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The origins of economic prosperity

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Origins of Economic Prosperity - Lessons from the Enlightenment.

Public Lecture, Zurich June 20

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NOTE: Some of the following is based on Morgan Kelly, Joel Mokyr, and Cormac Ó Gráda, *Why Britain? A New View of the Industrial Revolution,* Princeton: Princeton University Press, forthcoming.

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If the origins and causes of the Great Divergence, the Great Reversal, and the Great Enrichment had to be summed up in one concept, what would it be?

Useful Knowledge.

Why? Because all other forms of growth such as the gains from trade and k-accumulation are subject to the "curse of concavity."

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By the eighteenth century, at the onset of the Industrial Revolution, the knowledge divergence was already there:

Dr. Samuel Johnson's fictional Abyssinian prince Rasselas asked his philosopher friend Imlac in 1759

"By what means are the Europeans thus powerful; or why, since they can so easily visit Asia and Africa for trade or conquest, cannot the Asiatics and Africans invade their coasts, plant colonies in their ports... the same winds that carry them back would bring us thither." The answer that was provided was: "they are more powerful than we, sir, because they are wiser; knowledge will always predominate over ignorance. But why their knowledge is more than ours I know not." (emphasis added).

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A fairly recent phenomenon

Yet compared to the three great Asian Civilizations, there is no evidence of any European advantage in knowledge, say around 1250 AD.

Other civilizations at that time were more advanced in science and technology, had a better educational infrastructure, higher literacy, more sophisticated state capacity and governance, and more human capital.

So what drove the reversal?

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The cultural movement that drove the growth of knowledge in the seventeenth and eighteenth centuries is what I have proposed to name *the Industrial Enlightenment* (Mokyr, 2002).

Much like the "Industrial Revolution," it is something of a misnomer.

How should we think of this concept? Should economists be even interested in the Enlightenment?

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The Enlightenment as a pivotal historical event
Two views

"What, then, is this event that is called the *Aufklärung* and that has determined, at least in part, what we are, what we think, and what we do today?"

Michel Foucault, 1983

"No topic of historical debate...has exercised anything like the hold which the enlightenment does over the ideological divisions of the modern world."

Anthony Pagden, 2013

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The other pivotal event of the eighteenth century is of course the Industrial Revolution, which by all accounts is a game-changing turning point in economic history.

Many scholars still think that real divergence between East and West did not start before. The Industrial Revolution was the pivotal event.

That may be a bit of an overstatement, but clearly by, say, 1700 the gap in living standards between Europe and the three great Asian civilizations was not large.

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The Enlightenment and the Industrial Revolution

It would seem a coincidence almost beyond belief that two events this momentous, occurring roughly at the same time and (more or less) the same place, would be unrelated.

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Is an “Industrial Enlightenment” a useful concept?

The “Enlightenment” is a big tent.

Others have sliced the Enlightenment in similar ways.

