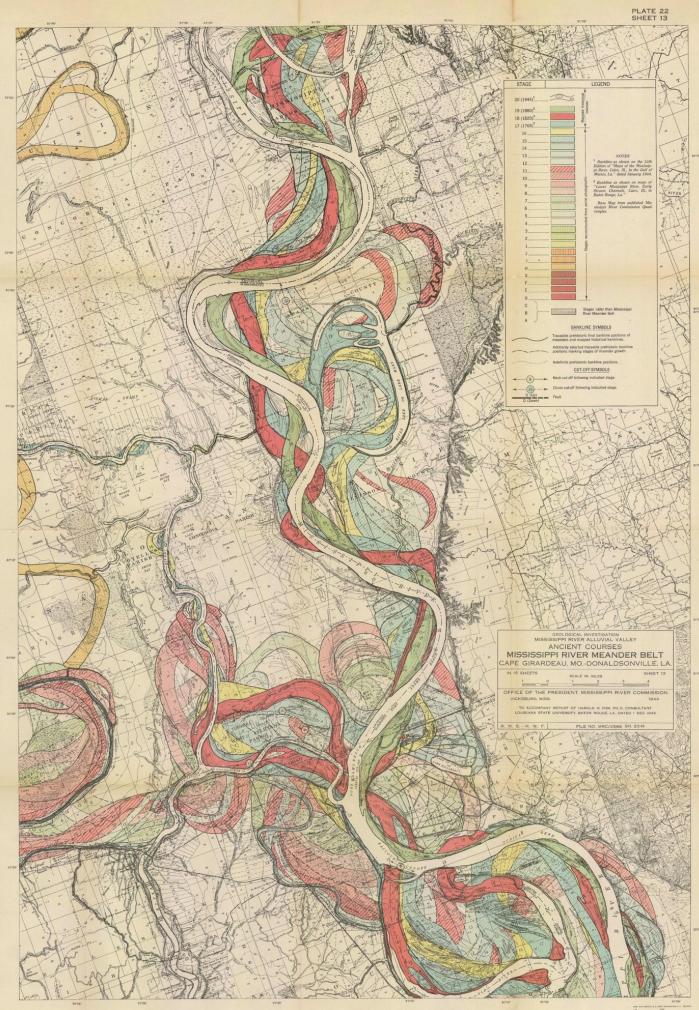
hired by the Corps of Engineers to create the Meander Maps

context: the Corps needed better maps of the rural MS alluvial valley to predict and prevent flooding along this key trade route

