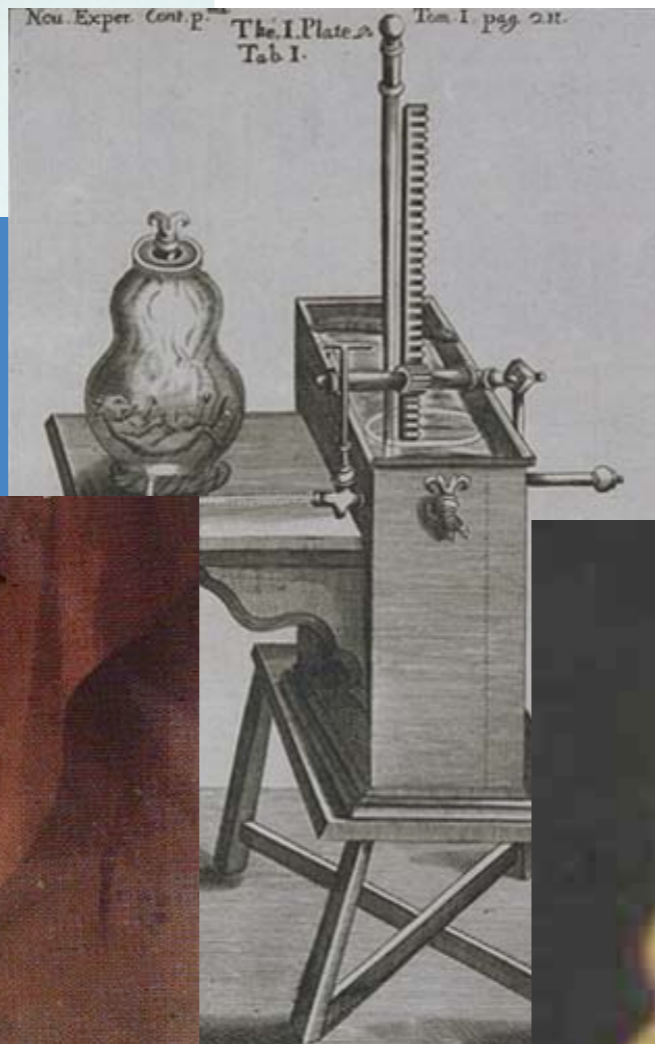


scientific information

**History of Information
September 26
2007**



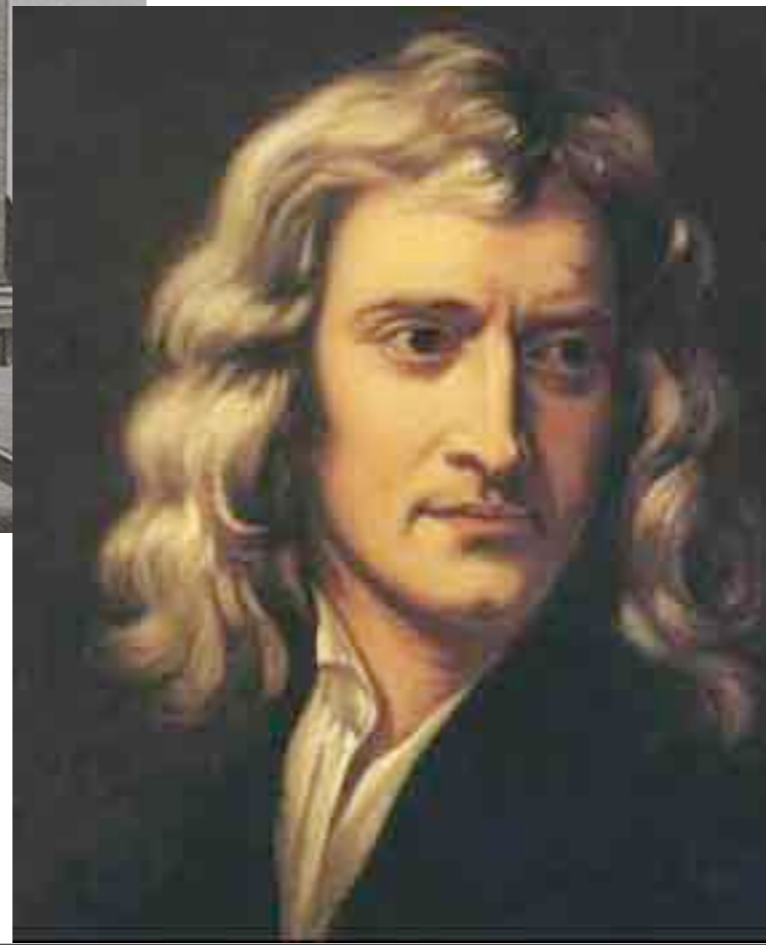
PHILOSOPHIÆ
NATURALIS
PRINCIPIA
MATHEMATICA.

Autore J. S. NEWTON, Trin. Coll. Cantab. Soc. Matheseos
Professore Lucasiano, & Societatis Regalis Sodali.

IMPRIMATUR.
S. PEPYS, Reg. Soc. PRÆSES.
Julii 5. 1686.

LONDINI,

Jussu Societatis Regiæ ac Typis Josephi Streater. Prostat apud
plures Bibliopolas. Anno MDCLXXXVII.





overview

the scientific revolution
the English experience

the background & the model

an example
kill or cure

problems with the model

science in the history of information

(visualization)



"de revolutionibus ..."



"The Scientific Revolution outshines everything since the rise of Christianity and reduces the Renaissance and Reformation to the rank of mere episodes, mere internal displacements within the system of medieval Christianity".

Herbert Butterfield,
The Origins of Modern Science, 1300-1800, 1948



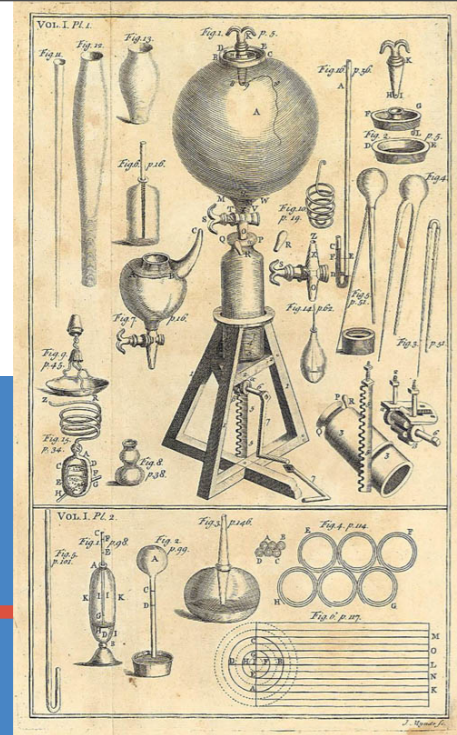
scientific revolution?

what happened

what came before

what came afterwards

who was involved



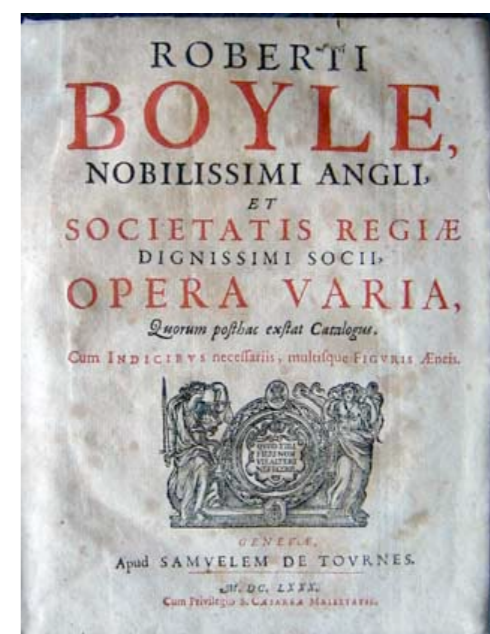
technological revolution?

"Printing ... the most useful invention ever found out ... make men Polite .. encrease the Knowledge of Letters ... all useful Arts and Sciences ... Perfection of Human Knowledge."

Defoe, *Regulation of the Press*, 1704



telescopes
air pumps
apples
books





political revolution

"Those dreadful
revolutions, which
cannot be beheld
upon Paper,
without horror."
Sprat, History

English Civil War, 1642-1651

Commonwealth & Protectorate, 1649-1659

Restoration, 1660

Great Plague, 1665

Fire of London, 1666

Glorious Revolution, 1688

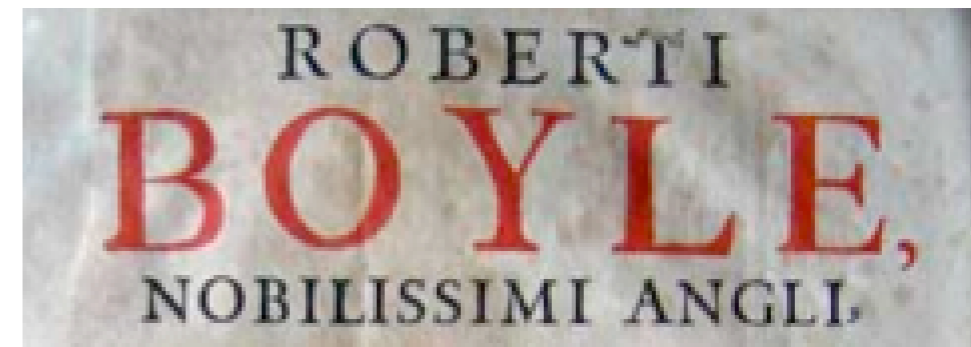


social revolution



café society
public sphere

the English gentleman





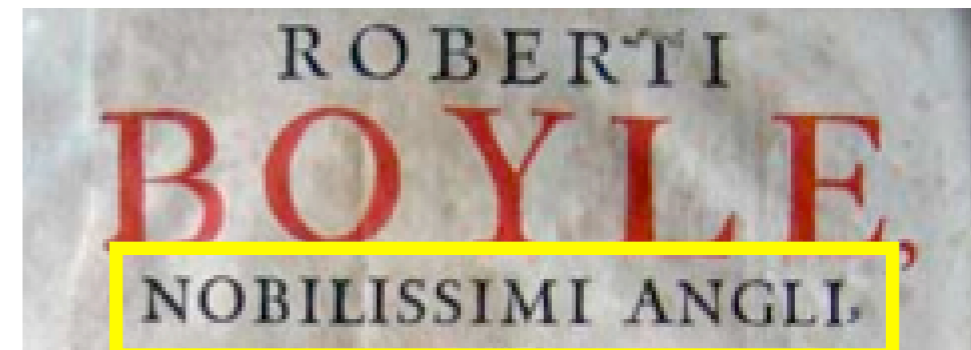
social revolution



café society

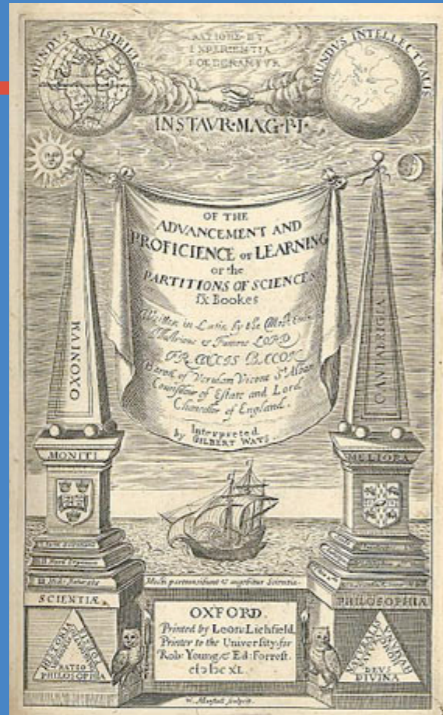
public sphere

the English gentleman





what happened?