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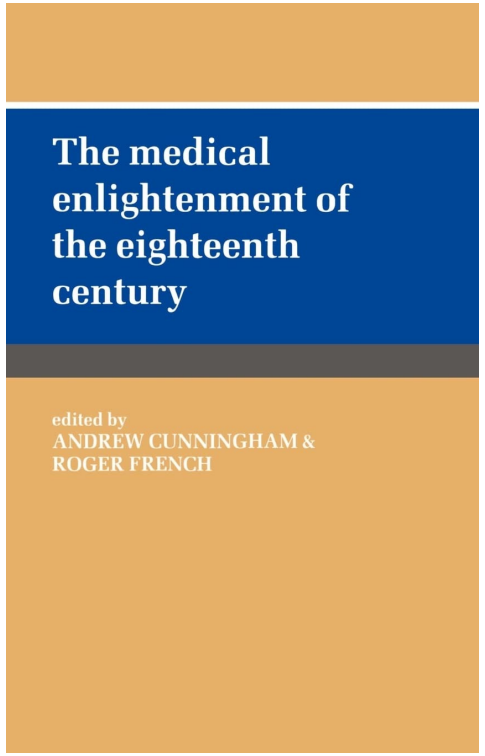
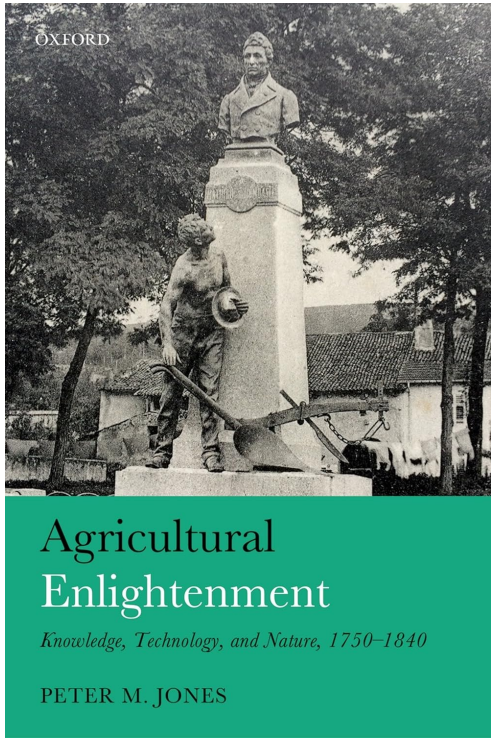
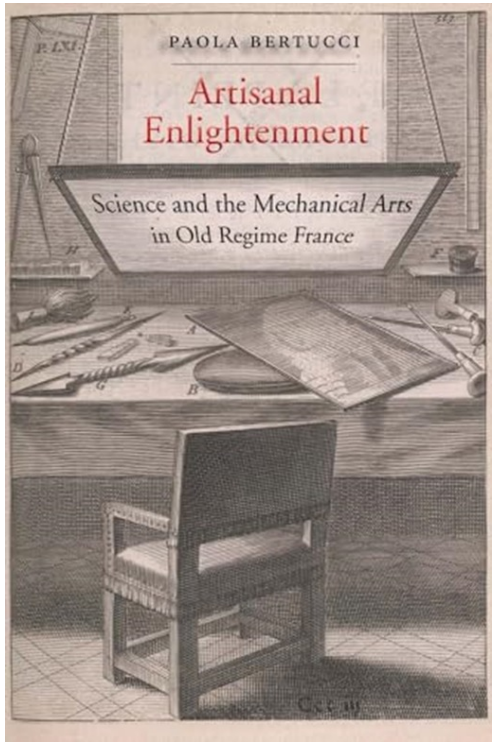
The idea of "slicing the Enlightenment" by categories of useful knowledge seems to have caught on:







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But if we look at these different cultural movements, what is their common denominator?

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Belief in progress

One possible common denominator of the different "enlightenments" is ***a belief in progress.***

This is not unproblematic either: *what kind* of progress? And progress *for whom*?

Economic growth or an increase in material welfare seem to be intuitively attractive, but in turn raises many well-known problems. But there was a sense that useful knowledge was a key to progress.

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Brief digression: how radical was the idea of progress in c. 1650?

Most historians of antiquity seem to find little evidence of it. Not just the famous statement in the book of *Ecclesiastes*. Very few examples in classical Graeco-Roman literature.

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Veneration of past sages

This intuition gets combined with an instinctive notion that great wisdom was revealed to earlier generations: China had Confucius and Zhu Xi, Islam had the Quran and the Hadith (and later Al-Ghazali), Christianity had the New Testament and later Aristotle as interpreted by St Thomas's *Summa Theologica* --- books get sacrosanct because of our respect for authorities.

This veneration of past sages is to some extent built-in by the education system: if you spent six years studying medicine as formulated by Galen and Rhazes, you will instinctively defend it against innovators who try to overthrow it. The same is true, a fortiori, for the poor Chinese lads studying Zhu Xi's comments on Confucius in preparation for the Civil Service examinations.

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Traditional Jewish Culture is the same

Jewish culture, which goes back 3000 years, shows little of it: the ultimate progress only happens when the Messiah comes, until then, things are bad.

The idea of *yeridat hadorot* --- the "decline of generations" points to the cultural inferiority complex of pre-modern Jewish intellectuals, expressed in this Mishnaic dictum: "if those who were before us (*rishonim*) were like angels, we are but men; and if those who were before us were like men, we are but asses" (Sabbath, 112).

