EDWARD R. TUFTE

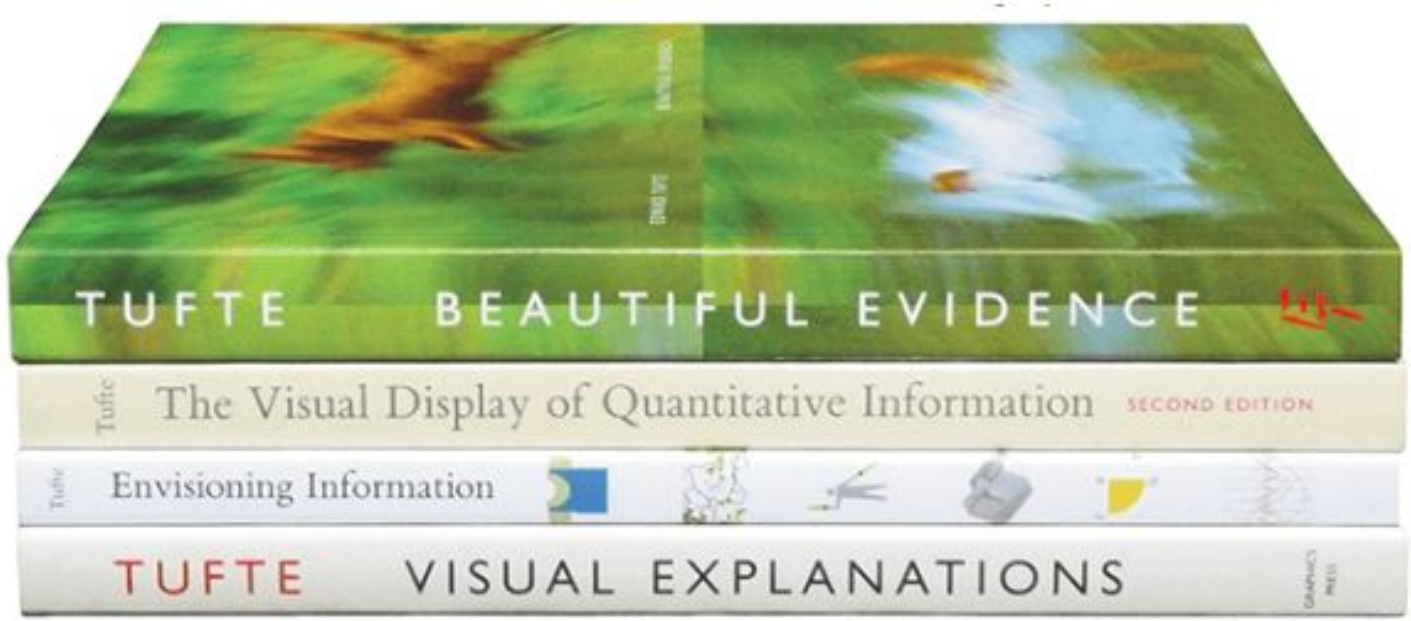
DATA VISUALIZATION PIONEER

STATISTICIAN

PROFESSOR

SCULPTOR

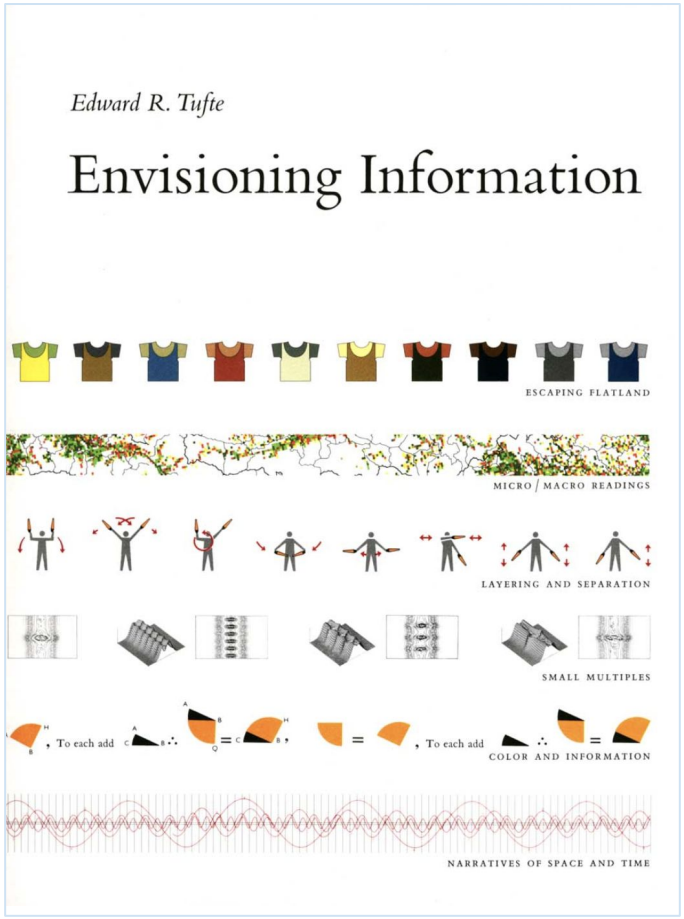
WRITER



BACKGROUND

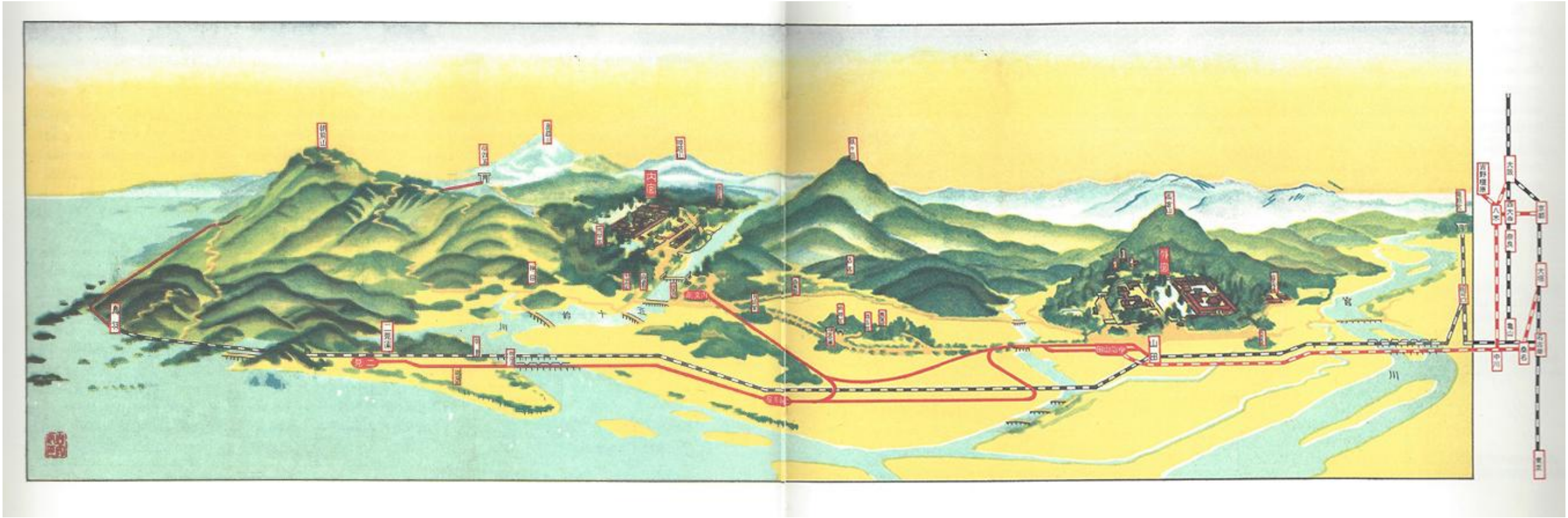
Born 1942
Professor Emeritus at of Political Science, Statistics, and Computer Science at Yale