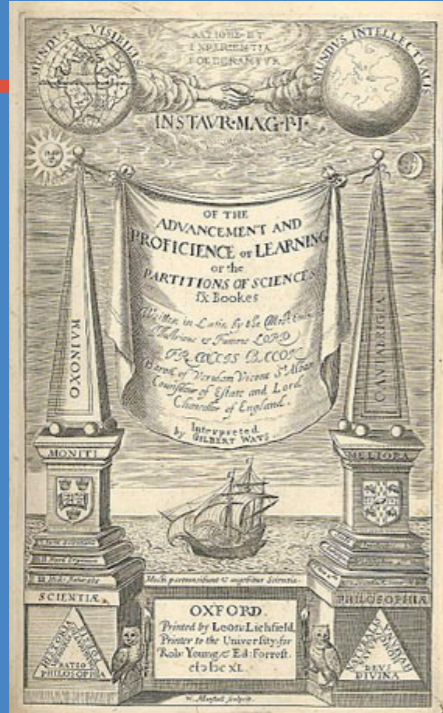


"the advancement of *Real Knowledge*"
--Sprat





what happened?

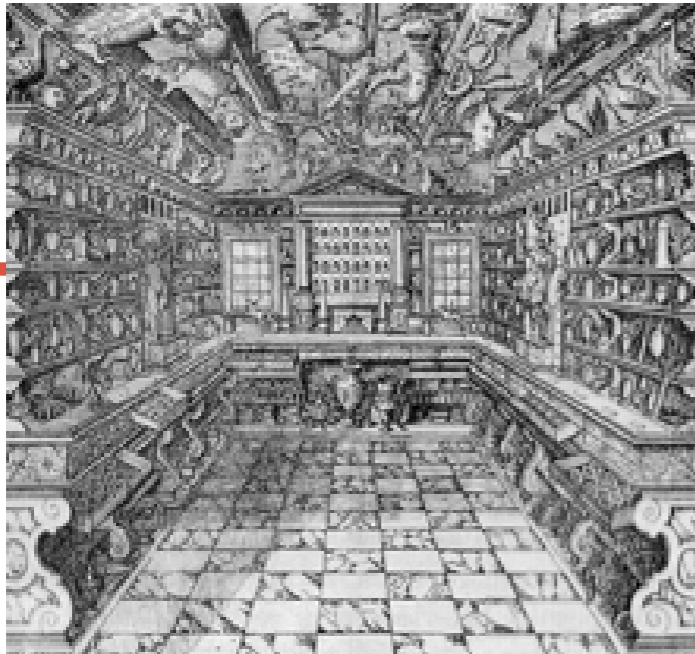


"the advancement of *Real Knowledge*"
--Sprat

"reliable truth-generating
practices were put in place and
institutionalized"

Steven Shapin,
A Social History of Truth, 1994





a century of facts

the impulse to order things and facts

observation and description

explanation

prediction

calculation

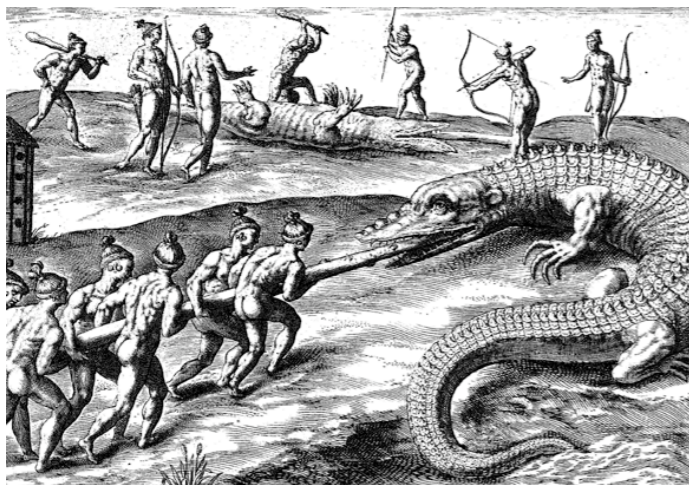
replication

"The Experiments that be made at the charge of the Society. Two Curators at least shall be appointed for the Inspection of those which cannot be perform'd before the Society: by them the bare report of matter of Fact shall be stated and return'd."

Sprat, History

"Facts are stubborn things"

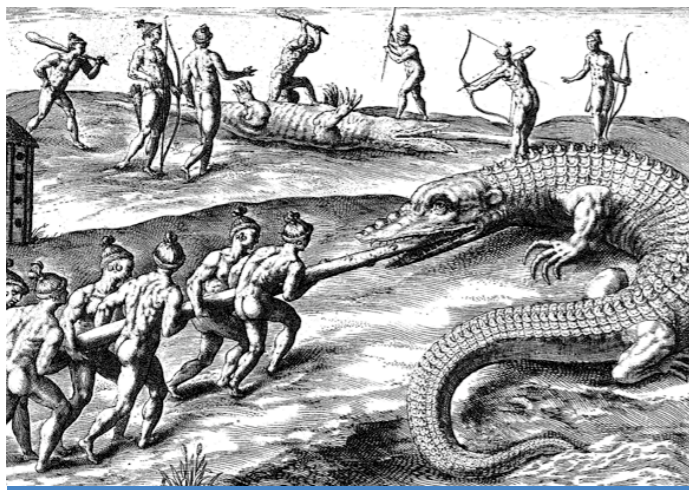
Smollett, Gil Bas,
1749



before

tall tales

And of the Cannibals that each other eat,
The Anthropophagi, and men whose heads
Do grow beneath their shoulders.

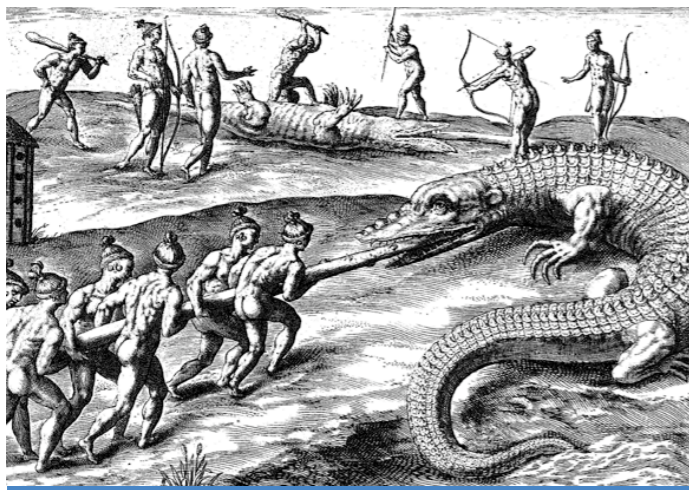


before

tall tales

And of the Cannibals that each other eat,
The Anthropophagi, and men whose heads
Do grow beneath their shoulders.





before

tall tales

And of the Cannibals that each other eat,
The Anthropophagi, and men whose heads
Do grow beneath their shoulders.

"Having in our company Captn. Minnes, with whom I was much pleased to hear him talk in fine language, but pretty well for all that. Among other things, he and the other Captains that were with us tell me that negros drowned look white and lose their blackness, which I never heard before"

Samuel Pepys, *Diary*, 11 April, 1662





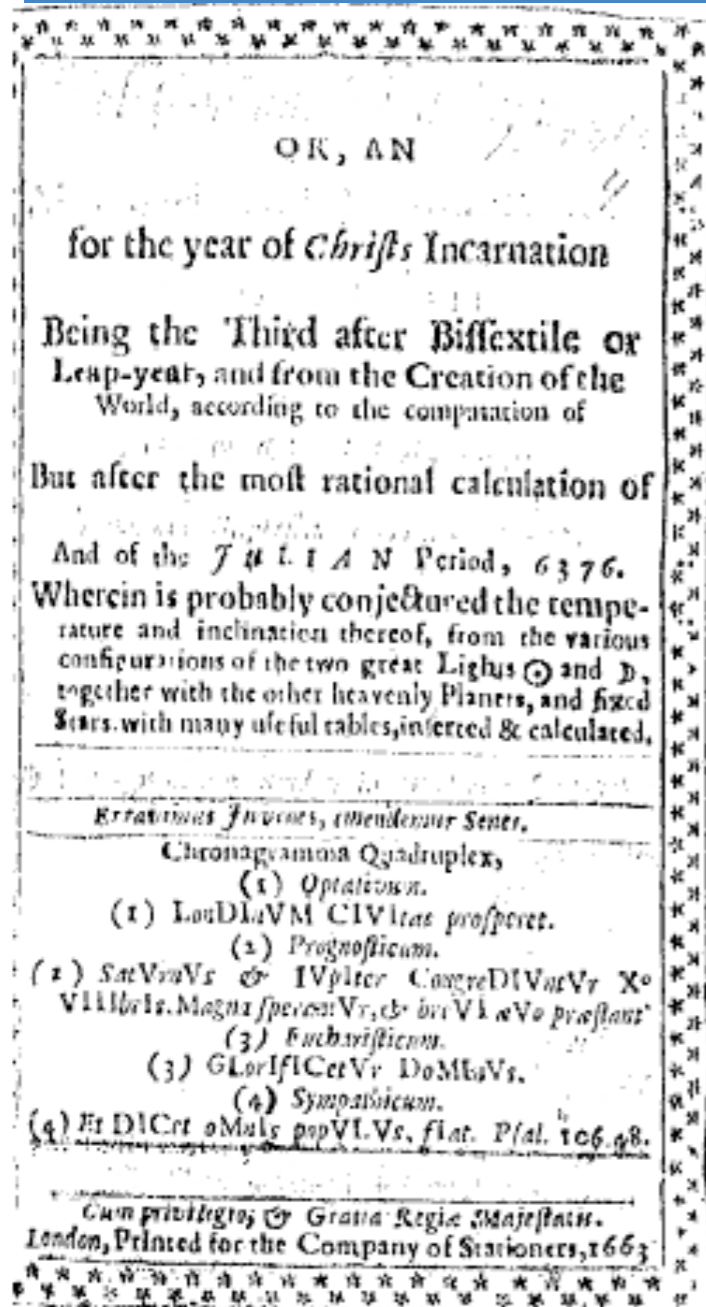
portents

A lioness hath whelped in the streets;
And graves have yawn'd, and yielded up their dead;
Fierce fiery warriors fought upon the clouds,
In ranks and squadrons and right form of war,
Which drizzled blood upon the Capitol;



"La sange du juste à Londres fera faute
 Bruslez par foudre de vingt trois le six,
 La dame antique cherra de place haute
 De meme sute plusieurs seront occis"

conspiracy theory



"Sir Thomas Crewe hath heard at the
 Committee for examining the burning of the
 city,that it was done by plots ... it was
 bragged by several Papists that upon such a day
 in such a time, we should find the hottest
 weather that ever was in England; and words of
 plainer sense"

--Pepys, November 2, 1666

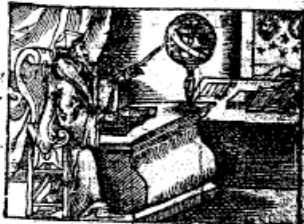
"We talked much of Nostradamus his prophecy of
 these times, and the burning of the City of
 London, some of whose verses are put into
 Booker's Almanac this year My Lady Carteret
 hersilf did tell us how abundance of pieces of
 burnt paper were cast by the wind .. .she took
 one up ... wheron thre remained no more nor less
 than these words: "Time is, it is done"

February 3, 1666/7

An Almanack
for the yere. M. D. lviij.

Composed by M. Michael
Rastradamus Doctour
in Physicke of Saloñ of
France in Prouince.