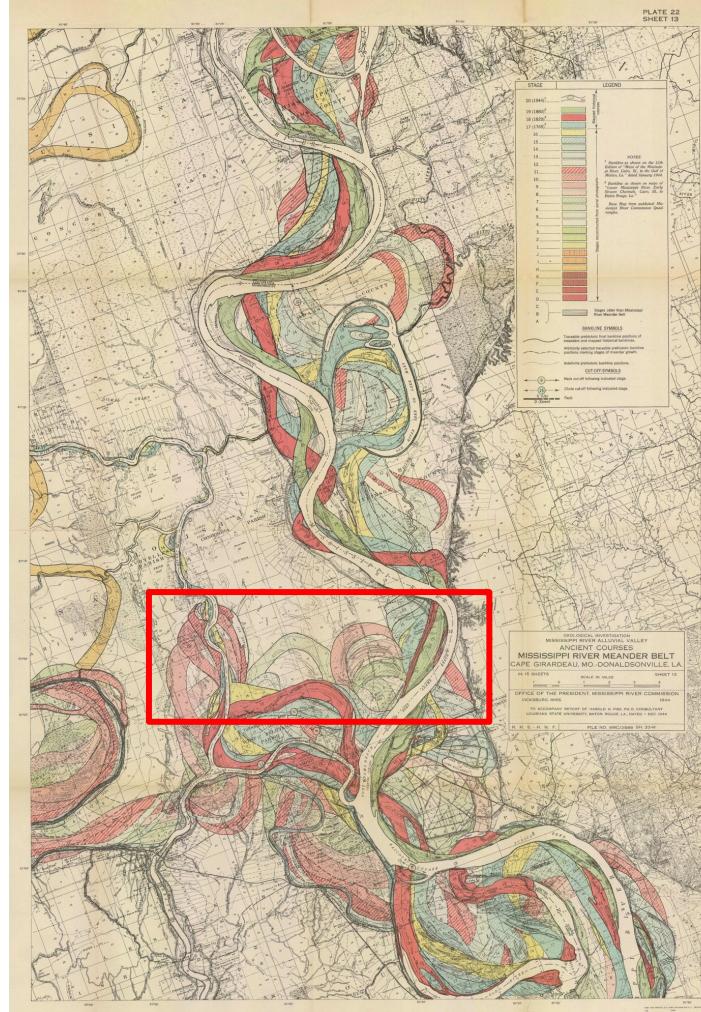
source: kottke.org

Tufte: 6 principles

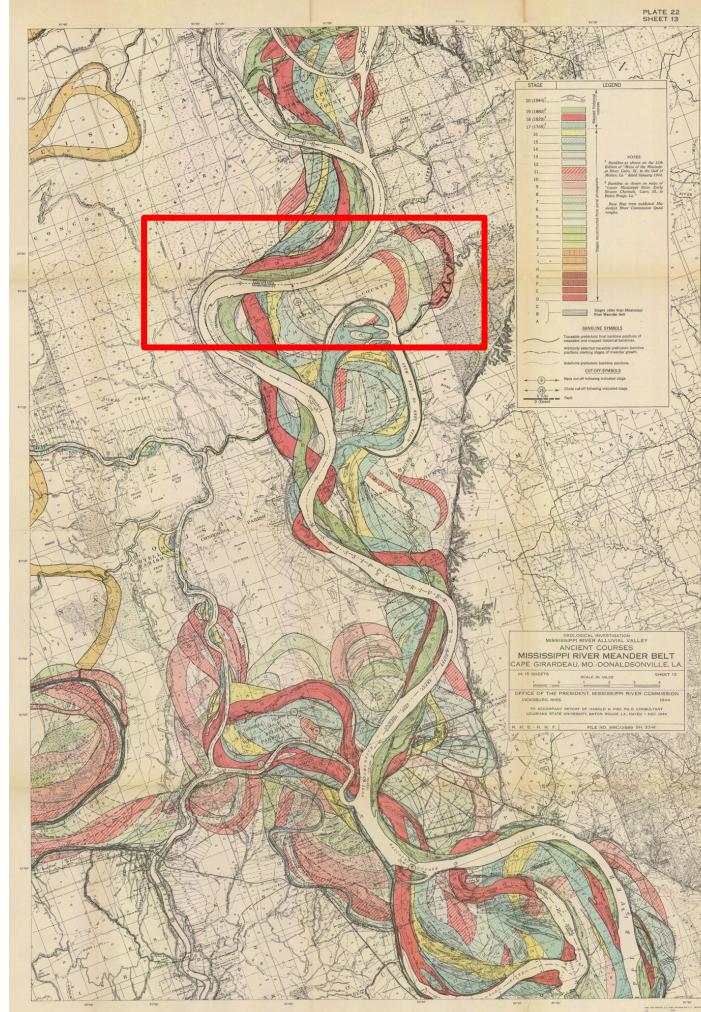
1. comparisons
  2. causality
  3. multivariate analysis
  4. integration of evidence
  5. documentation
  6. content