Education:
Statistician / Stanford / B.A., M.A.
Political Science / Ph.D Yale



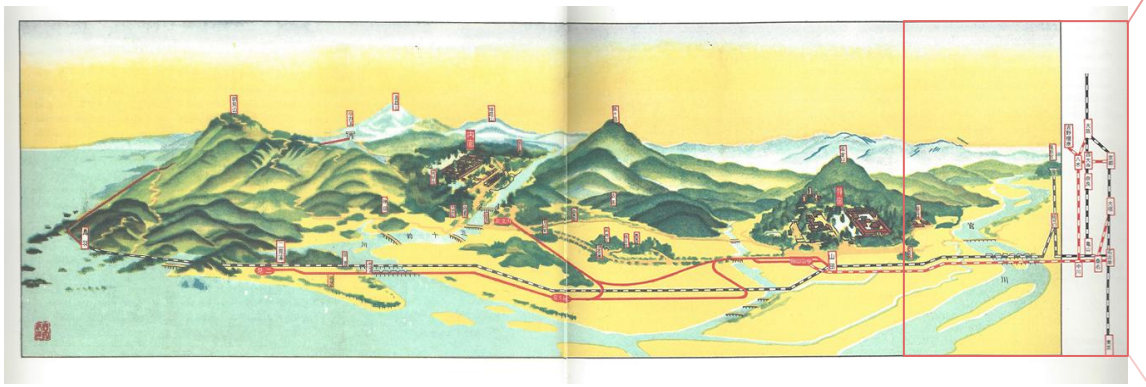
https://www.edwardtufte.com/tufte/

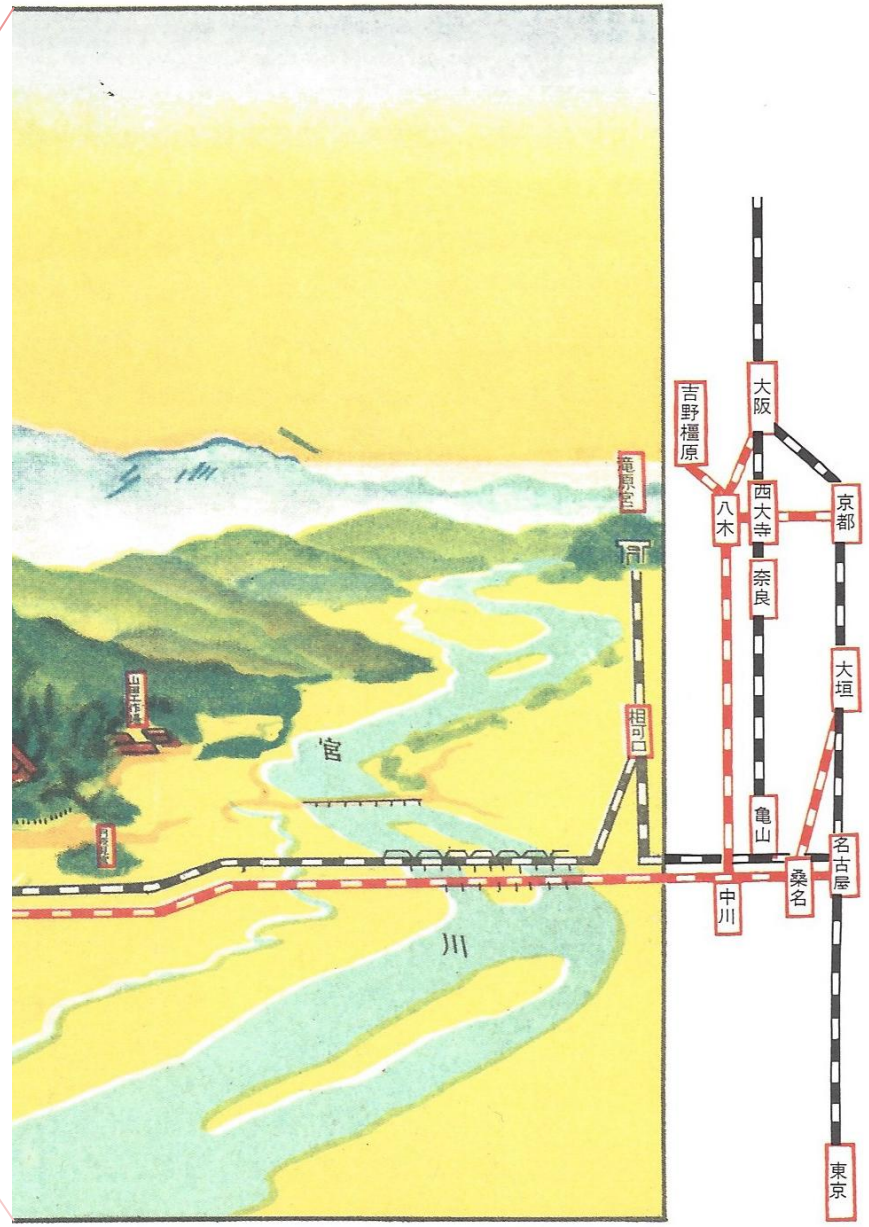
ESCAPING FLATLAND



Guide for Visitors to Ise Shrine (Ise, Japan; no date; published between October 1948 and April 1954, according to The Library, Ise Shrine, Mie Prefecture).

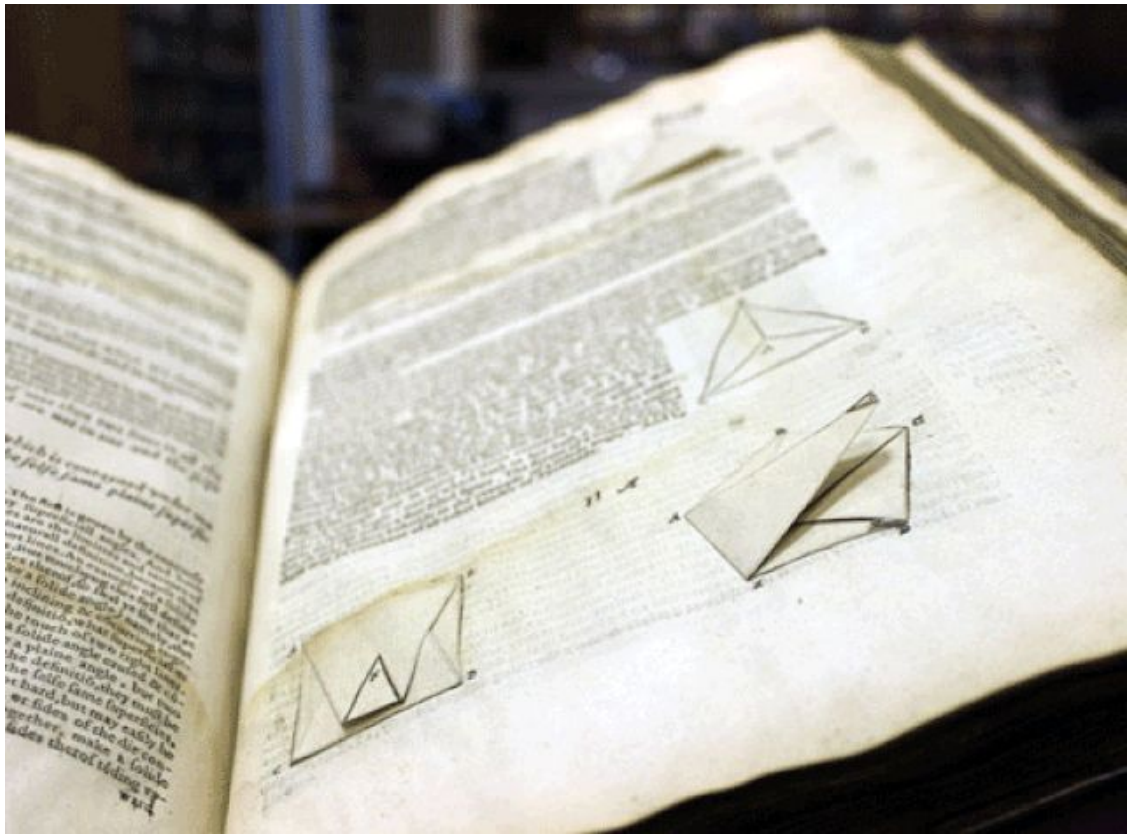
Methods to increase the number of dimensions that can be represented on plane surfaces, and increasing data density.





Guide for Visitors to Ise Shrine (Ise, Japan; no date; published between October 1948 and April 1954, according to The Library, Ise Shrine, Mie Prefecture).

Extra-dimensional Models



Euclid, The Elements of Geometrie (London, 1570).

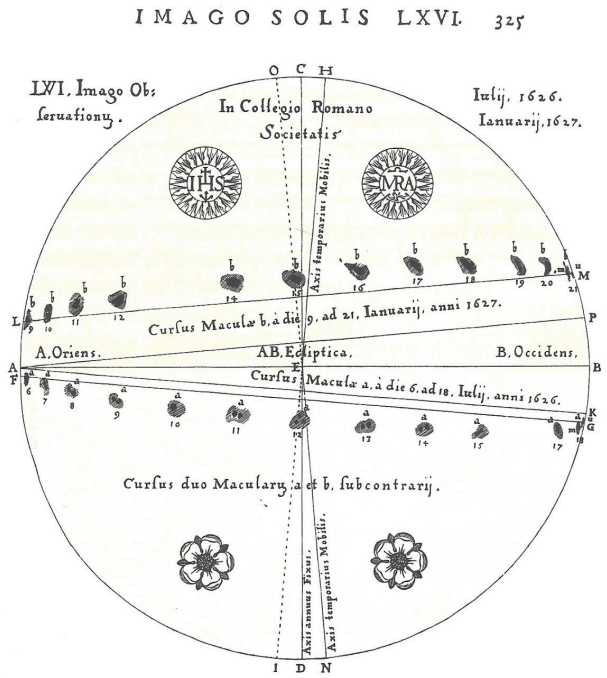
> **“The future grows out of studying great works of the past.”**
>
> -Edward Tufte

Stereoscopic Illustrations

Color stereopair of Bonaduz, Canton of Grisons, Switzerland, October, 1975, photographs taken with Wild Leitz aerial camera RCIO. Scale about 1:11,000.

[6] Stereoscopic viewers will assist in obtaining three-dimensional images. The effects can be seen without optical devices by some, however. The views here are arranged for the *wide-eyed* or *pie-eyed* method of viewing stereograms; those using the popular *cross-eyed* method will see sunken mountains and raised rivers. See Thomas Avery and Graydon Berlin, *Interpretation of Aerial Photographs* (Minneapolis, 4th edition, 1985), pp. 25-90.

cumbersome. Christopher Scheiner's *Rosa Ursina sive Sol*, completed in 1630, arrays the apparent path of spots across a stationary disk,

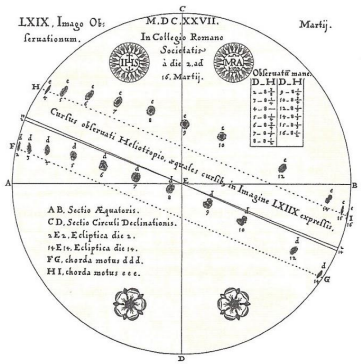


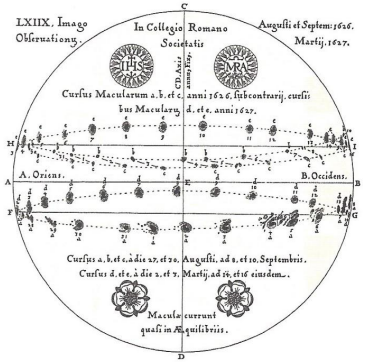
an ingenious method for tracking simple sunspot structures but tending to jumble up complex data. Symbols of Scheiner's patron and religious order decorate those areas without spots in a hundred such diagrams, a reminder of Jonathan Swift's indictment of 17th-century cartographers who substituted embellishment for data:

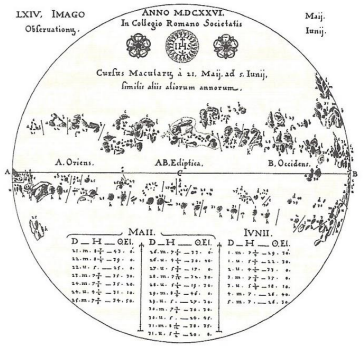
> *With savage pictures fill their gaps,*
> *And o'er unhabitable downs,*
> *Place elephants for want of towns*

These symbols, similar to a modern trademark or logotype, may have served as a seal of validation for the readers of 1630. Today they appear somewhat strident, contradicting nature's rich pattern.

