

*The Art and Science of Depiction*  
**Representation Systems**

Fredo Durand  
MIT-Lab for Computer Science

*Rouen revisited*

- Paul Debevec

Limitations: contrast & palette

2

*Assignments for Monday 23.*

- Solso *Cognition and the Visual Arts*
  - Chapter 7
- Essay
  - Peer review
  - Final essay
- Final project
  - subject

Limitations: contrast & palette

3

*Plan*

- A paradigm: Cartography
- Representation systems
  - Drawing and projection
  - Denotation
  - Tone & color

Limitations: contrast & palette

4

*Digression: infamous “Paradigm”*

- A personal pet-subject
- Paradigm:
  - An outstandingly clear or typical example or archetype
- After Thomas Kuhn,  
*The Structure of Scientific Revolutions*
  - A philosophical and theoretical framework of a scientific school or discipline within which theories, laws, and generalizations and the experiments performed in support of them are formulated
- Vocabulary inflation (see also “framework”)

Limitations: contrast & palette

5

*A paradigm: Cartography*

- A map is a depiction of a reality
- Can be more efficient than photo
- There is no perfect universal solution
- However, quantitative is more important than for most pictures
- The systems are usually explicit
- And same issues as studied before (Gestalt, etc.)
- Amount of detail

Limitations: contrast & palette

6

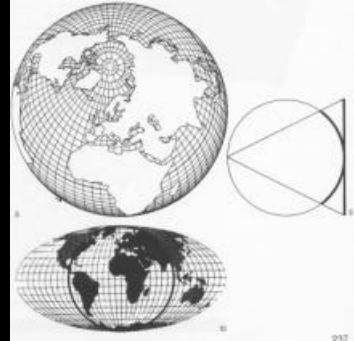
## Map making

- Which information will be represented
- Projection
- Which kind of symbols will be used
- Color codes

Limitations: contrast & palette

7

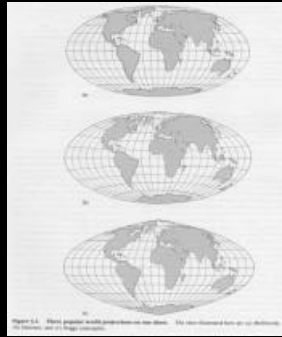
## Projection



Limitations: contrast & palette

8

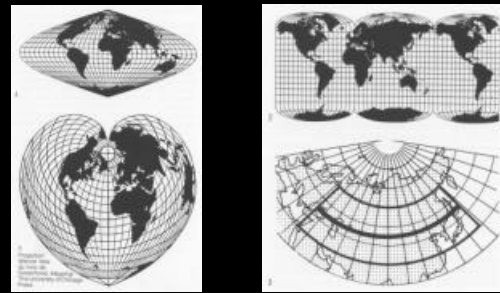
## Projection



Limitations: contrast & palette

9

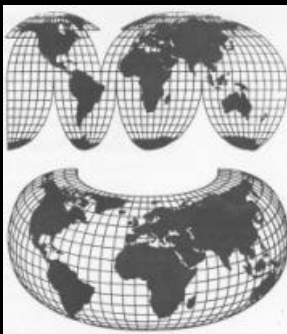
## Projection



Limitations: contrast & palette

10

## Projection



Limitations: contrast & palette

11

## Projection

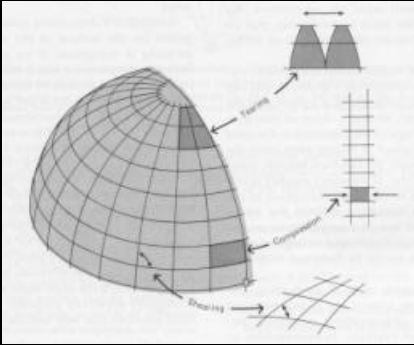
- Buckminster Fuller



Limitations: contrast & palette

12

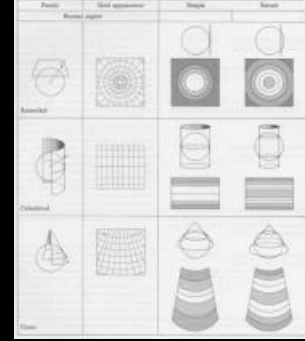
## Projection & distortion



Limitations: contrast & palette

13

## Projection & distortion



Limitations: contrast & palette

14

## Distortion and politics

### How Look at the World

More than 50 years of using the Van der Grinten projection for 18 maps, the National Geographic Society has adopted the Robinson projection.