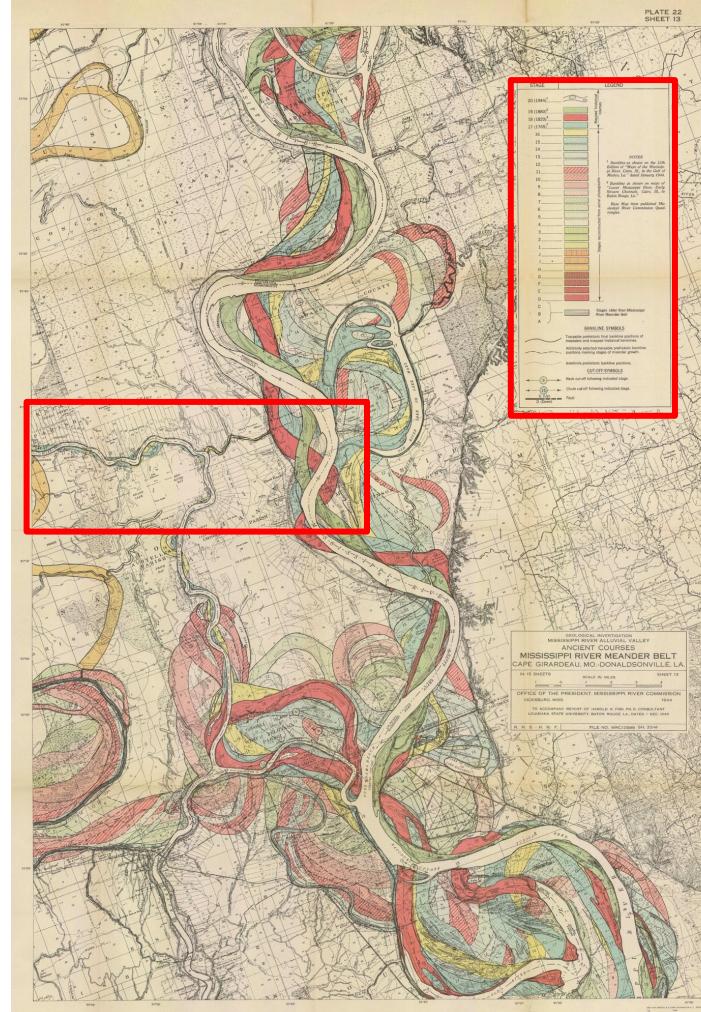
1. comparisons - river movement across time; between plates, in different topographical contexts
2. causality
3. multivariate analysis
4. integration of evidence
5. documentation
6. content



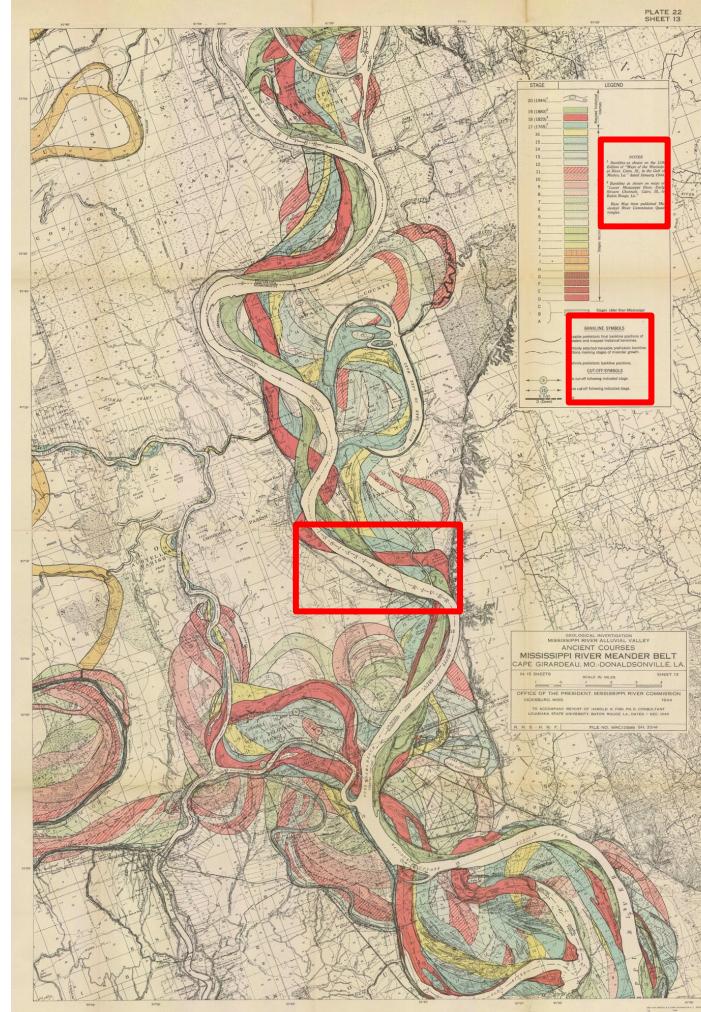
1. comparisons
2. **causality - topography, hills and evidence of surrounding creeks and rivers**
3. multivariate analysis
4. integration of evidence
5. documentation
6. content