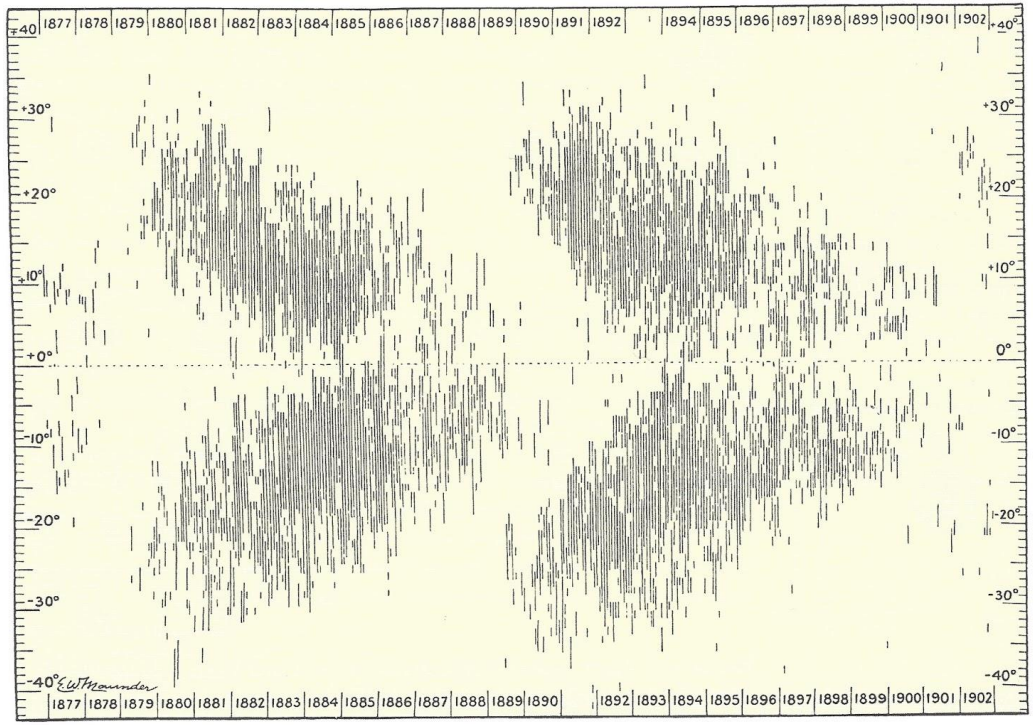
Sol (Bracciani, 1626–1630), 317, 325, 333, and 339.







Continuous Observation

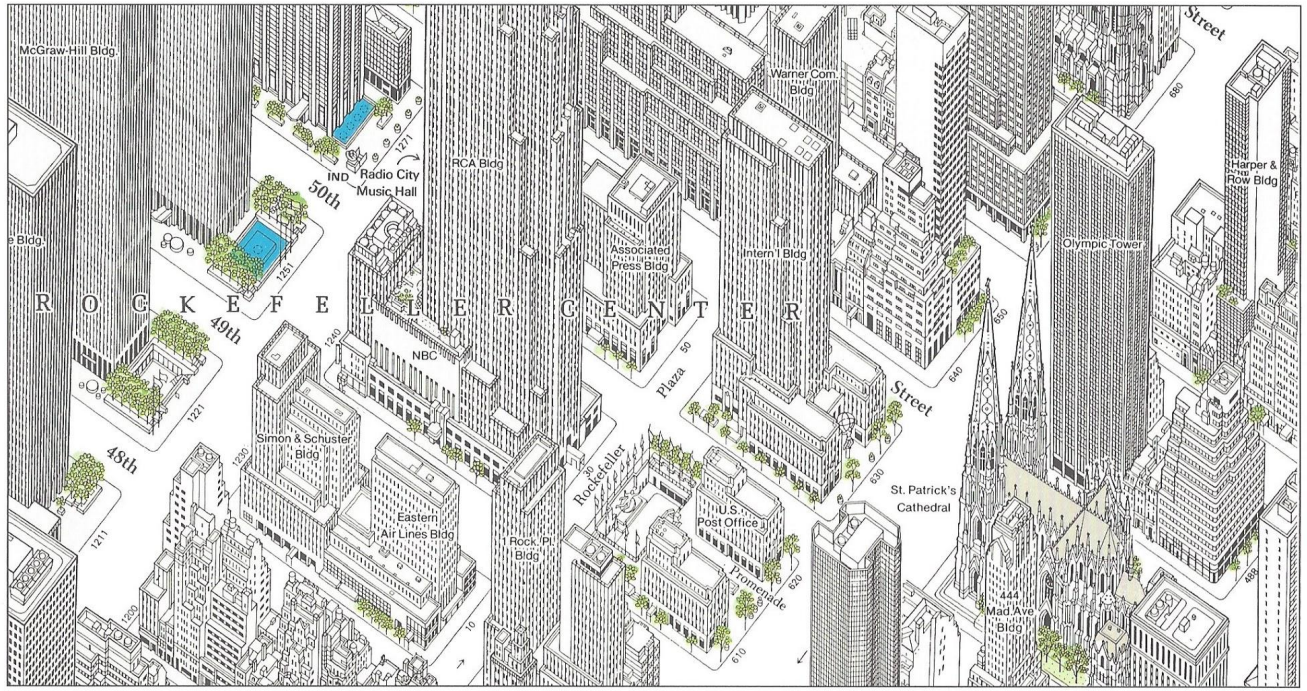


E.W. Maunder, "Notes on the Distrbution of Sun-Spots in Heliographic Latitude, 1874, to 1902," *Royal Astronomical Society Monthly Notices*, 64 (1904).

MACRO/MICRO READINGS

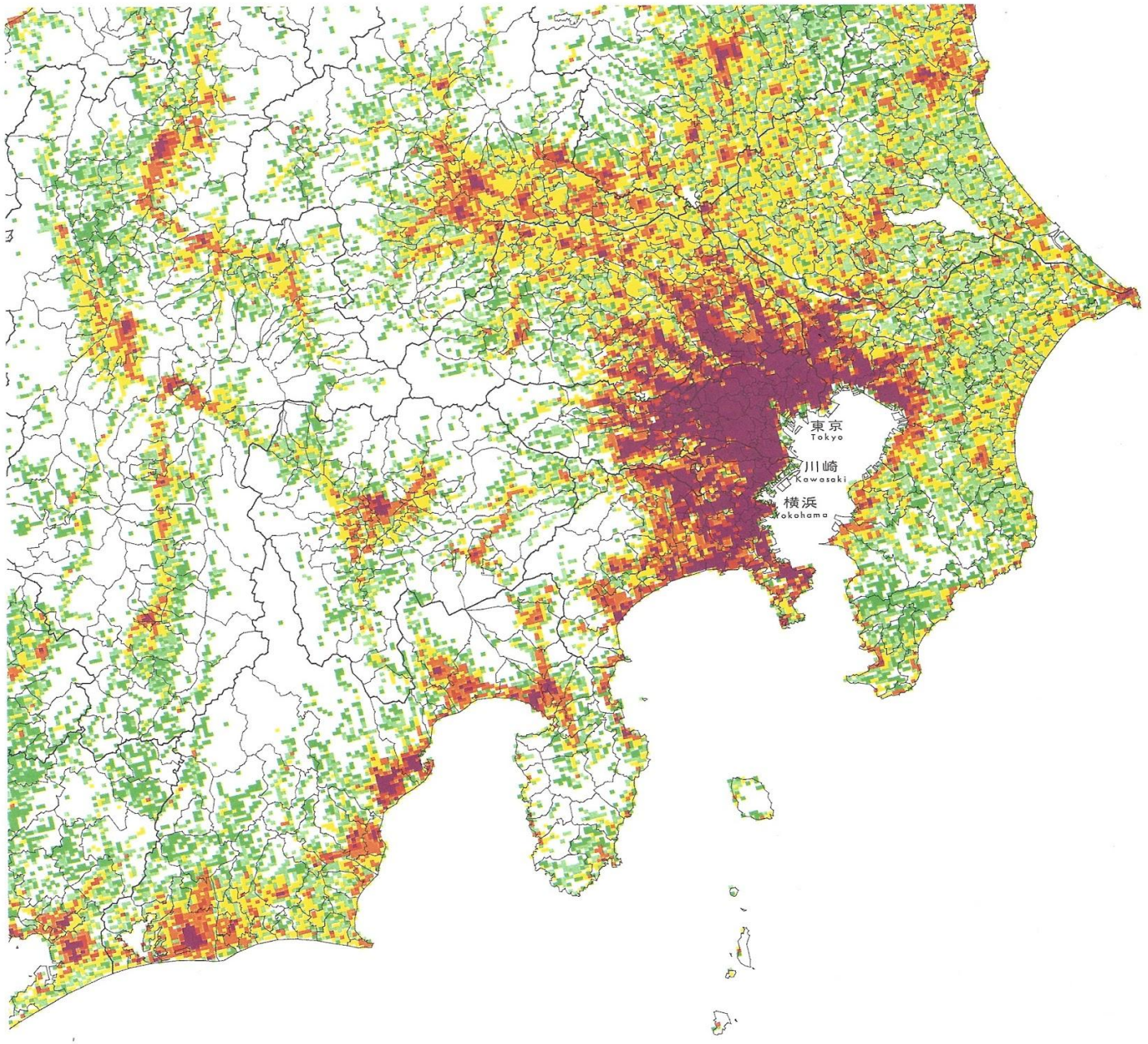
"A most unconventional design strategy is revealed: *to clarify, add detail*."