Whā the Sonne sayleth & fieth then shall
the monſter be ſcene in the playne day
then ſhall interprete it farre otherwiſe
death hath no reſpect, none ſhall pro-
uide for it.



disgrace to reason

"It is indeed a disgrace to the Reason, and honor of mankind, that every fantastical Humorist should presume to interpret all the secret Ordinances of Heven; and to expound the Times, and Seasons, and Fates of Empires, though he be never so ignorant of the very common Works of Nature, that lye under his Feet. There can be nothing more injurious than this, to mens public, or privat peace. This withdraws our obedience, from the true Image of God the rightfull Sovereign, and makes us depend on the vain Images of his pow'r, which are fram'd by our own imaginations. This weakens the constancy of human actions. This affects men with fears, doubts, irresolutions, and terrors. It is usually observ'd, that such presaging, and Prophetical Times, do commonly fore-run great destructions, and revolutions of human affairs. And that it should be so is natural enough, though the presages, and prodigies themselves did signify no such events. For this melancholy, this frightful, this Astrological humor disarms mens hearts, it breaks their courage; it confounds their Councils, it makes them help to bring such calamities on themselves"

--Sprat



'alchymy'

respect for the past?

For there is mention made, both of Salt-peter and Aqua fortis, in the Writings of Geber, a Spanish More, and an Alchymist; but at what time he lived is unknown, though it be certain, some hundreds of years before Raimund Lully; who about the year 1333. published some of his Books, wherein he treats of Salt-peter and Aqua fortis. It is no ill conjecture of Maierus, that the foresaid Monk, being a skilful Alchymist, had a design to draw a higher Spirit from Peter than the common Aqua fortis, and that he might better open the body of Peter, he ground it with Sulphur and Charcoal, by which Composure he soon became the Inventour of Gun-powder.

--Sprat



matter of fact

"The Royal Society originated on November 28, 1660, when 12 men met after a lecture at Gresham College, London, by Christopher Wren (then professor of astronomy at the college) and resolved to set up "a Colledge for the promoting of Physico-Mathematicall Experimentall Learning."

Britannica

building a movement

It was therefore, some space after the end of the Civil Wars at Oxford, in Dr. Wilkins his Lodgings, in Wadham College, which was then the place of Resort for Vertuous, and Learned Men, that the first meetings were made, which laid the foundation of all this that follow'd. The Vniversity had, at that time, many Members of its own, who had begun a free way of reasoning; and was also frequented by some Gentlemen, of Philosophical Minds, whom the misfortunes of the Kingdom, and the security and ease of a retirement amongst Gown-men, had drawn thither.

Hofl Introduction - 15

--Spratt



who?

scientific revolutionaries

Boyle (1627-1691)

Wren (1632-1723)

Locke (1632-1704)

Hooke (1635-1703)

Newton (1642-1727)

Halley (1656-1742)

Huygens (1629-1695)

Mercator (1620-1687)

Moxon (1627-1691)

Graunt (1620-1674)

Petty (1623-1687)



follies of *virtuosi*

"I have sent one to weigh Air at the Picque of Teneriff that's the lightest Air. I shall have a considerable Cargo of that Air. Sheerness and the Isle of Dogs Air is the heaviest. Now if I have a mind to take Countrey Air, I send for, may be, forty Gallons of Bury Air, shut all my windows and doors close and let it fly in my Chamber.."

Shadwell, *Virtuoso*

"the King came and stayed an hour or two laughing at Sir W. Petty, who was there about his boat; and at Gresham College in general; at which poor Petty was, I perceive, at some loss; but did argue discreetly, and bear the unreasonable follies of the King's objections and other bystanders with great discretion; .. but the King ... cried him down with words only. Gresham College he mightily laughed at, for spending time only in weighing of ayre, and doing nothing else since they sat."

--Pepys, February 1, 1663/4

Sprat's *model*

Nature alone, which could pleasantly entertain them ... Trials in Chymistry, or Mechanicks ... their intention was more to communicate to each other their discoveries ... [as now in Paris], where they have at last turn'd their thoughts, from Words to experimental Philosophy

Their purpose is, in short, to make faithful Records, of all the Works of Nature, or Art, which can come within their reach: that so the present Age, and posterity, may be able to put a mark on the Errors, which have been strengthened by long prescription: to restore the Truths, that have lain neglected

to separate the knowledge of Nature, from the colours of Rhetorick, the devices of Fancy, or the delightful deceit of Fables

Sprat's *model*

They have labor'd to inlarge it, from being confin'd to the custody of a few; or from servitude to private interests.

They have striven to preserve it from being over-press'd by a confus'd heap of vain, and useless particulars; or from being straitned and bounded too much up by General Doctrines

They have studi'd, to make it, not onely an Enterprise of one season, or of some lucky opportunity; but a business of time; a stedly, a lasting, a popular, an uninterrupted Work.

Sprat's *model*

They have attempted, to free it from the Artifice, and Humors, and Passions of Sects; to render it an Instrument, whereby Mankind may obtain a Dominion over Things, and not onely over one anothers Iudgements.

And lastly, they have begun to establish these Reformatations in Philosophy, not so much, by any solemnity of Laws, or ostentation of Ceremonies, as by solid Practice, and examples: not, by a glorious pomp of Words; but by the silent, effectual, and unanswerable Arguments of real Productions.

Members ... different Religions, Countries [note he mentioned earlier the French equivalent], and Professions ... not to lay the Foundation of an English, Scotch, Irish, Popish, or Protestant Philosophy; but a Philosophy of Mankind. ... the Church of England ought not to be apprehensive to settle a constant Intelligence ... the general Banck, and Free-Port of the world

does Prat seem to you to be talking about science as we think of it today?

your views: NO

I do not get the impression that the science Sprat speaks of is in reference to the same science we think of today. It seems that the society is more of a sort of a professional union. I do not get the impression that they are exchanging scientific theories or research. More ... theoretical ideas and current events than actual practical knowledge... more oriented toward professions than academic science. --Danny Bean

This model of investigation really doesn't look like our method of science today ... very different ideas of what kind of person qualifies to carry out our science --Clare Hutchinson

TOO DOGMATIC

Sprat seems to describe science as the process of trying to find the one truth to describe a phenomenon. And once that truth is found, all other opinions are wrong or weaker (Pages 61-63). This is very different from how science is viewed today. --Jeff Lai

does Prat seem to you to be talking about science as we think of it today?

your views: NO

TOO MUCH POLITICS

The intent of his writing, however (concerning its political purpose), is directed toward the people in the name of civil administration and how the Royal Society benefits the public.

--Sean Carlin

[A]lthough philosophically Thomas nails many modern ideas, a lot of what he spends time talking about isn't about science as politics.

--Filip Furmanek

there is a lot more political influence on Sprat's definition of science, as it revolves around this particular society and social obligation that dictates how science should be treated, which is not so apparent in our view of science today. --Jonathan Lesser

does Prat seem to you to be talking about science as we think of it today?

your views: NO

TOO INSULAR

Reading this excerpt lead me to believe that The Royal Society's "Philosophy of Mankind" was limited to the Caucasian nationalities listed. Science, and all knowledge for that matter should not be elitist.

--Amanda Coffee

the methods of scientific inquiry remain the same and so too have its applications; however, there have been notable changes in science as a practice and science as a community. --Nathan Murthy

I pondered about this for a while and couldn't help but wonder if he believed that the knowledge of nature could be understood by people from different countries but only discerned in England. --Roger Guerrero

does Prat seem to you to be talking about science as we think of it today?

your views: NO

TOO INSTRUMENTAL

I believe the environmental movement is beginning to dispute the often destructive goal of human domination over its environment. -- Columbani

Claiming to use the natural and real world through experimentation does not constitute science. One can observe and "experiment," however if one does not properly apply the scientific method, this is still not science. --

Anthony Shu

I don't know how Sprat defined Nature (with a capital 'N') so there could be a distinction about the focus of mastering nature. Did "Nature" mean just environment and our resources? Did "Nature" encompass human nature and human disease and malfunctioning? --Melissa Wong

does Prat seem to you to be talking about science as we think of it today?

your views: NO

NOT INSTRUMENTAL ENOUGH

Science in my opinion has become much more privatized and controlled by businesses. Its purpose is for pure profit and not philosophic value.

--Milan Shah

does Prat seem to you to be talking about science as we think of it today?

your views: NO

TOO PHILOSOPHICAL

It seems that he speaks of "science" in a much more philosophical sense --Ryan Luecke

Sprat's science is quite different from the way we think of science today. ... Here, we see science as more of a process of rational thinking and it includes philosophy which we do not associate with science today. However, there are more similarities than meet the eye. ...This idea of finding truth by disregarding emotion and personal prejudice is highly regarded by the Royal Society. So in many ways, the science of 400 years ago did in fact lead to the science we have today --Nisha Desai

Prat mentions "philosophy" many times in this reading which is why I think that the science that he is referring to is more abstract and in regard to intellectual ideas of science. --Helena Lin

does Prat seem to you to be talking about science as we think of it today?

your views: YES BUT...

DIVIDED

I am reminded of its clear pronunciation in the split between U.C. Berkeley's physicists Earnest Orlando Lawrence, who represented the experimentalist tradition on the one hand, and Robert Oppenheimer representing the theoretical physics tradition on the other. --Colin Elbasani

As he writes, he seems to have his critics in the back of his mind, because he makes several points as pre-emptive strikes against what they may say.

--Janine Kovac

what he eventually describes is incongruent with the popular view of science, despite what so many high school science teachers have tried to instill by making teenagers memorize words like "hypothesis" and "independent variable". Sprat talks broadly about the very fundamentals that compose the scientific method,

--Jeff Remer

does Prat seem to you to be talking about science as we think of it today?

your views: YES

Sprat's explanation of the mission of the Royal Society lays out the very basic foundations of what we consider experimental science and the scientific methods. He anticipates friction between the new ways of approaching the world and the dogma of previous ages; ... Today, the conflict between science and dogma is present evident in the debate over evolution. --Dennis Bedford

Sprat explains the idea of peer revision, which is an essential part of science today. He says: "For by despising men, for not being absolutely excellent; we keep them from being so: while admonitions, join'd with praises; and reproofs, with directions; would quickly bring all things to a higher perfection" --Bernard Carreon

He stresses the incremental nature of science, that scientists "insinuate their useful alterations, by soft, and unperceivable degrees." This is a departure from the often epochal nature of science in ancient times --Alex Castle

It is this advance to empiricism that the Royal Society provided modern science with a foundation. --Tricia Davitt

Essentially, this is along the same ideas today, where logic and scientific figures conflict with more theological beliefs which are supported mainly by faith, rather than science. --Mike Manalo

does Prat seem to you to be talking about science as we think of it today?

next up

Above all, the fundamental trust in “the Method”, the scientific method, that Sprat talks about seems so quintessential to science both today and when the Royal Society was first conceived --Tom Meagher

towards the end Prat does take a different approach when he speaks of inventions and their possibility of curing diseases --Kyle Murray

this type of professional scientific society is markedly different than today’s scientific community which is a far more diverse, egalitarian, “open-source” society filled with social activists, scientists, attorneys and regular citizens from all aspects of life. --Rohan Verma



too instrumental?