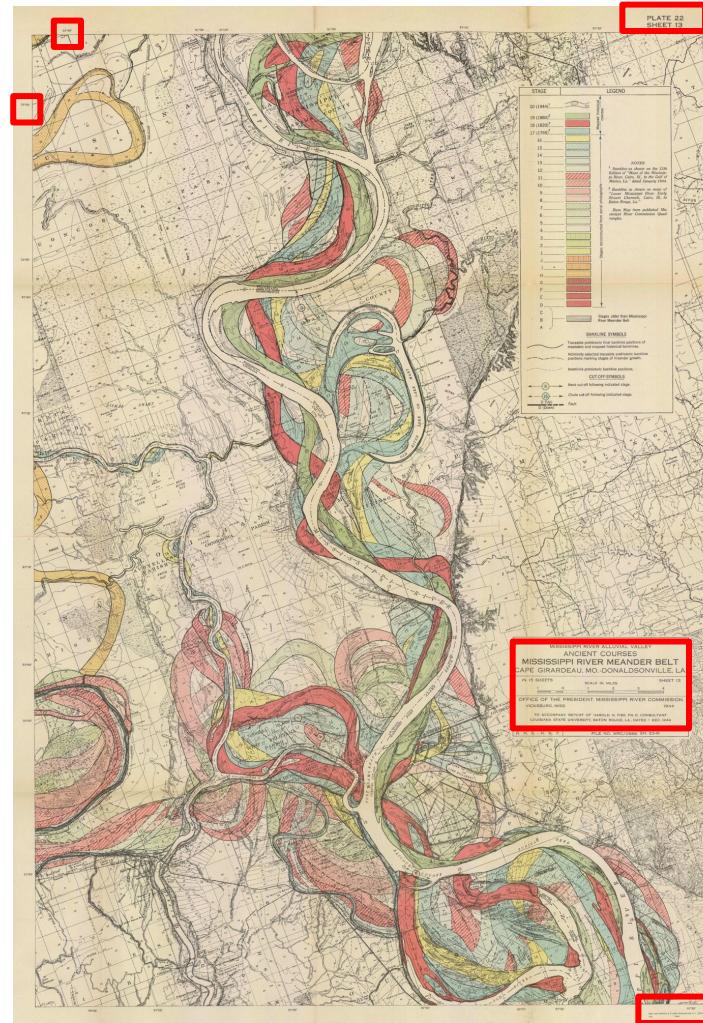
1. comparisons
2. causality
3. **multivariate analysis - time, geography, land type, platt division**
4. integration of evidence
5. documentation
6. content