-Edward Tufte



The Isometric Map of Midtown Manhattan, 1989. The Manhattan Map Company.

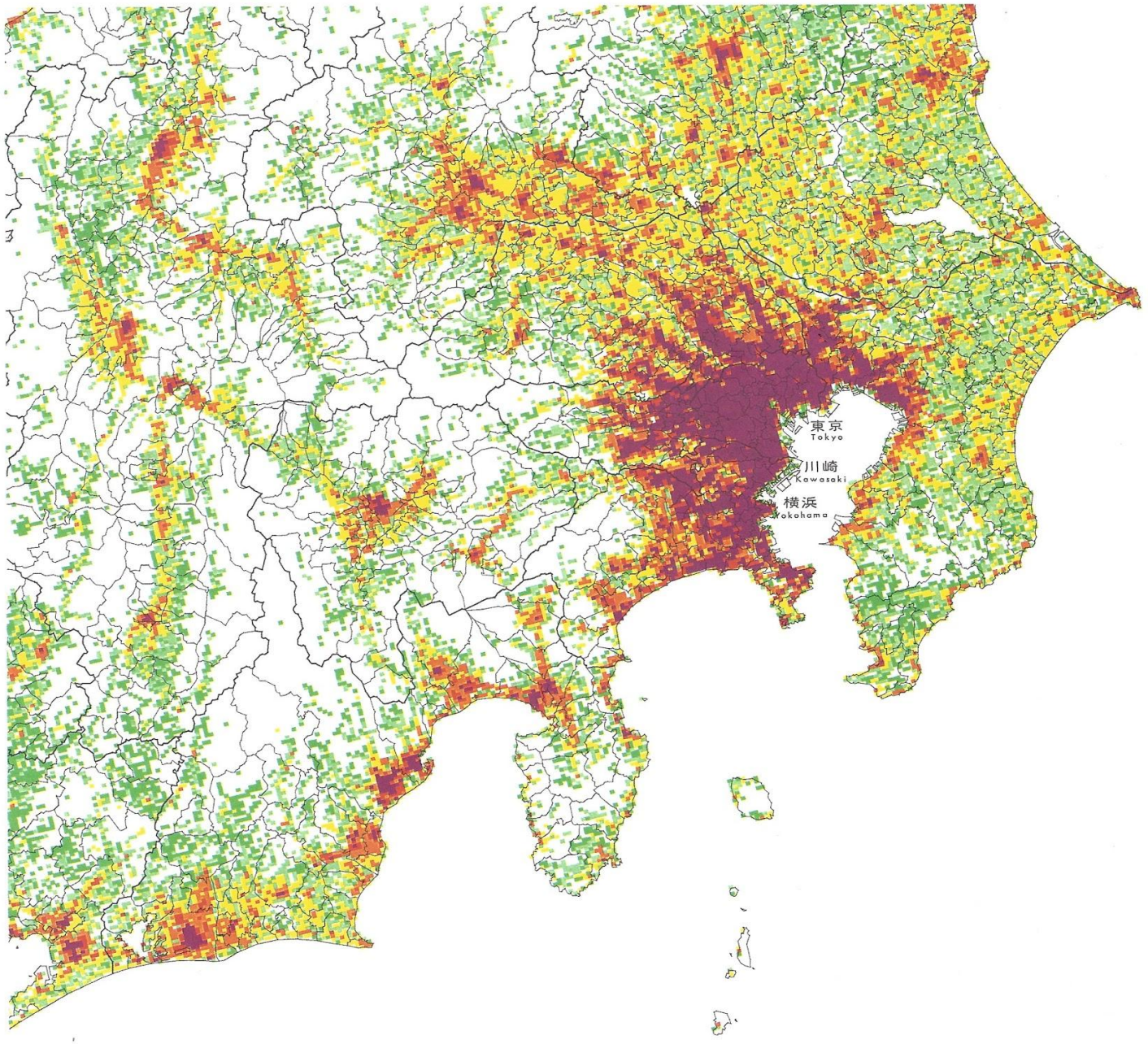
Mesh Maps of 379,000 Equal Sized Units



Statistics Bureau, Prime Minister's Office,
Statistical Maps on Grid Square Basis:
The 1980 Population Census Results
(Tokyo, 1985).

Mesh Maps of 379,000 Equal Sized Units

What about simplifying and boiling down the information overload?

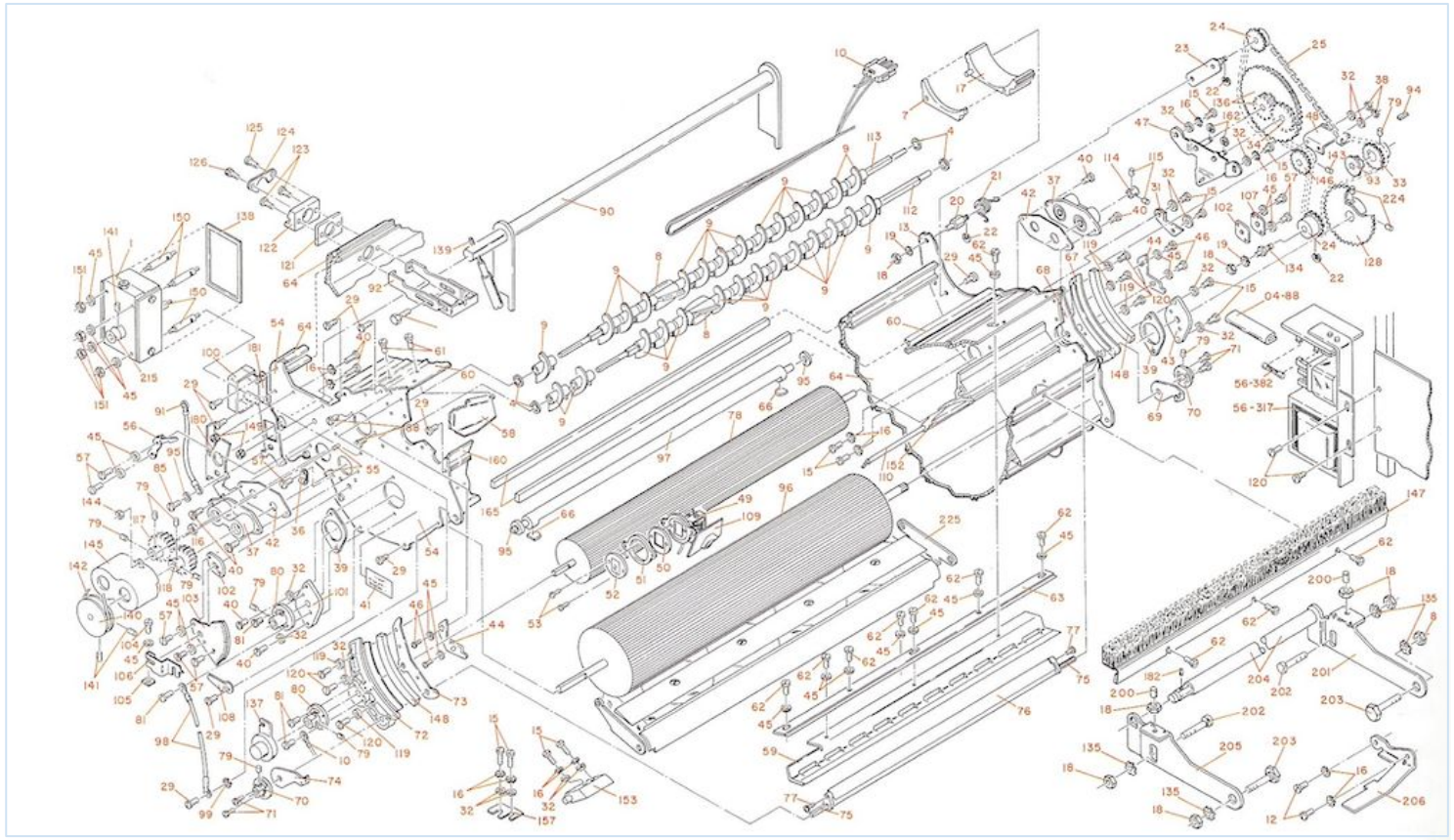


Statistics Bureau, Prime Minister's Office,
Statistical Maps on Grid Square Basis:
The 1980 Population Census Results
(Tokyo, 1985).

“Clutter and confusion are failures of design, not attributes of information.”