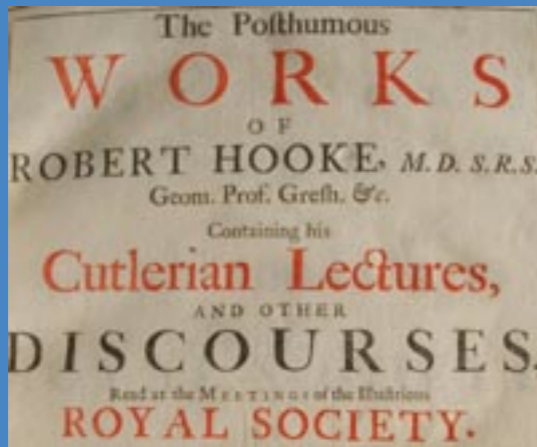
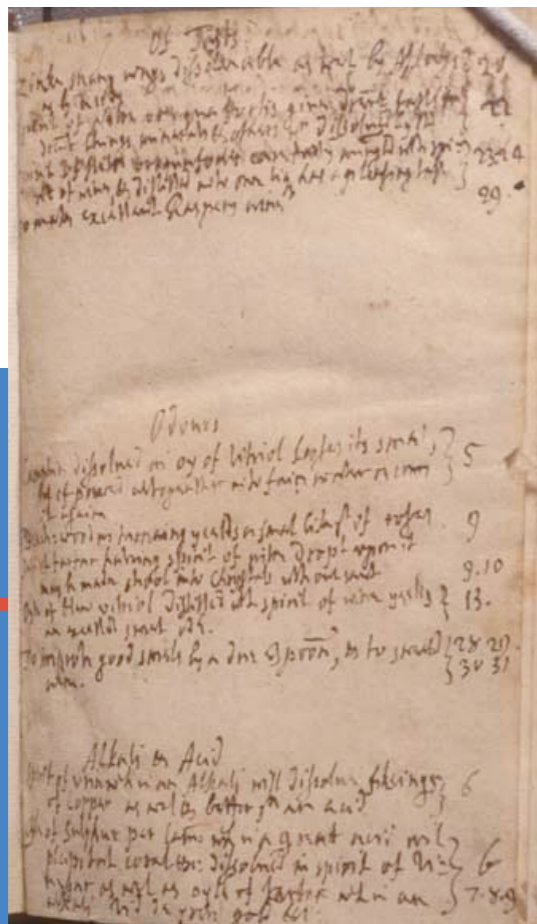
"to teach people to plow, to sow,
to plant to spin, to build houses,
to find out new countries"

experimenting

experimental philosophy

arts & improvement of arts

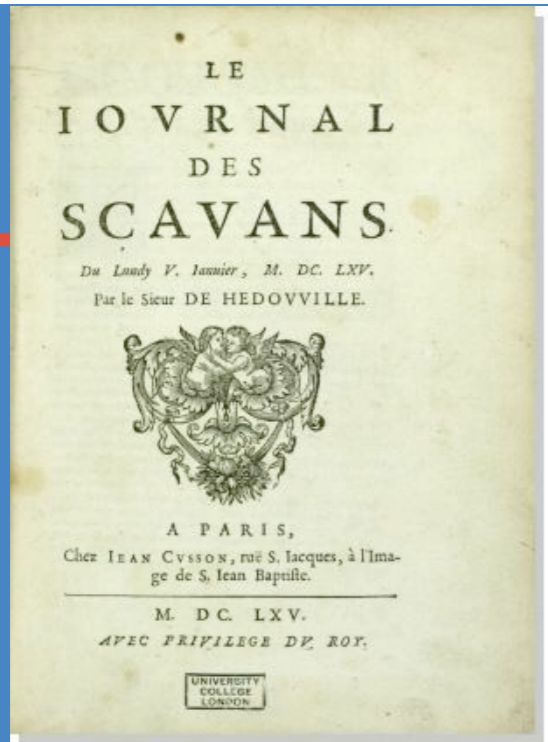
systems



"open"

"to print a Paper of advertisements... wherein will be contained heads or substance of the inquiries they are most solicitous about, together with the progress they have made and the information they have received from other hands ... a short account of such other philosophical matters as accidentally occur."

--Robert Hooke



society of letters

corresponding secretary

Henry Oldenberg, 1662

Journal des Scavans, 1665

Philosophical Transactions, 1665

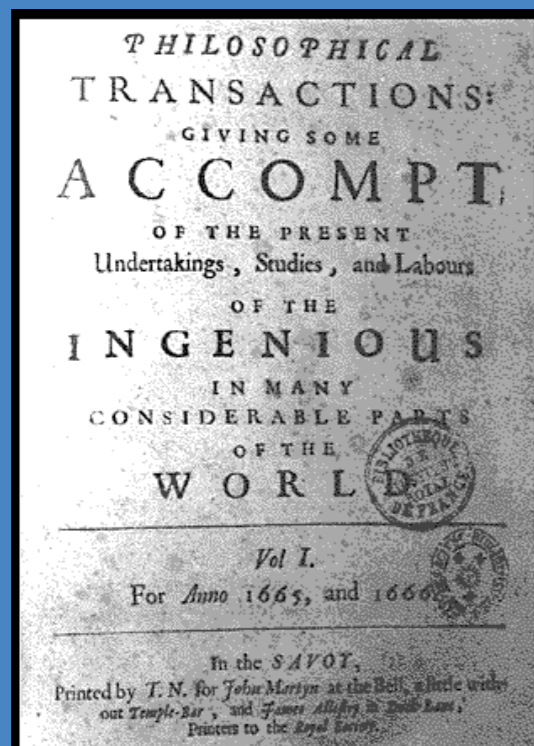
advertisements, articles, abstracts

Boyle, random publication

v

Hooke, ordered

Hofl Introduction - 32





(1)

Numb. 1.

PHILOSOPHICAL TRANSACTIONS.

Munday, March 6. 166⁴.

The Contents.

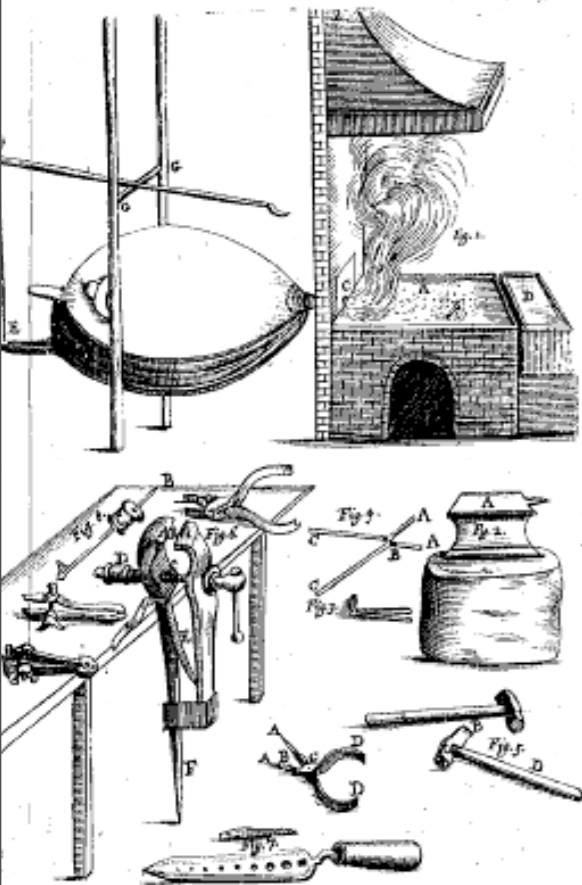
An Introduction to this Tract. An Account of the Improvement of Optick Glasses at Rome. Of the Observation made in England, of a Spot in one of the Belts of the Planet Jupiter. Of the motion of the late Comet predicted. The Heads of many New Observations and Experiments, in order to an Experimental History of Cold; together with some Thermometrical Discourses and Experiments. A Relation of a very odd Monstrous Calf. Of a peculiar Lead-Ore in Germany, very useful for Essays. Of an Hungarian Bolus, of the same effect with the Bolus Armenus. Of the New American Whale-fishing about the Bermudas. A Narrative concerning the success of the Pendulum-watches at Sea for the Longitudes; and the Grant of a Patent thereupon. A Catalogue of the Philosophical Books published by Monsieur de Fermat, Counsellour at Tholouse, lately dead.



(10)

An Account of a very odd Monstrous Calf.

By the same Noble person was lately communicated to the *Royal Society* an Account of a very Odd Monstrous Birth, produced at *Limmington* in *Hampshire*, where a Butcher, having caused a Cow (which cast her Calf the year before) to be covered, that she might the sooner be fatted, killed her when fat, and opening the Womb, which he found heavy to admiration, saw in it a Calf, which had begun to have hair, whose hinder Leggs had no Joynts, and whose Tongue was, *Cerberus*-like, triple, to each side of his Mouth one, and one in the midst: Between the Fore-leggs and the Hinder-leggs was a great Stone, on which the Calf rid: The *Sternum*, or that part of the Breast, where the Ribs lye, was also perfect Stone; and the Stone, on which it rid, weighed twenty pounds and a half; the outside of the Stone was of Grenish colour, but some small parts being broken off, it appeared a perfect Free-stone. The Stone, according to the Letter of Mr. *David Thomas*, who sent this Account to Mr. *Boyle*, is with Doctor *Haughteyn* of *Salisbury*, to whom he also referreth for further Information.



MECHANICK
EXERCISES,

OR,
The Doctrine of
Handy-works.

Began Jan. 1. 1677. And intended to be
Monthly continued.

By *Joseph Moxon* Hydrographer to the
Kings most Excellent Majesty.



LONDON,

Printed for *Joseph Moxon* at the sign of *Atlas* on
Ludgate-Hill, 1677.

opening

Edward Moxon, *Mechanic Exercises* 1677-

"Cunning or Sleight,
or Craft of the
Hand ... cannot be
taught by Words, but is
only gain'd by
Practice and Exercise"

Moxon, *Mechanick
Exercises*

"hunger during the war, taken together with
the liberation of the press, resulted in an
out-pouring of cookbooks, after the war,
that themselves carried ideological weight,
signifying a movement from a society where
secret know-how was passed on orally, to a
society in which knowledge was available
publicly.

Diane Purkiss, *The English Civil War*, 2006

John Ziman, *Public Knowledge*, 1967

Stubbe's animadversions

Mistakes about the SWEATING-SICKNES, and its Cure.

TO shew the great Utility of the Royal Society, he sayes

They will be able by degrees to purchase such Extraordinary Inventions, which are now close lock'd up in Cabinets; and then to bring them unto one Common Stock, which shall be upon all occasions exposed to all mens use. This is a most Heroick Invention; For by such concealments, there may come very much hurt to mankind. If any certain remedy should be found out against an Epidemicall disease, if it were suffer'd to be engross'd by one man, there would be great Swarms swept away, which otherwise might be easily sav'd. I shall instance in the Sweating-Sickness. The Medicine for it was almost Infallible. But, before that could be generally published, it had almost dispeopled whole Towns. If the same disease should have returned, it might again have been as destructive, had not the Lord Bacon ta-ken care to set down the particular course of Physick for it in his History of Henry the Seventh, and so put it beyond the possibility of any private man's invading it. This out to be imitated in all other Sovereign Cures of the like nature to avoid such dreadful casualties.

One would think by the words of our Historian, That the Cure of the Sweating-Sickness, were recorded by no Body but the Lord Bacon that it was almost Infallible; that the Sweating-Sickness did not return again; And that the Cure was rather concealed (and needed to be generally published) at first, then to be discovered by Observation and Experiments of those that first fell sick. But there is no such thing: for the same cure is related by Polydore Virgil, and Holinshed in their Histories of Henry the Seventh. And the same sickness did rage in the twenty second year of the said King his Reign, as well as the first. And the Cure related was so far from being almost Infallible, that my Lord Bacon only saies it commonly recovered the sick: and after it was so generally known, yet the twenty second year of that Kings Reign, many dyed of it (as Holinshed saith) howbeit not in the same number, by reason of the remedy found out at the beginning of it. To convince the Reader of the truth of what I say, and to shew how unacquainted

Stubbe's animadversions

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TO shew the great Utility of the Royal Society, he sayes

They will be able by degrees to purchase such Extraordinary Inventions, which are now close lock'd up in Cabinets; and then to bring them unto one Common Stock, which shall be upon all occasions exposed to all mens use. This is a most Heroick Invention; For by such concealments, there may come very much hurt to mankind. If any certain remedy should be found out against an Epidemicall disease, if it were suffer'd to be engross'd by one man, there would be great Swarms swept away, which otherwise might be easily sav'd. I shall instance in the Sweating-Sickness. The Medicine for it was almost Infallible. But, before that could be generally published, it had almost dispeopled whole Towns. If the same disease should have returned, it might again have been as destructive, had not the Lord Bacon ta-ken care to set down the particular course of Physick for it in his History of Henry the Seventh, and so put it beyond the possibility of any private man's invading it. This out to be imitated in all other Sovereign Cures of the like nature to avoid such dreadful casualties.