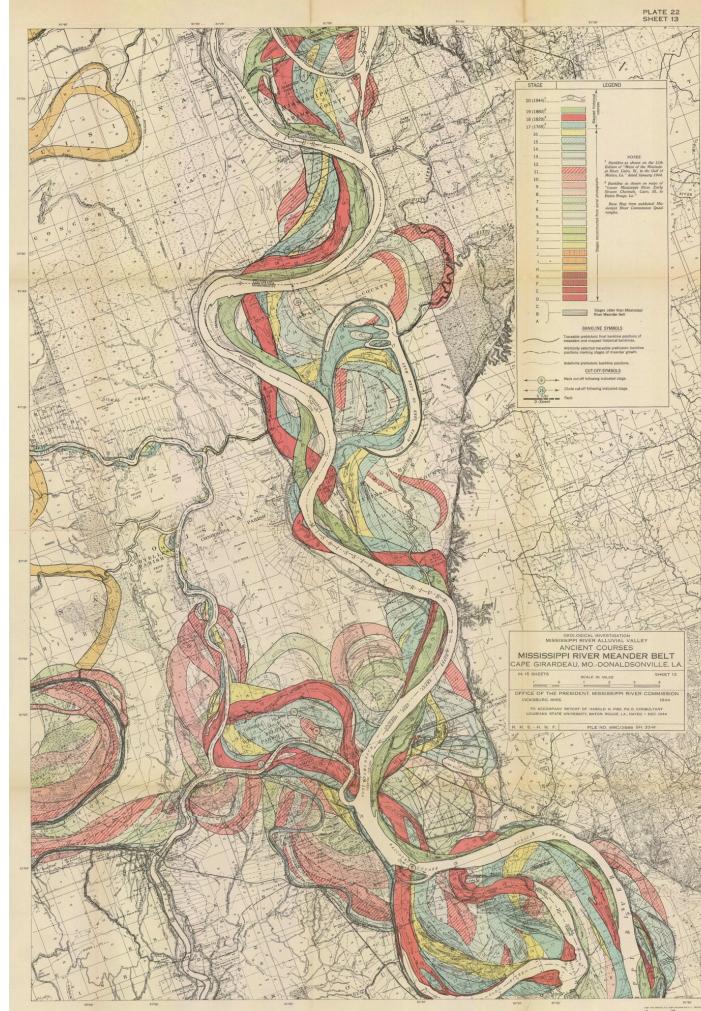
1. comparisons
2. causality
3. multivariate analysis
4. **integration of evidence - (evidence vs. data) names of different part of rivers, towns, place-names; land characteristics, contour lines and numbers; “traceable prehistoric final bankline positions of meanders and mapped historical banklines”;**  
**“Base Map from published Mississippi River Commission Quadrangles”**
5. documentation
6. content



1. comparisons
2. causality
3. multivariate analysis
