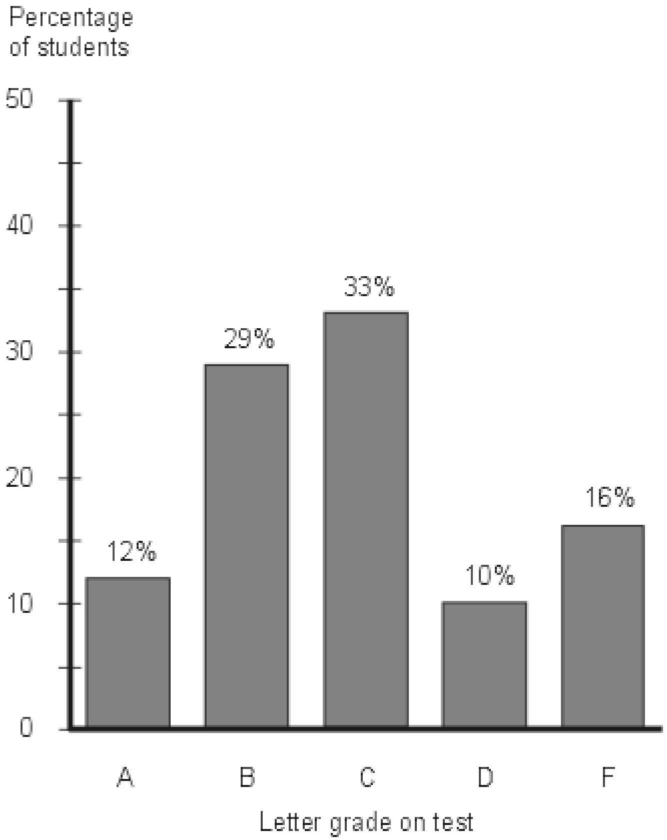
ST ANNE
Limehouse
ST STEPHEN
OF THE

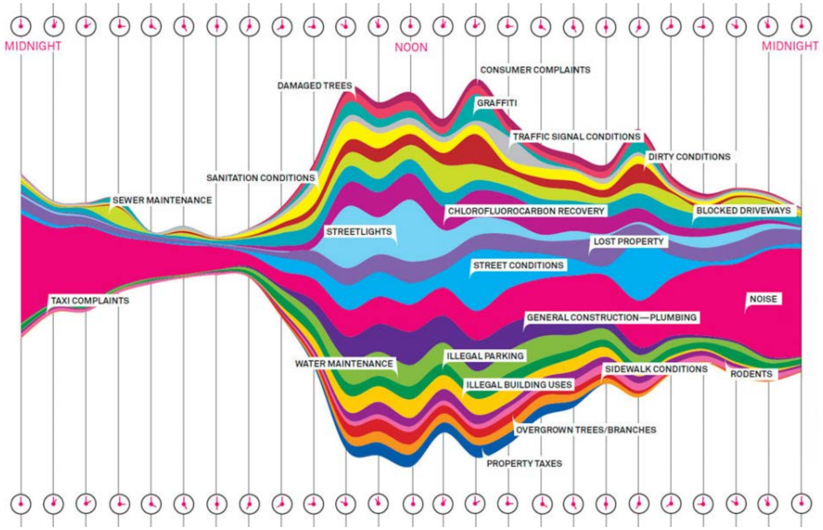
Geog 126: Maps in Science and Society

The History of
Quantitative Graphics to 1850

How old are graphs and charts?



The Birth of Quantitative Graphics



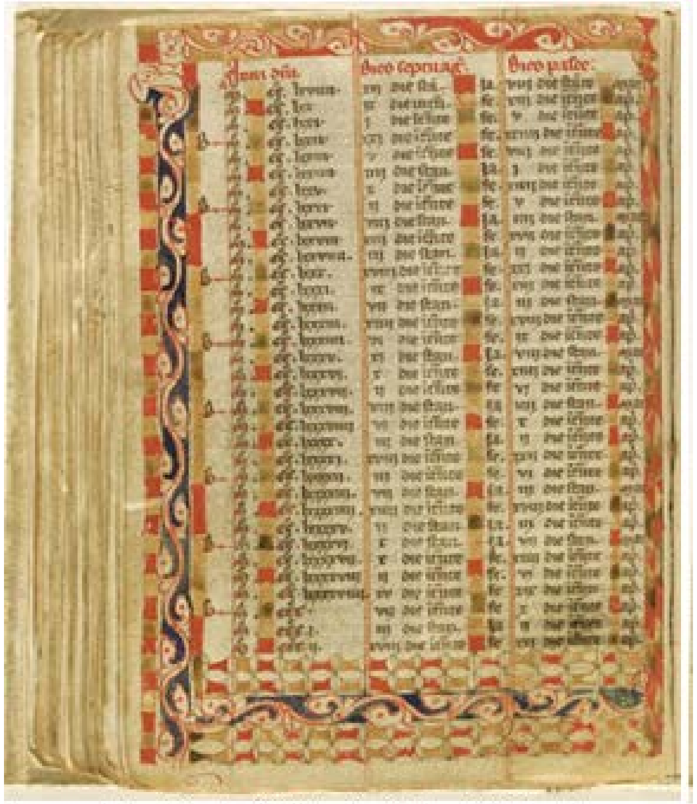
- Tied to the emergence of statistical thinking and data collection
- Tied to media
  - Printers, paper, computer screens etc.
- This lecture source mostly from:
- http://www.math.yorku.ca/SCS/Gallery/milestone/

Precise Scientific Observation

- Data graphics are bound to data collection
- Census in Egypt 3340 BC and in 3050 BC
  - Well-developed and precise data collection techniques: Late 1500's

Visual Thinking C13th on

- Diagrams began to accompany mathematical proofs
- Various graphic forms were invented to help communicate numerical / statistical findings e.g. color coding

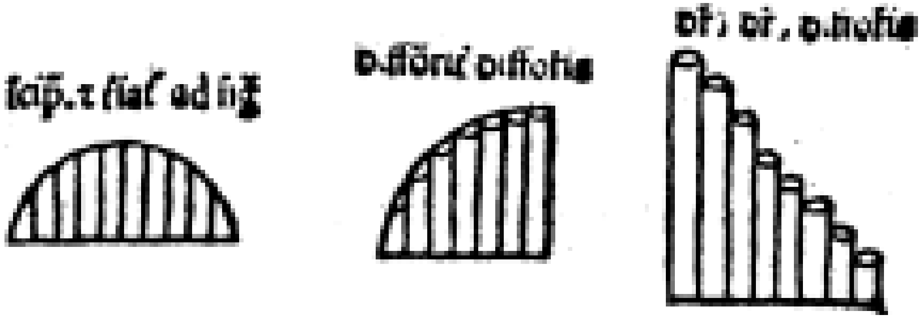


Manuscript written in 1269 for the Order of Cistercians.

1
1
5
5
SOUTHWESTSOLUTIONSGROUP
6
7
9
1
See more photos

1350: Proto-bar graph

- Nicole Oresme
  - Bishop of Lisieux (1323-1382)
  - French
  - Proposed the use of a graph for plotting a variable magnitude whose value depends on another
  - Implies a coordinate system!
- Before Descartes



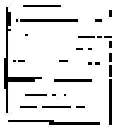
¶ Incipit perutilis tractatus de latitudinibus formarum secundum reverendum doctorem magistrum Nicholaum Horen.

Quia formarum latitudines multipliciter variantur que multiplicitas difficulter discernitur nisi ad figuras geometricas consideratio referatur. Ideo premissis quibusdam divisionibus latitudinum cum diffinitionibus ipsarum species infinitas ad figuras ipsas finitas applicabo per quas propositum clarius apparebit. pª diui. ¶ Latitudinum quedam uniformis quedam difformis. ¶ Latitudo uniformis est illa que est eiusdem gradus per totum. ¶ Latitudo difformis est illa que non est eiusdem gradus per totum. 2ª diui. ¶ Latitudo difformis est duplex quia quedam est finie et tota difformis et quedam non. ¶ Latitudo finie et tota difformis est cuius nulla pars est uniformis. ¶ Latitudo non finie et tota difformis est illa cuius aliqua pars est uniformis. [illegible] Ergo una latitudo fit difformiter et alia non finie et tota difformis quod quilibet earum per se uniformis est ut in 2ª parte inclinata apparebit. 3ª diui. ¶ Latitudinum finie et tota difformium quedam est uniformiter difformis et quedam difformiter difformis. ¶ Latitudo uniformiter difformis est illa cuius est eque excessus graduum inter se eque distantium. ¶ Latitudo difformiter difformis est illa cuius non est equalis excessus graduum inter se eque distantium. 4ª diui. ¶ Latitudinum uniformiter difformium quedam incipit a non gradu et terminatur ad certum gradum: quedam incipit a certo gradu et terminatur ad non gradum: quedam incipit a certo gradu et terminatur ad certum gradum. Non enim potest reperiri latitudo incipiens a non gradu et terminata ad non gradum que sit uniformiter difformis: quia in principio intenderetur et in fine remitteretur: sic uniformiter difformis foret [illegible]. ¶ Latitudinum difformiter difformium quedam finie et tota est difformiter difformis quedam non. 5ª diui. ¶ Latitudo finie et tota difformiter difformis est illa cuius nulla pars est uniformis vel uniformiter difformis [illegible]. ¶ Latitudo non finie et tota difformiter difformis est illa cuius aliqua pars est uniformis vel uniformiter difformis. 6ª diui. ¶ Latitudinum difformiter difformium quedam est uniformiter difformiter difformis quedam difformiter difformiter difformis. Propter quod notandum est quod sicut dictum est latitudo [illegible] in sui partibus variatur quia vocatur uniformis; quando autem variatur per istas partes quas vocamus difformis fit. Quando que sic uniformiter variatur vocatur uniformiter difformis. Et per oppositum difformiter variata vocatur difformiter difformis. Ita ymaginamur quandam variationem latitudinis uniformem quandam difformem. Et ratione istarum variationum difformium quandam uniformiter difformem et quandam difformiter difformem. Unde sicut uniformis latitudinis variatio reddit latitudinem uniformiter difformem, ita difformis latitudinis variatio reddit latitudinem difformiter difformem. Item sicut uniformiter difformis variatio reddit latitudinem uniformiter difformiter difformem, sic difformiter difformis variatio reddit latitudinem difformiter difformiter difformem. ¶ Latitudo uniformiter difformiter difformis est illa que inter excessus graduum eque distantium servat eandem proportionem et aliam tamen a proportione equalitatis. Nam si inter excessus graduum eque distantium servaretur proportio equalitatis tunc esset latitudo uniformiter difformis: ut patet ex diffinitionibus in secunda divisione. Similiter si nulla proportio servaretur tunc nulla posset attendi uniformitas in latitudine tali et sic non esset uniformiter difformiter difformis. ¶ Latitudo difformiter difformiter difformis est illa que inter excessus graduum eque distantium non servat eandem proportionem sed [illegible]. ¶ Notandum tamen est quod in suprascriptis diffinitionibus ubi loquitur de excessibus graduum inter se eque distantium debet accipi distantia secundum partes latitudinis extensive et non intensive. Iterum loquitur de excessibus et distantiis graduum secundum latitudinem gradualem.

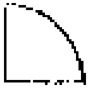
¶ Secundum caput.

Sequitur secunda pars in qua ut superadicta intelligantur ad sensum per figuras geometricas ostenduntur. Et ut ad omnes species latitudinum perfecte intellectus noster occurrat apparentior latitudines formarum ad figuras geometricas applicabo. Ista pars dividitur in tria capitula: quorum primum continet diffinitiones, 2ᵐ suppositiones, 3ᵐ propositiones. Diffinitiones vero capiuntur ex Euclide primo. Figura est que est figura plana vel curva que linea recta vel curva que angulus rectus vel [illegible] continetur. pª diui. Figurarum quedam angulares quedam non angulares. ¶ Figura angularis est illa que habet angulos seu angulum. ¶ Figura non angularis est illa que non habet angulos nec angulum ut circulus. 2ª diui. ¶ Figurarum angularium quedam sunt rectangulares et quedam non rectangulares. ¶ Figure non angulares sunt que habent unum solum angulum [illegible]

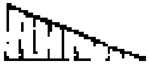
Lati.ᵒ vnif.ᵉ



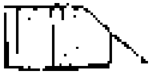
Latitudo vnif.ᵉ



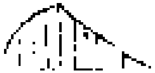
Difformis finie et tota



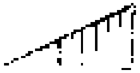
Non finie et tota diff.ᵉ



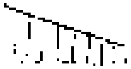
Difformiter difformis



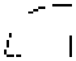
Incipiens a non gradu



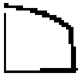
Incipiens a certo



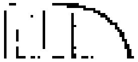
Difformiter incipiens a non gra.



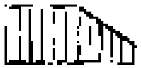
Incipit et terminatur ad g.



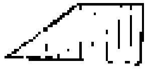
Non tota difformiter diffor.



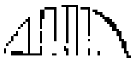
Incipit et terminat ad g.



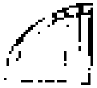
Incipiens a non gradu



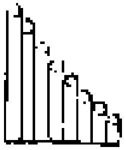
Incipiens a certo gradu



difformiter difformis



difformiter difformiter difformis

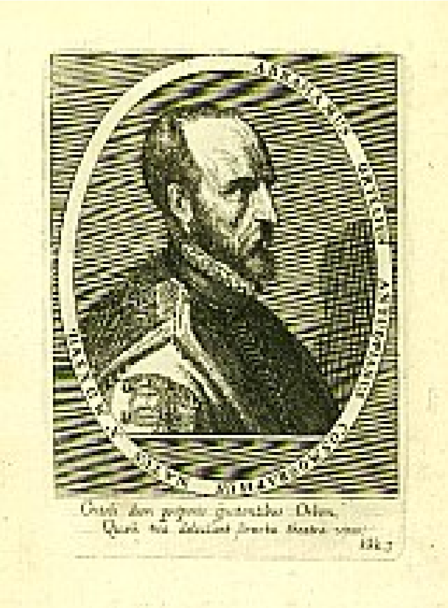


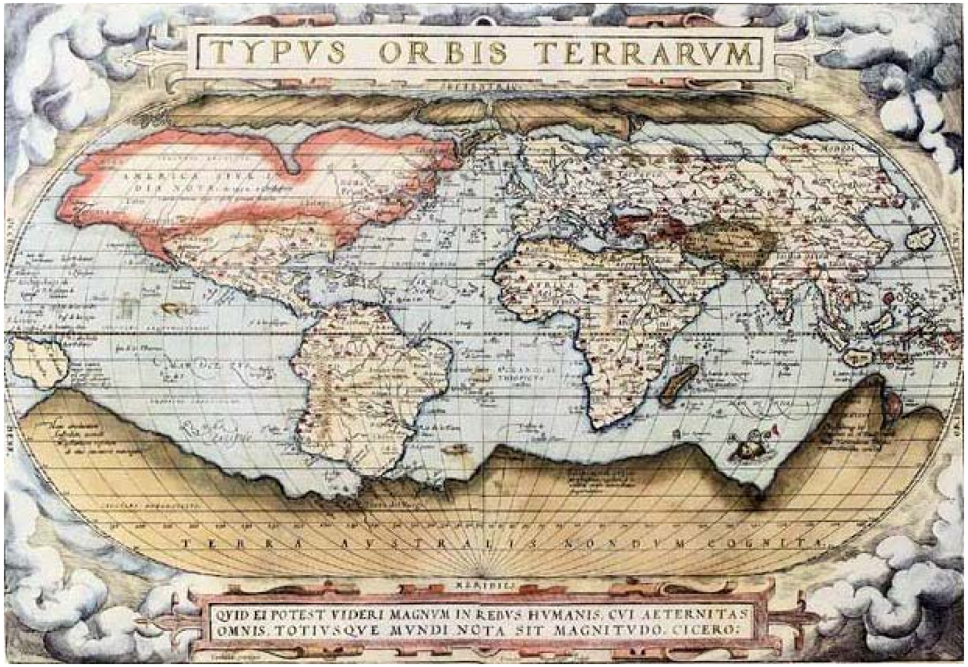
Linea recta

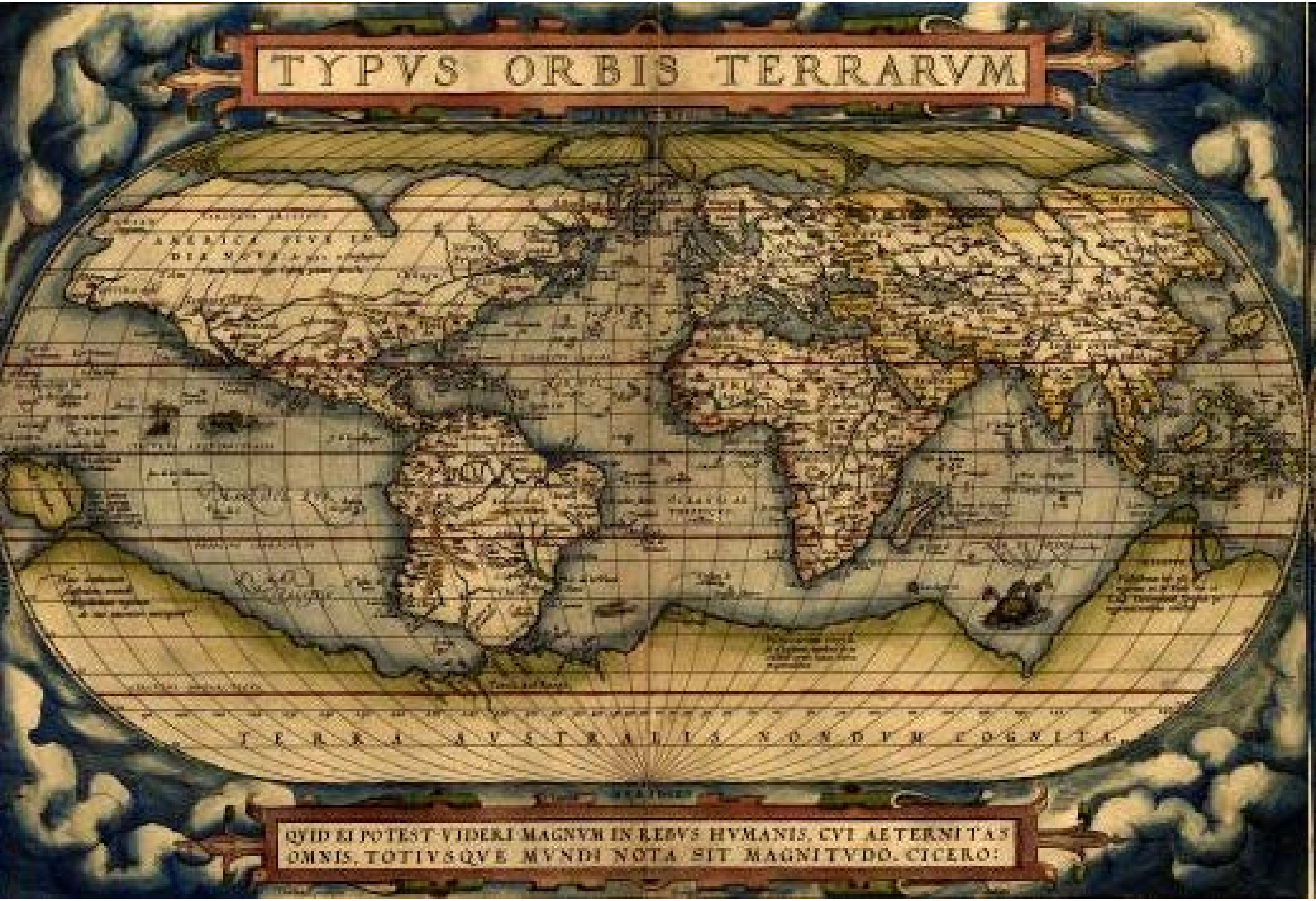
Linea curva

1570: First Modern Atlas

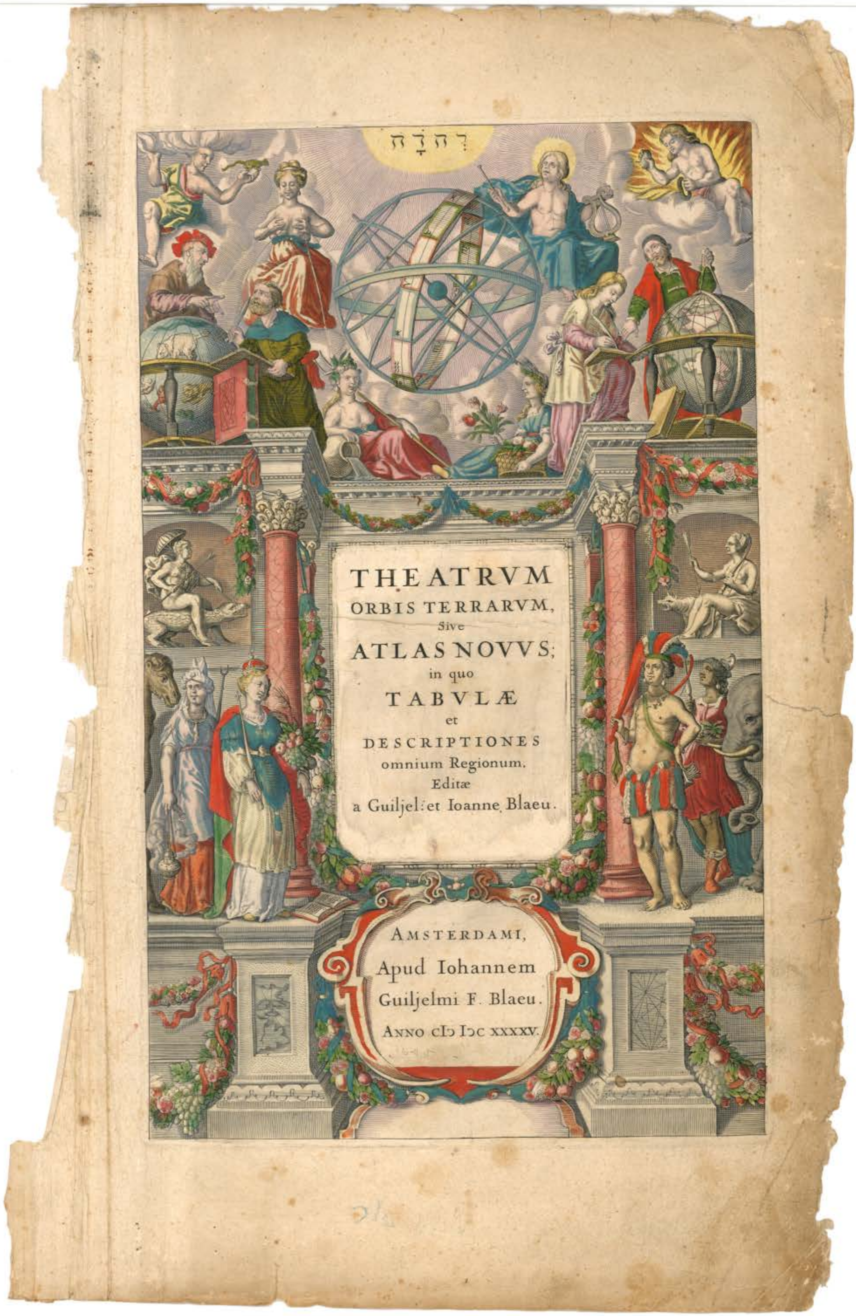
- Theatrum Orbis Terrarum: Text, few data
- Abraham Ortelius, 1527-1598
- Belgian
- Gave credit to cartographers