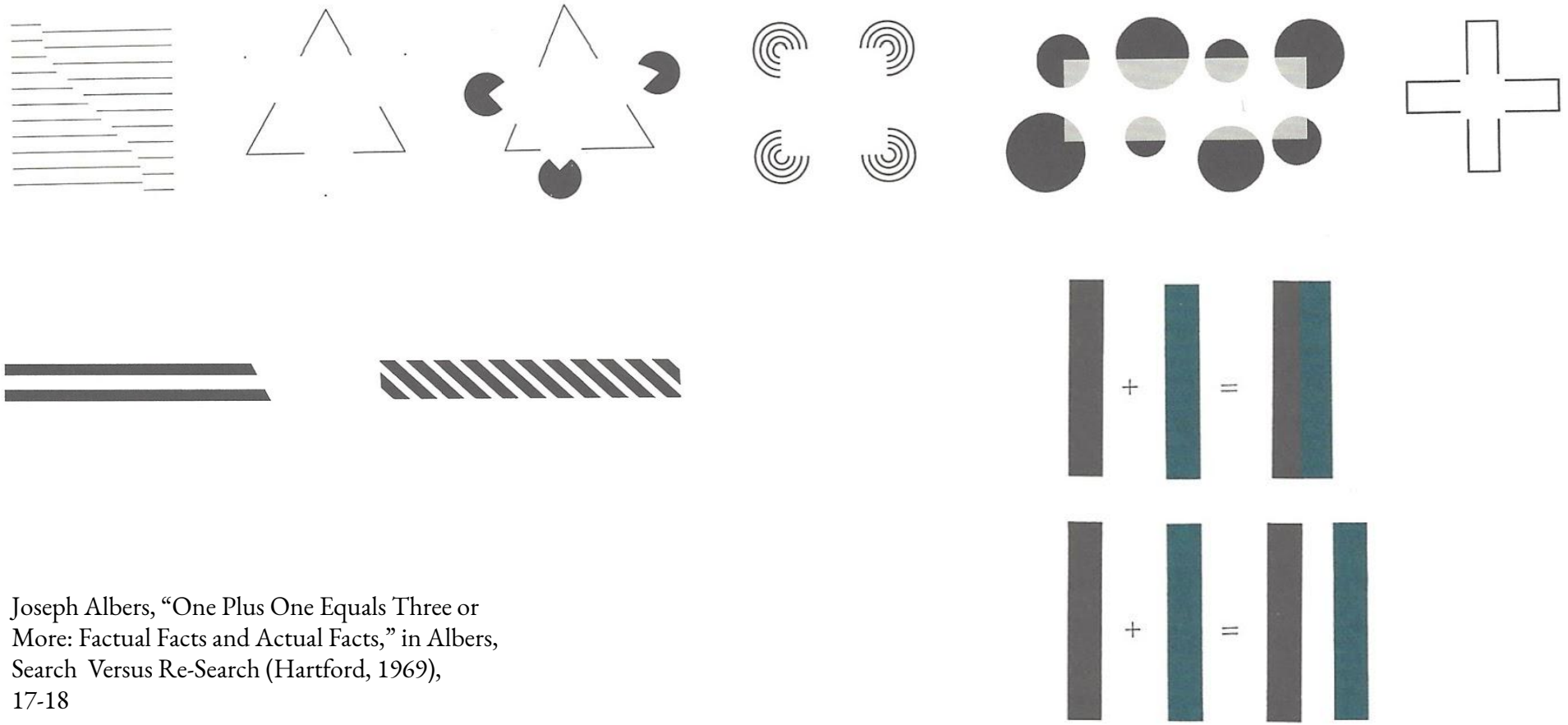
-Edward Tufte

LAYERING AND SEPARATION



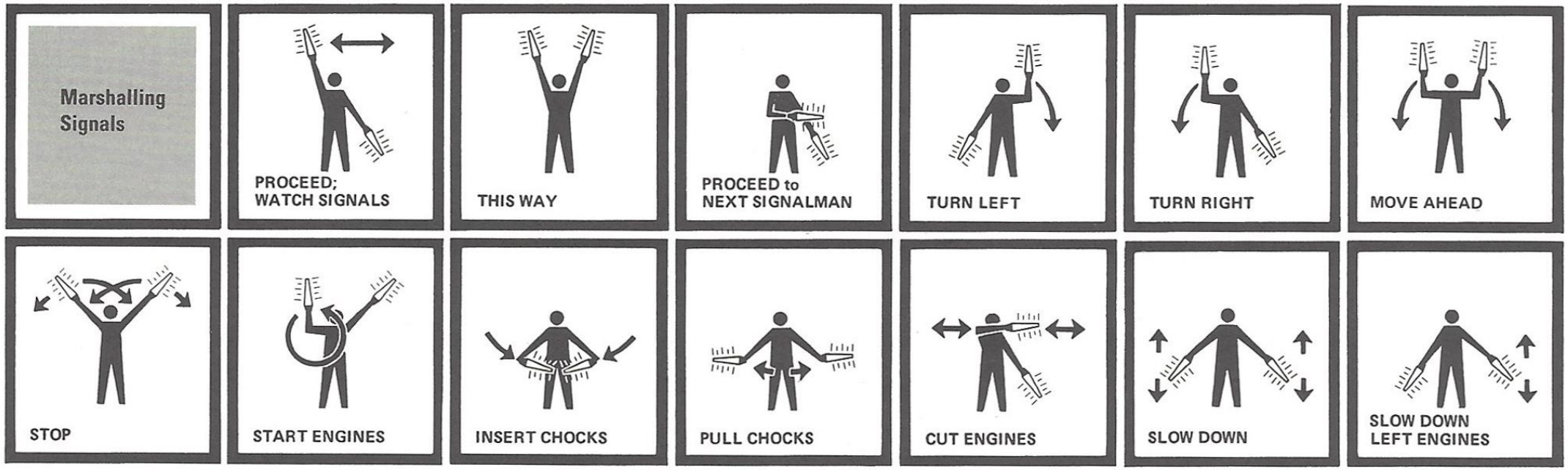
IBM Series III Copier/Duplicator, Adjustment Parts Manual (Boulder, Colorado, 1976), 101. Drawn by Gary E. Graham.

1 + 1 = 3 or More



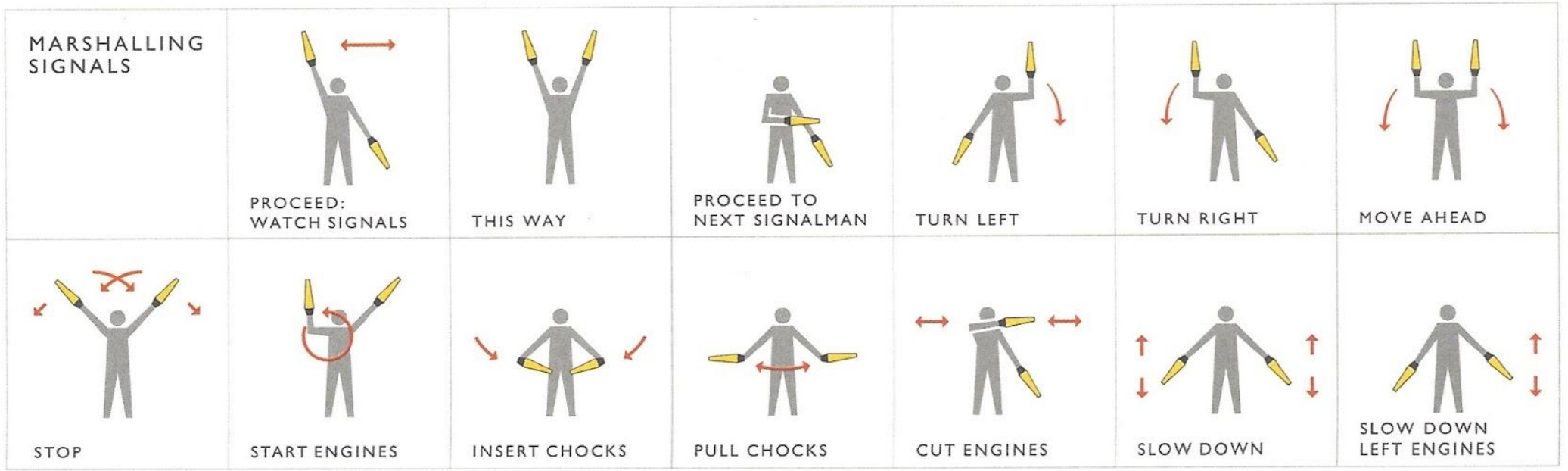
Joseph Albers, “One Plus One Equals Three or More: Factual Facts and Actual Facts,” in Albers, Search Versus Re-Search (Hartford, 1969), 17-18

Escaping the information prison of 1 + 1 = 3 clutter



Eduard Imhof, Cartographic Relief Presentation (Berlin, 1982) edited and translated by H.J. Steward from Imhof's Kartographische Geländedarsellung (Berlin, 1965), 72.

Escaping the information prison of ~~1 + 1 = 3 clutter~~

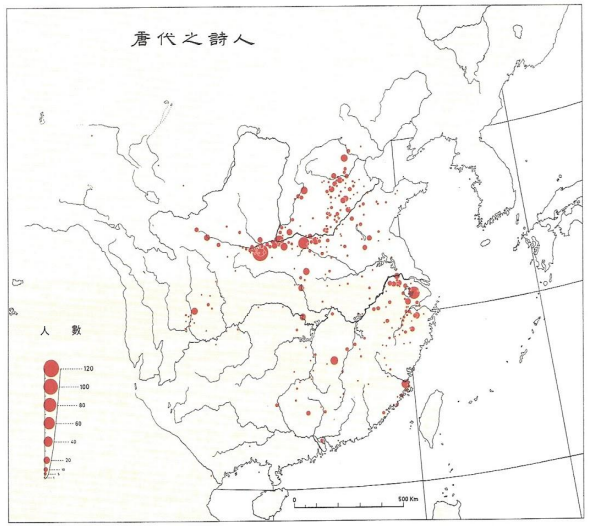


Eduard Imhof, Cartographic Relief Presentation (Berlin, 1982) edited and translated by H.J. Steward from Imhof's Kartographische Geländedarsellung (Berlin, 1965), 72.