4. integration of evidence
- 5. documentation - name, date, organization; scale and legend; plate number; lat/lon numbers**
6. content



1. comparisons
2. causality
3. multivariate analysis
4. integration of evidence
5. documentation
- 6. content - almost existential scope, plus actual application for river flood prevention; wild movement of river over time across its flood plain**



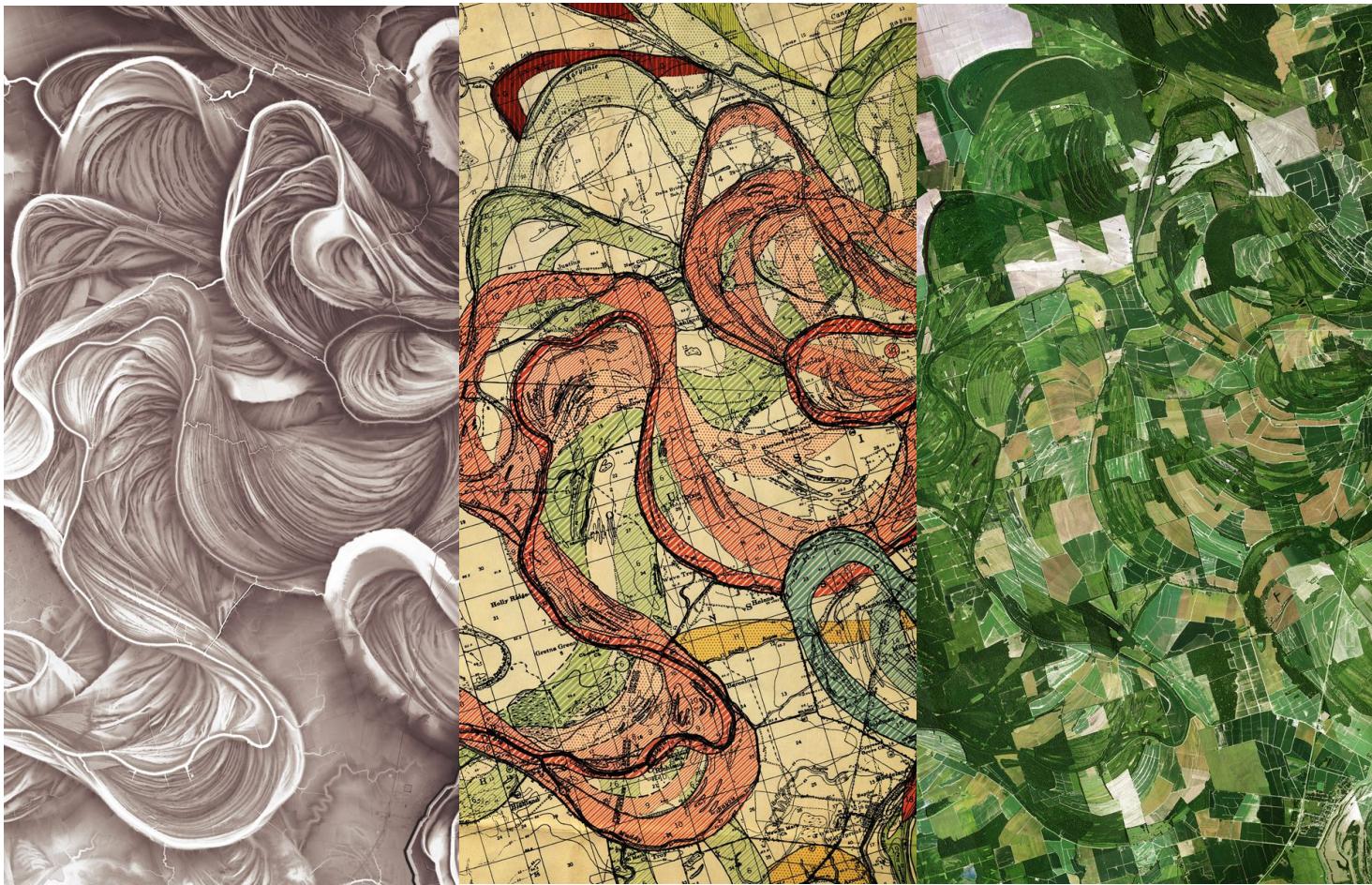
USGS LiDAR imagery (2020) vs.  
Mississippi River Meander Belt  
maps (1944)