TYPVS ORBIS TERRARVM
TERRA AVSTRALIS NONDVM COGNITA
QVID EI POTEST VIDERI MAGNVM IN REBVS HVMANIS, CVI AETERNITAS OMNIS, TOTIVSQVE MVNDI NOTA SIT MAGNITVDO. CICERO:

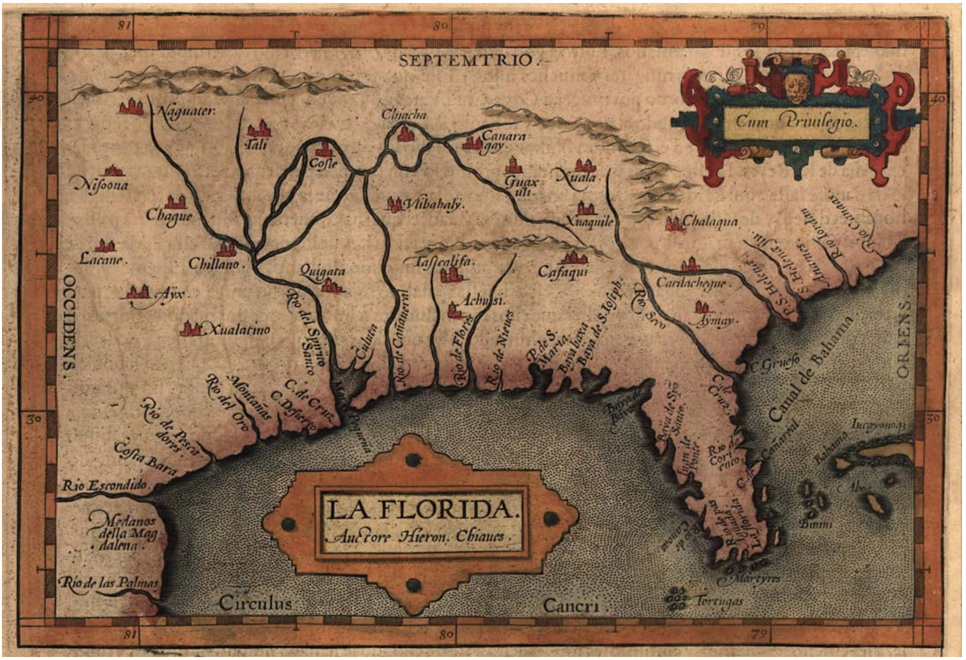

TYPVS ORBIS TERRARVM
AMERICA SIVE INDIA NOVA
AFRICA
TERRA AVSTRALIS NONDVM COGNITA
QVID EI POTEST VIDERI MAGNVM IN REBVS HVMANIS, CVI AETERNITAS OMNIS, TOTIVSQVE MVNDI NOTA SIT MAGNITVDO. CICERO:

1584 edition

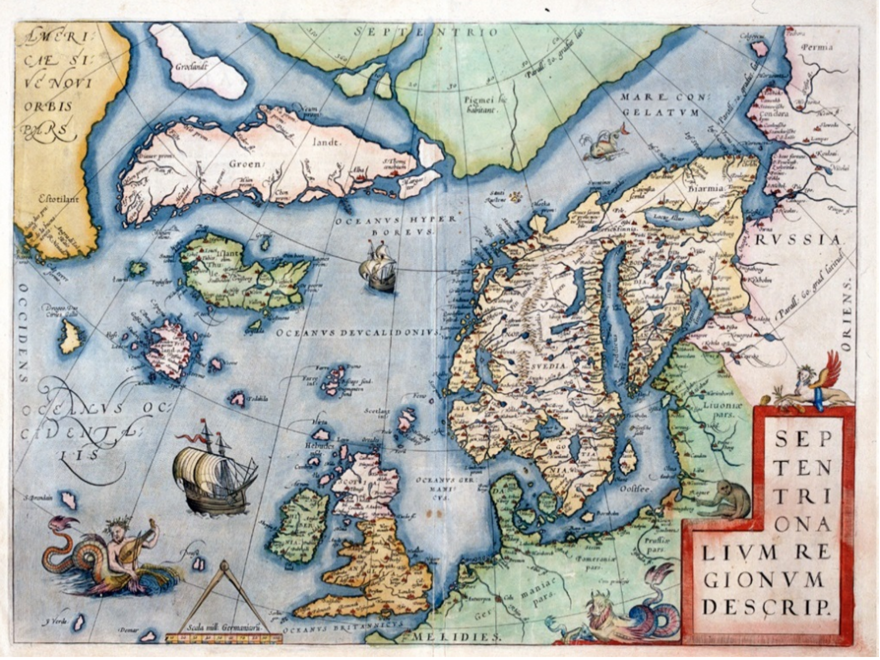


THEATRVM
ORBIS TERRARVM,
Sive
ATLAS NOVVS;
in quo
TABVLÆ
et
DESCRIPTIONES
omnium Regionum,
Editæ
a Guiljel: et Ioanne Blaeu.

AMSTERDAMI,
Apud Iohannem
Guiljelmi F. Blaeu.
ANNO CIƆ IƆC XXXXV.



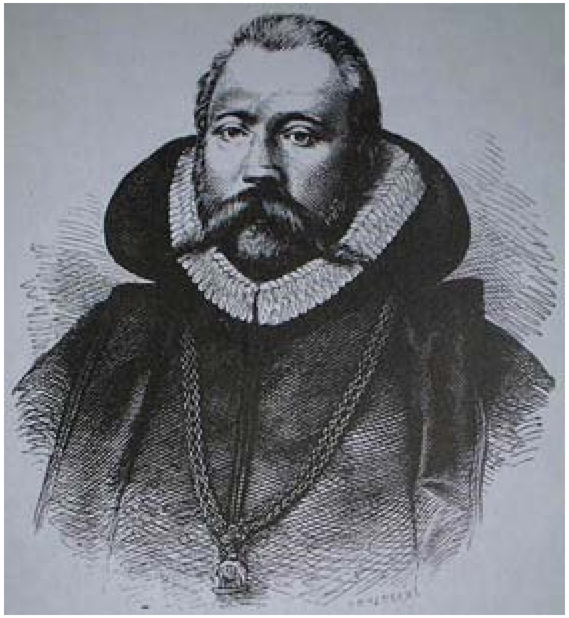
SEPTEMTRIO.
Cum Priuilegio.
OCCIDENS.
ORIENS.
LA FLORIDA.
Auctore Hieron. Chiaues
Circulus
Cancri
Naguater
Tali
Chiacha
Coste
Canaragay
Nisoona
Chague
Vilbahaly
Guaxuli
Xuala
Xuaquile
Chalaqua
Lacane
Chillano
Quigata
Tascalisa
Casaqui
Aÿx
Achusi
Xualatino
Rio Escondido
Medanos della Magdalena
Rio de las Palmas
Costa Brava
Canal de Bahama
Tortugas
Martyres
Bimini

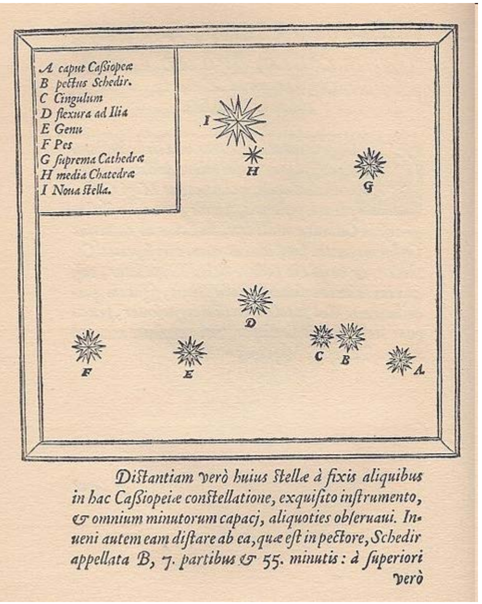


SEPTENTRIONALIUM REGIONUM DESCRIP.
SEPTENTRIO
AMERICÆ SIVE NOVI ORBIS PARS
OCCIDENS
ORIENS
MELIDIES.
MARE CONGELATUM
OCEANUS HYPERBOREUS
OCEANUS DEUCALIDONIUS
OCEANUS OCCIDENTALIS
OCEANUS GERMANICUS
OCEANUS BRITANNICUS
Groenlandt
Estotilant
Islant
RUSSIA
SUEDIA
Biarmia
Pigmei
Permia
Livoniæ pars
Prussiæ pars
Scala milli Germanicorum

1572: Instruments for astronomy

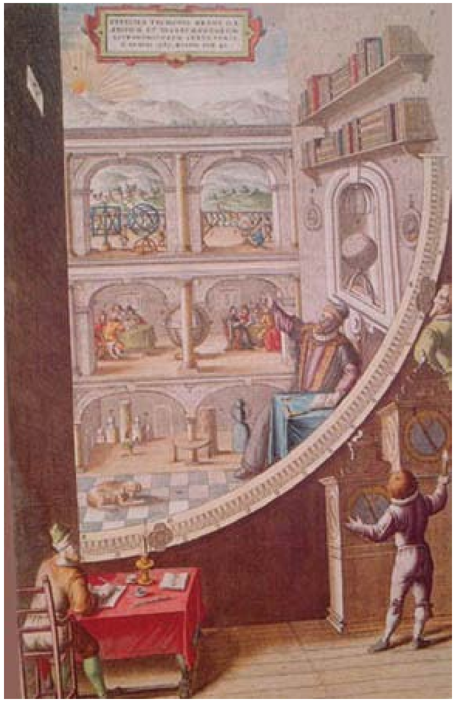
- Tycho Brahe 1546-1601, Danish
- Improved instruments for accurate measurement of stars and planets
- Kept own records and supported observational record keeping





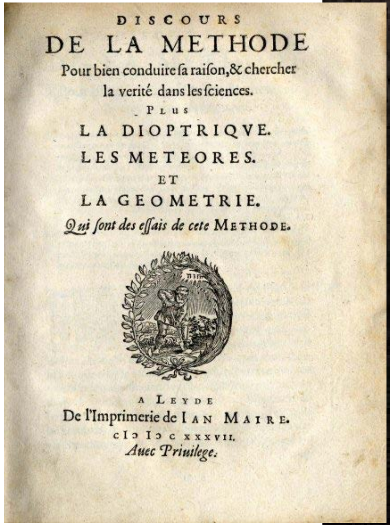
A caput Caſsiopeæ
B pectus Schedir.
C Cingulum
D flexura ad Ilia
E Genu
F Pes
G ſuprema Cathedræ
H media Chatedræ
I Noua ſtella.

Diſtantiam verò huius ſtellæ à fixis aliquibus in hac Caſsiopeiæ conſtellatione, exquiſito inſtrumento, & omnium minutorum capacj, aliquoties obſeruaui. Inueni autem eam diſtare ab ea, quæ eſt in pectore, Schedir appellata B, 7. partibus & 55. minutis : à ſuperiori verò



1637: Coordinates reintroduced

- Cartesian Coordinates
- Relationship established between graphed lines and equations
- Rene Descartes 1596-1650
  - – French
  - – “La Gèomètrie” 1637



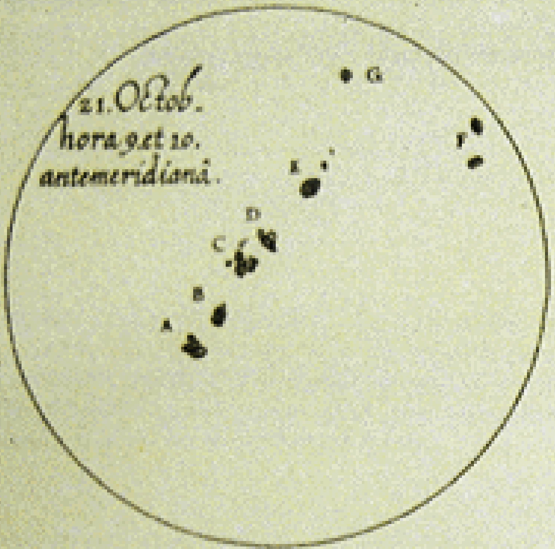
DISCOURS
DE LA METHODE
Pour bien conduire ſa raiſon, & chercher
la verité dans les ſciences.
PLUS
LA DIOPTRIQVE.
LES METEORES.
ET
LA GEOMETRIE.
Qui ſont des eſſais de cete METHODE.

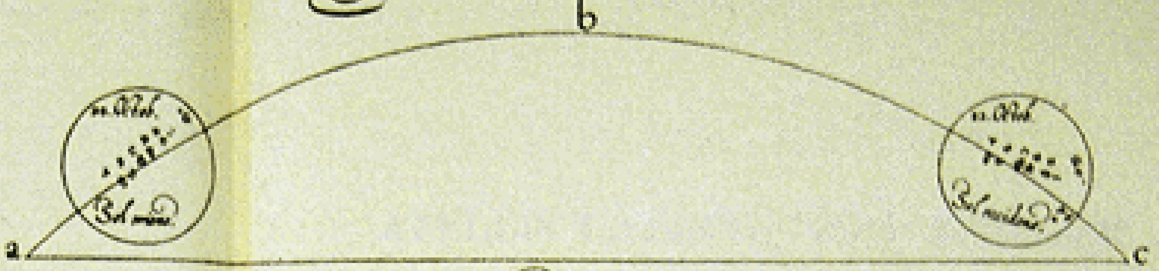
A LEYDE
De l'Imprimerie de IAN MAIRE.
cIↄ Iↄ c xxxvii.
Auec Priuilege.

1626: First “Small Multiples”

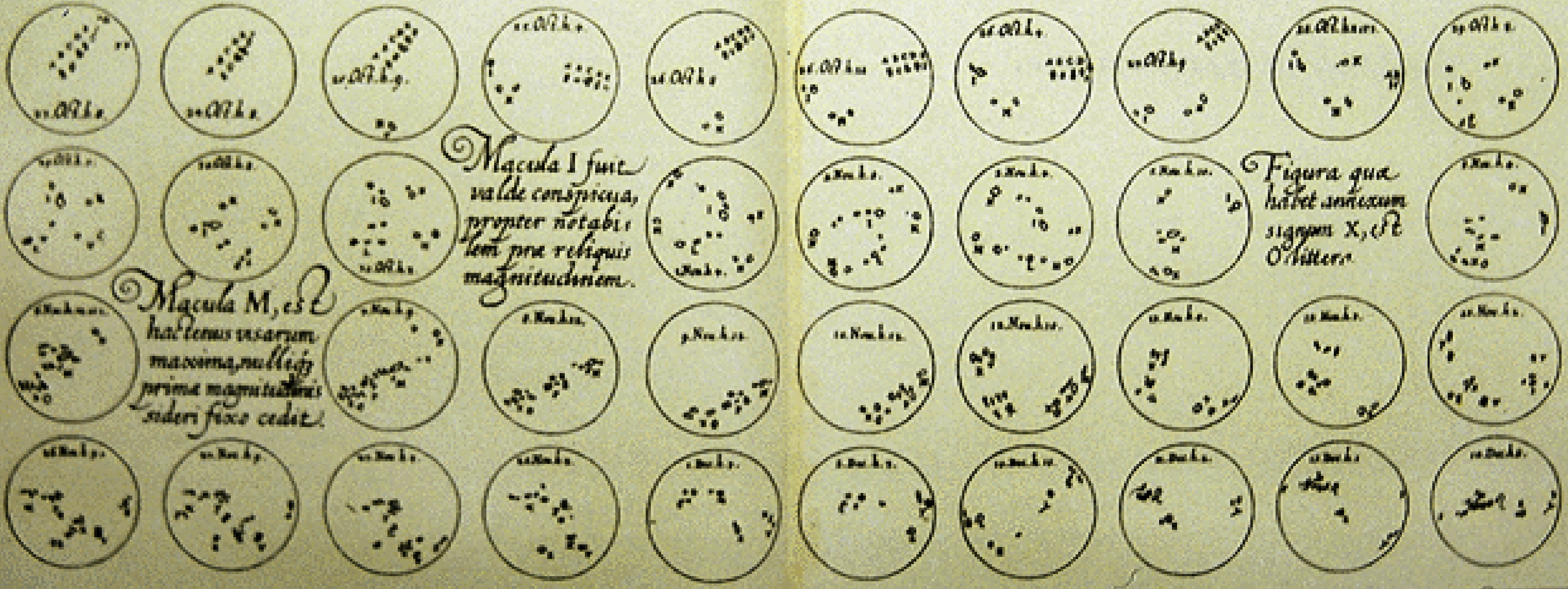
- Shows a series of images
  - Arranged in a logical sequence
  - Depicts changes over time graphically
- Christopher Scheiner (1575-1650)
  - Italian
  - Changes in sunspots over time
  - Same idea used by Galileo in 1610

MACVLAE IN SOLE APPARENTES, OBSERVATAE anno 1611. ad latitudinem grad. 48. min. 40.


21. Octob.
hora 9. et 10.
antemeridianâ.
A
B
C
D
E
F
G


a
b
c
Sol oriens
Sol occidens

a c, horizon. a b c, arcus solis diurnus. Sol oriens ex parte a, maculas exhibet quas vides, occidens verò c, easdem ratione primi motus, nonnihil inuertit. Et hanc matutinam vespertinamq; mutationem, omnes maculæ quotidie subeunt. Quod semel exhibuiſſe et monuiſſe, sufficiat.



Macula I fuit valde conspicua, propter notabilem præ reliquis magnitudinem.

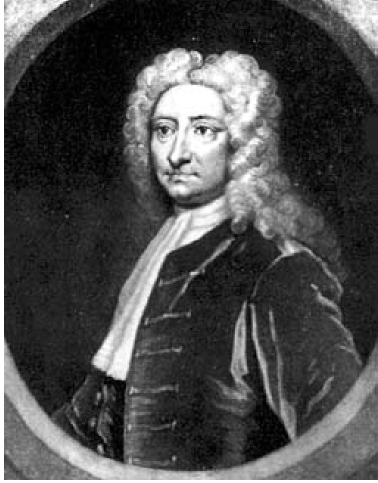
Figura quæ habet annexum signum X, est Octobris.

Macula M, est hactenus visarum maxima, nulliq; primæ magnitudinis sideri fixo cedit.

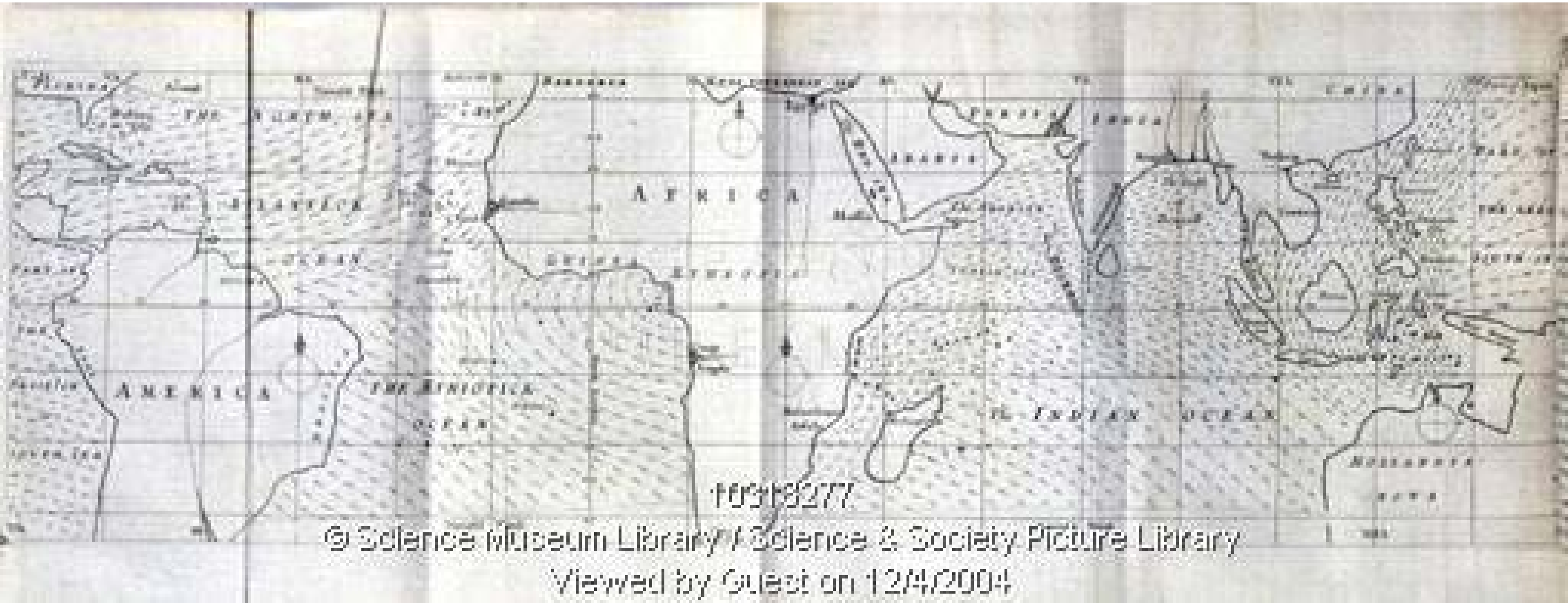
Alex. Mair Aug. incidit.

Cum gratia Cæs.