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The growth of knowledge after 1600

Knowledge is cumulative.

In the seventeenth century, the French intellectual Bernard de Fontenelle pointed out the rather obvious fact that the scientists of his age knew what Aristotle knew, but not the reverse, and hence there was inevitable growth of knowledge. Other scholars felt the same way.

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Why did this view become so influential after 1600?

Knowledge is not inevitably cumulative; it can be and was lost. Much of the learning and wisdom of antiquity did not survive or survived only in second-hand and third-hand form. But losing knowledge seemed unlikely in the age of Fontenelle.

One difference was the *printing press*, which almost assured that codified knowledge would not be lost as it was produced in multiple and identical copies.

Moreover, the Great Voyages and the invention of more sophisticated tools to observe nature opened new horizons and allowed people to see things that had never been seen.

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Knowledge as a key to progress

This is consonant with definition of the *Aufkl*ärung famously expressed by Kant emphasizes **learning and knowledge** (*sapere aude*). The question is: knowledge of *what*?

For the economist, the answer is obvious: the kind of knowledge that can increase productivity and economic welfare and enhance economic security. It is this belief that constituted the heart of the Industrial Enlightenment.

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The Enlightenment adopted a firm (if not universal) belief in the likelihood of progress, and many of the *philosophes* were well-determined to help it further along.

They felt confident that it had happened in the past.

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The “spirit of the age”: The belief in past material improvement

In 1760 David Hume wrote in his “Of Refinements in the Arts” about “the spirit of the age” which, in his view, “roused the minds of men from their lethargy and put them into a fermentation ... to carry improvement into every art and science” (Hume, [1777], 1985, p. 271).

Joseph Priestley, one of the most articulate and distinguished English proponent of Baconian optimism, felt that “all things (and particularly whatever depends on science) have of late years been in a quicker progress toward perfection than ever... The wisdom of one generation will ever be the folly of the next” (1771, pp. 253, 265). In this rosy view, the ability of people to command and control nature would not only lead to them having a life that was more easy and comfortable, but also mean that they would “grow daily more happy” (ibid., p. 6).

And of course Adam Smith in a famous passage in WON ([1776] 1976) pp. 365-66) stressed that the “annual produce” at the time of writing was much greater than at the time of restoration and in turn much greater at restoration that at the time of Elizabeth.

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The idea of social and economic progress through the progress of useful knowledge became firmly entrenched for obvious reasons during the 16th and 17th centuries. The “querelle” between the “ancients” and the “moderns” ended in the triumph of the moderns between 1650 and 1700.

The sense of inferiority relative to the wisdom of earlier generations had more or less disappeared by 1700. This development, too, was an essential component of the Industrial Enlightenment.