One would think by the words of our Historian, That the Cure of the Sweating-Sickness, were recorded by no Body but the Lord Bacon that it was almost Infallible; that the Sweating-Sickness did not return again; And that the Cure was rather concealed (and needed to be generally published) at first, then to be discovered by Observation and Experiments of those that first fell sick. But there is no such thing: for the same cure is related by Polydore Virgil, and Holinshed in their Histories of Henry the Seventh. And the same sickness did rage in the twenty second year of the said King his Reign, as well as the first. And the Cure related was so far from being almost Infallible, that my Lord Bacon only saies it commonly recovered the sick: and after it was so generally known, yet the twenty second year of that Kings Reign, many dyed of it (as Holinshed saith) howbeit not in the same number, by reason of the remedy found out at the beginning of it. To convince the Reader of the truth of what I say, and to shew how unacquainted



Safari

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Stubbe's animadversions

Mistakes about the SWEATING-SICKNES, and its Cure.

TO shew the great Utility of the Royal Society, he says

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Create your Hawaii dream vacation.

Prices start at just \$515



BOOK NOW



Blount

too philosophical?

seeking truth?

"Women do not bring into the world at one time real children, and at another time counterfeits which are with difficulty distinguished from them"

Socrates, *Theaetatus*

"If falsehood, like truth, had only one face, we would be in better shape, For we would take as certain the opposite of what the liar said. But the reverse of truth has a hundred thousand shapes and a limitless field."

Montaigne, "Of Lyars"

"Our thoughts and beliefs 'pass,' so long as nothing challenges them, just as bank-notes pass so long as nobody refuses them."

William James, *Pragmatism*



truth & trust

Cramp be thou faintless
As our Lady was sinless
When she bare Jesus

Pepys

sickness
a test for trustworthiness

"so great a Number of
Contemporaries ... that lov'd truth so
zealously; sought it so constantly;
and upon whose labours, mankind might
so freely rely"

--Sprat

"Mistakes about the Sweating-Sicknes"

--Stubbe



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--Stubbe



plague

black death: 1347

plague again: 1665

in London, of about 1/2 million, 100,00 died

"[W]ar, plague, famine -- reduced the population of France by the end of the reign to its lowest point for three centuries." Blanning

This is a most
heroick Invention:
For by such
concealments, there
may come very much
hurt to mankind. If
any certain remedy
should be found out
against an
Epidemical disease;
if it were suffer'd
to be ingross'd by
one man, there would
be great swarms
swept away, which
otherwise might be
easily sav'd.

--Sprat



slow progress

The plague is much in Amsterdam, and we in fears of it here, which God defend. Pepys, December 31,
1663

The talk upon the 'Change is, that De Ruyter is dead, with fifty men of his own ship, of the
plague, at Cales, June 30, 1664

We were told to-day of a Dutch ship of 3 or 400 tons, where all the men
were dead of the plague, and the ship cast ashore at Gottenburgh.
September 24, 1664

Thence to the Coffee-house with Creed, where I have not been a great while, where all the newes is
of the Dutch being gone out, and of the plague growing upon us in this towne, May 24, 1665

In the evening home to supper; and there, to my great trouble, hear that the plague is come into
the City (though it hath these three or four weeks since its beginning been wholly out of the
City); but where should it begin but in my good friend and neighbour's, Dr. Burnett, in Fanchurch
Street: which in both points troubles me mightily. June 10, 1665

The towne grows very sickly, and people to be afeard of it; there dying this last week of the
plague 112, from 43 the week before,.

The Mortality Bill is come to 267; June 29th, 1665 Above 700 died of the plague this week.
July 13, 1665

I hear the sickness is... almost every where, there dying 1089 of the plague this week. July 19,



Beef Recall Amid E. coli Worries

identifying causes

fatal mistakes





POX



Queen Anne (1665-1714)

17 pregnancies

3 still births

10 miscarriages

3 died in infancy of smallpox

William Duke of Gloucester (1689-1700)



prevention



inoculation

Tibet, 11th century

Turkey, ? 16th century

England, France 18th century

"gradual eradication of small pox was responsible for much of the population growth that occurred in England in the eighteenth century."

Mr. MAITLAND'S
ACCOUNT
OF
INOCULATING
THE
SMALL POX
Vindicated,

From Dr. WAGSTAFFE'S Misrepresentations of that PRACTICE; with some Remarks on Mr. MASEY'S Sermon.

The Second Edition.

To which is added,
His First ACCOUNT of *Inoculating*
the SMALL POX.

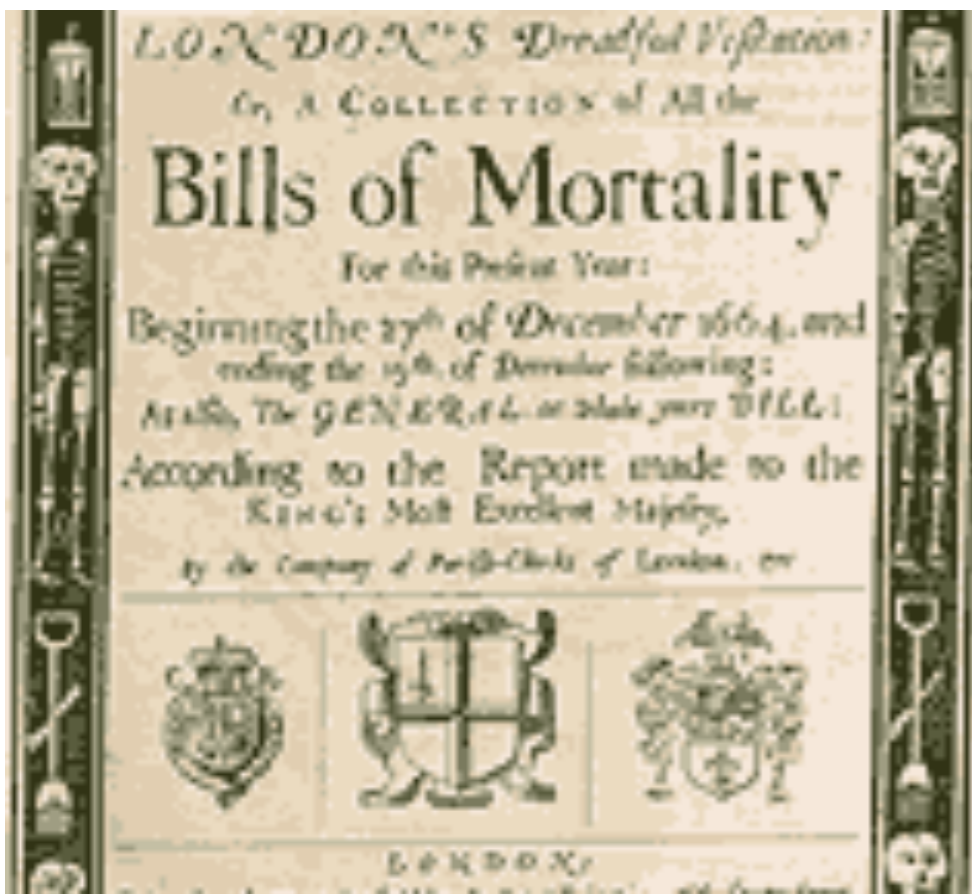
L O N D O N:

Printed and Sold by J. PEELE, at *Lock's*
Head in *Paternoster-Row*. 1722.

inoculation

"It is whispered in Christian Europe that the English are mad and maniacs: mad because they give their children smallpox to prevent their getting it, and maniacs because they cheerfully communicate to their children a certain and terrible illness with the object of preventing an uncertain one. The English on their side say: 'The other Europeans are cowardly and unnatural: cowardly in that they are afraid of giving a little pain to their children, and unnatural because they expose them to death from smallpox some time in the future'. To judge who is right in this dispute, here is the history of this famous inoculation which is spoken of with such horror outside England."

Voltaire, *Letters on England*



bills of mortality

1603: regular bills of mortality

1611: incorporation of parish clerks counting by "searchers"

1629: other deaths

1728: age of deceased

1837: last bills

A general Bill for this present year, ending the 19 of December 1665. according to the Report made to the KING'S most Excellent Majesty. By the Company of Parish Clerks of London, &c.

The Diseases and Casualties this year.

A Bortive and Stillborne	517	Executed	21	Palfie	30
Aged	1545	Flux and Small Pox	655	Plague	68528
Aque and Peaver	5257	Found dead in Streets, fields, &c.	20	Plasme	6
Appoplex and Suddenly	216	French Pox	86	Plurisie	19
Bedric	10	Frighted	23	Poxed	4
Blasid	5	Gout and Sciatica	27	Quinke	35
Bleeding	16	Grief	46	Rickets	157
Bloody Flux, Scouring & Flux	187	Gripping in the Guts	1238	Killing of the Lights	197
Burnt and Scalded	8	Hanged & made away themselves	7	Rupture	14
Colentre	3	Head smothered & Misdemeanors	14	Scurvy	107
Cancer, Gangrene and Fistula	56	Jaundies	100	Shingles and Swine pox	2
Canker, and Thrush	121	Impositione	227	Sores, Ulcers, broken and healed	82
Childbed	625	Kild by severall accidents	46	Limbs	82
Christomes and Infants	1258	Kings Evill	86	Spleen	14
Cold and Cough	65	Leprosie	2	Spotted Fever and Purples	1929
Collick and Winde	134	Lethargy	14	Scopping of the stomack	344
Consumption and Tiflick	4808	Livergrowne	21	Stone and Strangury	38
Convulsion and Morice	2054	Meargrom and Headach	81	Suet	1014
Distracted	5	Measles	7	Teeth and Worms	1014
Droove and Tempany	1476	Murthered and Shot	9	Vomiting	71
Drowned	5	Overlad & Starved	455	Vunn	7

♂ Males	5114	Buried	♂ Males	48569	Of the Plague	68528
♀ Females	4853		♀ Females	48717		
♂ In all	9967		♂ In all	97286		

Increased in the Burials in the 130 Parishes and at the Pest-houses this year. 79009
 Increased of the Plague in the 130 Parishes and at the Pest-houses this year. 68528



political arithmetic

politics and population

William Petty, RS (1623-1687)

surveyor

Political arithmetic of Ireland

velocity of circulation
natural vs market price
economic surplus
population change



An Extraēt of two Essays in Political Arithmetick concerning the comparative Magnitudes, &c. of London and Paris by Sr. William Petty Knight. R. S. S.

The excellent Author of these two Essays, has in several former of the same Nature made it appear that Mathematical Reasoning, is not only applicable to Lines and Numbers, but affords the best means of Judging in all the concerns of humane Life. In the present he endeavours to prove *London*, as it now is, the most considerable City now in being, by shewing it much to exceed *Paris*, (which not only the *French* but foreigners have asserted to be the chief City of *Europe*.) both in People, Housing, and Wealth: The first by comparing the Bills of Mortality, whereby he finds that the People of *London* are as many as those of *Paris* and *Rouen* put together. The second by comparing the number of Houses, which by the Chimny-Books are found above 80000 in *London*, whereas a great Author among the *French*, (who seldome faile to magnifie their own things,) reckons but 50000 Houses in *Paris*. As to the third, to wit the Wealth, he conceives that there is yet a much greater disproportion, there being no comparison between them for Trade, and besides a good argument drawn from the Law-Suites of both places, he concludes from the *Paris* bills of Mortality, that two 5ths of the People of *Paris* are so poor

competitive counts

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A further Assertion of the Propositions concerning the Magnitude, &c. of London, contained in two Essays in Political Arithmetic; mentioned in Philos. Transact. Numb. 183; together with a Vindication of the said Essays from the Objections of some Learned Persons of the French Nation, by Sr. W. Petty Knt. R.S.S.

1. I T could not be expected that an Assertion of *Londons* being bigger than *Paris* and *Rouen*, or than *Paris* and *Rome* put together, and bigger than any City of the World, should scape uncontradicted, and 'tis expected that I (if continuing in that Perswasion) should make some Reply to these contradictions.