1686: First Weather Map



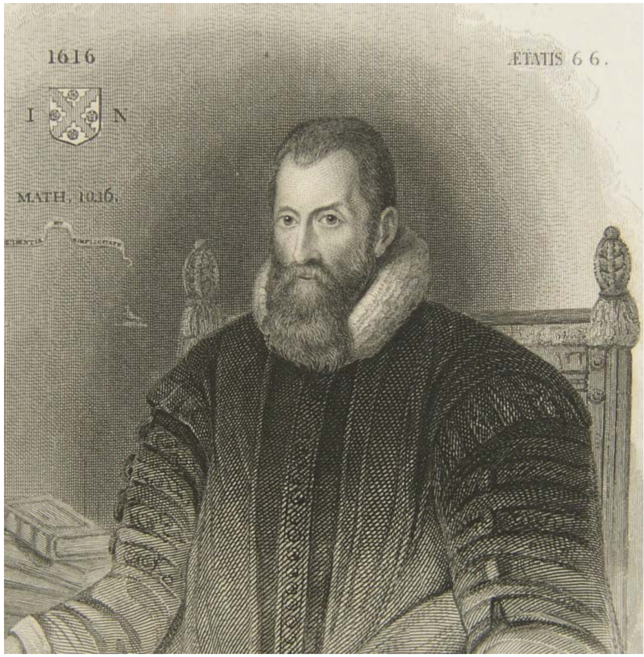
- Edmond Halley, 1656-1742
  - English
- Prevailing winds atop a geographic map


THE NORTH SEA
THE ATLANTICK OCEAN
AFRICA
ARABIA
PERSIA
INDIA
CHINA
AMERICA
THE ETHIOPICK OCEAN
THE INDIAN OCEAN

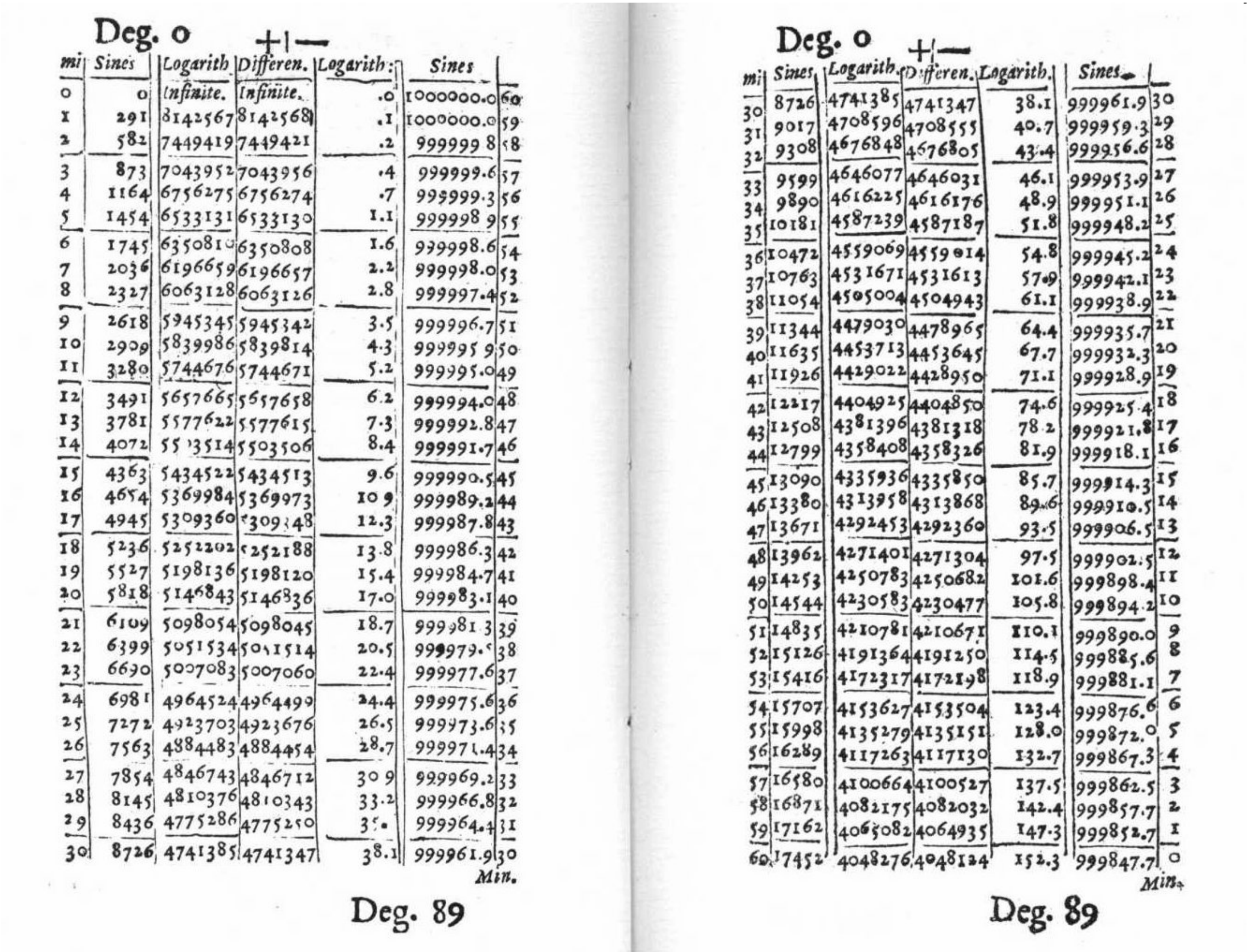
10318277
© Science Museum Library / Science & Society Picture Library
Viewed by Guest on 12/4/2004

18th and 19th centuries: Statistical Thinking

- Numbers, calculations and tables **John Napier** (1550 -1617)
- Leonhard Euler connects to the exponential function in the 18th century.
- Data collection surges
  - People/social stats
  - Medical stats
  - Economic stats
- Need for reporting/summarizing



Napier’s Tables



Deg. 0 +|—

mi	Sines	Logarith	Differen.	Logarith:	Sines	
0	0	Infinite.	Infinite.	.0	1000000.0	60
1	291	8142567	8142568	.1	1000000.0	59
2	582	7449419	7449421	.2	999999 8	58
3	873	7043952	7043956	.4	999999.6	57
4	1164	6756275	6756274	.7	999999.3	56
5	1454	6533131	6533130	1.1	999998 9	55
6	1745	6350810	6350808	1.6	999998.6	54
7	2036	6196659	6196657	2.2	999998.0	53
8	2327	6063128	6063126	2.8	999997.4	52
9	2618	5945345	5945342	3.5	999996.7	51
10	2909	5839986	5839814	4.3	999995 9	50
11	3280	5744676	5744671	5.2	999995.0	49
12	3491	5657665	5657658	6.2	999994.0	48
13	3781	5577622	5577615	7.3	999992.8	47
14	4072	5503514	5503506	8.4	999991.7	46
15	4363	5434522	5434513	9.6	999990.5	45
16	4654	5369984	5369973	10 9	999989.2	44
17	4945	5309360	5309348	12.3	999987.8	43
18	5236	5252202	5252188	13.8	999986.3	42
19	5527	5198136	5198120	15.4	999984.7	41
20	5818	5146843	5146836	17.0	999983.1	40
21	6109	5098054	5098045	18.7	999981 3	39
22	6399	5051534	5051514	20.5	999979.5	38
23	6690	5007083	5007060	22.4	999977.6	37
24	6981	4964524	4964499	24.4	999975.6	36
25	7272	4923703	4923676	26.5	999973.6	35
26	7563	4884483	4884454	28.7	999971.4	34
27	7854	4846743	4846712	30 9	999969.2	33
28	8145	4810376	4810343	33.2	999966.8	32
29	8436	4775286	4775250	35.	999964.4	31
30	8726	4741385	4741347	38.1	999961.9	30

Min.

Deg. 89

Deg. 0 +|—

mi	Sines	Logarith.	Differen.	Logarith.	Sines	
30	8726	4741385	4741347	38.1	999961.9	30
31	9017	4708596	4708555	40.7	999959.3	29
32	9308	4676848	4676805	43.4	999956.6	28
33	9599	4646077	4646031	46.1	999953.9	27
34	9890	4616225	4616176	48.9	999951.1	26
35	10181	4587239	4587187	51.8	999948.2	25
36	10472	4559069	4559014	54.8	999945.2	24
37	10763	4531671	4531613	57.9	999942.1	23
38	11054	4505004	4504943	61.1	999938.9	22
39	11344	4479030	4478965	64.4	999935.7	21
40	11635	4453713	4453645	67.7	999932.3	20
41	11926	4429022	4428950	71.1	999928.9	19
42	12217	4404925	4404850	74.6	999925.4	18
43	12508	4381396	4381318	78.2	999921.8	17
44	12799	4358408	4358326	81.9	999918.1	16
45	13090	4335936	4335850	85.7	999914.3	15
46	13380	4313958	4313868	89.6	999910.5	14
47	13671	4292453	4292360	93.5	999906.5	13
48	13962	4271401	4271304	97.5	999902.5	12
49	14253	4250783	4250682	101.6	999898.4	11
50	14544	4230583	4230477	105.8	999894.2	10
51	14835	4210781	4210671	110.1	999890.0	9
52	15126	4191364	4191250	114.5	999885.6	8
53	15416	4172317	4172198	118.9	999881.1	7
54	15707	4153627	4153504	123.4	999876.6	6
55	15998	4135279	4135151	128.0	999872.0	5
56	16289	4117263	4117130	132.7	999867.3	4
57	16580	4100664	4100527	137.5	999862.5	3
58	16871	4082175	4082032	142.4	999857.7	2
59	17162	4065082	4064935	147.3	999852.7	1
60	17452	4048276	4048124	152.3	999847.7	0

Min.

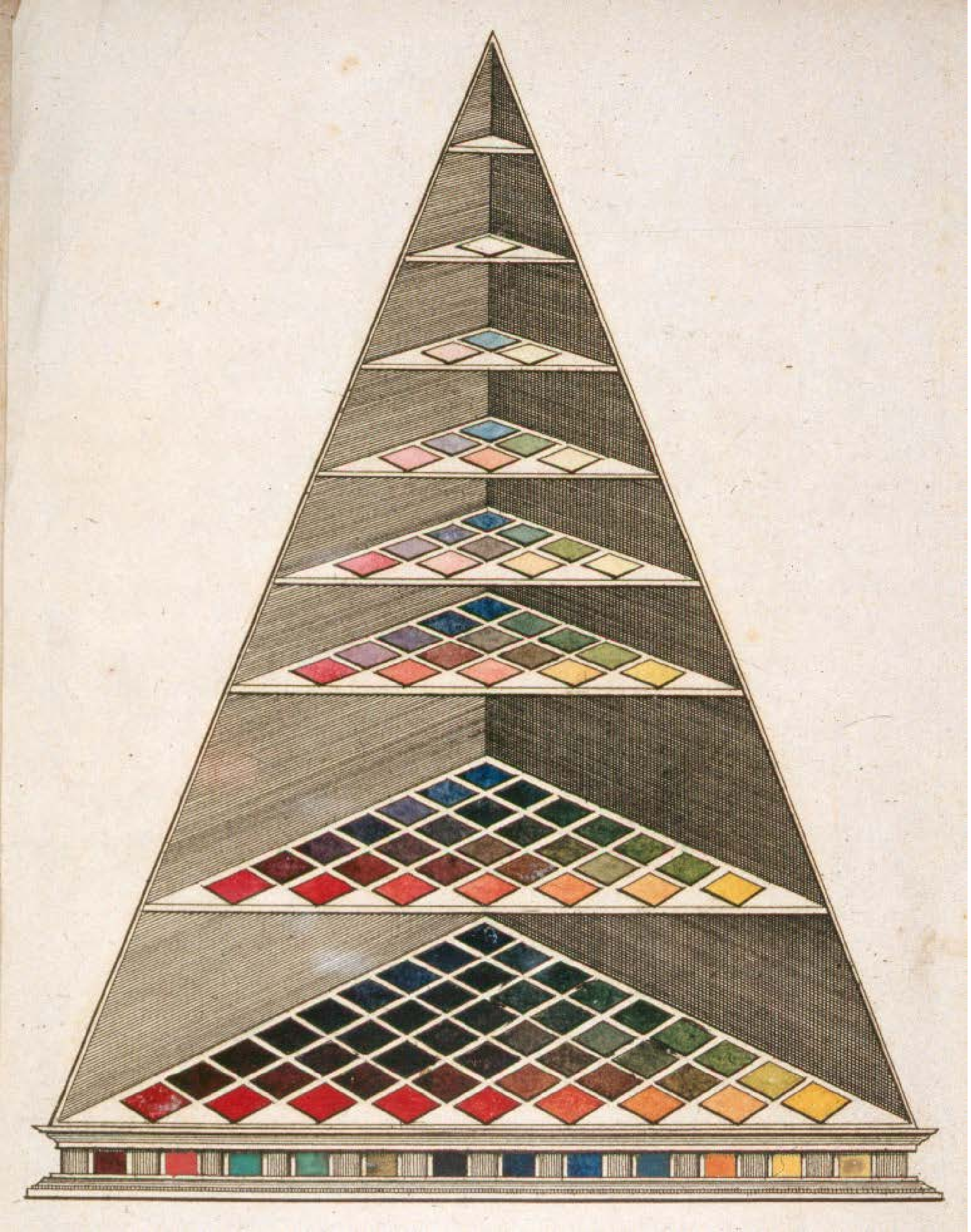
Deg. 89

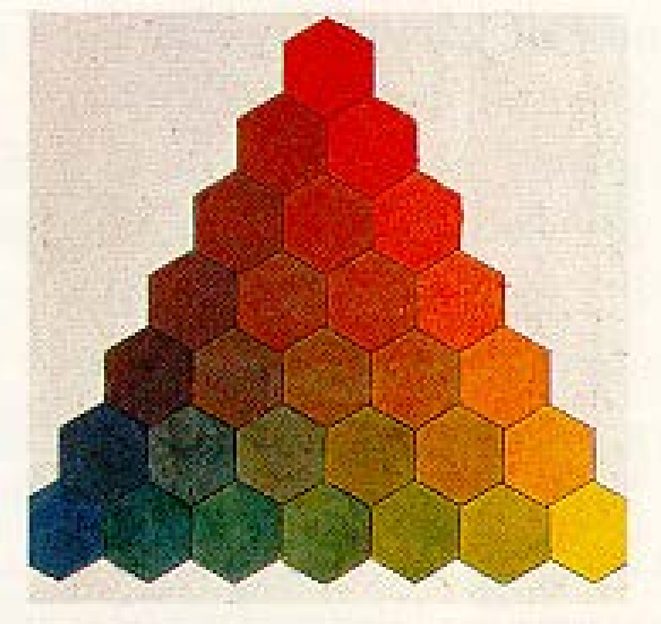
1700's

- 1710: Three-color printing invented
- 1748: First use of the word "statistik"
- 1752: Three-dimensional coordinates (*x*,*y*,*z*)

1758-1772: Color Diagrams

- Diagrams to represent color spaces
- 3D pyramid
- Johann Heinrich Lambert
  - German
- Tobias Mayer
  - German





1782: Proportional Symbols

- First use of geometric figures to compare attributes
- Charles de Fourcroy
    - French
    - Tableau Poléometrique 1782
- Used area of squares to depict urban statistics

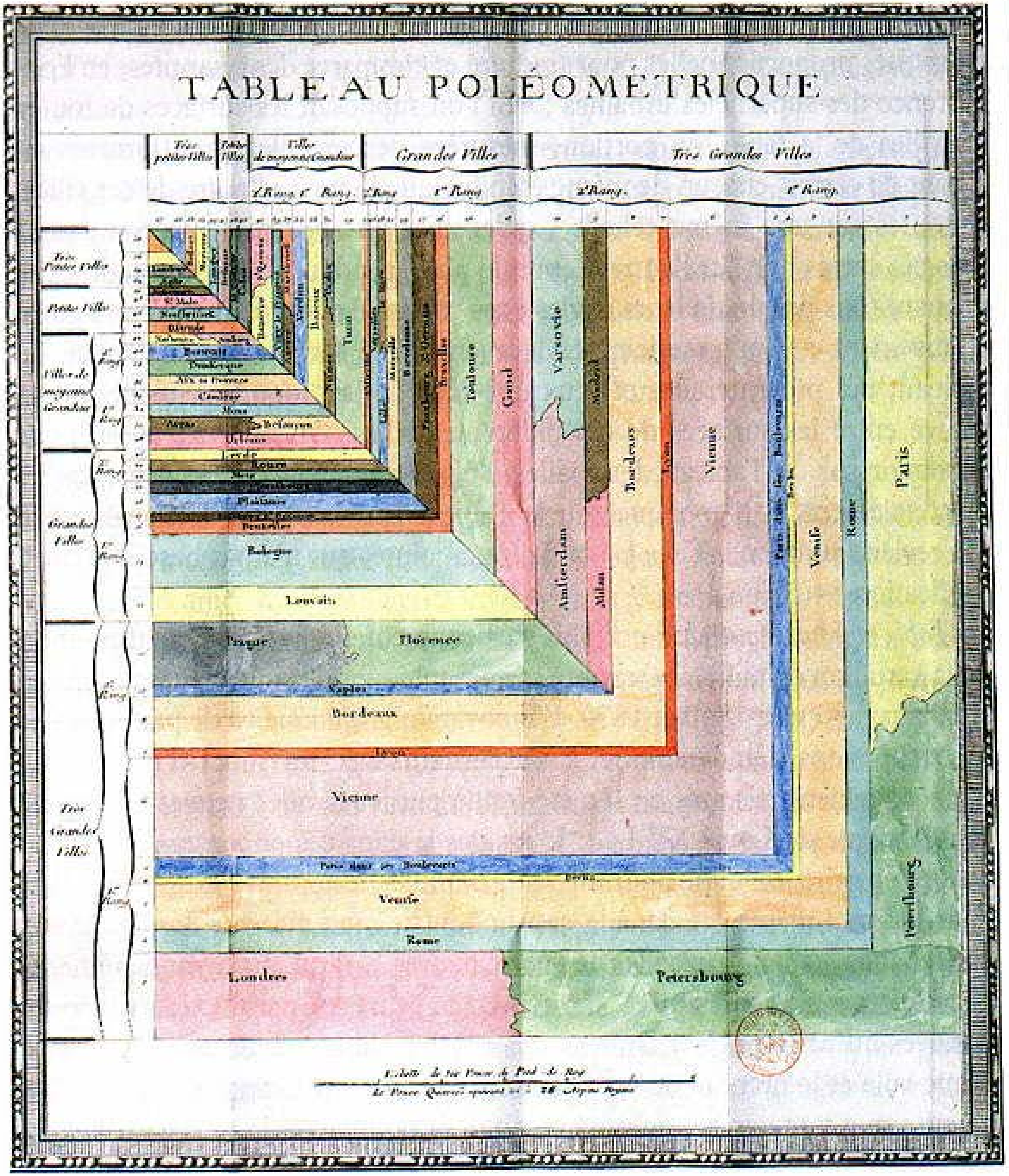
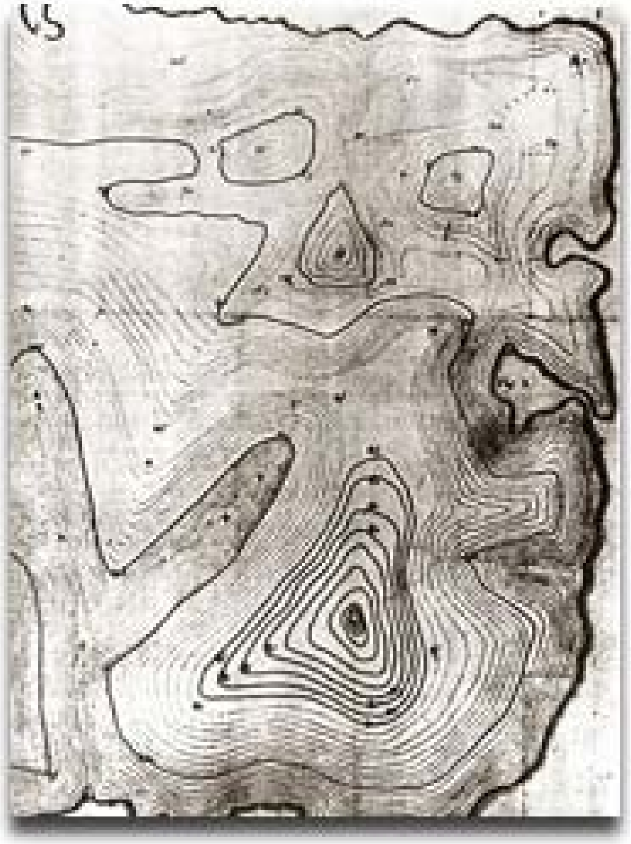


TABLEAU POLÉOMÉTRIQUE

1782

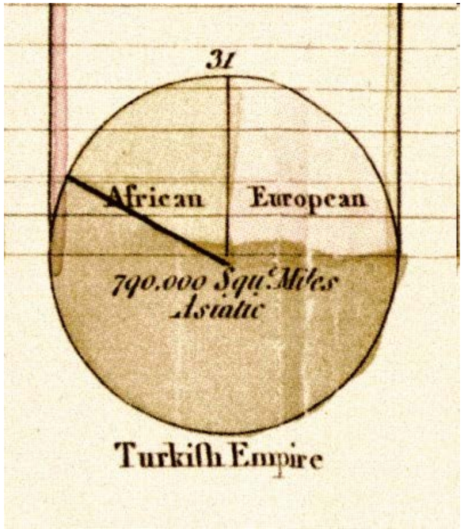
- First topographical map
- Marcellin du Carla-Boniface
  - France

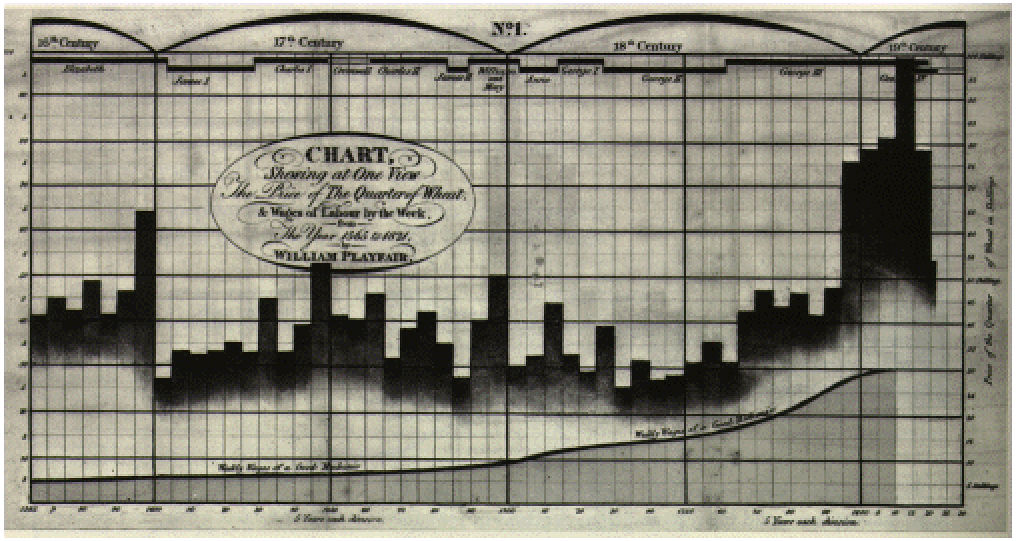
Expression des nivellements; ou, Méthode nouvelle pour marquer sur les cartes terrestres et marines les hauteurs et les configurations du terrain.