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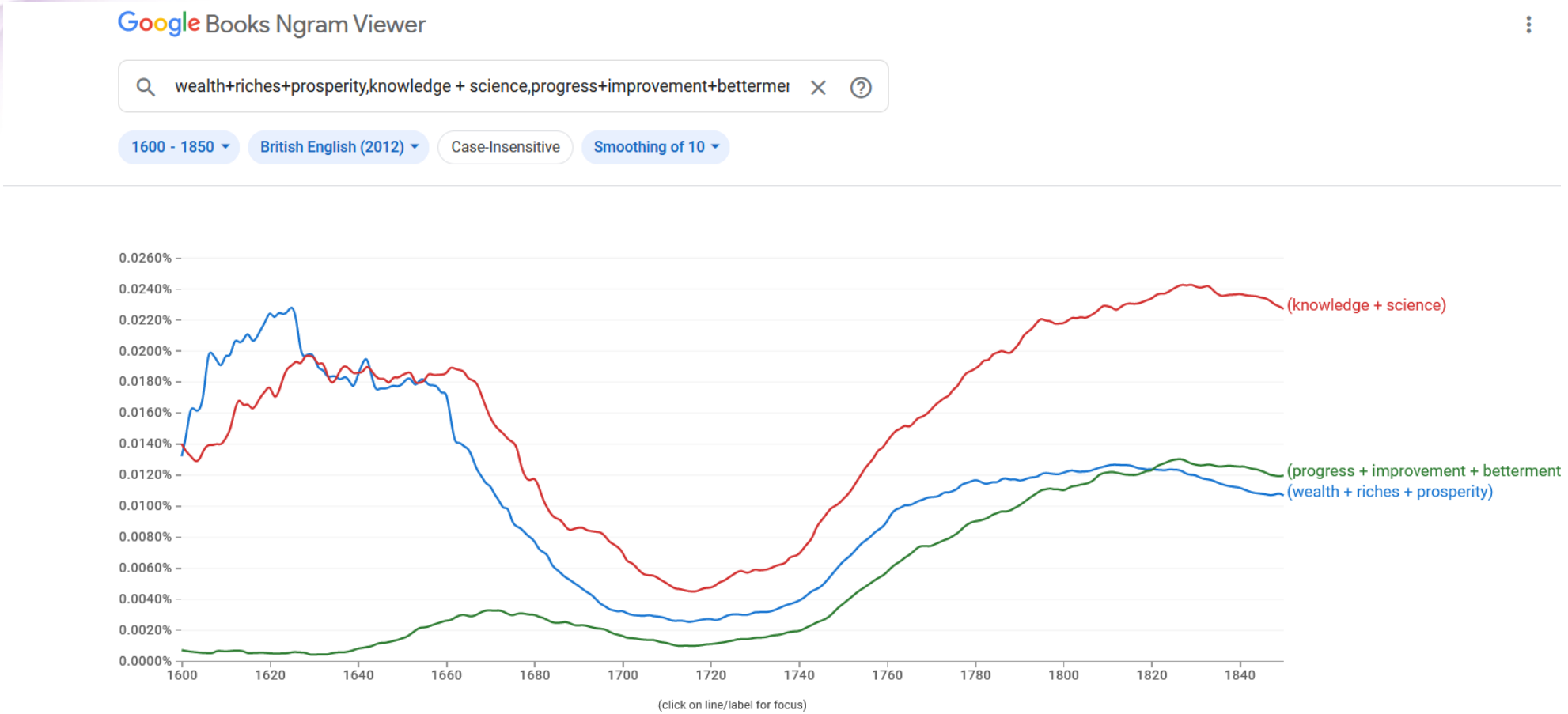

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The British Industrial Revolution

So what about the Industrial Revolution?

Was there something unusual about the **British** Enlightenment that helped generate Britain's precocity?

Britain's Enlightenment shared with Continental thinkers a belief in the possibility and desirability of progress.

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The British Enlightenment

But its emphasis was less focused on political and social themes, and it concentrated on the kind of material progress driven by practical useful knowledge leading to economic advances.

Much of the works written by Continental *philosophes* was about improvements of society, of morals and morality, of behavior, of institutions and civil society, of relations between rulers and citizens, about freedom of conscience and expression, and distribution of resources.

These questions felt less acute in Britain than on the ancien régime Continent. Instead, it was pragmatic, materialistic, aimed at practical solutions: how do we pump water out of mines? How do we determine longitude at sea? More than anywhere else, the British Enlightenment was an Enlightenment of nuts and bolts, of pulleys and belts, of cogs and springs.

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And that is what takes us back to the Industrial Enlightenment.

The economic significance of the Industrial Enlightenment depended on two critical actions:

(1) The **generation** of new useful insights and inventions (big and small) and

(2) Their **diffusion** to people who could use them.

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Inventives and Access

This required two separate advances:

On the supply side:

1. The creation of *new* useful knowledge by creating **incentives** and a friendly social environment for innovators.
2. **Improved access** to *existing* knowledge: access had to be made easier and cheaper.

[There was also a demand side coming from the growing belief of entrepreneurs and industrialists that useful knowledge was key to their business success. This is another story.]

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1. Incentives

The problem with useful knowledge creation, of course, is that it has strong public good properties: non-rivalrous, hard to exclude, substantial externalities. The Industrial Enlightenment clearly recognized this instinctively and suggested various ways of overcoming the built-in under production of useful knowledge

It is important here to distinguish between technological inventions and scientific or other intellectual insights and discoveries.