2. I begin with the Ingenious Author of the *Novelles de la Republique des Lettres*, who saith that *Rey* in *Persia* is far bigger than *London*; for that in the 6th. Century of Christianity (I suppose *An. 550*) It had 15000, or rather 44 thousand *Moschees* or *Mahometan Temples*. To which I reply, that I hope this Objector is but in jest, for that *Mahomet* was not borne till about the Year 570, and had no *Moschees* till about

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battle with 'declinists'



headcounters

Natural and Political
OBSERVATIONS
Mentioned in a following INDEX,
and made upon the
Bills of Mortality.

By *JOHN GRAUNT*,
Citizen of
LONDON.

With reference to the *Government, Religion, Trade,*
Growth, Age, Diseases, and the several Changes of the
said *CITY.*

— *Nae, mi ut miratur Turba, labere.*
Contentus pauper LeBarbier —

LONDON,
Printed by *Tho: Keyser,* for *John Martin, James Allcock,*
and *Tob: Dineen,* at the Sign of the Bell in *St. Paul's*
Church-yard, **MDCLXII.**

His Majesty gave this particular charge to His Society, that if they found any more such Tradesmen, they should be sure to admit them all, without any more ado

Pepys

John Graunt, RS
Natural and Political
Observations ...
upon the Bills of Mortality
1662





births, marriages, & deaths

(194)

The Number of the Weddings, Christenings, and Burials, that were in the Parish of Cranbrook, from March 26, 1560 to March 24, 1649; (as appeareth by the Register) only in the years 1574 and 1585 the Christenings are wholly omitted, because the Register is very imperfect for the greater part of those years.

Years	Weddings	Christened			Buried		
		M.	F.	Both	M.	F.	Both
1560	20	36	35	69	29	21	50
61	24	46	33	79	33	32	65
62	33	33	26	59	40	31	71
63	15	28	21	49	19	24	43
64	23	29	29	58	10	8	18
65	29	44	29	73	37	34	71
66	25	39	26	65	69	35	104
67	28	43	41	84	36	21	57
68	22	38	44	82	31	31	62
69	22	36	35	71	25	19	44
	231	370	312	682	319	246	565

(195)

The Table of the Parish of Cranbrook.

Years	Weddings	Christened		Both	Buried		Both
		M.	F.		M.	F.	
1570	22	37	44	74	35	26	61
71	18	31	27	58	28	16	44
72	21	31	34	65	30	19	49
73	29	28	31	59	29	21	50
74	21				28	23	51
75	25				18	14	32
76	29	49	42	91	37	16	53
77	16	35	48	83	25	21	46
78	14	43	32	75	19	15	34
79	22	47	42	89	26	18	44
	215	298	302	600	241	225	466
80	20	47	45	92	26	23	49
81	28	42	45	87	32	30	62
82	24	50	49	99	32	27	59
83	28	59	44	103	24	20	44
84	25	57	37	94	24	19	43
85	21	60	32	92	17	14	31
86	27	37	30	67	28	22	50
87	20	41	33	74	23	22	45
88	24	37	39	76	24	21	45
89	19	30	44	74	17	15	32
	215	312	304	616	271	248	519

of the
Plague



counting difficulties

AN INDEX of the Positions, Observations, and Questions contained in this Discourse.

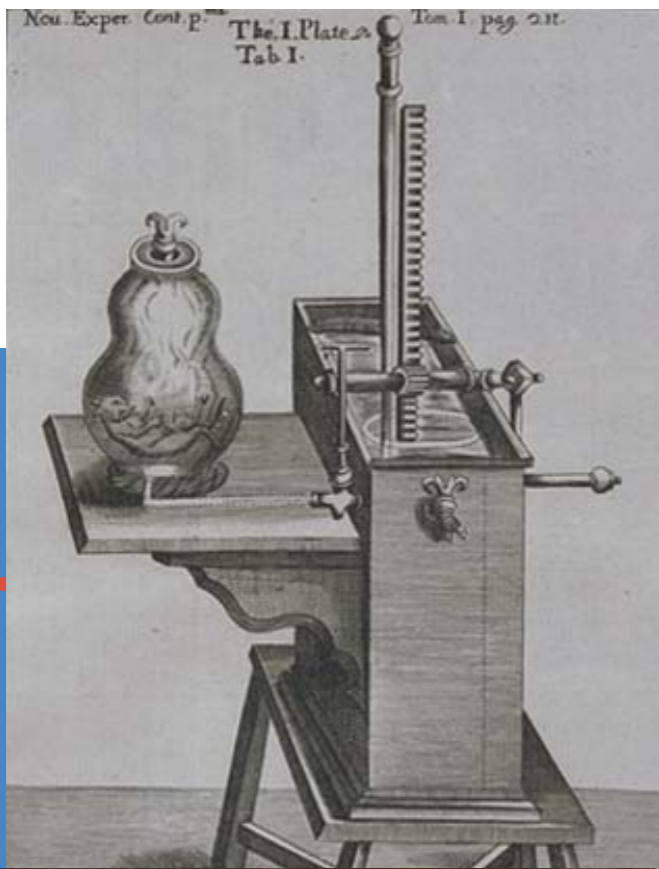
1. **T**he Occasion of keeping the Account of Burials arose first from the Plague, Anno 1592, page 3
2. Seven Alterations, and Augmentations of the published Bills, between the years 1592, and 1662, pag. 4, 5, 6, 7, 8, 9, 10
3. Reasons, why the Accounts of Burials, and Christnings should be kept universally, and now called for, and perused by the Magistrate, p. 11
4. A true Account of the Plague cannot be kept, without the Account of other Diseases, p. 12
5. The ignorance of the Searchers no impediment to the keeping of sufficient, and usefull Accounts, p. 13
6. That about one third of all that were ever quick die under five years old, and about thirty six per Centum under six, p. 14
7. That two parts of nine die of Acute, and seventy of two hundred twenty nine of Chronical Diseases, and four of two hundred twenty nine of outward Griets, 14, 15
8. A Table of the Proportions dying of the most notorious, and formidable Diseases, or Casualties, p. 16
9. That seven per Centum die of Age, bid.
10. That some Diseases, and Casualties keep a constant proportion, whereas some other are very irregular, p. 16, 17
11. That not above one in four thousand are Starved, p. 17
12. That

shame

"The Old-Women Searchers, after the mist of a Cup of Ale, and the bribe of a two-grout fee ... cannot tell whether this emaciation or leanness were from a phthisis, or from an Hectick Fever, Atrophy, &c. or from an Infection of the Spermatick parts ... onely hated persons, and such, whose very Noses were eaten off were reported by the searchers to have died of this too frequent Malady."

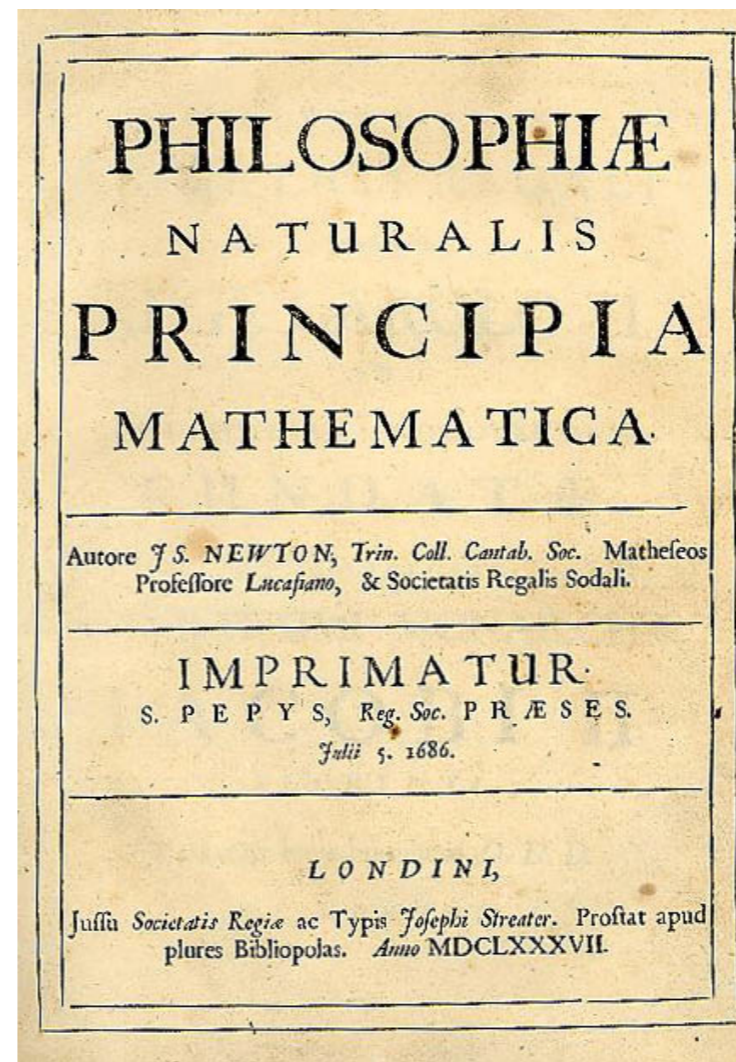
principle

fear



scientific knowledge

matters of fact, matters of trust



in facts
in books
in people



facts

experiments and replication
machina boyleana



failed demos

"And thither anon come all the Gresham College, and a great deal of noble company: and the new instrument was brought called the Arched Viall, where, being tuned with lute-strings, and played on with keys like an organ, a piece of parchment is always kept moving; and the strings, which by he keys are prssed down upon it, are grated in imitation of a bow, by the parchment; and so it is intended to resemble several vialls played on with one bo, but so basely and harshley, that it will never do. But, after three hours' stay, it could not be fixed in tune"

--Pepys, October 5, 1664



books

battle of the books

Adrian Johns, *The Nature of the Book*, 1998

*rican Whale-fishing about the Bermudas. A Narrative concerning
the success of the Pendulum-watches at Sea for the Longi-
tudes; and the Grant of a Patent thereupon. A Catalogue of the*

error

"piracy"

plagiarism

fraud

"Swiftboating"

"The wits .. had powerful strategies at their disposal for challenging the worth of any printed book ... and the truth of any printed statement".

--Johns



forward to the past

"I will write my Name in each Book with my own Hand"

J. Desaguliers,

Course of Experimental Philosophy, 1734

"These men had discovered the central, overwhelming paradox rending early modern print culture. The only really effective way to guarantee the authenticity of their printed sheets was to abandon the defining element of print itself. ... they returned to inscribing their authorship by hand"

--Johns



people

"Some men ...
have ... made use of
such experiments of
mine, as I have
strong motives to
think they never
made nor saw, only
because they had
been related by one,
after whom they
thought they might
without a hazard of
their credit deliver
any matter of fact"

Boyle *New
Experiments Touching
Cold*, 1665

"from the honor, and reputation, of these Men
... *Gentlemen*, free and unconfind'd"
--Sprat

Boyle

Thomas Hobbes & the gap
between fact & theory

Graunt

"shop arithmetic"



Petty
Anne Greene



animadversions

Philosophical Transactions "report an
untruth"

"there is less credit to be placed in the
Narrations of some of our *Virtuosi*, who
have been so mistaken in their Accounts ...
with what *negligence* and *imperfectness* will
they register thing? how *un-philosophical*
will their memories be?"
--Stubbe



from open ...

"Put an advertisement in the *Courant* "by that Means, you'll have the Assistance of the most able Men in the Kingdom."