SMALL MULTIPLES

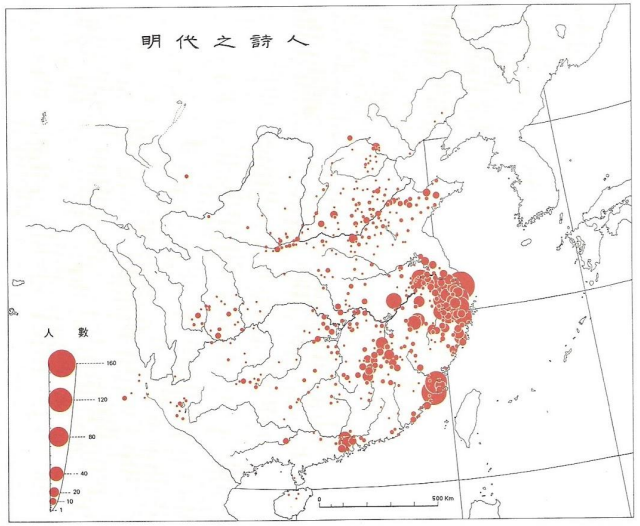
Redrawn from Yumi Takahashi and Ikuyo Shibukawa, Color Coordination (Tokyo, 1985).

Compared to What?

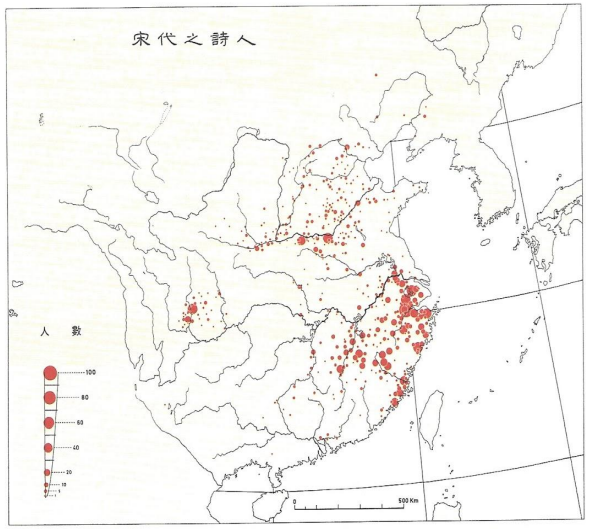


Redrawn from Chen Cheng-Siang, *An Historical and Cultural Atlas of Chin* (Tokyo, 1981), maps 36, 50, 62, and 82.

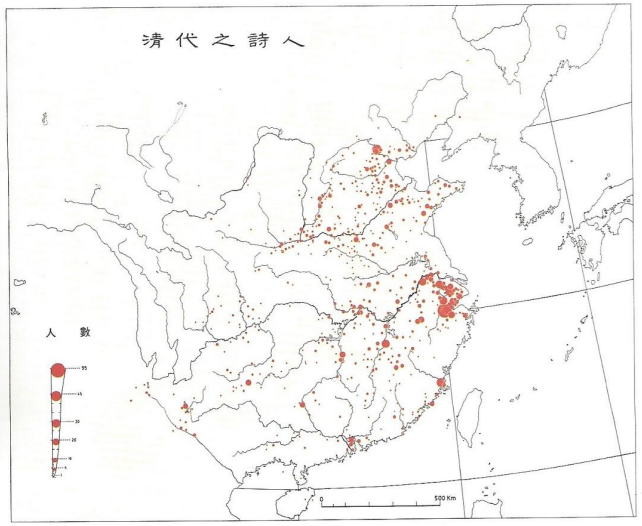
Birthplaces of the 2,625 Tang poets, 618–907



Birthplaces of the 3,005 Ming poets, 1368–1644



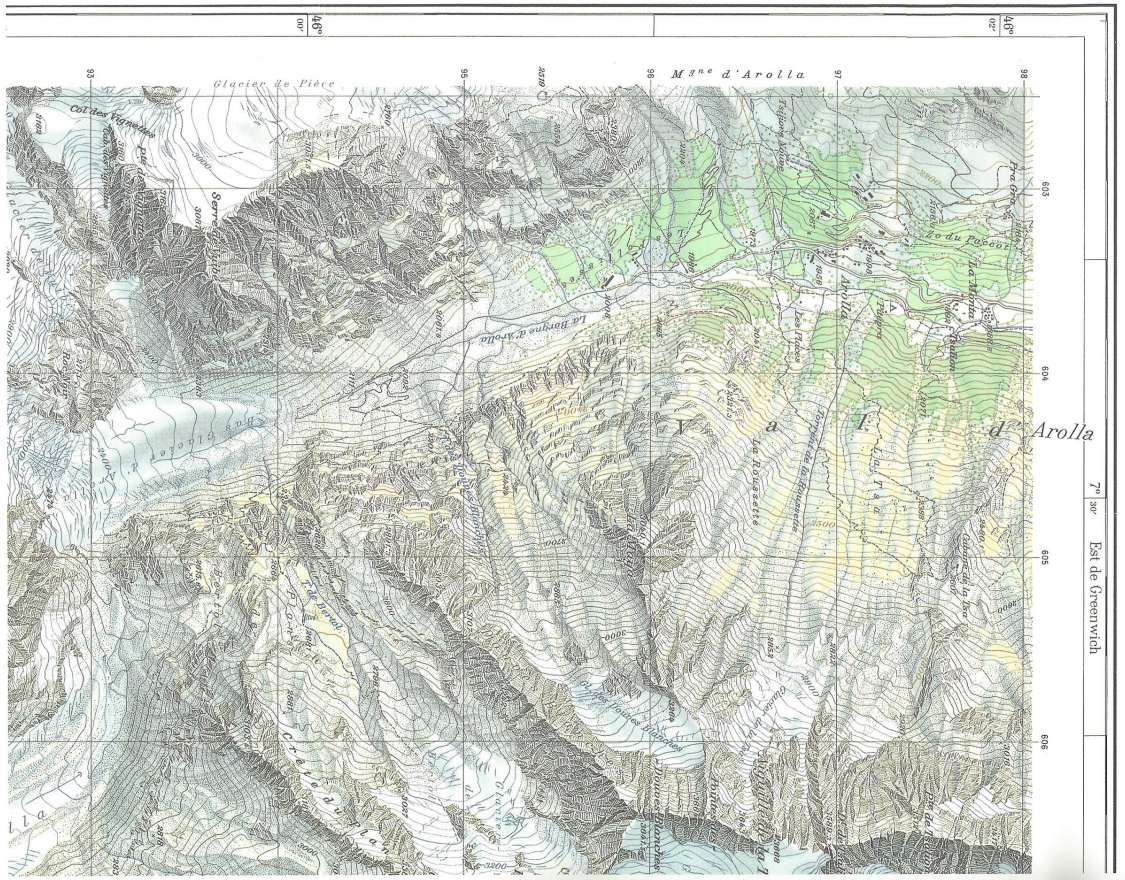
Birthplaces of the 2,377 Sung poets, 969–1279