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How were intellectual and scientific innovators incentivized?

Patronage was a central importance to the encouragement of new propositional knowledge: many intellectual stars were rewarded with cushy patronage jobs such as court philosophers, tutors, private physicians, members of academies and such.

Such positions provided three things:

- economic security and a comfortable (not opulent) existence.
- the opportunity to do research and write.
- social status.

A few superstars ended up with “celebrity status” such as Newton and Leibniz.

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Non-pecuniary incentives

Honors and prestigious distinctions that were low-cost but enhanced reputations and hence the possibility for patronage.

In the 16th and 17th centuries some of these nonpecuniary rewards already existed. The Industrial Enlightenment strove to expand and improve them.

Examples: university chairs (Lady Margaret, Regius and other endowed professorships), Society of Arts (Howes, 2020), Copley Medal (established in 1736), Rumford Medal, 1799.

Beyond that, there was simply *fame*: Intellectuals wanted (and still want) to achieve peer recognition, which Adam Smith stressed in his *Theory of Moral Sentiments*.

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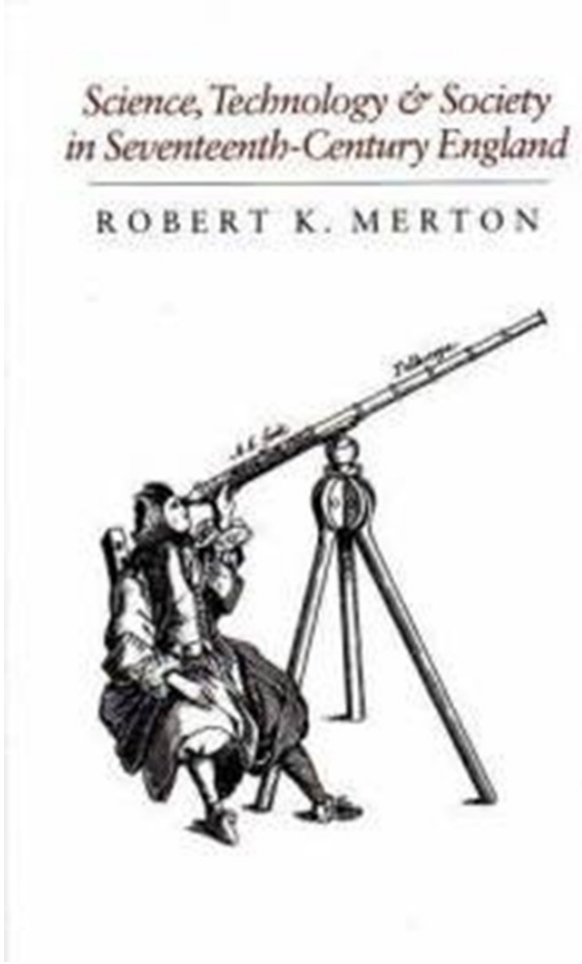
Of course there were other non-pecuniary (intrinsic) motives

One was simply curiosity and the desire to study nature to understand the wisdom of the creator (e.g., the Merton Thesis).



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Incentives for inventors

On the whole, naturally far more biased toward financial incentives.

An important component: IPR's.

The concept of IPR's is a European idea (dating from the late fifteenth century): we see nothing of the sort in other civilizations till the late nineteenth century.

Patents and copyright in embryonic form preceded the Industrial Enlightenment but became far more prominent in the eighteenth century as they were recognized to be a key to progress.

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Patents and the Industrial Enlightenment

The Industrial Enlightenment was permeated with the notion that inventions should be seen as “property” and that inventors “owned” the rights to it even though they should be required the divulge the details of their invention.

Over time, thus, the eighteenth century turned the concept of a “patent” from a monopoly and a privilege (and thus primarily a form of rent-seeking) into a property right that stimulated invention and thus increased efficiency, reflecting the ideas of the Industrial Enlightenment.

The basic idea of a patent was perfectly consonant with the Industrial Enlightenment — a patent had to be potentially useful for practical purposes to be granted at all, but would only become financially valuable if it met the market test. Enlightenment intellectuals such as Adam Smith and Johann Wolfgang Goethe agreed on this.