-Susanne Centilivre, *Love's Contrivance*, 1703

"it suffices, if many of them be plain, diligent, and laborious observers: such, who though they bring not much knowledg, yet bring their hands, and their eyes uncorrupted"

-Sprat





... to closed

membership

peer review

**natural history to natural
philosophy**

back to the university



on to vizualization

Impact of being out 'sick'



When retirement savings start

Age group	Avg. age
18 to 28	23.8
29 to 30	28.0
40 to 57	34.1
58 or older	58.5

States with the highest gas tax (cents per gallon)

GAS	
Washington	36.0
Pennsylvania	31.2
Rhode Island	31.0
Wisconsin	30.9



Personal Budget

Monthly Net Income

Income Type	Amount
Monthly Net Income	\$4,500
Planned Monthly Savings	\$300
Available Cash	\$4,200

Additional Income

Details	Month	Amount
Mid Year Bonus	June	\$2,000
Year End Bonus	December	\$3,000
	January	
Total Additional Income		\$5,000

1. Enter your income information in the two income tables.
2. Enter your expenses. Use the Monthly Expenses table for recurring expenses.
3. Enter a starting balance in the January column on the Annual Budget table.

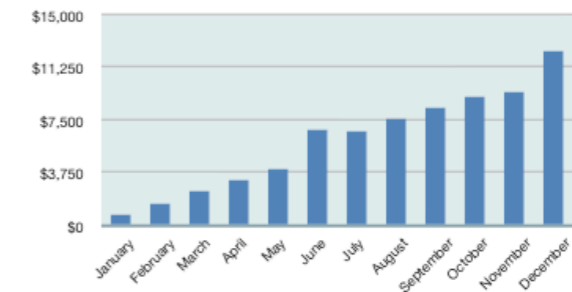
Monthly Expenses

Expense	Costs
Mortgage	\$2,300
Taxes	\$600
Car Payment	\$350
Car Insurance	\$60
Home Owners Insurance	\$127
Cable Bill	\$120
Gas/Electric	\$88
Monthly Prescription	\$50
Total Monthly Expenses	\$3,695

Planned Expenses

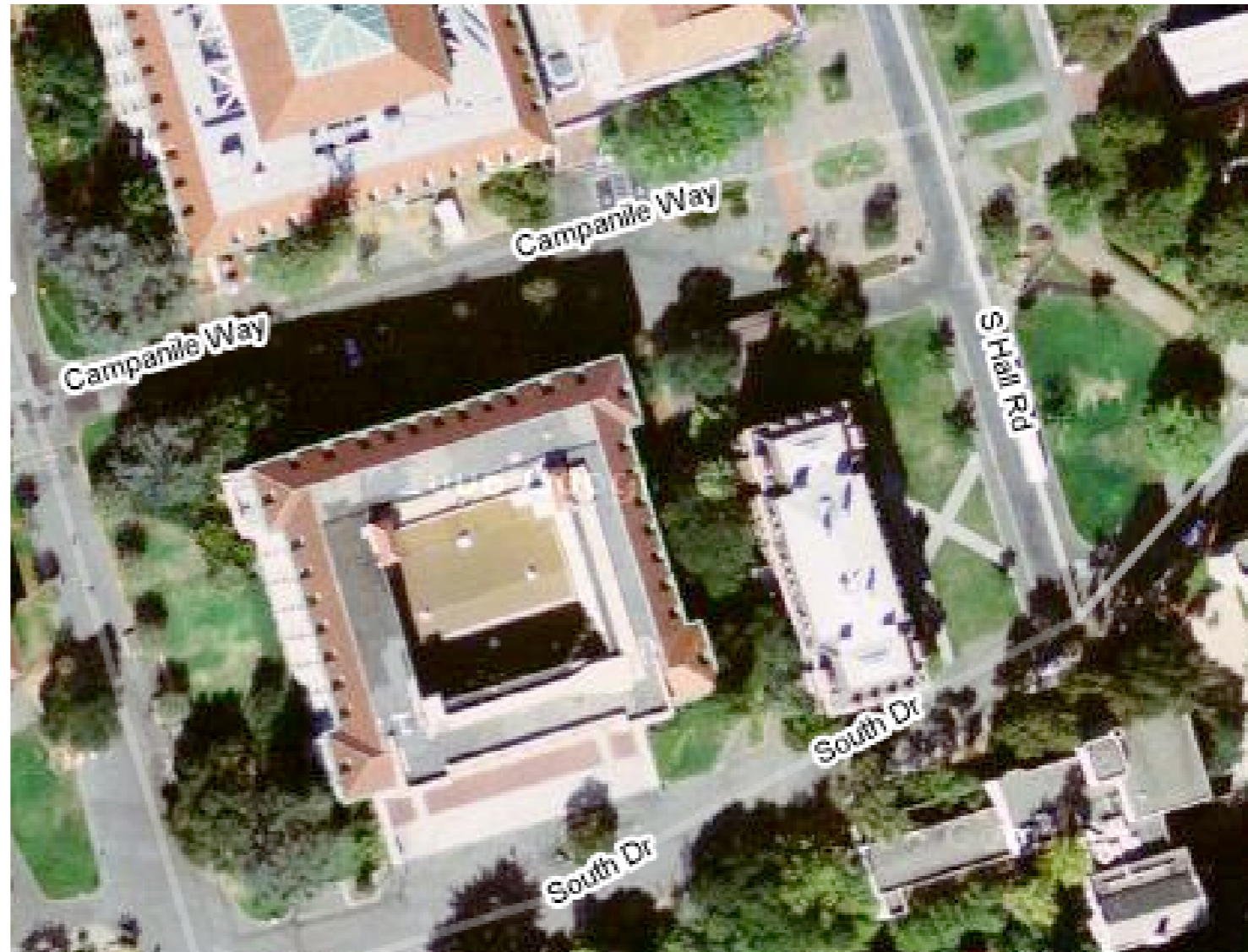
Expenditure	Month	Amount
November vacation	November	\$450
Home for the holidays	December	\$600
Gifts for family	December	\$300
Family vacation	July	\$880
	January	
	January	
	January	
	January	
Total Planned Expenses		\$2,230

Savings



Annual Budget by Month

Income and Expenses	January	February	March	April	May	June	July	August	September	October	November	December
Previous month's balance		\$805	\$1,610	\$2,415	\$3,220	\$4,025	\$4,830	\$5,635	\$6,440	\$7,245	\$8,050	\$8,855
Available cash	\$4,200	\$4,200	\$4,200	\$4,200	\$4,200	\$4,200	\$4,200	\$4,200	\$4,200	\$4,200	\$4,200	\$4,200
Additional income	\$0	\$0	\$0	\$0	\$0	\$2,000	\$0	\$0	\$0	\$0	\$0	\$3,000
Monthly expenses	\$3,695	\$3,695	\$3,695	\$3,695	\$3,695	\$3,695	\$3,695	\$3,695	\$3,695	\$3,695	\$3,695	\$3,695
Planned expenses	\$0	\$0	\$0	\$0	\$0	\$0	\$880	\$0	\$0	\$0	\$450	\$900
Savings	\$805	\$1,610	\$2,415	\$3,220	\$4,025	\$4,830	\$5,635	\$6,440	\$7,245	\$8,050	\$8,855	\$9,660





playing leapfrog

"the further they are to the north, the more gross and brutish they are"

Al Masudi (871-957)

quantification and visualization

Alfred Crosby, *The Measure of Reality*, 1997





a quick view of visualization

science

tables

charts

graphs

politics

maps

illustrations



when were tables?

Origen's Hexapla, c . 234





prognostications & anti prognosticon

☉ 27° ♂ 5°
 ☾ 254° ♃ 32°
 ♀ 36° ♃ 127°
 ♀ 345°



Aprill hath xxv. dayes.

To take no hede you shall be more offended,
 Than vveake strong the inquisitions peafible,
 They cie the hunger the people are oppressed
 The fea vvaxe redde, the long curst and vviced.

1	g	Thedoze mar. pil.	23	faire weather
2	a	Wary Egip.	art: 6	Rumor populi
3	b	Richard bish.	es 19	● New moon. 1st
4	c	Ambrose bish.	tau: 1	day at 8. at night
5	d		rus 14	rain & widtumult
6	e	Sixtus bishop	tau. 20	at returne lucky.
7	f	Euphemie	gem. 8	shelthe. Joye
8	g		gem. 20	renewed.
9	a	Perpetuus.	can: 2	euyll weather
10	b		cer 14	friends enemies.
11	c	Selin taurus	cer 27	i. q. a. S. h. a. mi
12	d	Symon mar.	leo 9	Tempesta oric.
13	e	Epburcii & Ma.	leo 22	good policie
14	f	Appolin	vir: 4	reioycng
15	g	Carino begis.	go. 17	moderate season
16	a	Flidoze bish.	lib. 0	Contur. of enns.
17	b	Anicetus bish.	lib. 14	Domus deserta.
18	c	Victo2 bish.	lib. 27	raune of water
19	d		leo 2. 11	● Ful mo. 19. day
20	e	Alpbegi bish.	pio. 25	6. a cl. 7. mi. mo2
21	f		sagi: 10	ning, fair wether
22	g	Sother	tari. 25	great wyndes.
23	a	Geo2ge mar.	cap: 10	● what cruell



tables & numbers

Graunt, Petty

(194)

The Number of the Weddings, Christenings, and Burials, that were in the Parish of Cranbrook, from March 26, 1560 to March 24, 1649; (as appears by the Register) only in the years 1574 and 1565 the Christnings are wholly omitted, because the Register is very imperfect for the greater part of those years.

Years	Weddings	Christned			Buried		
		M.	F.	Both	M.	F.	Both
1560	30	36	35	69	29	21	50
61	34	46	33	79	23	22	45
62	33	32	26	58	40	31	71
63	15	28	21	49	19	24	43
64	23	29	29	58	10	8	18
65	29	44	29	73	57	54	111
66	25	39	26	65	09	35	104
67	28	43	41	83	36	21	56
68	22	38	44	82	31	31	62
69	23	36	35	71	25	19	44
	231	370	312	657	319	246	565

(195)

The Table of the Parish of Cranbrook.

Years	Weddings	Christned		Both	Buried		Both
		M.	F.		M.	F.	
1570	13	17	44	74	18	27	69
71	14	21	27	58	21	16	47
72	21	25	34	79	24	19	68
73	22	28	31	59	20	21	50
74	28	32	31	63	18	23	56
75	25	30	32	62	18	14	34
76	29	49	42	91	27	16	43
77	16	35	48	83	23	21	44
78	14	41	39	80	19	16	35
79	24	47	44	91	26	18	44
	235	238	298	601	241	225	466
1580	30	47	45	89	25	21	46
81	28	44	45	107	22	30	62
82	26	38	40	107	12	27	49
83	28	59	44	101	24	30	44
84	15	31	31	105	24	19	43
85	21	60	72	113	15	14	29
86	22	31	59	102	22	22	44
87	20	45	53	98	22	22	44
88	14	37	59	115	24	21	45
89	19	30	44	101	17	22	41
	235	314	304	701	271	248	519

Witness of the Plague

74 O 2 74

A Discourse of the Rule of the Decrease of the Height of the Mercury in the Barometer, according as Places are elevated above the Surface of the Earth, with an Attempt to discover the true Reason of the Rising and Falling of the Mercury, upon change of of Weather.

By EDM. HALLEY.

THE Elastick Property of the *Air* has been long since made out, by Experiments before the *R. Society* and elsewhere; and the Resistance of its Spring is found to be nearly equal to the Weight or Force that compresses it; as also, that the Spaces the same *Air* occupies, under dif-

proceeding

A Table shewing the Altitude to given Heights of the Mercury.

Inch.	Feet.
30	0
29	915
28	1862
27	2844
26	3863
25	4922
20	10947
15	18715
10	29662
5	48378
1	91831
0,5	110547
0,25	129262
0,1	29 mil. or 154000
0,01	41 mil. 216169
0,001	53 mil. 278338

A Table shewing the Heights of the Mercury at given Altitudes.