Birthplaces of the 2,079 Ching poets, 1644–1911

SMALL MULTIPLES

COLOR AND INFORMATION



to label

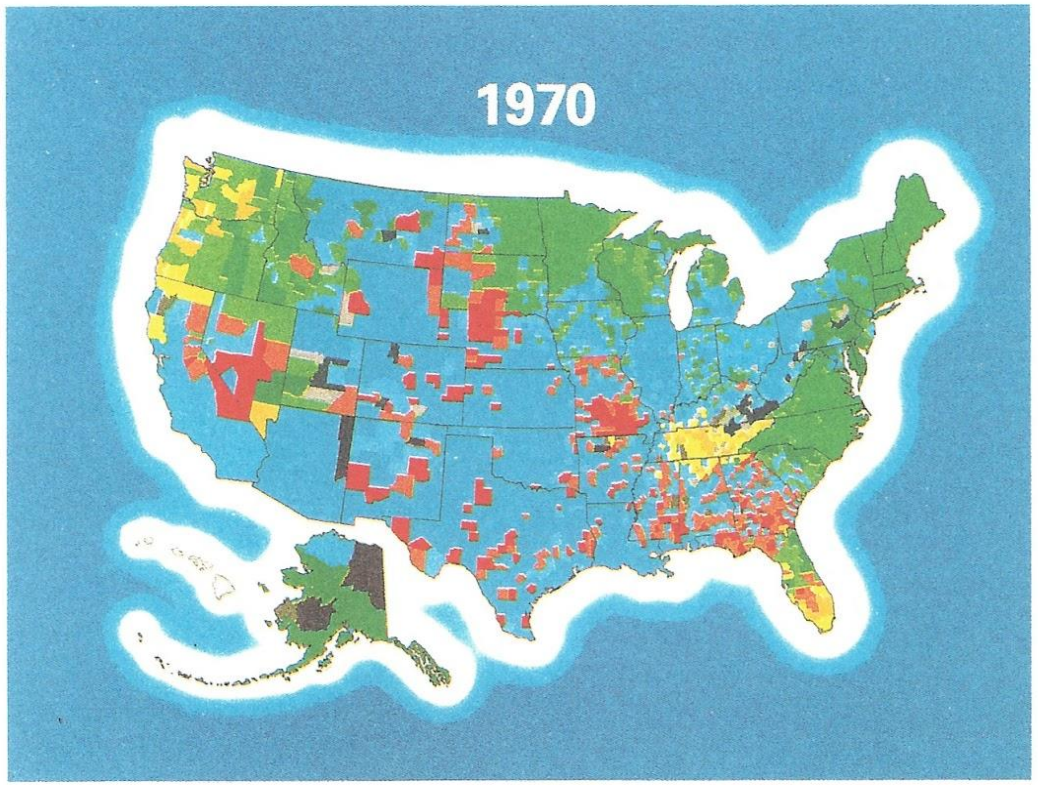
to measure

to represent reality

to enliven or decorate

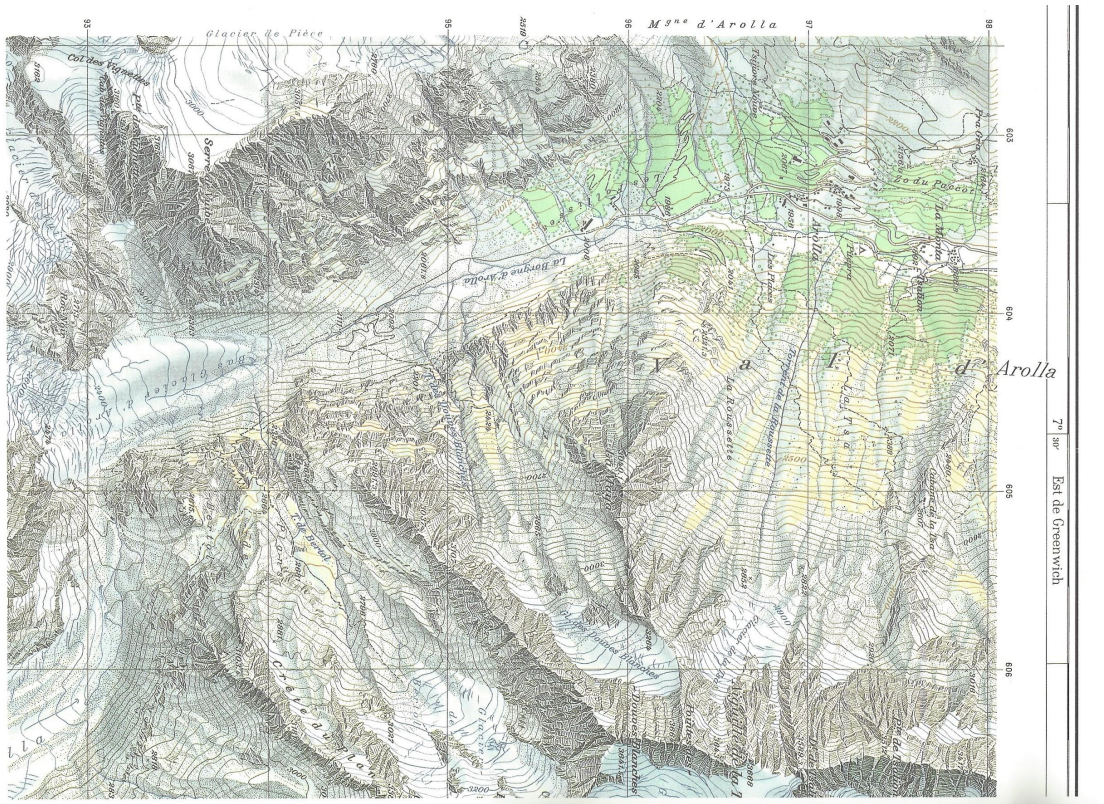
Matterhorn, Landeskarte der Schweiz, 1347, Bundesamt für Landestopographie (Waber, 1983), scale 1 : 25,000.

Minimize Color Damage

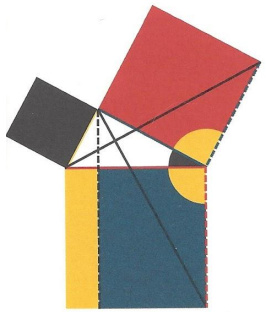


"Primary Home Heating Fuel, by Counties of the United States: 1950, 1960, 1970," GE-70, Bureau of the Census, United States Department of Commerce (Washington, DC, n.d.).

Use Colors Found in Nature



Matterhorn, Landeskarte der Schweiz, 1347, Bundesamt für Landestopographie (Waber, 1983), scale 1 : 25,000.



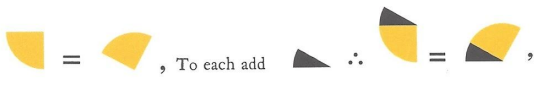
IN *a right angled triangle* 

the ſquare of the hypotenuſe —— *is equal to*

the ſum of the ſquares of the ſides, (—— *and* ——).

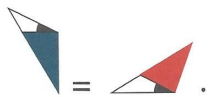
On ——, —— and —— deſcribe ſquares,

Draw --------- || --------- alſo draw —— and ——.



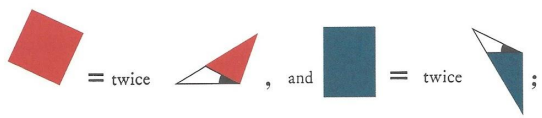
, To each add

—— = --------- and —— = ---------;

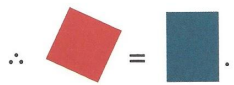


.

Again, becauſe —— || ---------



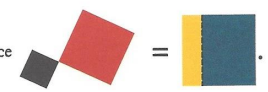
= twice , and = twice ;



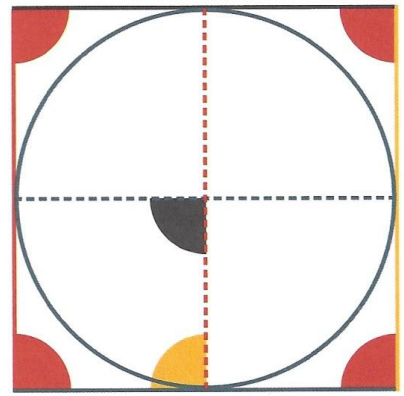
.

In the ſame manner it may be ſhown

that  ;

hence  .

Redrawn from Oliver Byrne, *The First Six Books of the Elements of Euclid in which coloured diagrams and symbols are used instead of letters for the greater ease of learners* (London, 1847), 48-49.



ABOUT *a given circle*  *to circumſcribe a ſquare.*

Draw two diameters of the given circle perpendicular to each other, and through their extremities draw ——, ——, ——, and —— tangents to the circle;

and  is a ſquare.

 a right angle, (B. 3. pr. 18.)

alſo  (conſt.),

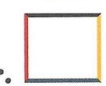
∴ —— || -------; in the ſame manner it can be demonſtrated that —— || -------, and alſo that —— and —— || --------;

∴  is a parallelogram, and

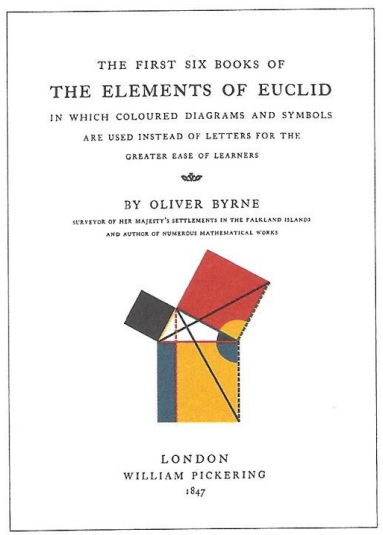
becauſe 

they are all right angles (B. 1. pr. 34):

it is alſo evident that ——, ——, —— and —— are equal.

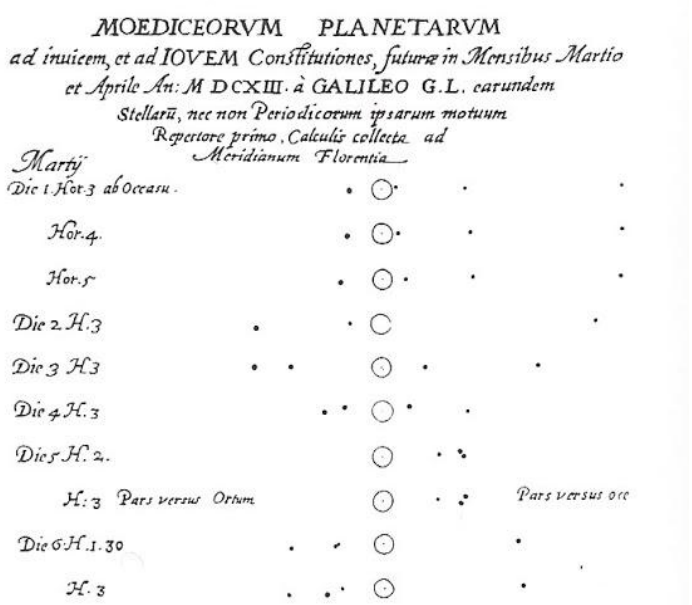
∴  is a ſquare.