Percentages show the distortion of land area



Limitations: contrast & palette

15

## Topological map

- Beck's map of London underground, 1931

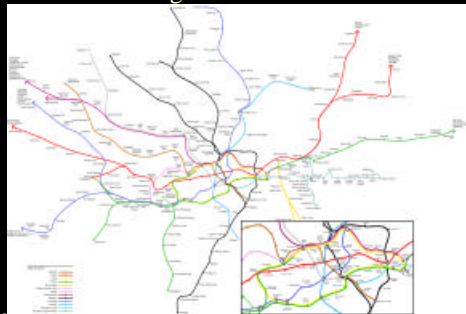


Limitations: contrast & palette

16

## Geographical map

- London underground

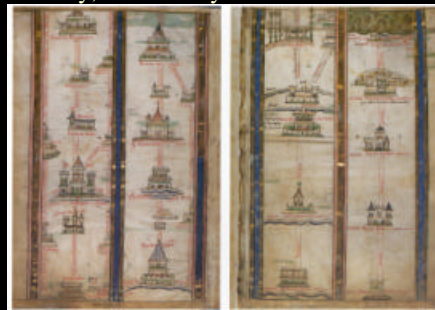


Limitations: contrast & palette

17

## Topological map

- Itinerary, 13<sup>th</sup> century



Limitations: contrast & palette

18

## Metaphoric Projection

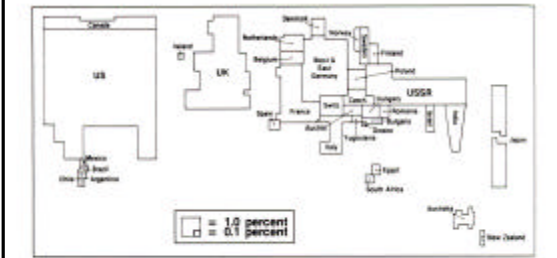
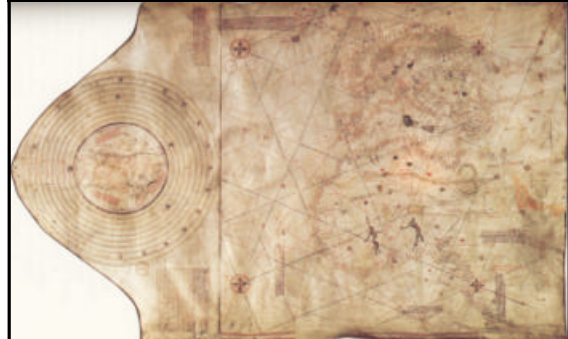


Figure 16.2. Contributions of countries to world scientific authorship. (Source: Andrew B. Ainsworth, "Metaphoric Authorship and Technological Progress" (unpublished), Journal of Geography (1961-1962) 70(5) 238. Reprinted by permission of the National Council for Geographic Education.)

Limitations: contrast & palette

19

## Error: Columbus's map



Limitations: contrast & palette

20

## Error/choice/distortion

- Descelier, 1546



Limitations: contrast & palette

21

## Error/choice/distortion

- Descelier, 1546
- E.g. huge elephant



Limitations: contrast & palette

22

## Map making

- Which information will be represented
- Projection
- Which kind of symbols will be used
- Color codes

Limitations: contrast & palette

23

## Denotation



Limitations: contrast & palette

24

## Denotation



Limitations: contrast & palette

25

## Denotation



Limitations: contrast & palette

26

## Denotation



Limitations: contrast & palette

27

## Symbols: dimension

Symbol type	Map type	
	Qualitative	Quantitative
Point	■ ● +	● ● ● ●
Ligne	— — — —	— — — — — — — —
Area	○ ○	○ ○
Volumen		■ ■ ■ ■

Limitations: contrast & palette

28

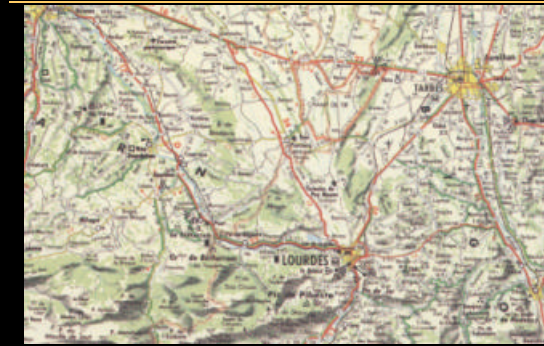
## Denotation: a complete example



Limitations: contrast & palette

29

## Denotation



Limitations: contrast & palette

30



## Map making

- Which information will be represented
- Projection
- Which kind of symbols will be used
- Color codes

Limitations: contrast & palette

31

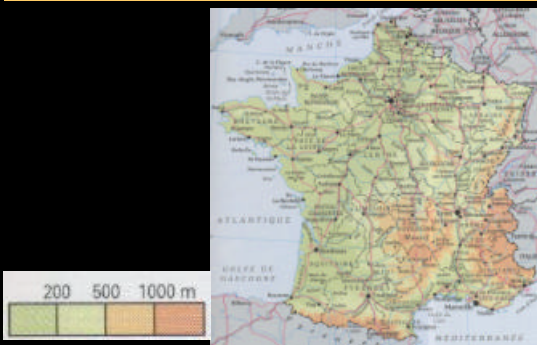
## Symbols: dimension & tone, color

Type of symbol	Visual dimensions			
	Size	Pattern texture	Color value	Color saturation
Points	Temperature in degree fahr 	 Low Medium High	 Low Medium High	 Less sat Medium sat More sat
Lines	Average stream flow 	 Low Medium High	 Low Medium High	 Less Sat Medium Sat More Sat
Areas	Population above 100,000 	 1000-2000 1000-2000 1000	 1000-2000 1000-2000 1000	 More Sat Less Sat Less Sat