Feet.	Inch.
0	30, 00
1000	28, 91
2000	27, 86
3000	26, 85
4000	25, 87
5000 feet	24, 93
1 mile	24, 67
2	20, 29
3	16, 68
4	13, 72
5	11, 28
10	4, 24
15	1, 60
20	0, 95
25	0, 23
30	0, 08

"A Discourse on the Rule of the Decrease of the Height of Mercury in the Barometer, According as Places are Elevated Above the Surface of the Earth, with an Attempt to Discover the True Reason of the Rising and Falling of the Mercury, upon Change of Weather"

Edmond Halley

Philosophical Transactions, 1686



ghost maps



John Snow, 1813-1858
On the Mode and Communication of Cholera



putting things in perspective



St. Dunstan at the feet
of Christ, 10c

"It was Giotto who opened the door of truth to those who have subsequently brought the art of painting to perfection"
Vasari, *Lives of the Artists*, 1550

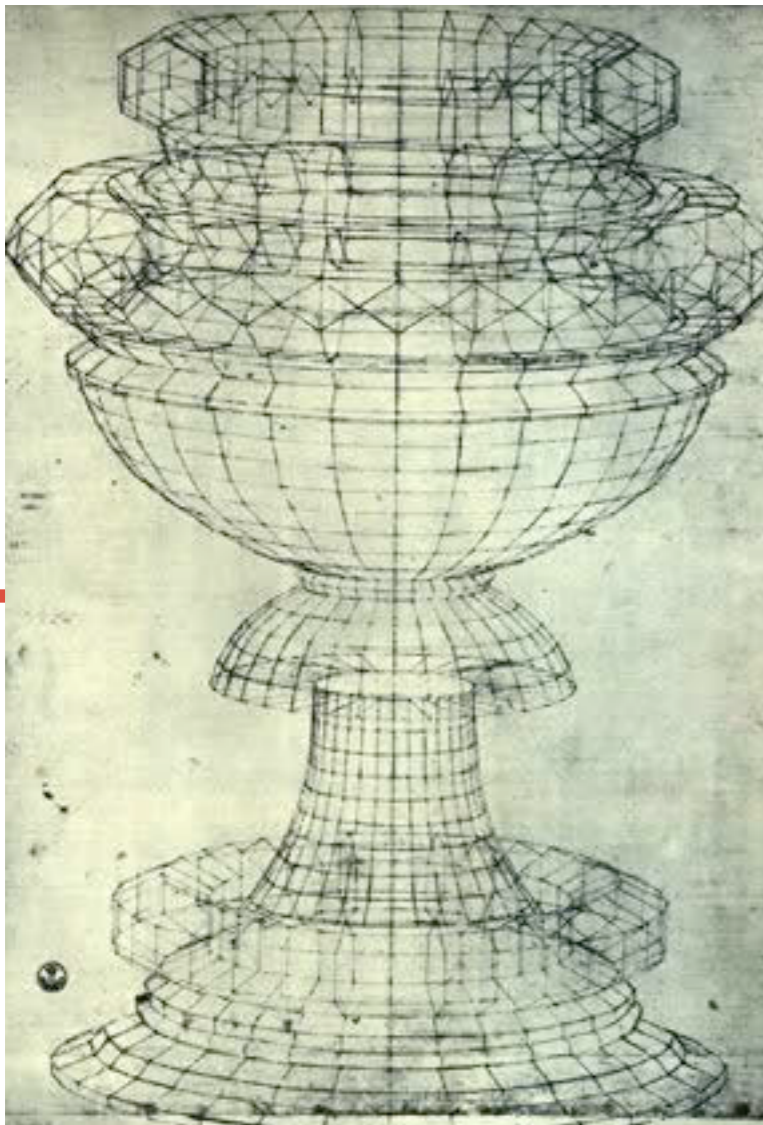


Florence, 14c



Giotto, 1267- 1337
Jesus before the Calif,
1305

losing perspective?



Uccello, 1397-1475
Chalice, c 1450

Alberti, *Della Pittura*, 1435

"The most captivating and imaginative painter to have lived since Giotto would certainly have been Paolo Uccello, if only he had spent as much time on human figures and animals as he spent, and wasted, on the finer points of perspective ... he found pleasure only in exploring certain difficult, or rather impossible, problems of perspective."

--Vasari

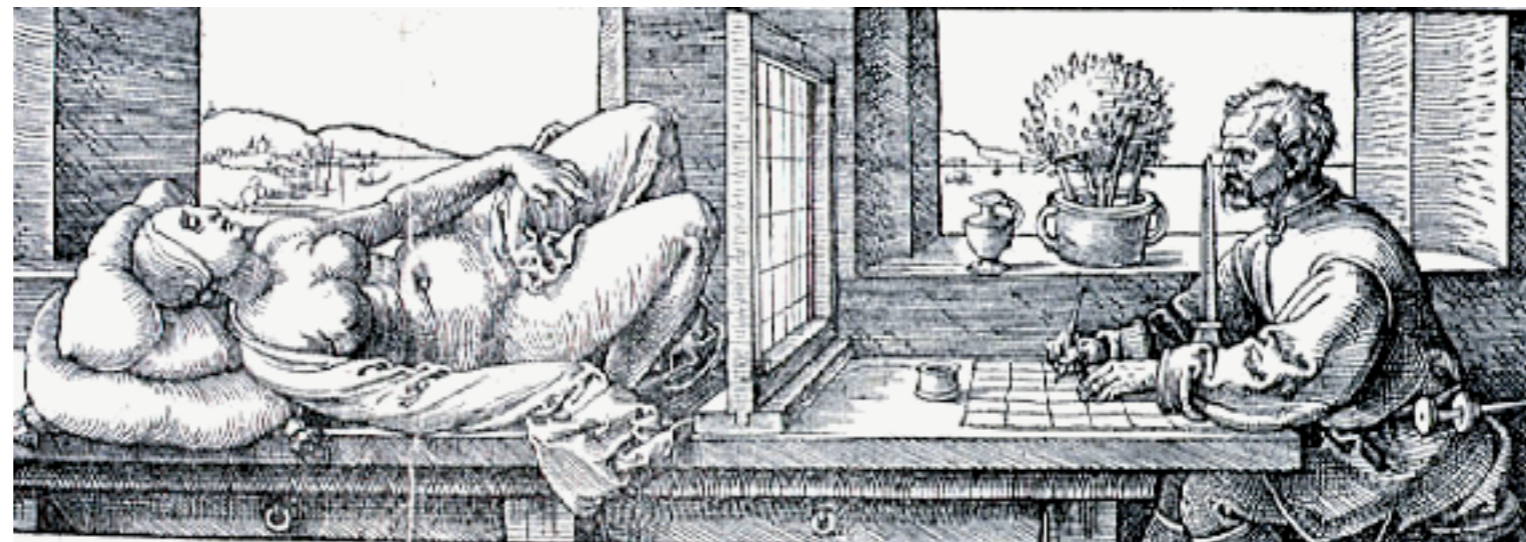


Piero della Francesca, 1422-92
The Flagellation, 1463-4



art or science?

costruzione legittima



Albrecht Durer, 1471-1528
Reclining nude in perspective, 1528



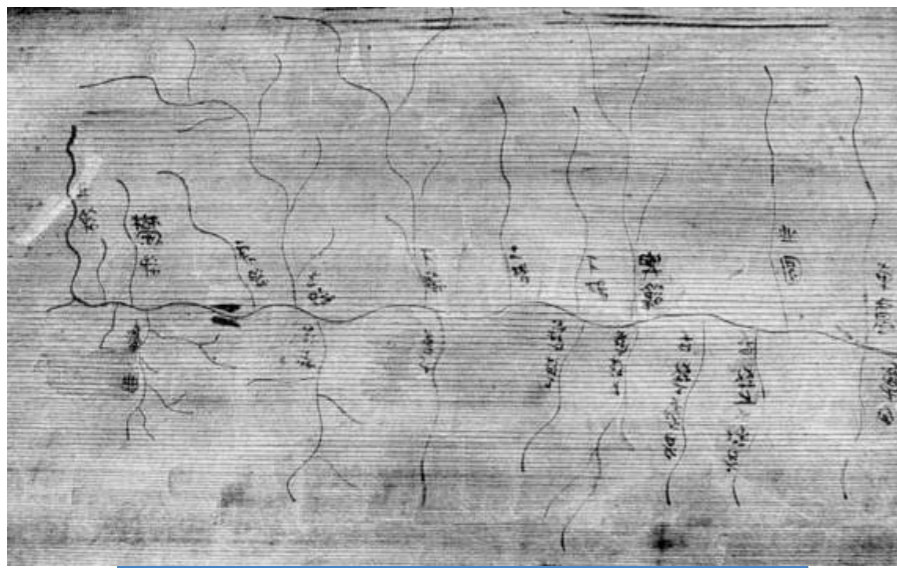
maps

"There were no uniform maps in the era when the voyages were made"

Portugal and treason

Prussian maps as state secrets

ships and weighted maps



no *European* maps

Pei Xiu, (224-271) *Yugong Diutu Xu*

6 principles of mapmaking
essentially

scale defined by graduated division

square grid for locational reference

right-angled triangles to derive distance

project the uneven surface onto a flat plane

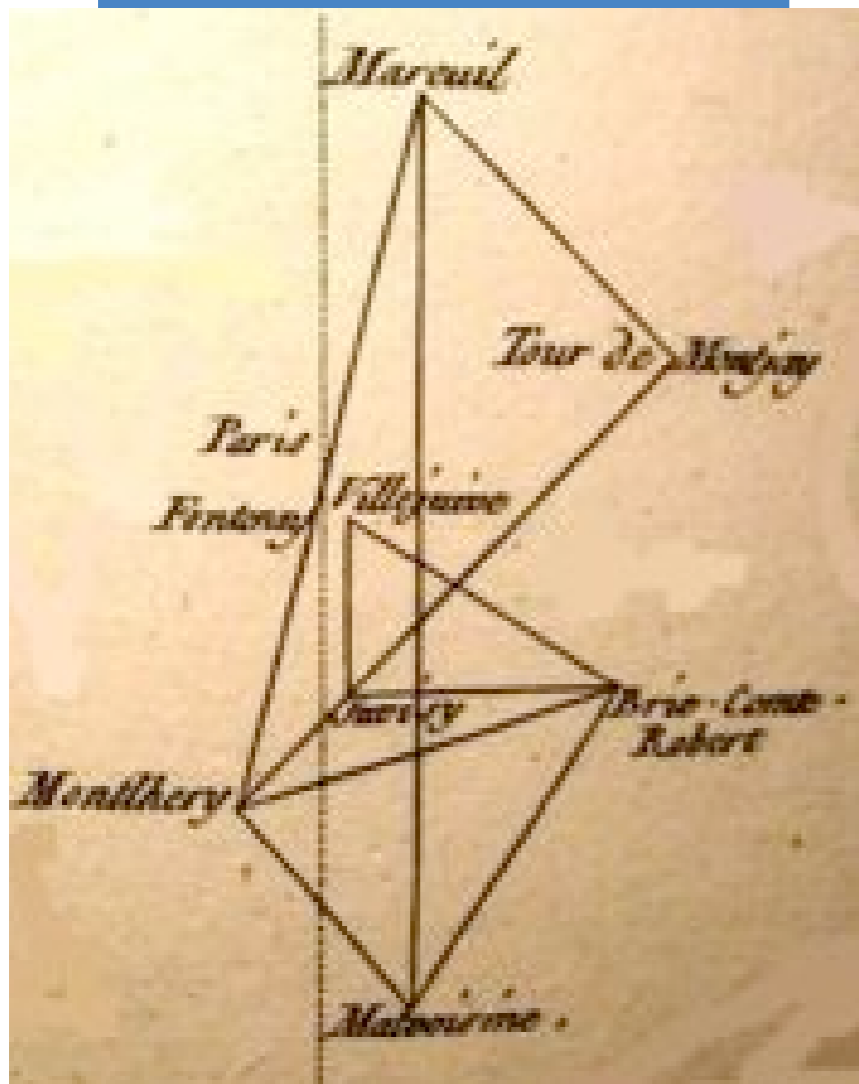
noting elevation

direction

gradient



triangulation



France

England

India