source:  
<https://dancoecarto.com/mississippi-river-comparison>



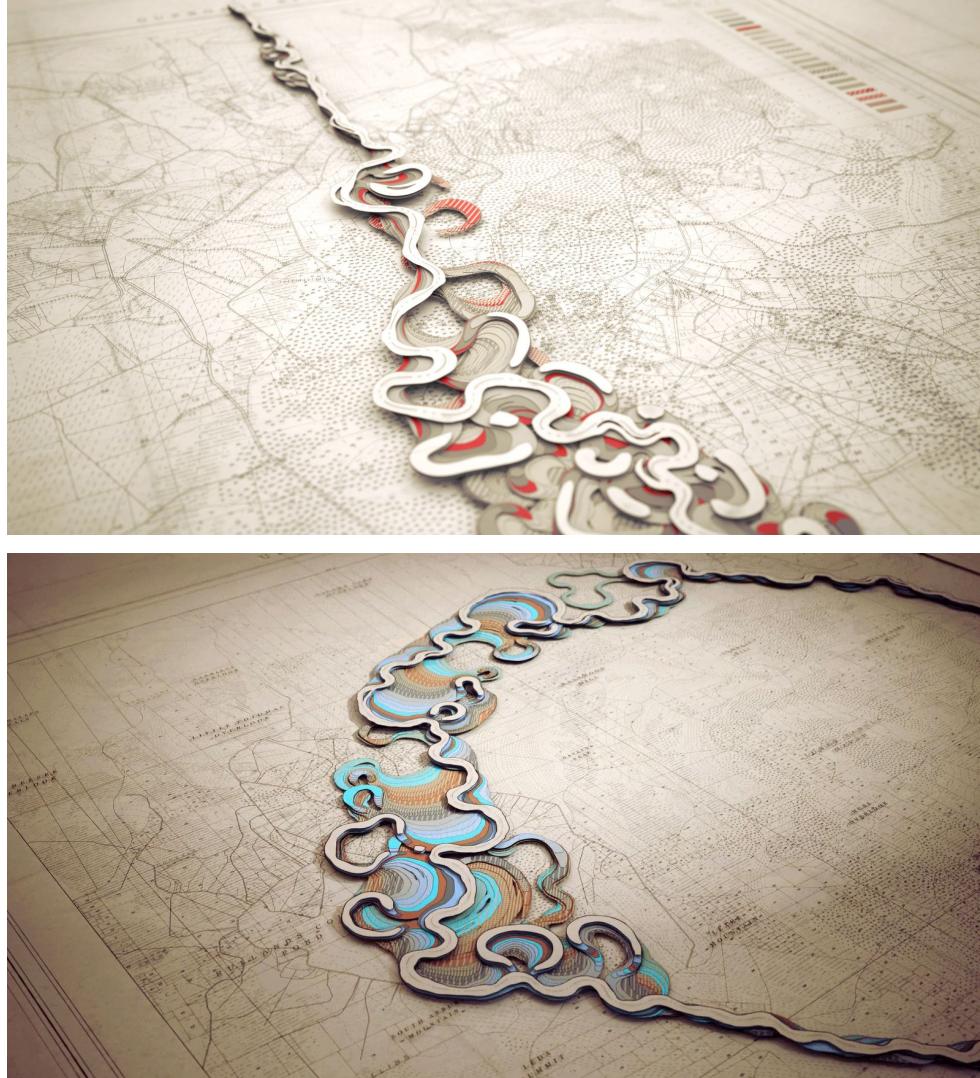
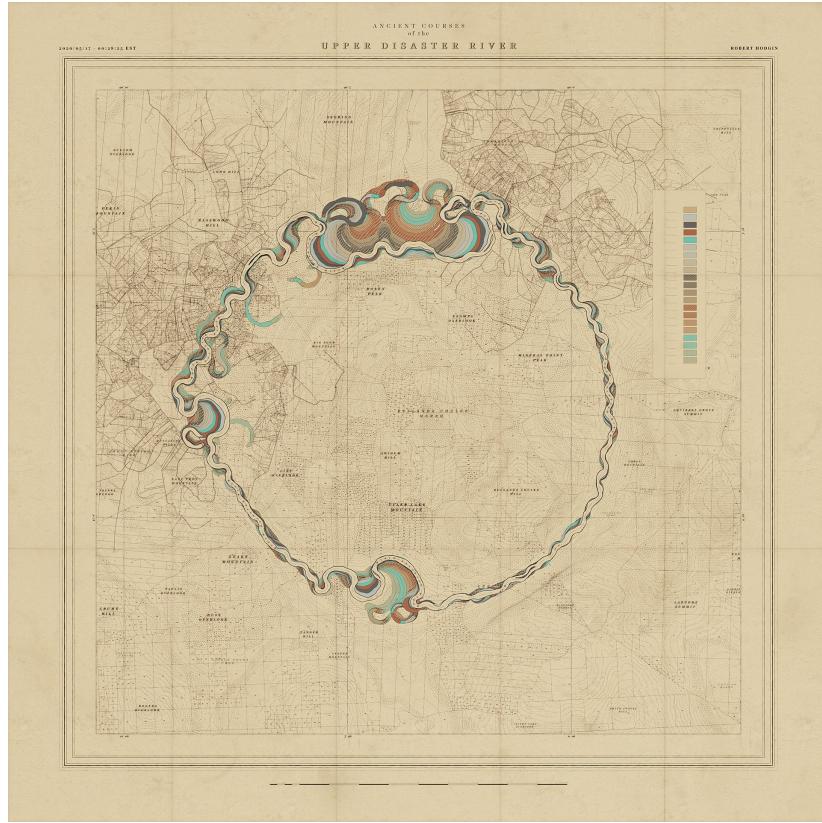
USGS LiDAR imagery  
(2020) vs. Mississippi  
River Meander Belt  
maps (1944) vs.  
satellite (aerial) view  
(2020)

source:  
<https://dancoecarto.com/mississippi-river-comparison>



## Meander Maps for Imaginary Rivers - Robert Hodgin

source: <https://roberthodgin.com/project/meander>



## Additional References

Kottke blog of interesting videos, maps, etc.:

<https://kottke.org/>

Dan Coe LiDAR cartographer, web mapper,  
storyteller: <https://dancoecarto.com/>

Tutorials working with LiDAR in QGIS:

<https://dancoecarto.com/tutorials>

Atlas of Places, collection of maps, architecture,  
projects, cinema, research, essays, etc.:

<https://www.atlasofplaces.com/>