Limitations: contrast & palette

32

## Color: elevation



Limitations: contrast & palette

33

## Color: geology



Limitations: contrast & palette

34

## Color: influence of cities



Limitations: contrast & palette

35

## Ambiguity: color or denotation?



Limitations: contrast & palette

36

## *A complex example*

- Population of the Bay Area



Limitations: contrast & palette

37

## *Plan*

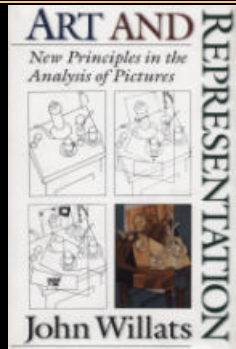
- A paradigm: Cartography
- Representation systems
  - Drawing and projection
  - Denotation
  - Tone & color

Limitations: contrast & palette

38

## *Representations systems*

- John Willats  
*Art and Representation:  
New Principle in  
the analysis of pictures*  
1997



Limitations: contrast & palette

39

## *Goals and context*

- Coarse-grain description of style
- Independent systems, independent decisions
- Description and comparison
- Synthesis (NPR)
- This is an exploratory system!
  - In progress
  - Incomplete
  - Different categories may overlap
- More a vocabulary

Limitations: contrast & palette

40

## *Representation systems*

- Drawing and projection
- Denotation
- Tone & color
- The two first systems are classical
- Because painting was the only recognized art form

Limitations: contrast & palette

41

## *Drawing system*

- Linear perspective
- Orthographic
- Topological
- Other

Limitations: contrast & palette

42

## Drawing system

- Linear perspective
  - Interior of St Bavo's church at Haarlem, Pieter Jansz Saenredam, 1648
- Orthographic
- Topological
- Other



Limitations: contrast & palette

43

## Drawing system

- Linear perspective
- Orthographic
  - Brooks-Greaves St Paul's Cathedral 1928
- Topological
- Other



Limitations: contrast & palette

44

## Drawing system

- Linear perspective
- Orthographic
- Topological
  - Paul Klee Another Camel 1939
- Other



Limitations: contrast & palette

45

## Drawing system: symbolic

- Linear perspective
- Orthographic
- Topological
- Other
  - Piero de la Francesca Mercy



Limitations: contrast & palette

46

## Representation systems

- Drawing and projection
- Denotation
- Tone & color

Limitations: contrast & palette

47

## Denotation system

- Silhouette:
  - 2D (regions)
- Line Drawing
  - 1D (lines)
- Optical
  - 0D (points)

Limitations: contrast & palette

48



## Denotation system

- Silhouette:
  - 2D (regions)
  - Picasso, *Rite of Spring*
- Line Drawing
  - 1D (lines)
- Optical
  - 0D (points)



Limitations: contrast & palette

49

## Denotation system

- Silhouette:
  - 2D (regions)
- Line Drawing
  - 1D (lines)
  - Picasso, *Portrait of Stravinsky*
- Optical
  - 0D (points)

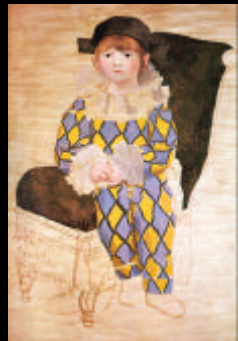


Limitations: contrast & palette

50

## Denotation system

- Silhouette:
  - 2D (regions)
- Line Drawing
  - 1D (lines)
- Optical
  - 0D (points)
  - Picasso, *Paul as Arlequin*



Limitations: contrast & palette

51

## A fourth denotation system

- Sculpture
  - 3D (volume)
  - Picasso, *Head of a Woman (Fernande)*, 1909
- Silhouette:
  - 2D (regions)
- Line Drawing
  - 1D (lines)
- Optical
  - 0D (points)



Limitations: contrast & palette

52

## Representation systems

- Drawing and projection
- Denotation
- Tone & color

Limitations: contrast & palette

53

## Tone & color system

- (Often a mix)
- Extrinsic
- Intrinsic
- Symbolic

Limitations: contrast & palette

54

## Extrinsic color

- Renzo Piano  
Tjibaou  
cultural  
center  
1991-98



Limitations: contrast & palette

55

## Extrinsic black and white

- Gordon Park,  
*Red Jackson*  
*Gang Leader*



Limitations: contrast & palette

56

## Optical intrinsic

- Botticelli *Primavera* 1482



Limitations: contrast & palette

57

## Pure intrinsic colors

- Jawlensky  
*Girl with Peonies*
- +symbolic+harmony



Limitations: contrast & palette

58

## Next sessions

- Linear perspective
- Canonical view
- Drawing systems
- Distortion and constraints

Limitations: contrast & palette

59