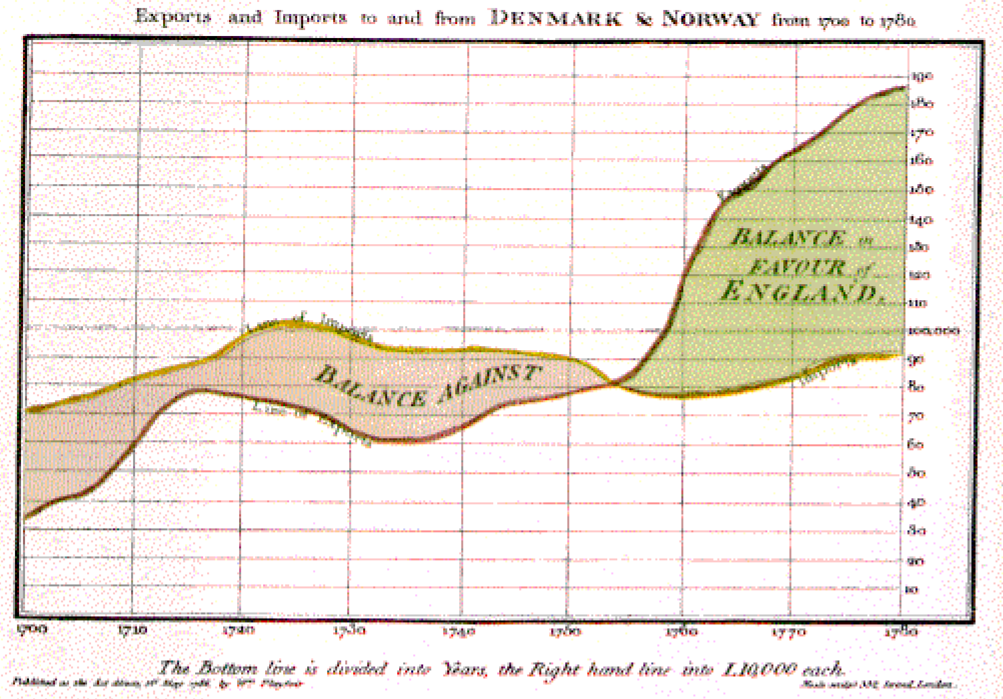


1786: Bar Charts, Line Graphs

- William Playfair (1759 –1823)
  - Huge figure in the world of figures
- First bar charts, line graphs, pie charts (1801)
- Trends in economic data




No.1.
16th Century
17th Century
18th Century
19th Century
Elizabeth
James I
Charles I
Cromwell
Charles II
James II
William and Mary
Anne
George I
George II
George III
CHART,
Showing at One View
The Price of The Quarter of Wheat,
& Wages of Labour by the Week,
from
The Year 1565 to 1821,
by
WILLIAM PLAYFAIR.
Weekly Wages of a Good Mechanic
5 Years each division
Price of the Quarter of Wheat in Shillings


Exports and Imports to and from DENMARK & NORWAY from 1700 to 1780
BALANCE AGAINST
BALANCE in FAVOUR of ENGLAND.
Line of Exports
Line of Imports
190
180
170
160
150
140
130
120
110
100,000
90
80
70
60
50
40
30
20
10
1700
1710
1720
1730
1740
1750
1760
1770
1780
The Bottom line is divided into Years, the Right hand line into L10,000 each.
Published as the Act directs, 1st May 1786, by Wm. Playfair
Neele sculpt. 352, Strand, London.

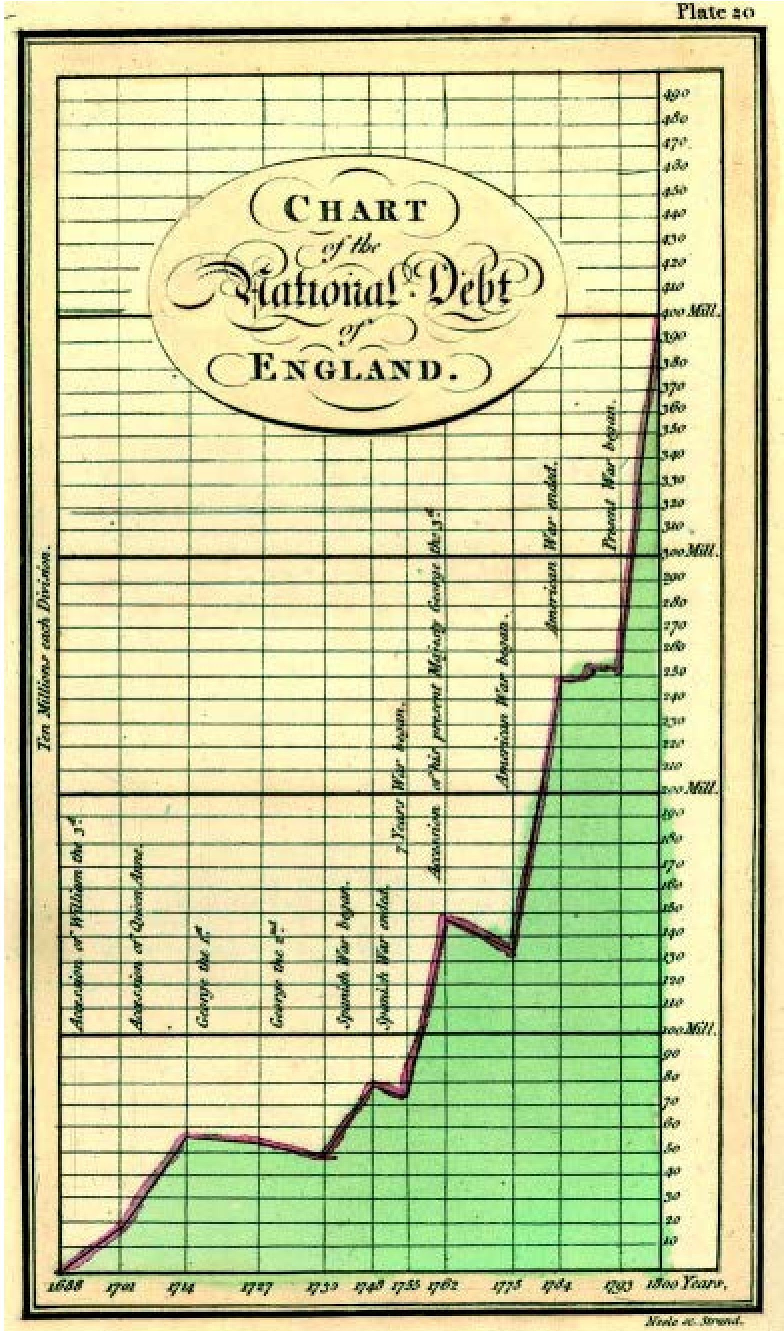
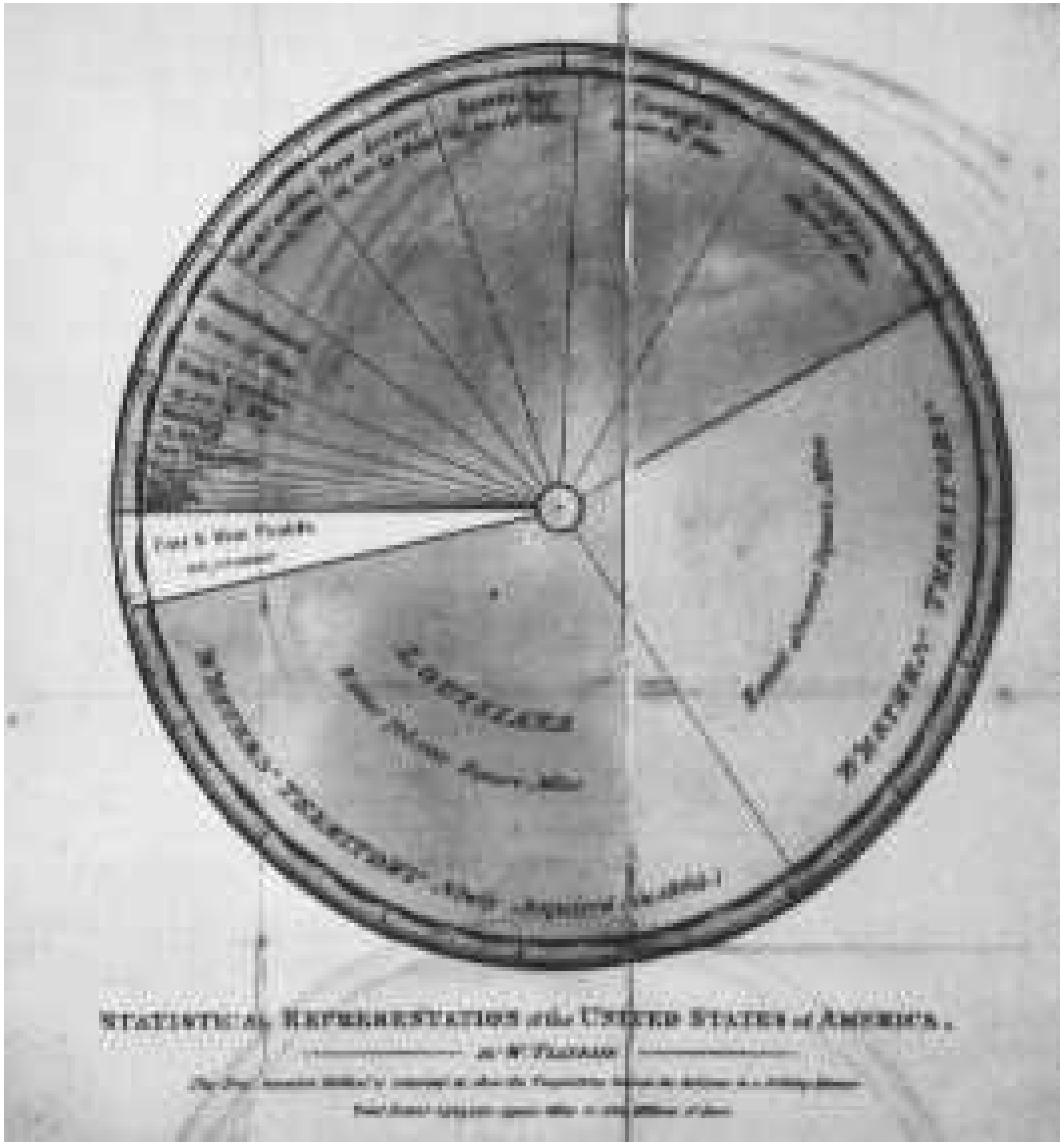


Plate 20
CHART of the National Debt of ENGLAND.
Ten Millions each Division.
Accession of William the 3d.
Accession of Queen Anne.
George the 1st.
George the 2nd.
Spanish War began.
Spanish War ended.
7 Years War began.
Accession of his present Majesty George the 3d.
American War began.
American War ended.
Present War began.
490
480
470
460
450
440
430
420
410
400 Mill.
390
380
370
360
350
340
330
320
310
300 Mill.
290
280
270
260
250
240
230
220
210
200 Mill.
190
180
170
160
150
140
130
120
110
100 Mill.
90
80
70
60
50
40
30
20
10
1688
1701
1714
1727
1739
1748
1755
1762
1775
1784
1793
1800 Years.
Neele sc. Strand.


East & West Florida
LOUISIANA
WESTERN TERRITORY
WESTERN TERRITORY (Newly Acquired ...)
STATISTICAL REPRESENTATION of the UNITED STATES of AMERICA,
by Wm Playfair

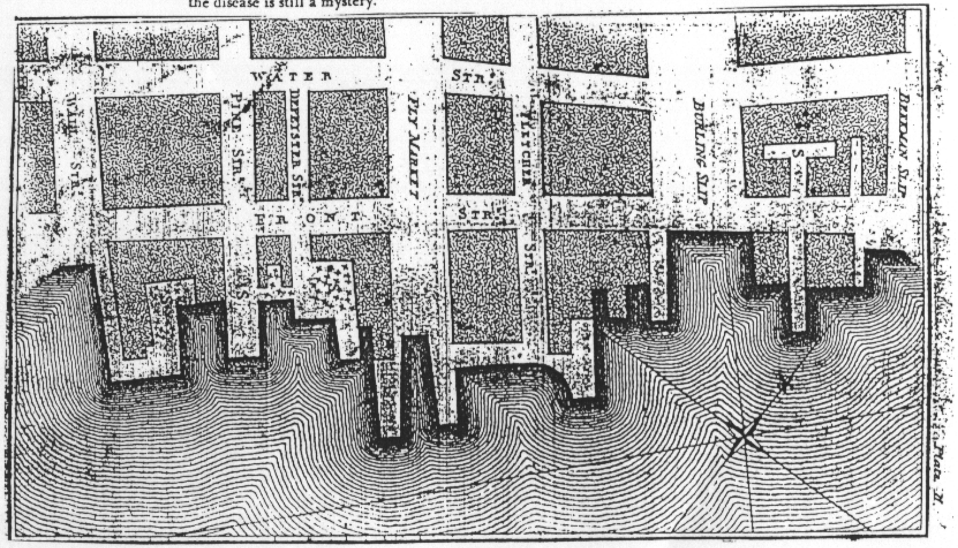
1798 First maps of the incidence of disease (yellow fever)

Yellow fever in New York, 1797. (*Med. Reposit.*, 1798, *1*, opp. 317; cf. n. 30).

"The south-eastern end of Pine-street, (S on plate II.) lies considerably lower than the dock which is continued from it; so that it there keeps a constant puddle of stagnant filthy water and mud. . . . The slips (SS) on each side of this central spot, have been left, during the summer, to be fortuitously filled up by the free contributions of the neighbourhood. . . . But beside all this, the spaces . . . marked S with crosses, particularly that to the north-eastward of the dock, has [sic], from its being open and so contiguous to the Market, become the common convenience to a multitude of people. . . ."

Cases of yellow fever were too numerous "to get an accurate history of them all." This and "the want of proper marks to identify it where it is slight" led Seaman to note only the fatal cases. Ten cases, listed by name, "appear to have originated in East George-street," all but two residing "within the small compass of seventeen houses, in the lower part of the street." Three more cases are listed in Chestnut, Roosevelt, and Water Streets respectively.

Then follow the cases numbered on the map: .1 Kelly/ .2 Wiggins/ .3 Van Deventer/ .4 Hitchcock/ .5 Hamilton/ .6 Comstock/ .7 Rogers/ .8 Beers. One more case (Mowatt) "resided in a healthy, cleanly part of the town: and how or where he could have taken the disease is still a mystery."

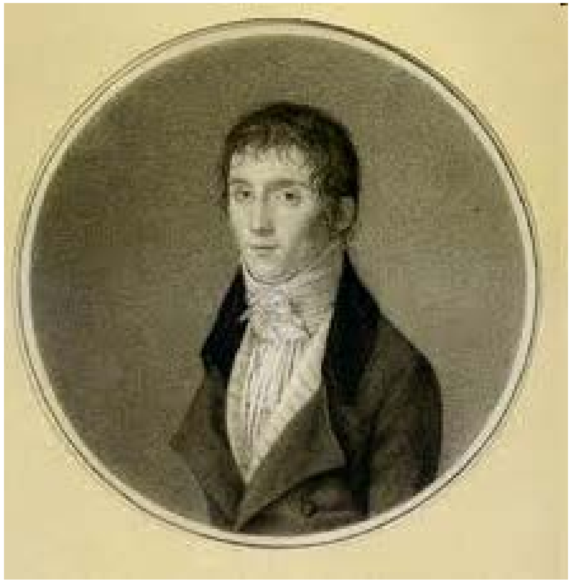


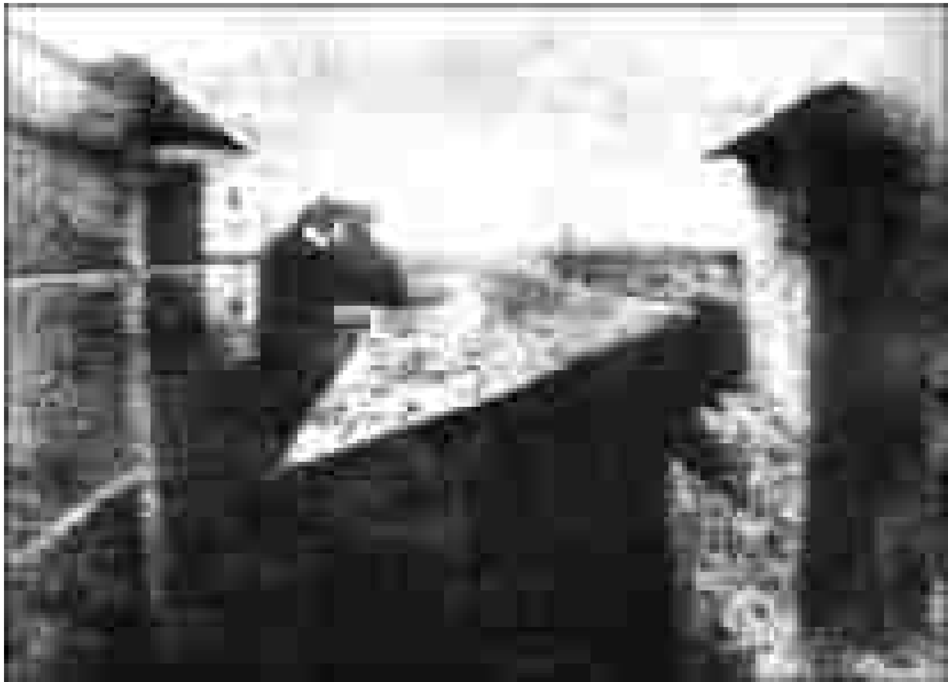
Using dots and circles to show individual occurrences in waterfront areas of New York

Valentine Seaman (1770-1817), USA

1827: First Successful Photograph

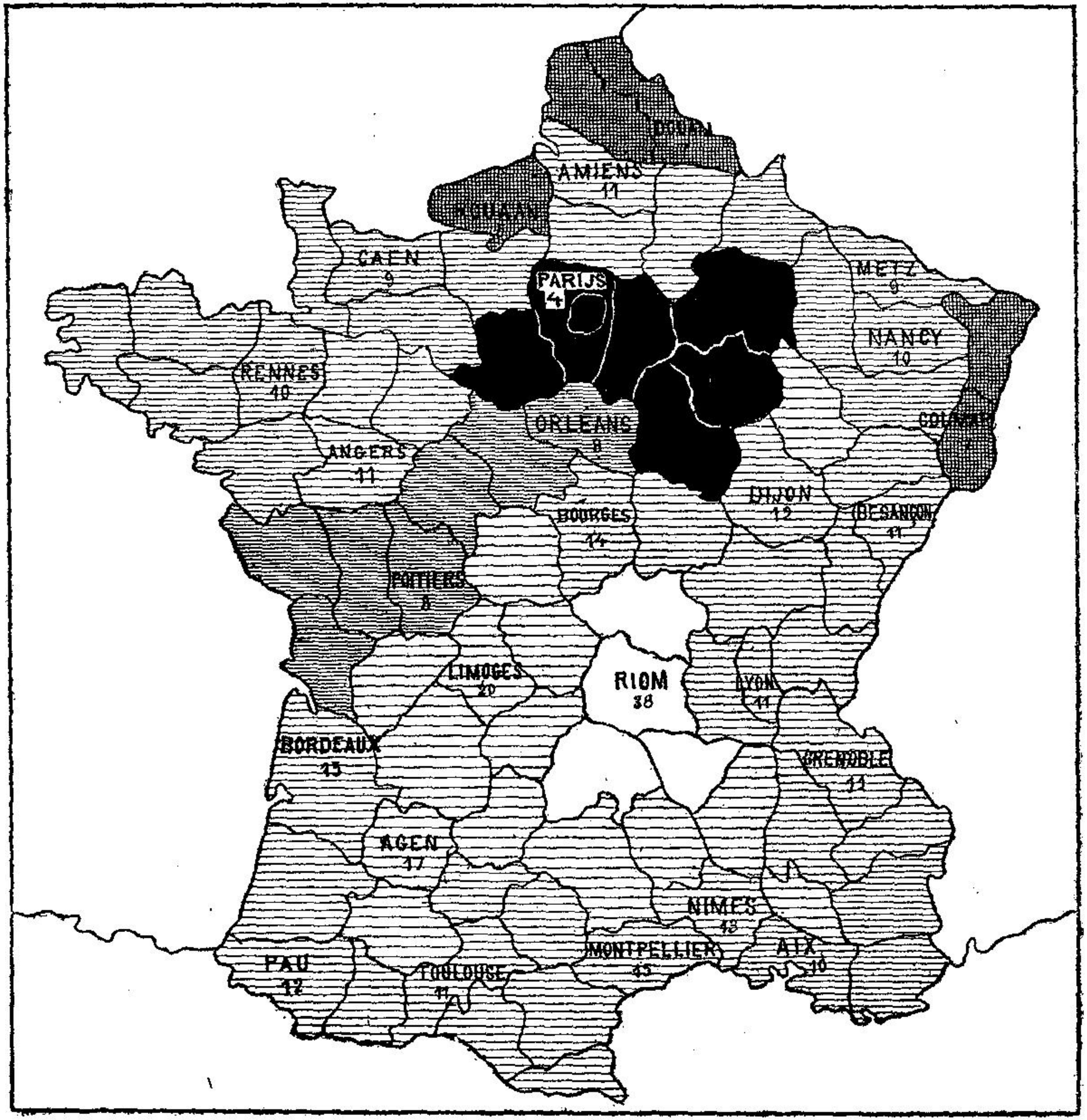
- 8-hour exposure
- Joseph Nicephore Niepce
  - French
  - Point de vue du Gras





1819: First Choropleth Map

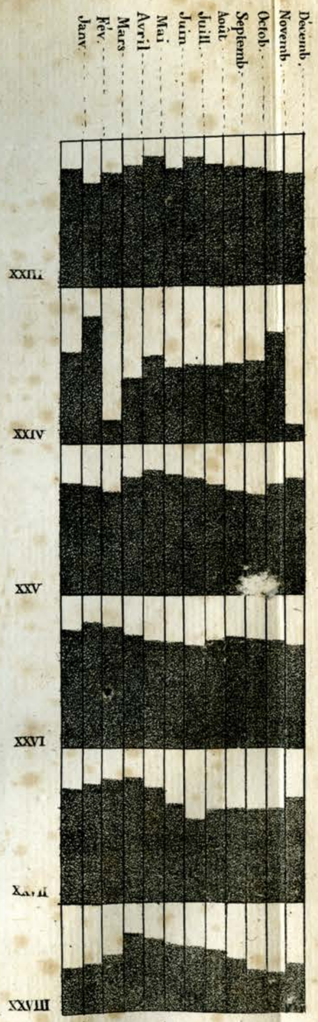
- Baron Pierre Charles Dupin 1784-1873
  - French
- Unclassed choropleth map of illiteracy
- First “modern statistical map”
- Social movement of “moral statistics”

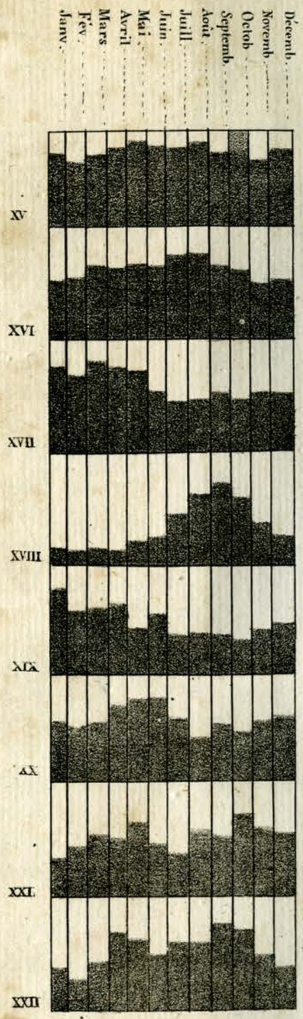

DOUAI
AMIENS
11
ROUAAN
CAEN
9
PARIJS
4
METZ
9
NANCY
10
RENNES
10
ORLEANS
8
COLMAR
ANGERS
11
DIJON
12
BESANÇON
11
BOURGES
14
POITIERS
8
LIMOGES
20
RIOM
38
LYON
11
BORDEAUX
15
GRENOBLE
11
AGEN
17
NIMES
43
MONTPELLIER
45
AIX
10
PAU
12
TOULOUSE
11

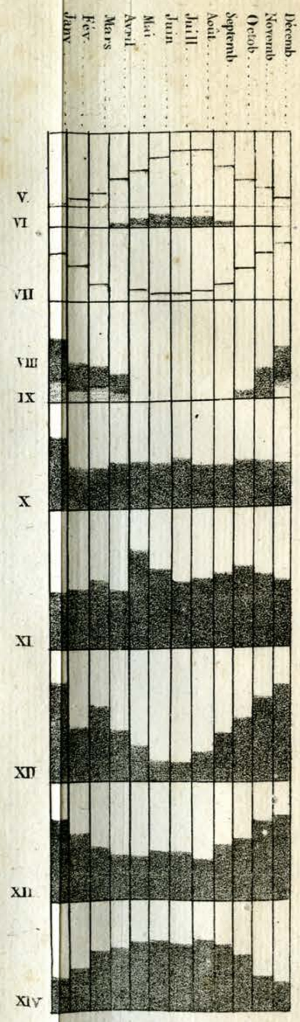
1829: Polar-(Radar) charts

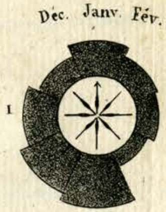
- Show frequency of cyclic phenomena
- Andre Michel Guerry 1802-1866
  - French
  - Lawyer and amateur statistician.
  - Together with Adolphe Quetelet founded moral statistics
  - Led to criminology, sociology and ultimately, modern social science.