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Patents (eventually) required full specification of how the invention worked. It has been argued (e.g., Biagioli, 2006) that this made it into an **exchange transaction**: a temporary monopoly awarded to an inventor in exchange for full disclosure of knowledge in the description submitted to the patent office upon filing.

Disclosure was important, and I will come back to it.

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How important were IPR's to the Industrial Revolution?

The issue is controversial.

One scholar concludes cautiously that the patent system in Britain "did indeed encourage the development and diffusion of technology during the Industrial Revolution" (Bottomley, 2014, p. 174). Others have disagreed.

The real question is: by how much? Moser and others have shown that the majority of important inventions were not patented.

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One way of thinking about it

British Patents during the Industrial Revolution were expensive and the majority were not commercially successful. We know of a few that made their inventors rich such as Charles Tennant's bleaching powder and of course Watt and Boulton's patent on steam power.

But the return on the average (and certainly the median) patentee was in all likelihood negative.

It was, in the harsh but not inaccurate words of that cantankerous Victorian, Charles Babbage, "a fraudulent lottery which gives its blanks to genius and its prizes to knaves" (Charles Babbage, 1830, pp. 333, 321).

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But people still buy lottery tickets, though the mean and median returns are negative.

Moreover, in lotteries the conditional and unconditional expected returns are the same. In the patent lottery, they are not the same: every inventor thinks that his invention will beat the odds.

As Adam Smith noted famously “The over-weening conceit which the greater part of men have of their own abilities... The chance of gain is by every man more or less over-valued, and the chance of loss... undervalued” (Smith, 1776, p. 120).

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The net result is that the “fraudulent lottery” was a positive factor in the Industrial Revolution in that it made people reduce the inherent under-incentivization (and thus underproduction) of new useful knowledge and inventions.

It may have been a bad deal for inventors, but it was a great deal for the British economy.

In this unintended way, an institution strongly connected to the Industrial Enlightenment contributed to the Industrial Revolution.

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2. Access and Diffusion

The expansion of useful knowledge will not have any effects if it cannot be deployed and harnessed to economic uses.

Access costs are simply the total resources (financial, time, effort) that have to be spent to learn some piece of knowledge that exists, but needs to be acquired and mastered before it can be used.

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Access and access costs

Why is access to knowledge so important?

- Gives innovators and industrialists access to best-practice science --- which may not have all that useful in many sectors (but was getting more so).
- Tells innovators where the shoulders are on which they stand (In some cases technology depended on scientific knowledge).
- Makes recombination and hybridization of existing knowledge easier.
- Avoids duplication and dead-end research.
- Research generating propositional knowledge often was directed by recognized technological needs.

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How did knowledge diffuse?

A lot depended on networking and “social capital”: were there avenues and bridges through which people engaged in production could learn a piece of propositional knowledge, and were there ways in which natural philosophers could learn things from artisans?

In other words, communications between *savants* and *fabricants* were crucial.

Since the famous article by Edward Zilsel (1942), people have realized that those bridges were important.

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In short, the Industrial Enlightenment meant that *savants* should communicate not only with one another but also with *fabricants*.

All over Europe, the eighteenth century saw a proliferation of scientific societies, local clubs and associations dedicated to learning, as well as informal meetings in salons, coffeehouses, taverns, and so on.

This was a phenomenon we see all over Europe; but in Britain it may have been most effective, as in the famed Lunar Society and the London Chapter Coffee House, as well as the meetings held at the Society of Arts after 1754. An argument has also been for enlightenment-based associations such as masonic lodges.

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Upper Tail Human Capital

Like much of the Enlightenment, the Industrial Enlightenment was deeply elitist: their ideas and suggestions catered almost exclusively to people with considerable education and/or training --- intellectuals, natural philosophers, local notables, politicians and judges, and the upper tail of the distribution of skilled artisans: engineers, clock- and instrument makers, millwrights, surveyors, coalmine viewers, and other highly skilled workers.

These people were increasingly well-networked.

Many of the early British industrialists were close to the Enlighten-ment movement and many of the leading scientists were interested in and consulted to agriculture and manufacturing. Educated industrialists such as Wedgwood, Robert Owen and William Strutt straddled both groups.