Q. E. D.

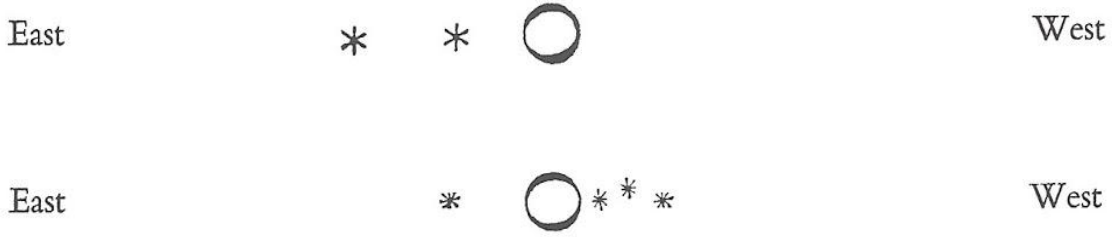


NARRATIVES OF SPACE AND TIME

Continuous Observation

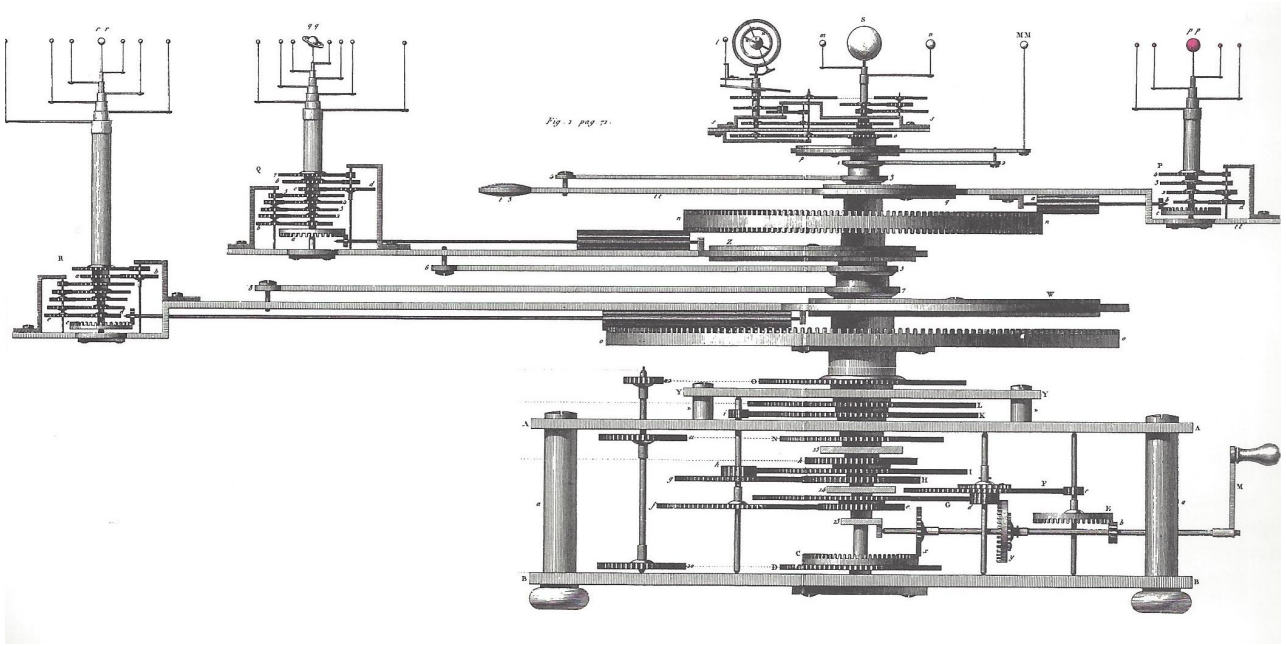


Galileo Galilei, *Istoria e dimostrazioni intorno alle macchie solari* . . . [Welser sunspot letters], (Rome, 1613), illustration of satellites (called by Galileo "Medicean stars" in honor of his patron) following p. 150.

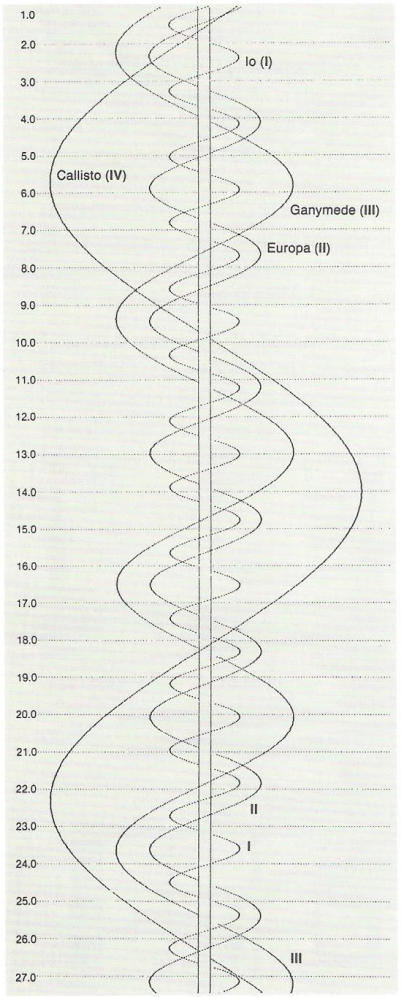


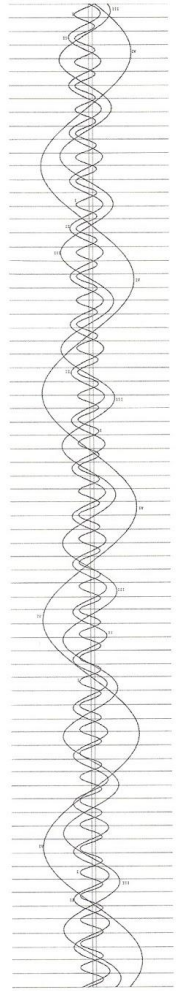
Bureau des Longitudes, *Connaissance des Temps* (Paris, 1766), 5.

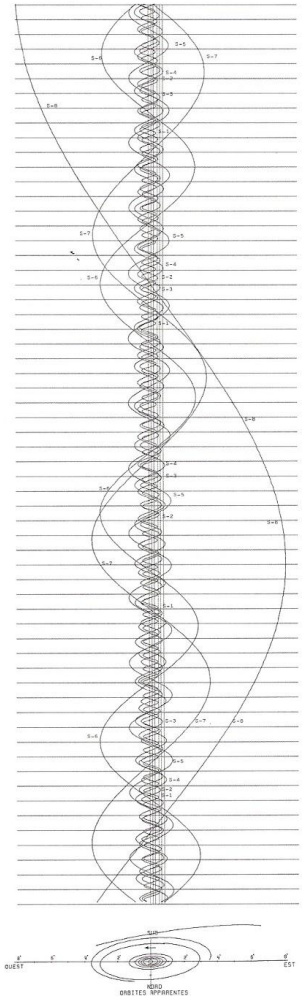
Patterns in Nature



William Pearson, "Planetary Machines," in Abraham Rees, ed., *The Cyclopeaedia; or, Universal Dictionary of Arts, Sciences, and Literature, Plates, Vol.* IV (London, 1820).

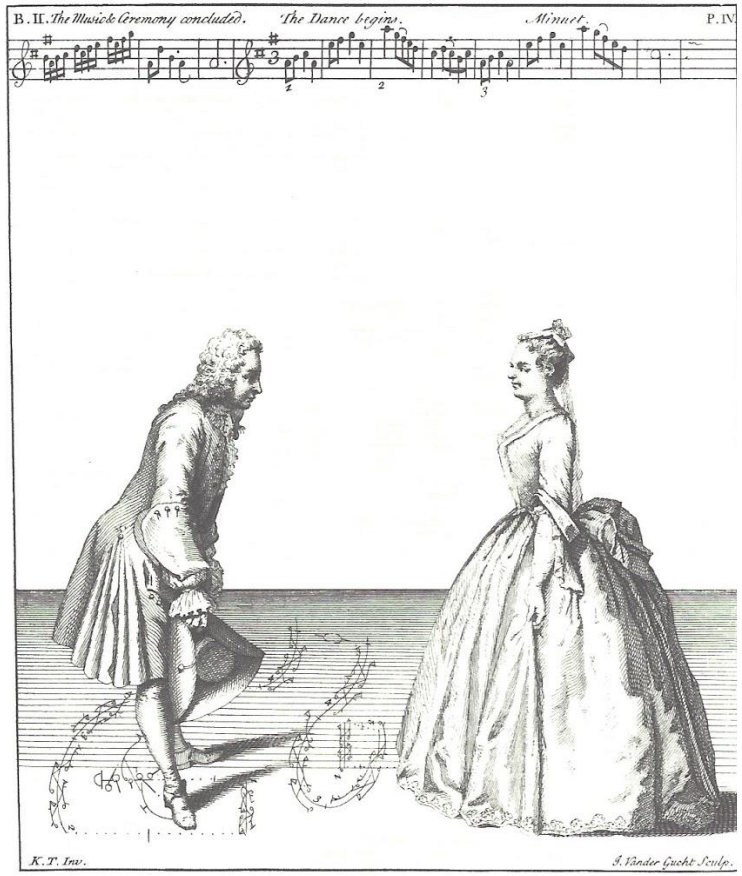


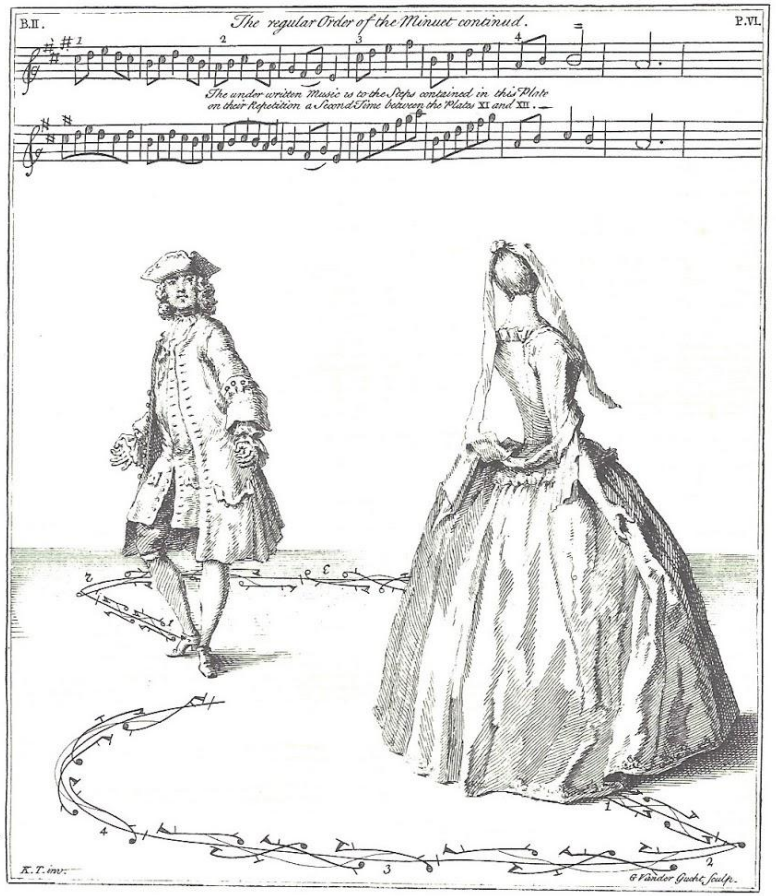




Antide Janvier, *Des révolutions des corps célestes par le méchanisme des rouages* (Paris, 1822), plate VI and plate IV.

Motions in Flatland





Kellom Tomlinson, *The Art of Dancing, Explained by Reading and Figures* (London, 1735), book II, plates IV, XIV, VIII, VI.

“***God is in the details.***”

-Mies van der Rohe