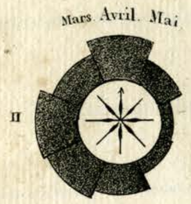
Liaison des variations météorologiques avec les phénomènes physiologiques.

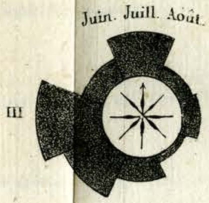


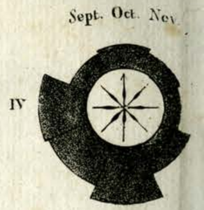


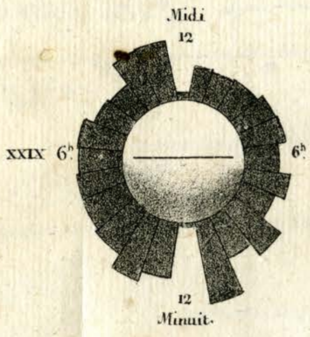


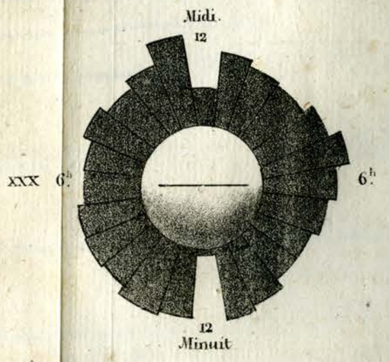




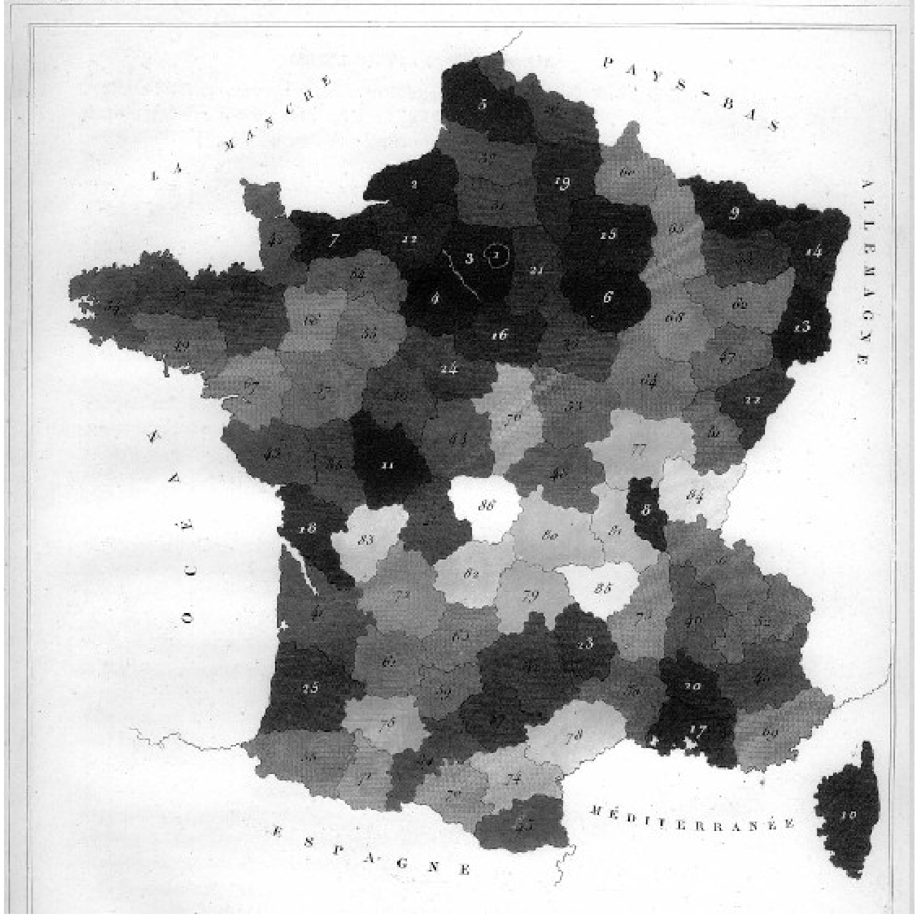




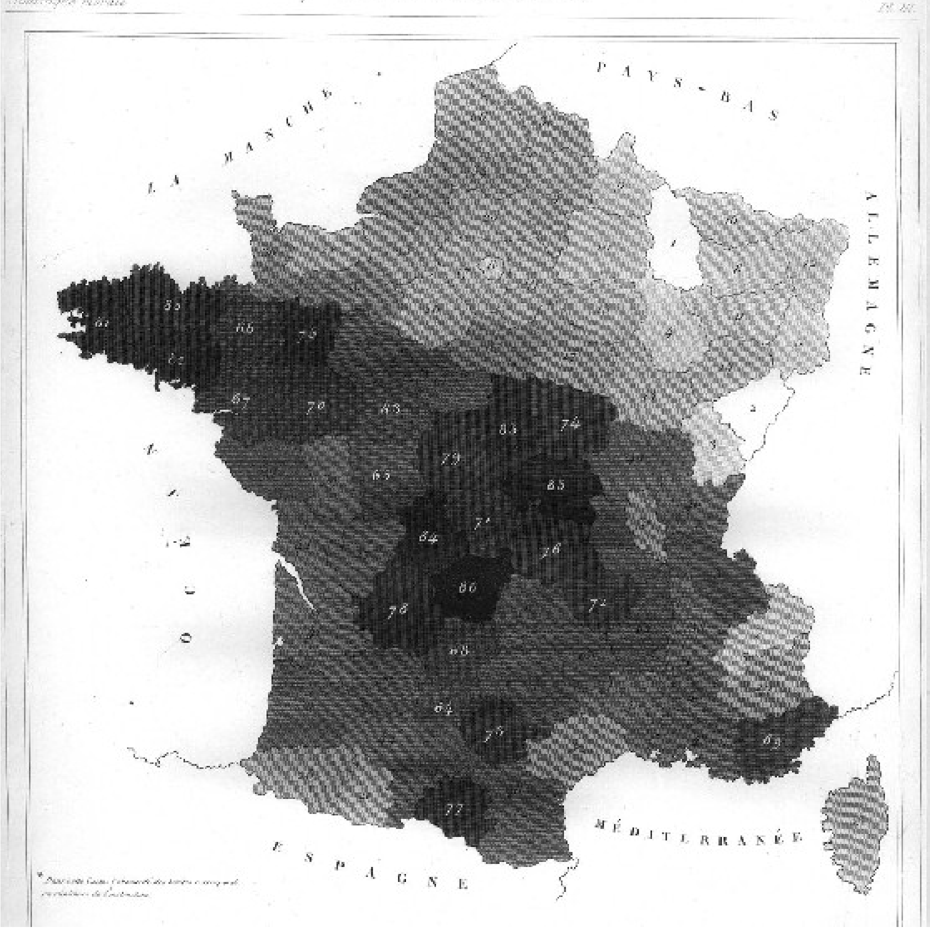




CRIMES CONTRE LES PROPRIÉTÉS.


Statistique morale
LA MANCHE
PAYS-BAS
ALLEMAGNE
OCÉAN
ESPAGNE
MÉDITERRANÉE

INSTRUCTION.


Statistique morale
LA MANCHE
PAYS-BAS
ALLEMAGNE
OCÉAN
ESPAGNE
MÉDITERRANÉE

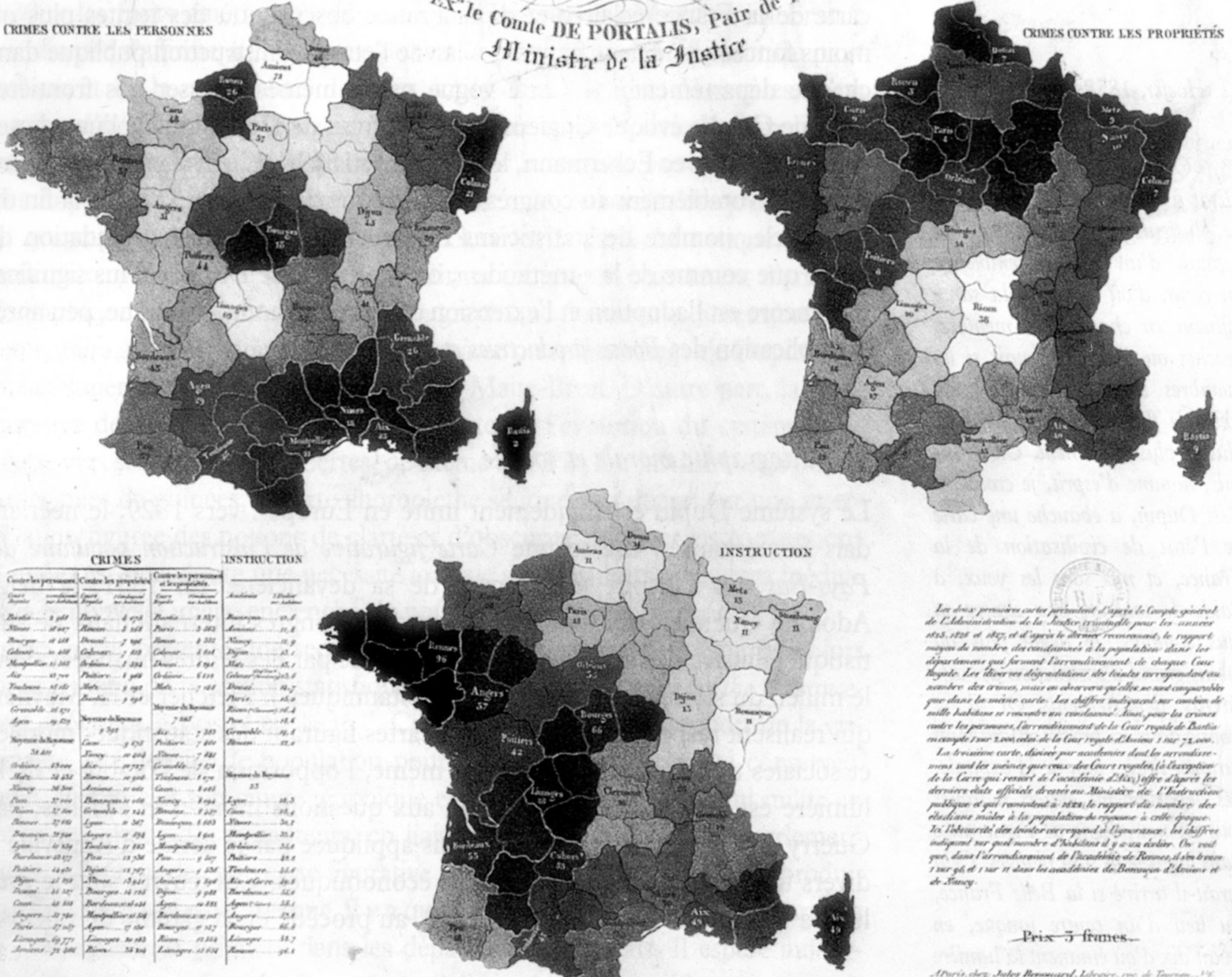
1829: First Cartographic Small Multiples

- Andre Michel Guerry
- Crimes against persons compared to poverty
- Balbi, Adriano, and André-Michel Guerry. 1829. *Statistique comparée de l'état de l'instruction et du nombre des crimes dans les divers arrondissements des Académies et des Cours Royales de France.* Paris
- Also studied suicide, analyzed text reports

STATISTIQUE COMPARÉE
DE L'ÉTAT DE L'INSTRUCTION ET DU NOMBRE DES CRIMES
dans les divers Arrondissemens des Académies et des Cours R.les de France

PAR A. BALBI & A.M. GUERRY, Avocat.

Dédié
A Son Ex.ce le Comte DE PORTALIS, Pair de France,
Ministre de la Justice


CRIMES CONTRE LES PERSONNES
Amiens 72
Douai 46
Rouen 26
Caen 48
Paris 57
Rennes 37
Angers 51
Bourges 16
Poitiers 44
Dijon 45
Colmar 21
Limoges 69
Grenoble 26
Bordeaux 43
Agen 29
Nîmes 16
Montpellier 21
Aix 22
Pau 37
Toulouse
Bastia 2
CRIMES CONTRE LES PROPRIÉTÉS
Douai 7
Rouen 5
Caen 9
Paris 4
Metz 9
Nancy 10
Colmar 7
Orléans 8
Rennes
Poitiers 8
Bourges 14
Dijon 12
Limoges
Riom 38
Bordeaux 16
Agen 17
Nîmes
Montpellier
Aix
Pau
Bastia 9
INSTRUCTION
Douai
Amiens 11
Metz 13
Nancy 11
Strasbourg
Paris 15
Rennes 96
Angers 57
Orléans 32
Dijon 13
Besançon 10
Bourges 66
Poitiers 42
Limoges 88
Clermont
Bordeaux 52
Cahors 53
Aix 49
Pau 18

CRIMES						INSTRUCTION	
Contre les personnes		Contre les propriétés		Contre les personnes et les propriétés			
Cours Royales	1 condamné sur habitans	Cours Royales	1 condamné sur habitans	Cours Royales	1 condamné sur habitans	Académies	1 Écolier sur habitans
Bastia	2 968	Paris	4 678	Bastia	3 137	Besançon	10.6
Nîmes	16 067	Rouen	5 268	Paris	3 862	Amiens	11.8
Bourges	16 438	Douai	7 296	Rouen	4 331	Nancy	11.9
Colmar	20 498	Colmar	7 833	Colmar	5 601	Dijon	13.1
Montpellier	21 303	Orléans	8 394	Douai	6 798	Metz	13.1
Aix	22 700	Poitiers	8 966	Orléans	6 118	Colmar (Strasbourg)	13.6
Toulouse	25 182	Metz	9 098	Metz	7 144	Douai	14.7
Rouen	26 016	Bastia	9 098			Paris	15.0
Grenoble	26 370			Moyenne du Royaume		Riom (Clermont)	16.4
Agen	29 879	Moyenne du Royaume		7 268		Pau	18.6
		9 898		Aix	7 383	Grenoble	19.6
Moyenne du Royaume		Caen	9 678	Poitiers	7 460	Rouen	22.0
32 411		Nancy	10 404	Nîmes	7 841		
Orléans	33 000	Aix	10 737	Grenoble	7 874		
Metz	34 452	Rennes	10 906	Toulouse	8 070	Moyenne du Royaume	
Nancy	36 300	Amiens	11 000	Caen	8 483	23	
Pau	37 000	Besançon	11 058	Nancy	8 094	Lyon	28.3
Riom	37 800	Grenoble	11 344	Rennes	8 487	Caen	28.4
Rennes	37 662	Lyon	11 367	Besançon	8 883	Nîmes	30.2
Besançon	39 940	Angers	11 194	Lyon	8 602	Montpellier	30.8
Lyon	41 859	Toulouse	11 883	Montpellier	9 074	Orléans	32.8
Bordeaux	43 177	Pau	12 736	Pau	9 207	Poitiers	42.0
Poitiers	44 430	Dijon	12 767	Angers	9 238	Toulouse	44.6
Dijon	45 898	Nîmes	13 941	Amiens	9 896	Aix et Corse	49.8
Douai	46 127	Bourges	14 188	Dijon	9 988	Bordeaux	52.0
Caen	48 818	Bordeaux	16 034	Agen	10 882	Agen (Cahors)	53.1
Angers	51 740	Montpellier	16 504	Bordeaux	11 105	Angers	57.8
Paris	57 087	Agen	17 130	Bourges	11 317	Bourges	66.8
Limoges	69 771	Limoges	20 183	Riom	17 344	Limoges	88.7
Amiens	72 486	Riom	38 304	Limoges	18 634	Rennes	96.1

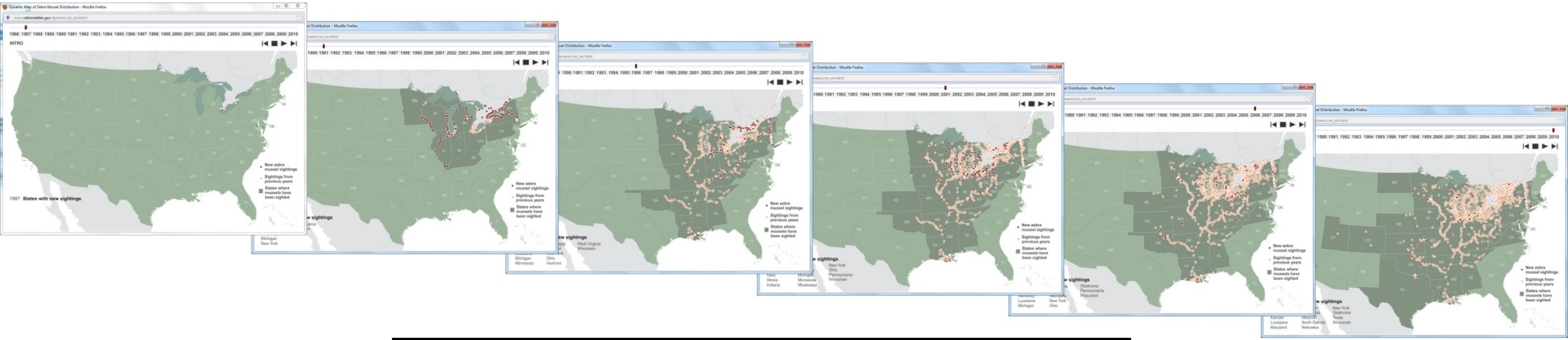
Les deux premières cartes présentent d'après le Compte général de l'Administration de la Justice criminelle pour les années 1825, 1826 et 1827, et d'après le dernier recensement, le rapport moyen du nombre des condamnés à la population dans les départemens qui forment l'arrondissement de chaque Cour Royale. Les diverses dégradations des teintes correspondent au nombre des crimes, mais on observera qu'elles ne sont comparables que dans la même carte. Les chiffres indiquent sur combien de mille habitans se rencontre un condamné. Ainsi, pour les crimes contre les personnes, l'arrondissement de la Cour royale de Bastia en compte 1 sur 2.000, celui de la Cour royale d'Amiens 1 sur 72.000.

La troisième carte, divisée par académies dont les arrondissemens sont les mêmes que ceux des Cours royales, (à l'exception de la Corse qui ressort de l'académie d'Aix,) offre d'après les derniers états officiels dressés au Ministère de l'Instruction publique et qui remontent à 1821, le rapport du nombre des étudians mâles à la population du royaume à cette époque. Ici l'obscurité des teintes correspond à l'ignorance; les chiffres indiquent sur quel nombre d'habitans il y a un écolier. On voit que, dans l'arrondissement de l'académie de Rennes, il s'en trouve 1 sur 96, et 1 sur 11 dans les académies de Besançon d'Amiens et de Nancy.

Prix 5 francs.

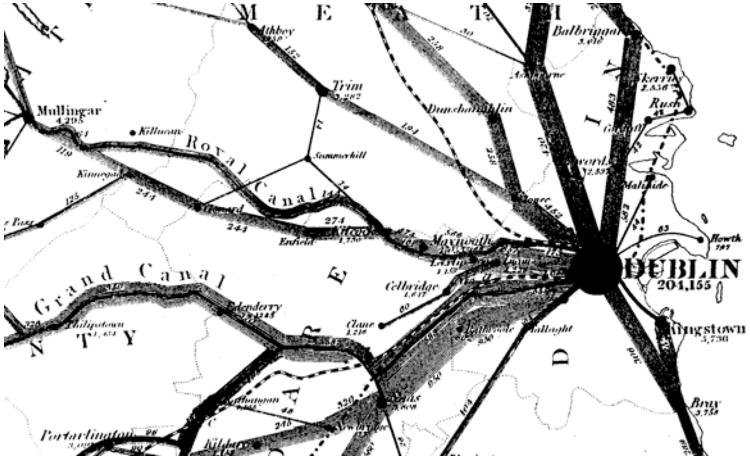
A Paris, chez Jules Renouard, Libraire, rue de Tournon, N° 6.

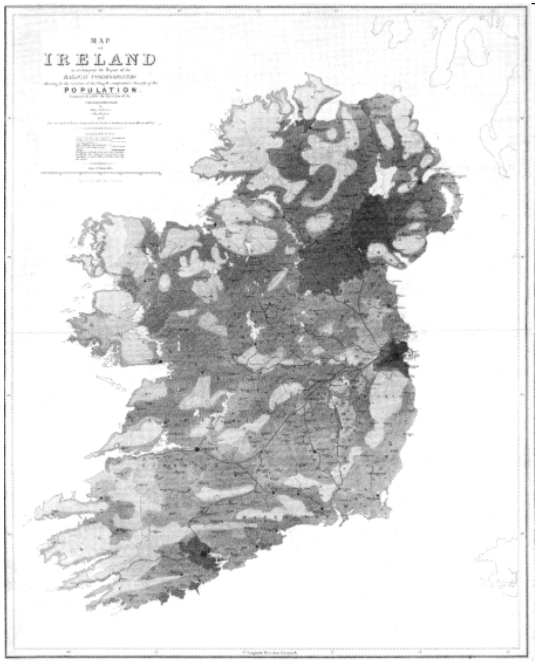
Small multiples-> animation


Dynamic Map of Zebra Mussel Distribution - Mozilla Firefox
www.nationalatlas.gov/dynamic/an_zm.html
1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
INTRO
New zebra mussel sightings
Sightings from previous years
States where mussels have been sighted
1987 States with new sightings

1837: First Flow Map

- Henry Drury Harness 1804-1883
  - Irish
  - Commander Royal Engineers at the siege and capture of Lucknow during the Indian Mutiny


Mullingar
4,295
Killucan
Royal Canal
Trim
2,282
Summerhill
Dunshaughlin
Balbriggan
3,016
Rush
Malahide
Howth
787
DUBLIN
204,155
Kingstown
5,736
Bray
3,758
Celbridge
1,617
Clane
1,216
Enfield
Grand Canal
Edenderry
Philipstown
Portarlington


MAP
IRELAND
POPULATION

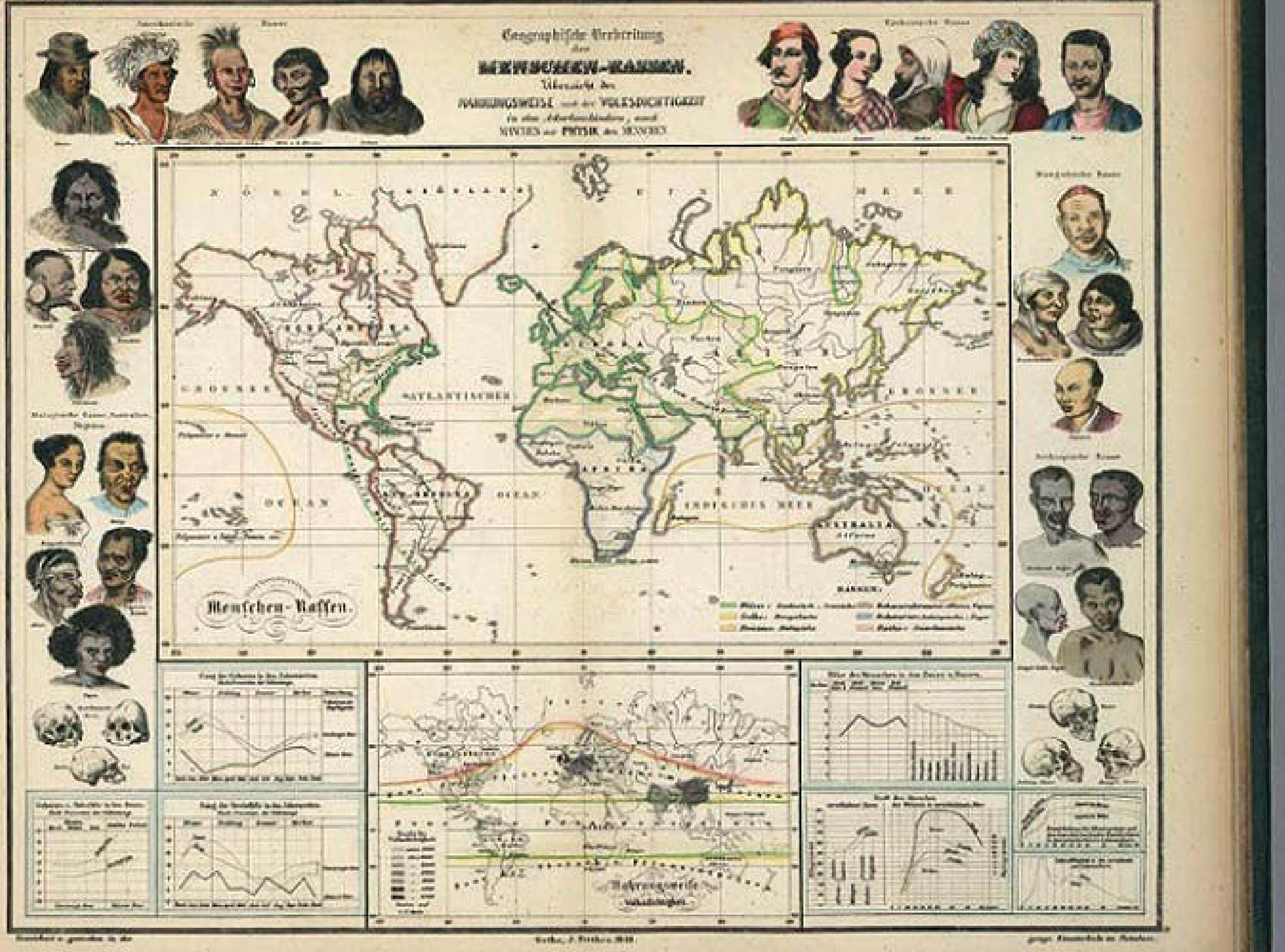
Thematic Atlas

- Heinrich Berghaus (1797-1884), Germany
- Worked on Prussian trigonometrical survey in 1816, pioneer at Potsdam
- Physical atlas of the distribution of plants, animals, climate, etc.
- Contained tables, graphs, pictorial profiles of distributions over altitude
- Cultural and human themes
- *Physikalischer Atlas* (Gotha, 1838–1848)

Geographiſche Verbreitung der MENSCHEN-RASSEN.

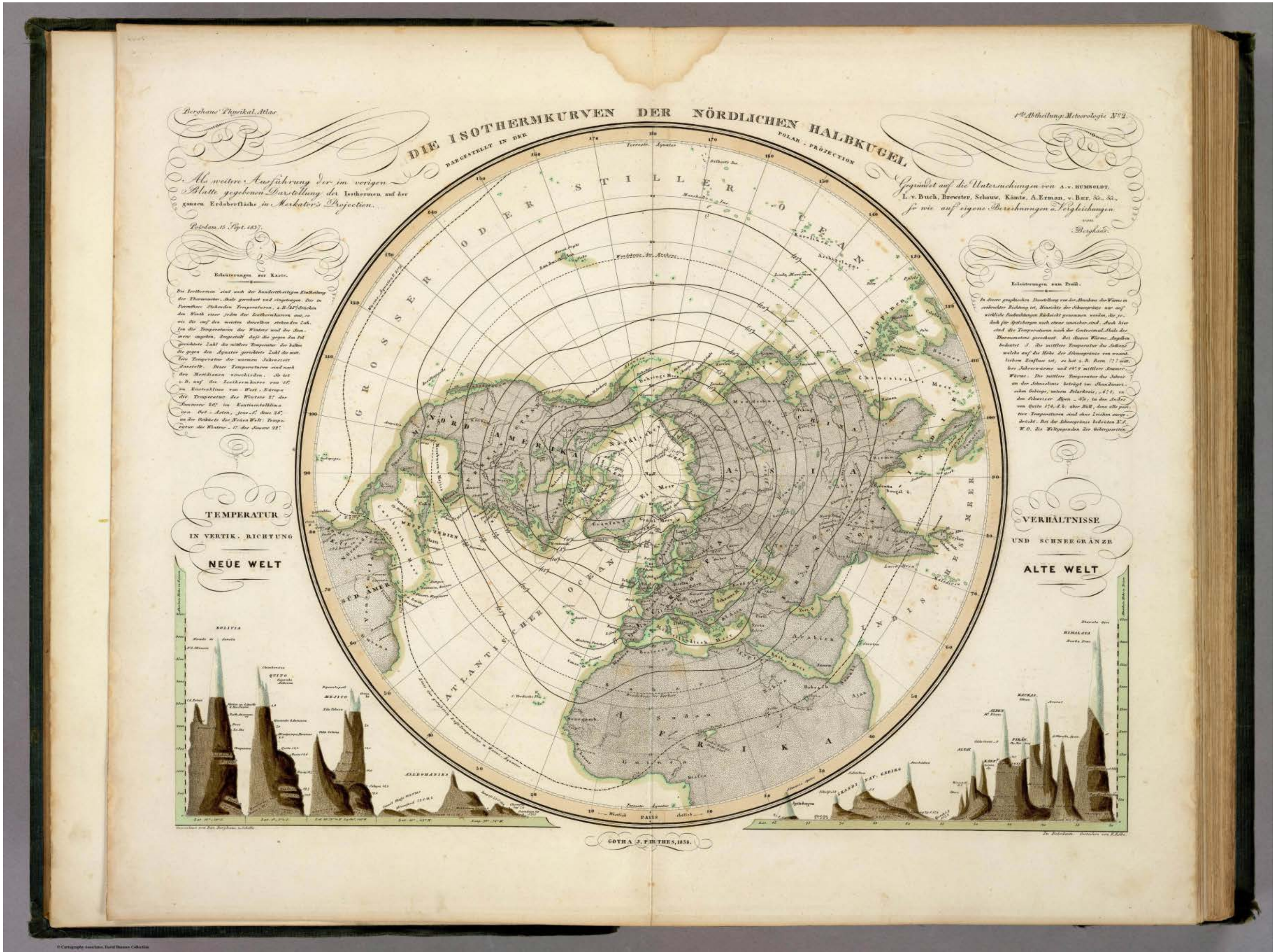
Übersicht der NAHRUNGSWEISE und der VOLKSDICHTIGKEIT in den Ackerbauländern; nach

[illegible] zur PHYSIK des MENSCHEN

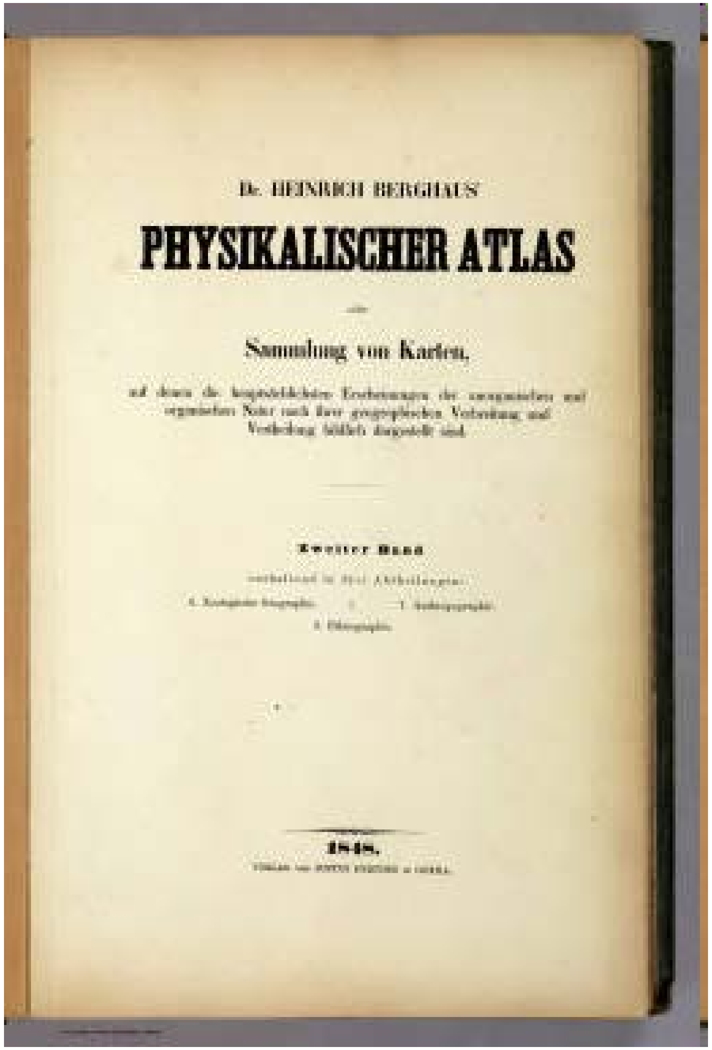

Menſchen-Raſſen.
NÖRDL. EISMEER
NORD AMERIKA
GROSSER OCEAN
ATLANTISCHES OCEAN
EUROPA
ASIA
AFRIKA
SÜD AMERIKA
INDISCHES MEER
AUSTRALIA
GROSSER OCEAN
Nahrungsweise

Gotha, J. Perthes [illegible]

Berghaus' Physikalischer Atlas (1837-1848)
Die Isothermkurven der nördlichen Halbkugel (1838)
Isotherms of the northern hemisphere


Berghaus' Physikal. Atlas
DIE ISOTHERMKURVEN DER NÖRDLICHEN HALBKUGEL
DARGESTELLT IN DER POLAR-PROJECTION
1te Abtheilung: Meteorologie No 2.
Potsdam, 15 Sept. 1837.
TEMPERATUR IN VERTIK. RICHTUNG
NEÜE WELT
VERHÄLTNISSE UND SCHNEE GRÄNZE
ALTE WELT
GROSSER ODER STILLER OCEAN
ATLANTISCHER OCEAN
NORD AMERIKA
SÜD AMER
ASIA
AFRIKA
INDISCHES MEER
GOTHA J. PERTHES, 1838.

Physikalischer Atlas



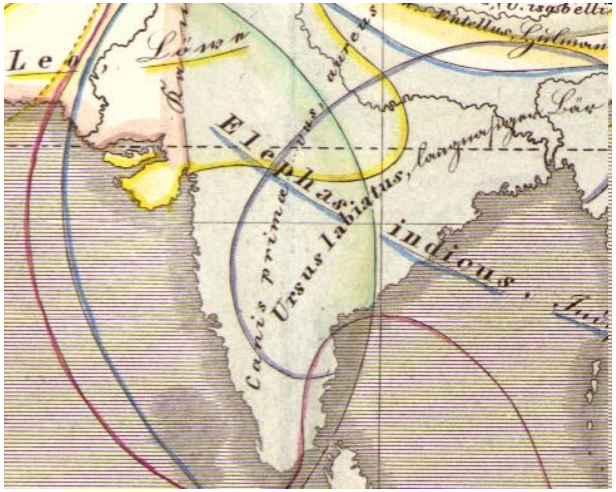
Dr. HEINRICH BERGHAUS'

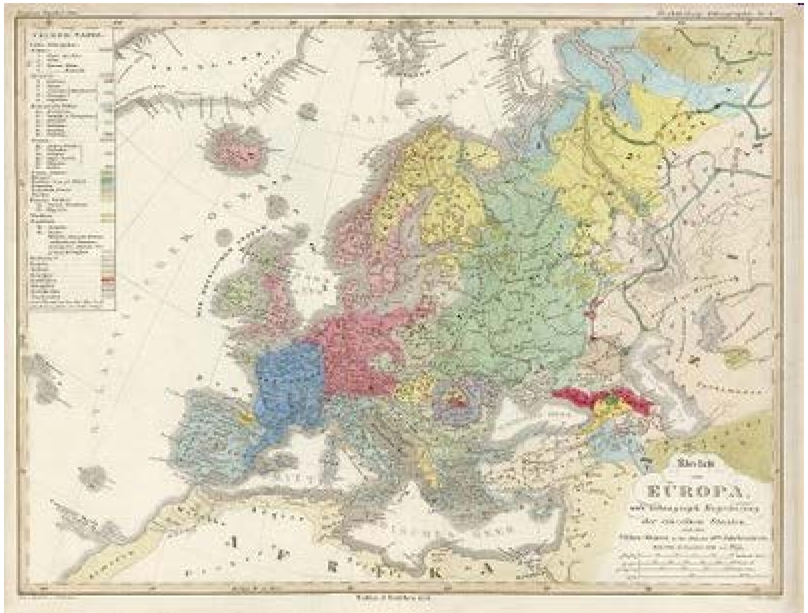
PHYSIKALISCHER ATLAS

Sammlung von Karten,

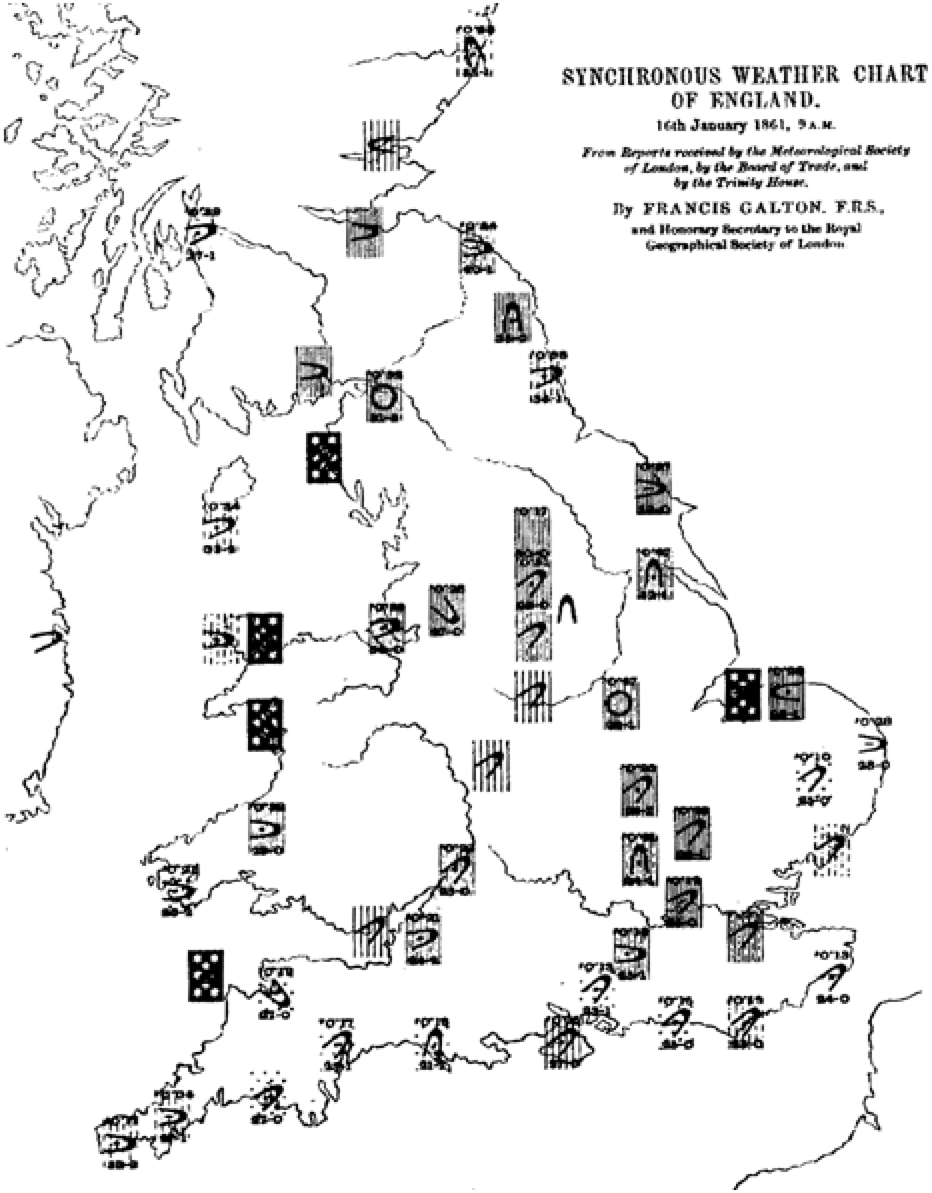
Zweiter Band

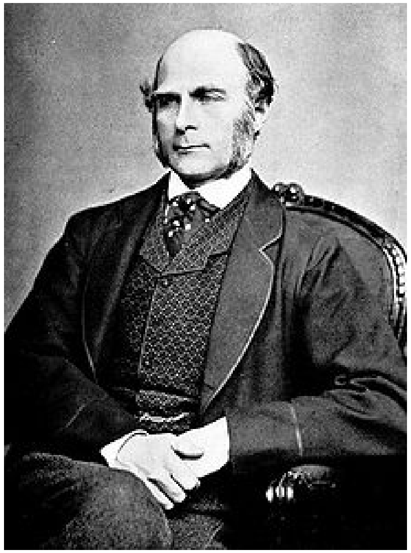
1848.


Leo
Löwe
Eléphas indicus,
Ursus labiatus,
Canis primaevus


EUROPA,
AFRIKA

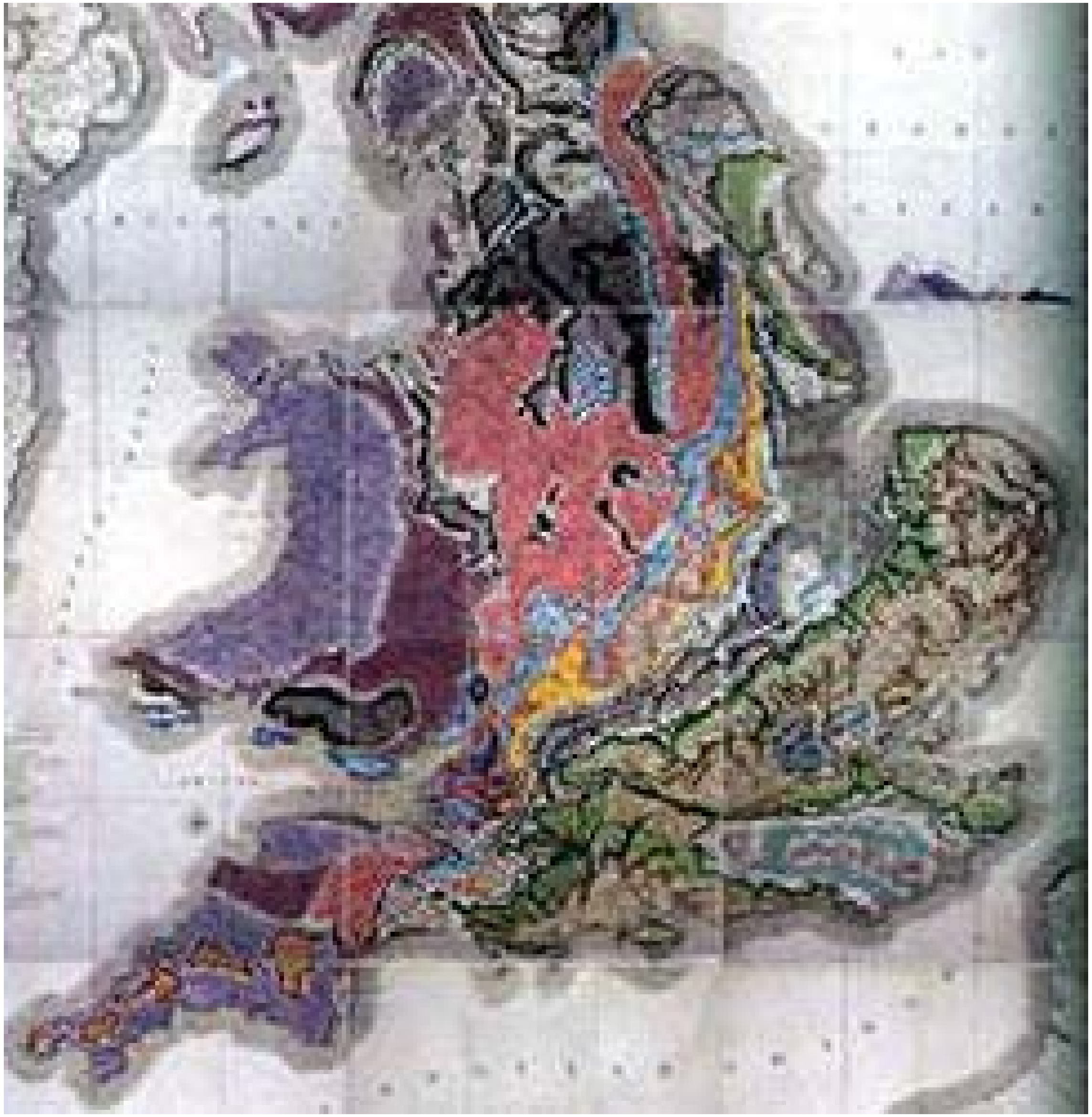
Francis Galton (1822-1911)

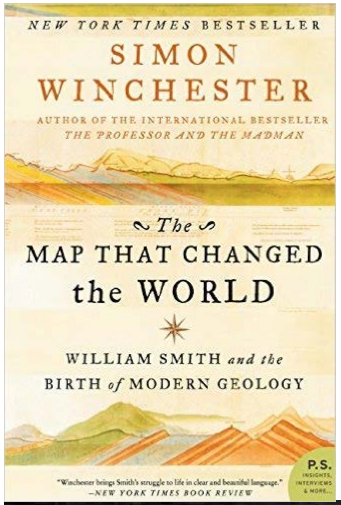

SYNCHRONOUS WEATHER CHART
OF ENGLAND.
16th January 1861, 9 A.M.
From Reports received by the Meteorological Society of London, by the Board of Trade, and by the Trinity House.
By FRANCIS GALTON, F.R.S.,
and Honorary Secretary to the Royal Geographical Society of London.



- **1861**The modern weather map, a chart showing area of similar air pressure and barometric changes by means of glyphs displayed on a map
- Created idea of correlation and regression
- Pioneered social surveys and study of human differences

William Smith (1769–1839), England
Drawn 1801, published 1815





NEW YORK TIMES BESTSELLER

SIMON WINCHESTER

AUTHOR OF THE INTERNATIONAL BESTSELLER
THE PROFESSOR AND THE MADMAN

The
MAP THAT CHANGED
the WORLD

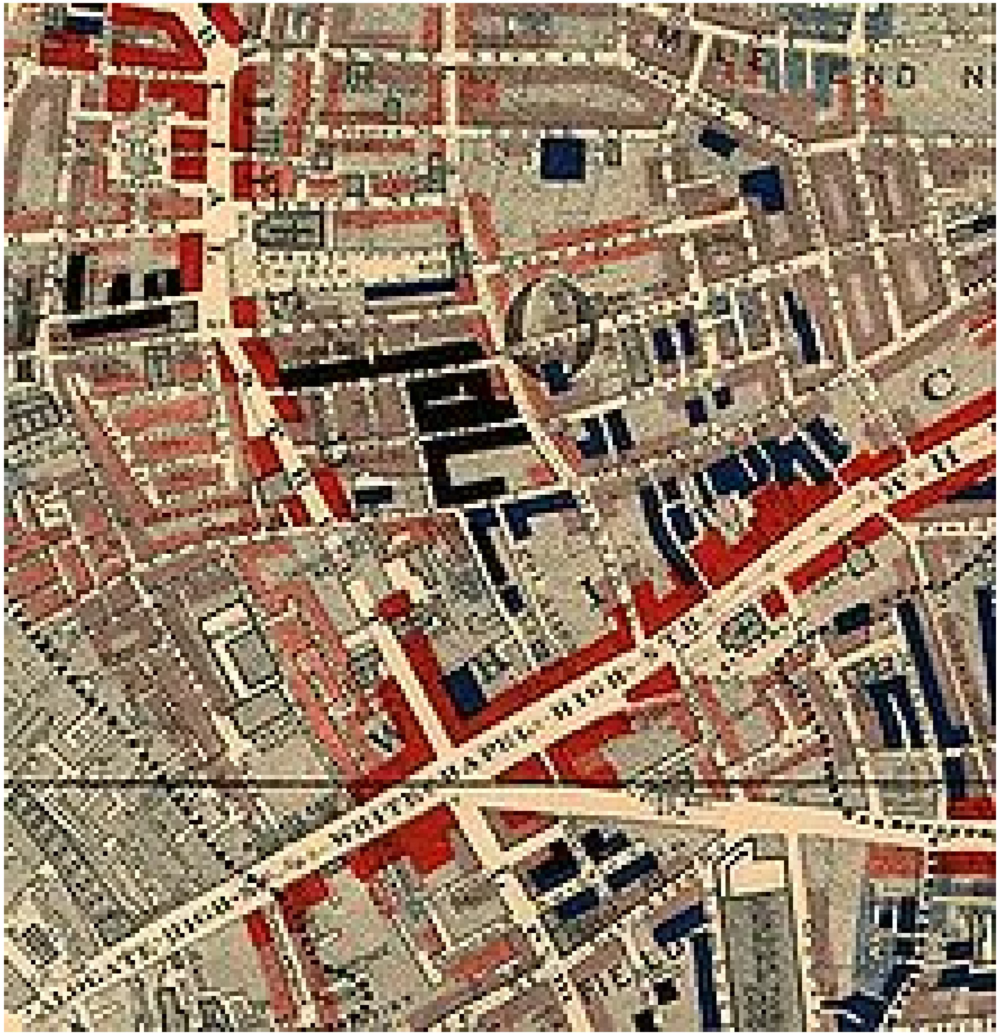
WILLIAM SMITH *and the*
BIRTH *of* MODERN GEOLOGY

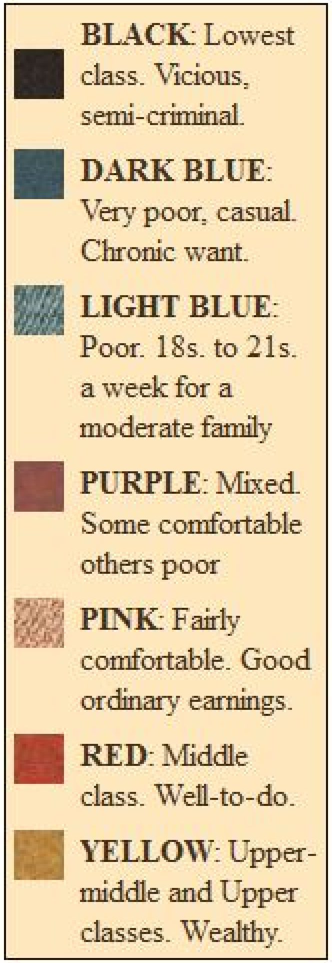
"Winchester brings Smith's struggle to life in clear and beautiful language."
—*NEW YORK TIMES BOOK REVIEW*

P.S.
INSIGHTS, INTERVIEWS & MORE...

Booth’s Atlas of London 1898-99

See: http://phone.booth.lse.ac.uk/





⬛ **BLACK**: Lowest class. Vicious, semi-criminal.

🟦 **DARK BLUE**: Very poor, casual. Chronic want.

▨ **LIGHT BLUE**: Poor. 18s. to 21s. a week for a moderate family

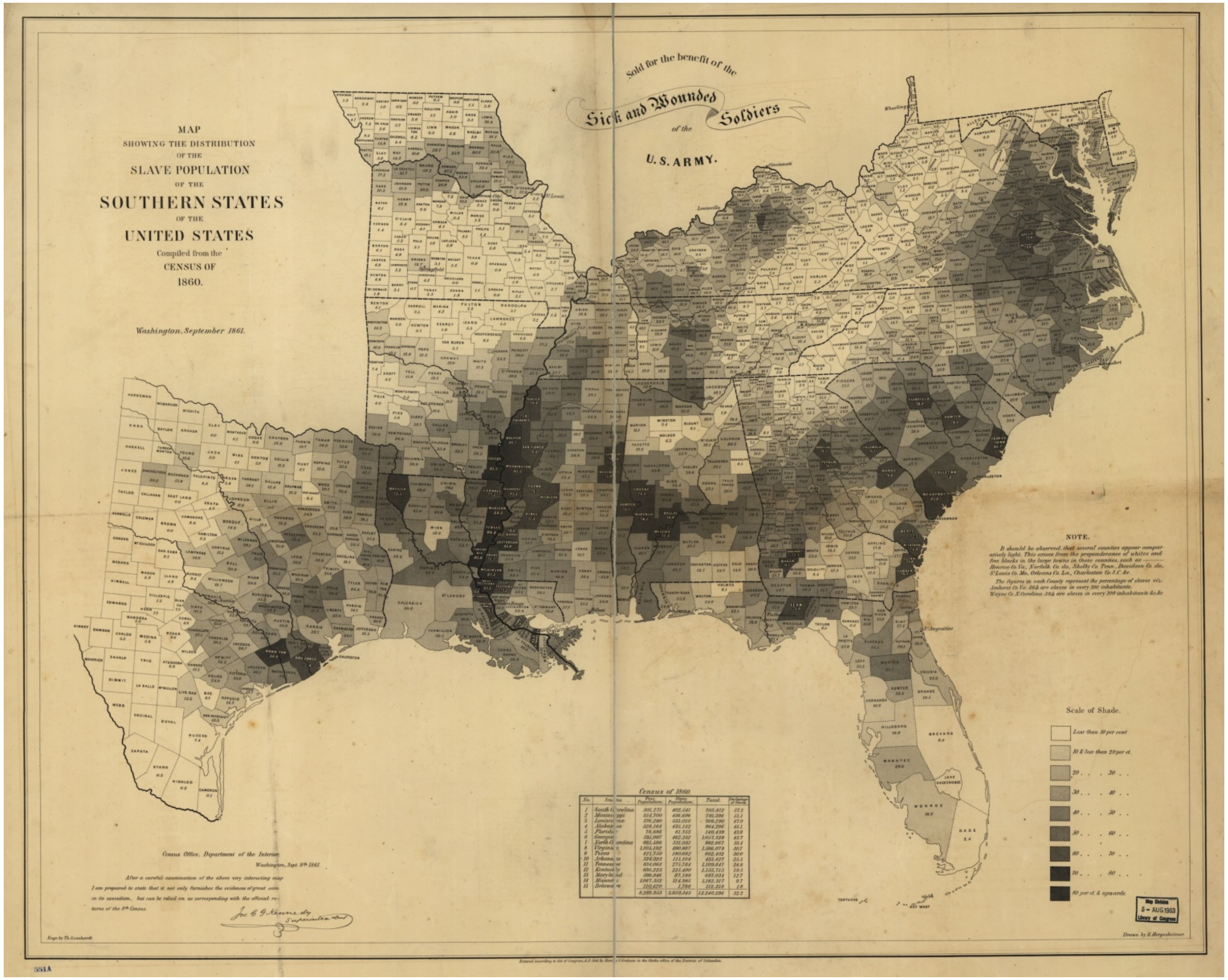
🟪 **PURPLE**: Mixed. Some comfortable others poor

▨ **PINK**: Fairly comfortable. Good ordinary earnings.

🟥 **RED**: Middle class. Well-to-do.

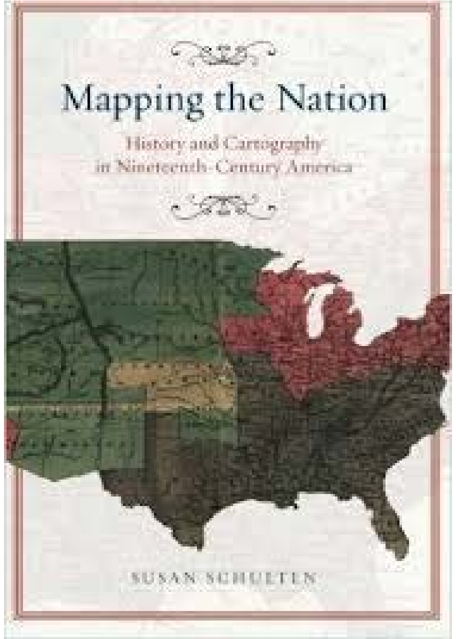
🟨 **YELLOW**: Upper-middle and Upper classes. Wealthy.

1860 Census Slavery Map

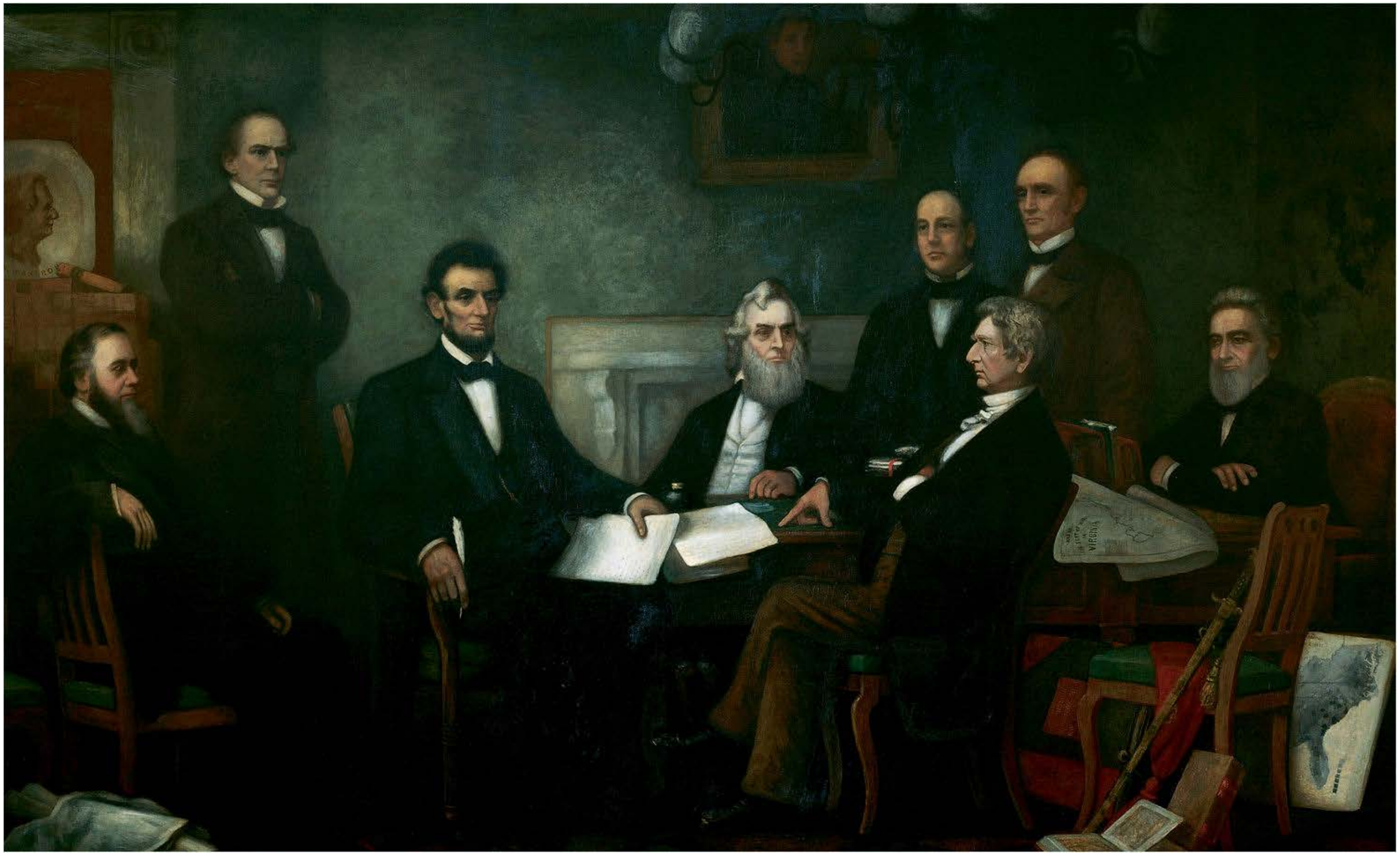

MAP
SHOWING THE DISTRIBUTION
OF THE
SLAVE POPULATION
OF THE
SOUTHERN STATES
OF THE
UNITED STATES
Compiled from the
CENSUS OF
1860.
Washington, September 1861.
Sold for the benefit of the
Sick and Wounded Soldiers
of the
U.S. ARMY.
NOTE.
Scale of Shade.
Census of 1860

Susan Schulten

Mapping the Nation: History and Cartography in Nineteenth-Century America


Mapping the Nation
History and Cartography in Nineteenth-Century America
SUSAN SCHULTEN

Francis Bicknell Carpenter (1864) “First Reading of the Emancipation Proclamation by President Lincoln”



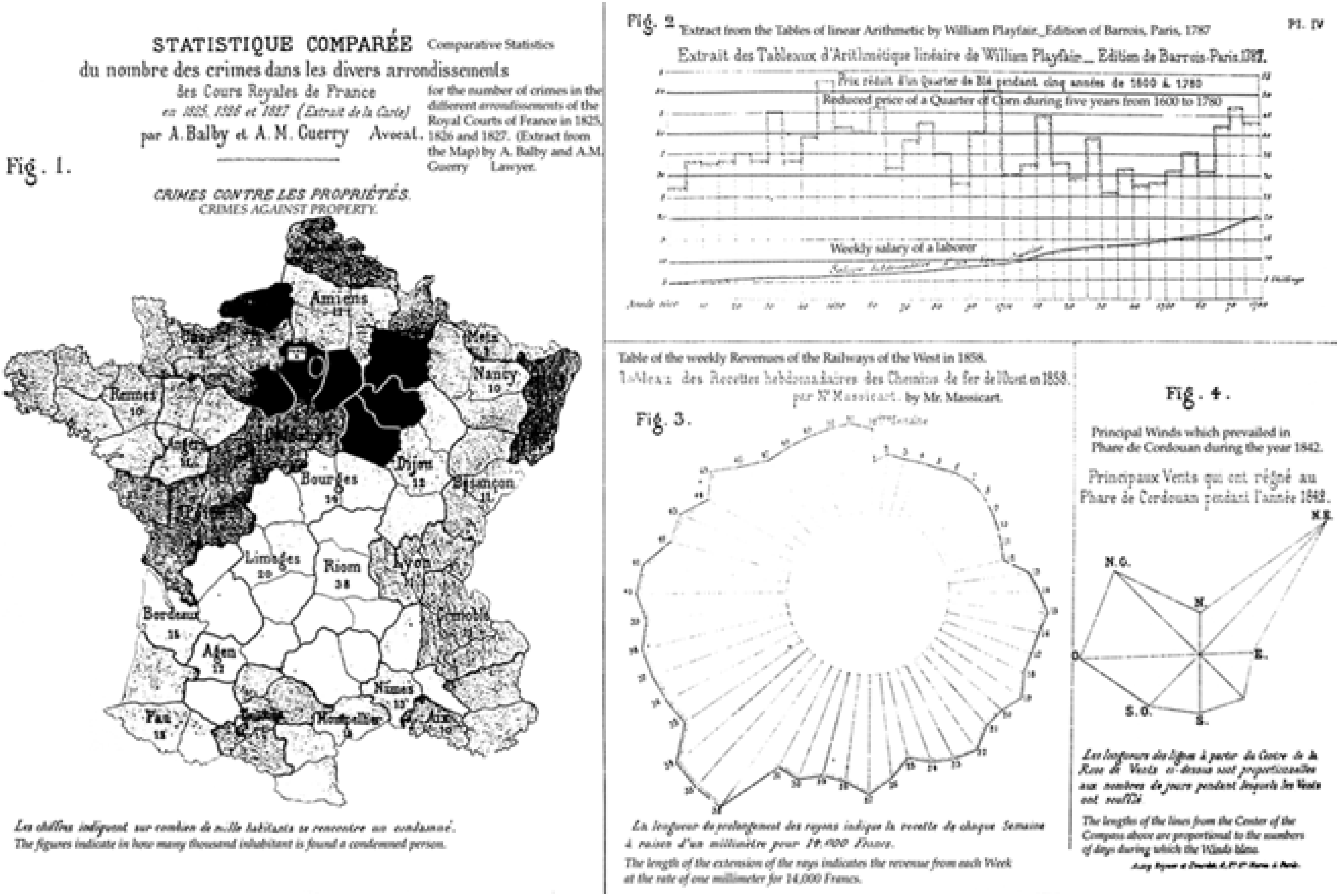


Fig. 1.

STATISTIQUE COMPARÉE du nombre des crimes dans les divers arrondissements des Cours Royales de France en 1825, 1826 et 1827 (Extrait de la Carte) par A. Balby et A. M. Guerry Avocat.

Comparative Statistics for the number of crimes in the different arrondissements of the Royal Courts of France in 1825, 1826 and 1827. (Extract from the Map) by A. Balby and A.M. Guerry Lawyer.

CRIMES CONTRE LES PROPRIÉTÉS.
CRIMES AGAINST PROPERTY.

Amiens
Metz
Nancy
10
Rennes
10
Angers
Bourges
Dijon
Besançon
Limoges
20
Riom
38
Lyon
Grenoble
Bordeaux
Agen
Nimes
Aix
Pau
Montpellier

Les chiffres indiquent sur combien de mille habitants se rencontre un condamné.
The figures indicate in how many thousand inhabitant is found a condemned person.

Fig. 2 Extract from the Tables of linear Arithmetic by William Playfair. Edition of Barrois, Paris, 1787

Pl. IV

Extrait des Tableaux d'Arithmétique linéaire de William Playfair. Edition de Barrois-Paris 1787.

Prix réduit d'un Quarter de Blé pendant cinq années de 1600 à 1780
Reduced price of a Quarter of Corn during five years from 1600 to 1780
Weekly salary of a laborer
Salaire hebdomadaire
Année 1600
1700
1780

Table of the weekly Revenues of the Railways of the West in 1858.
Tableau des Recettes hebdomadaires des Chemins de fer de l'Ouest en 1858.
par Mr Massicart. by Mr. Massicart.

Fig. 3.

La longueur du prolongement des rayons indique la recette de chaque Semaine à raison d'un millimètre pour 14.000 Francs.

The length of the extension of the rays indicates the revenue from each Week at the rate of one millimeter for 14,000 Francs.

Fig. 4.

Principal Winds which prevailed in Phare de Cordouan during the year 1842.

Principaux Vents qui ont régné au Phare de Cordouan pendant l'année 1842.

N.E.
N.O.
N.
O.
E.
S.O.
S.

Les longueurs des lignes à partir du Centre de la Rose de Vents ci-dessus sont proportionnelles aux nombres de jours pendant lesquels les Vents ont soufflé.

The lengths of the lines from the Center of the Compass above are proportional to the numbers of days during which the Winds blew.

Infographic Émile Levasseur (1828-1911), France

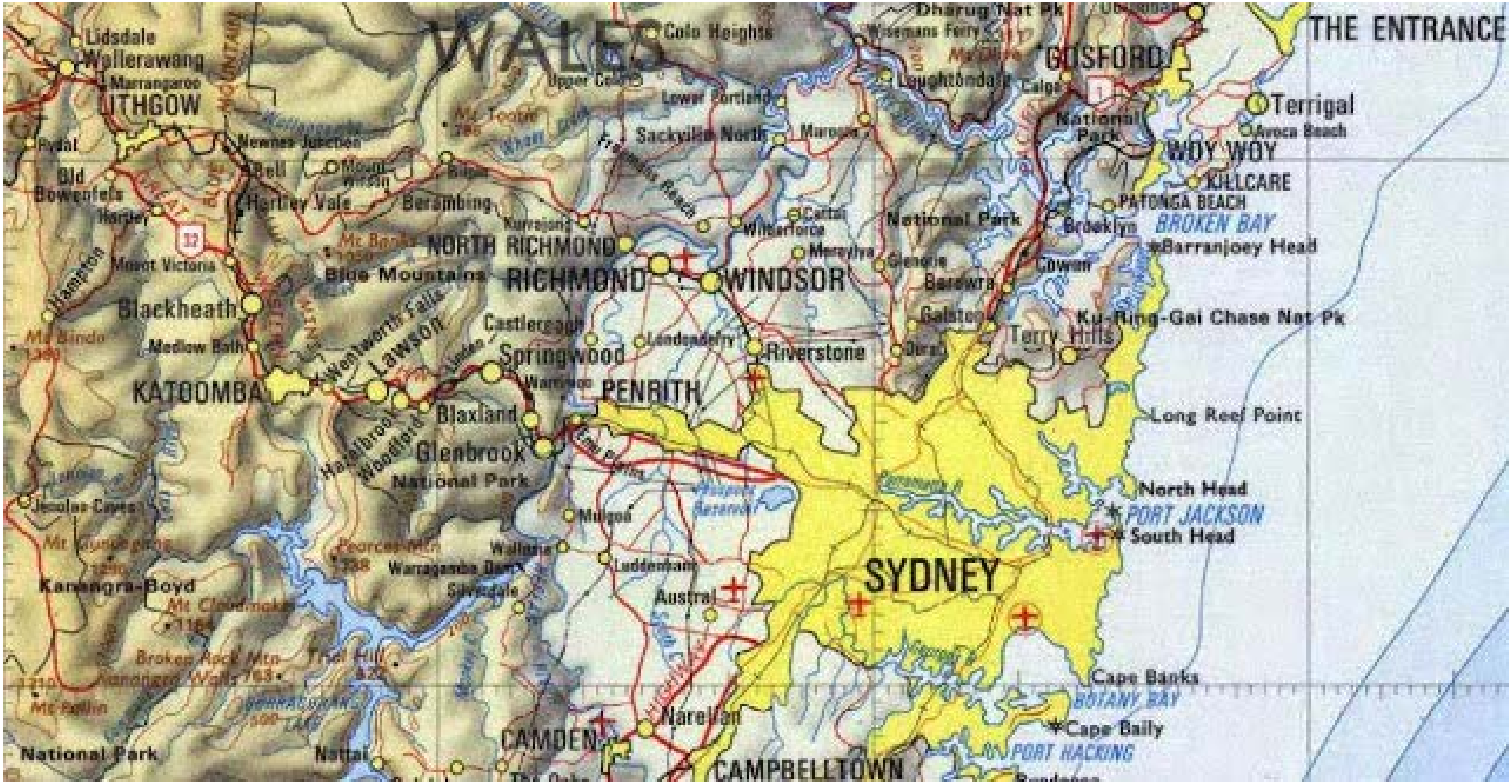
Since the mid-19th Century

- Rise of professional societies
- Attempts at symbol standardization
- Widespread use in science
- Increased use in government, especially for social issues e.g. public health
- Origins of computing in Hollerith cards
- Ideas appear in textbooks, comparisons made

International Map of the World Millionth map

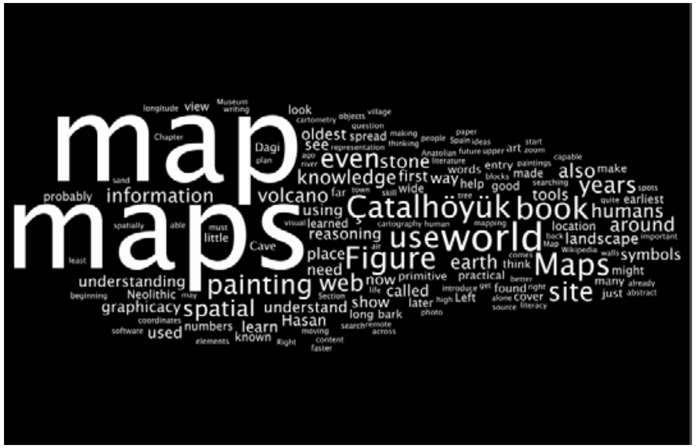
- Idea suggested by German Geographer Albrecht Penck (1858-1945) at the Fifth International Geographical Conference in 1891.
- Project begun in 1913 to create a complete map of the world according to internationally agreed standards
- Interrupted by WW1
- Central Bureau of the Map of the World established at the Ordnance Survey in London
- Archives partly destroyed by WWII German bombing
- After the Second World War, the United Nations took over the project, but interest waned
- Only 800 to 1,000 of 2,500 planned maps were completed.
- Officially abandoned in the early 1980s

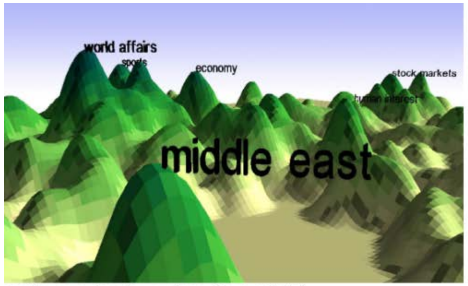
Australia: Maps coded using grid


WALES
Dharug Nat Pk
THE ENTRANCE
Lidsdale
Wallerawang
Marrangaroo
LITHGOW
Colo Heights
Wisemans Ferry
GOSFORD
Upper Colo
Lower Portland
Laughtondale
Calga
Terrigal
Avoca Beach
National Park
Sackville North
Maroota
Newnes Junction
Bell
Mount Wilson
Bilpin
Berambing
Hartley Vale
Bowenfels
Hartley
Pydal
WOY WOY
KILLCARE
PATONGA BEACH
BROKEN BAY
Brooklyn
Barranjoey Head
Cattai
Wilberforce
National Park
NORTH RICHMOND
RICHMOND
WINDSOR
Blue Mountains
Mount Victoria
Kurrajong
Mt Banks
Freemans Reach
Maraylya
Glenorie
Berowra
Cowan
Blackheath
Medlow Bath
Castlereagh
Londonderry
Riverstone
Galston
Dural
Terry Hills
Ku-Ring-Gai Chase Nat Pk
Wentworth Falls
Lawson
Linden
Springwood
Warrimoo
PENRITH
KATOOMBA
Blaxland
Glenbrook
Hazelbrook
Woodford
National Park
Long Reef Point
North Head
PORT JACKSON
South Head
Jenolan Caves
Mulgoa
Wallacia
Warragamba Dam
Silverdale
Luddenham
Austral
SYDNEY
Kanangra-Boyd
Mt Cloudmaker
Broken Rock Mtn
Cape Banks
BOTANY BAY
Cape Baily
PORT HACKING
Narellan
CAMDEN
CAMPBELLTOWN
National Park
Nattai
The Oaks

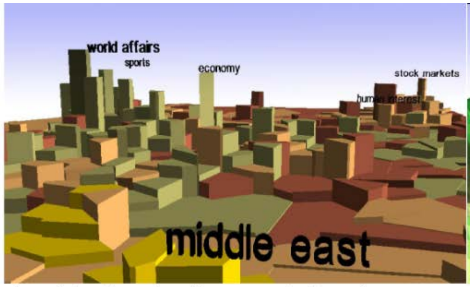
Rediscovery in cartography

- Scientific visualization
- GeoViz
- InfoViz
- Spatialization
- Data mining
- Network theory

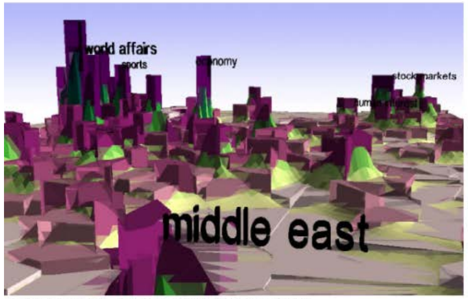

map
maps
longitude
view
Museum
writing
look
cartometry
objects
village
question
Chapter
oldest
spread
making
people
paper
see
representation
thinking
Spain
ideas
start
Dagi
art
zoom
ago
Anatolian
future
upper
plan
river
even
stone
literature
capable
sand
knowledge
first
way
words
entry
paintings
also
make
probably
information
volcano
far
town
skill
wide
help
blocks
made
searching
years
spots
good
tree
tools
quite
earliest
using
Çatalhöyük
book
humans
spatially
able
must
visual
learned
cartography
human
mapping
location
around
little
reasoning
useworld
back
landscape
important
Map
Cave
air
comes
Wikipedia
walls
symbols
least
place
Figure
earth
think
Maps
need
might
understanding
primitive
practical
better
many
already
painting
web
now
beginning
Neolithic
may
life
called
introduce
get
found
right
site
just
abstract
Section
high
Left
alone
cover
graphicacy
spatial
understand
show
later
source
literacy
long
bark
photo
coordinates
Hasan
numbers
learn
search
remote
software
used
known
moving
across
elements
Right
content
faster


world affairs
sports
economy
stock markets
human interest
middle east

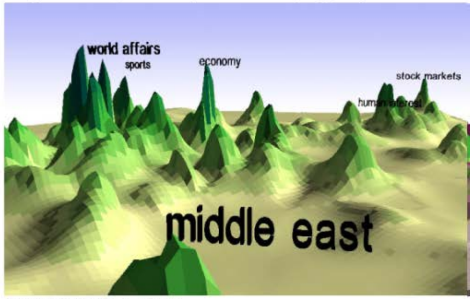
continuous density surface (from points)


world affairs
sports
economy
stock markets
human interest
middle east

stepped density surface (from voronoi polygons)

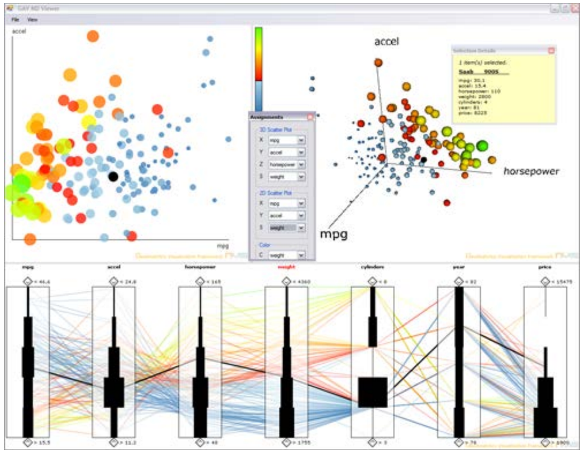

world affairs
sports
stock markets
middle east

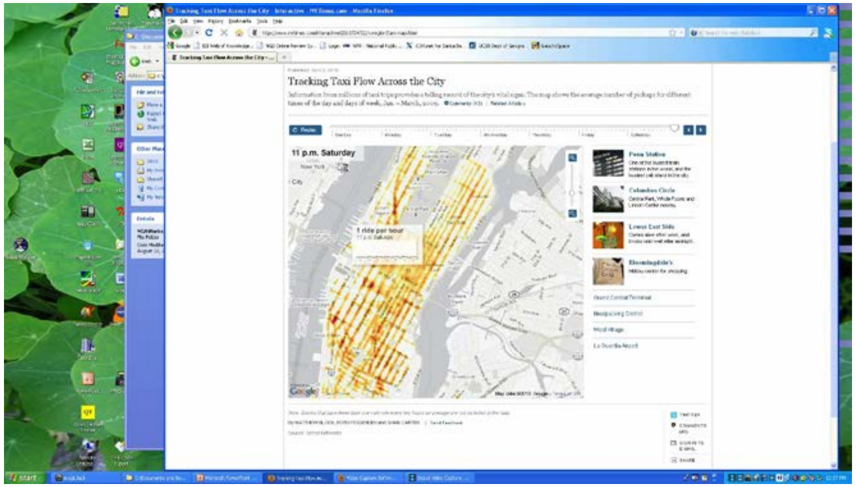
pycnophylactic reallocation (Tobler, 1979)

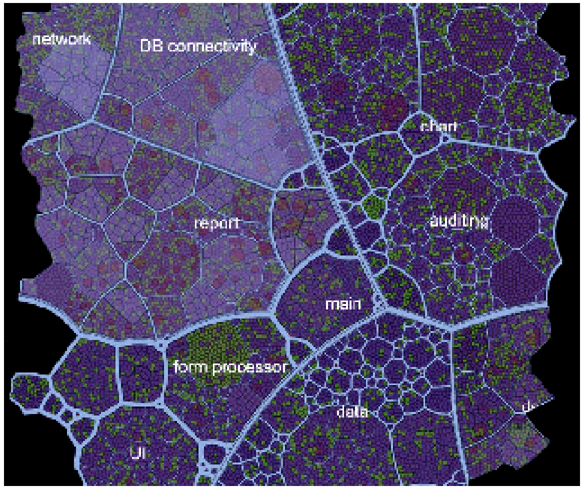

world affairs
sports
economy
stock markets
human interest
middle east

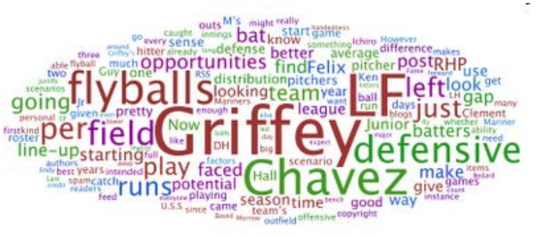
pycnophylactic surface

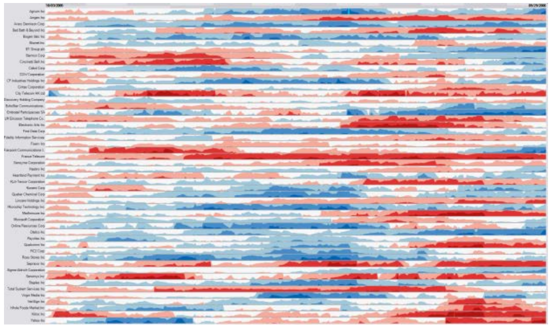
Visual analytics:
the science of analytic reasoning, facilitated by interactive visual interfaces.


accel
horsepower
mpg


Tracking Taxi Flow Across the City
11 p.m. Saturday

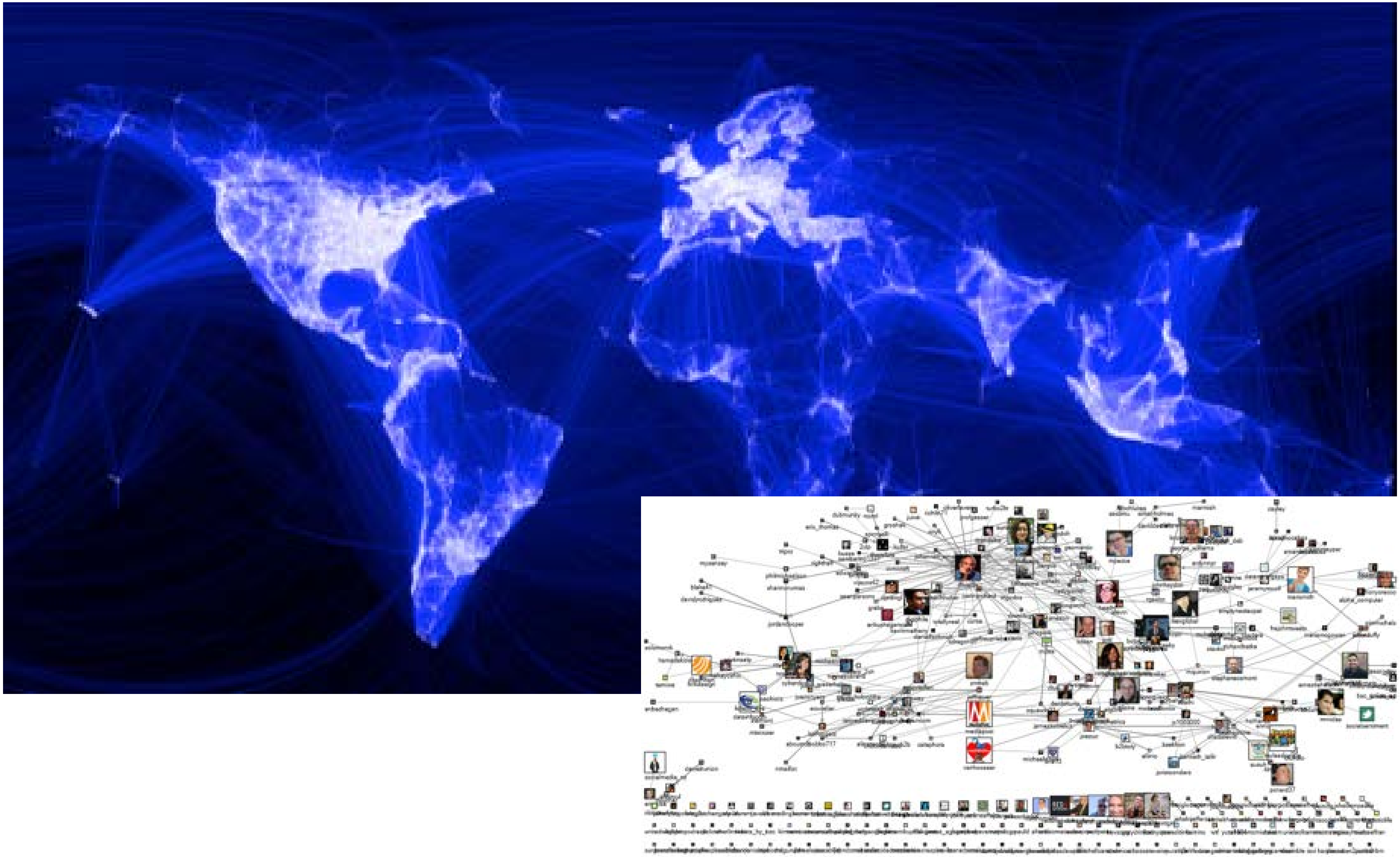

network
DB connectivity
chart
report
auditing
main
form processor
data
UI


Griffey
Chavez
flyballs
LF
defensive
perfield
left
just
play
runs



- http://vita.itn.liu.se/gav/gav/1.174303/GAV-Demo.png
- http://www.natural-environment.com/images/blog/space_junk_2.jpg
- http://kottkegae.appspot.com/images/taxi-flow-nyc.jpg
- http://ajperez.net/Images/InfoViz_small2.gif
- http://2.bp.blogspot.com/_InzW19CnouI/SaMDNpGClZI/AAAAAAAAAA8/3DGaPvuW7-Q/s1600-h/GriffeyWordle.png
- http://www.perceptualedge.com/blog/wp-content/uploads/2009/01/horizon-graph-large.jpg

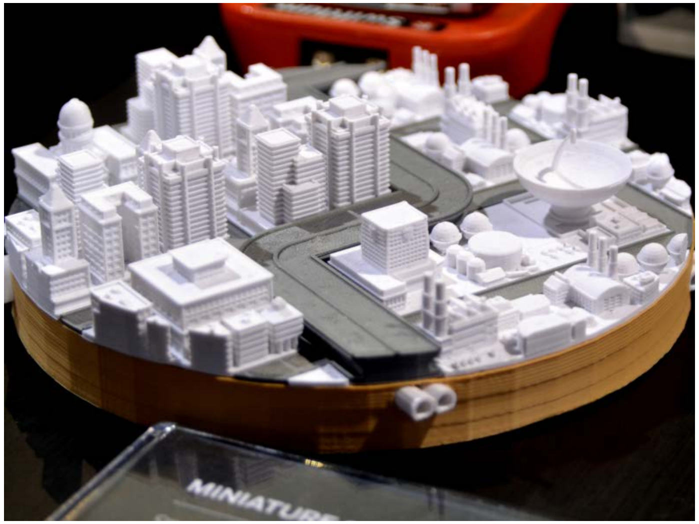
Facebook links



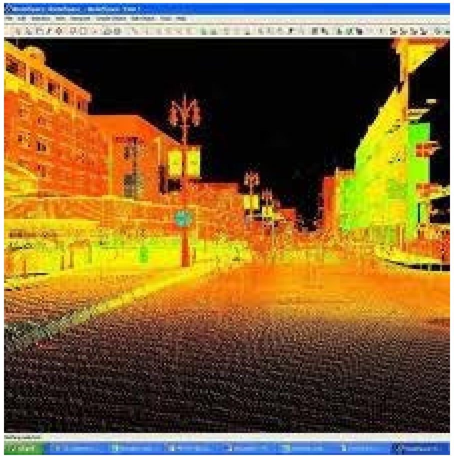
The Allosphere

3D Printing/Laser scanning

OBJET1000
OBJET



i-site
3D Laser Imaging



Summary

- Medieval origins of simple statistical graphics
- Close link to astronomy
- More rediscovery, e.g. Descartes
- Most modern methods have origins from 17th-19th century
- Playfair an important pioneer
- Berghaus pioneered rise of thematic Atlas
- Rediscovery as visual analytics/geovisualization, but far better tools!