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An important element of access: The Codification Project

Technological knowledge through history had been largely “tacit” and hence transmitted through personal contact. How to produce anything was known, of course, but was rarely written-down. Transmitted by personal contact.

One project of the Industrial Enlightenment was to codify it. Codified knowledge was more accessible and diffused faster than tacit knowledge.

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Access and Codification

One of the activities that the Industrial Enlightenment generated was the codification of useful knowledge that had previously been largely tacit. The codification of useful knowledge was at least if not more common on the Continent, and in many cases, as John R. Harris remarked, whereas the British invented, engineered, and produced, the continentals wrote about it.

The Age of Enlightenment witnessed a myriad of developments in improving access such as libraries, book indexes, alphabetized compendia and encyclopedias, compilations organized by topic or some other way, and so on.

Two examples:

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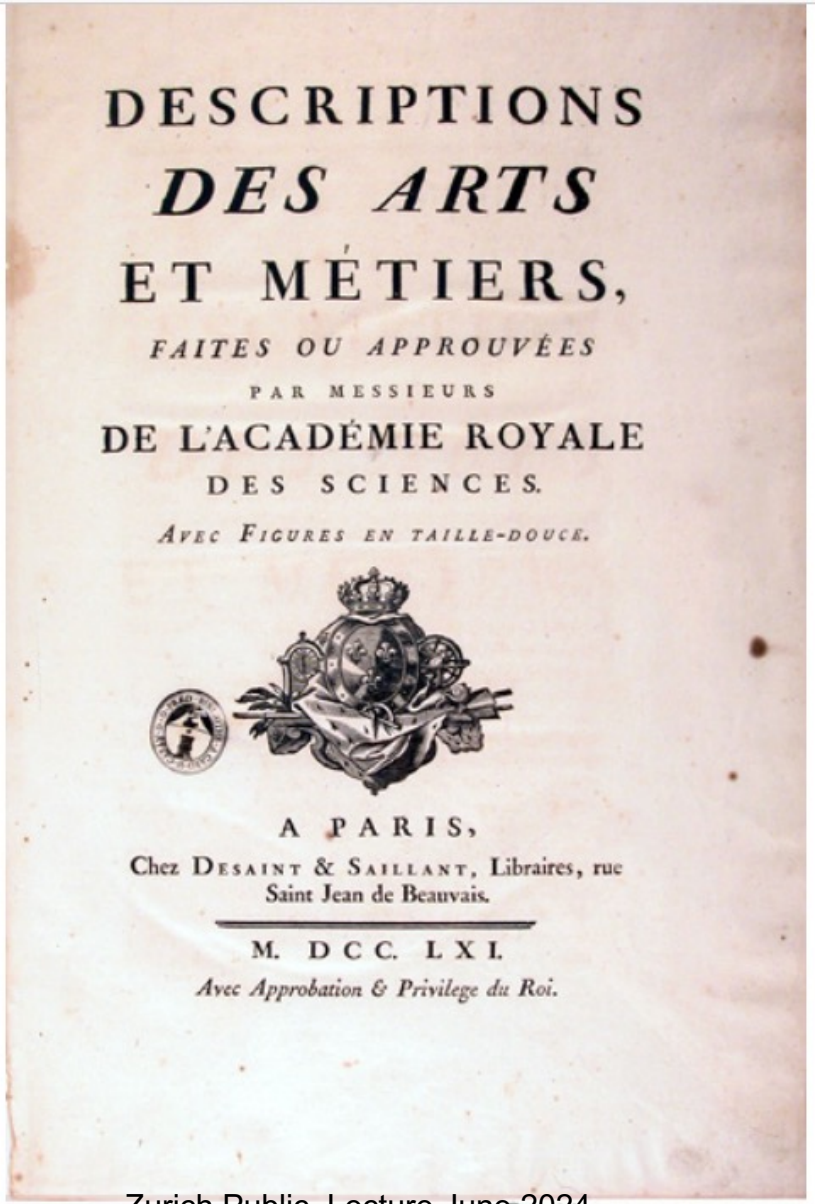
Less known than d'Alembert and Diderot



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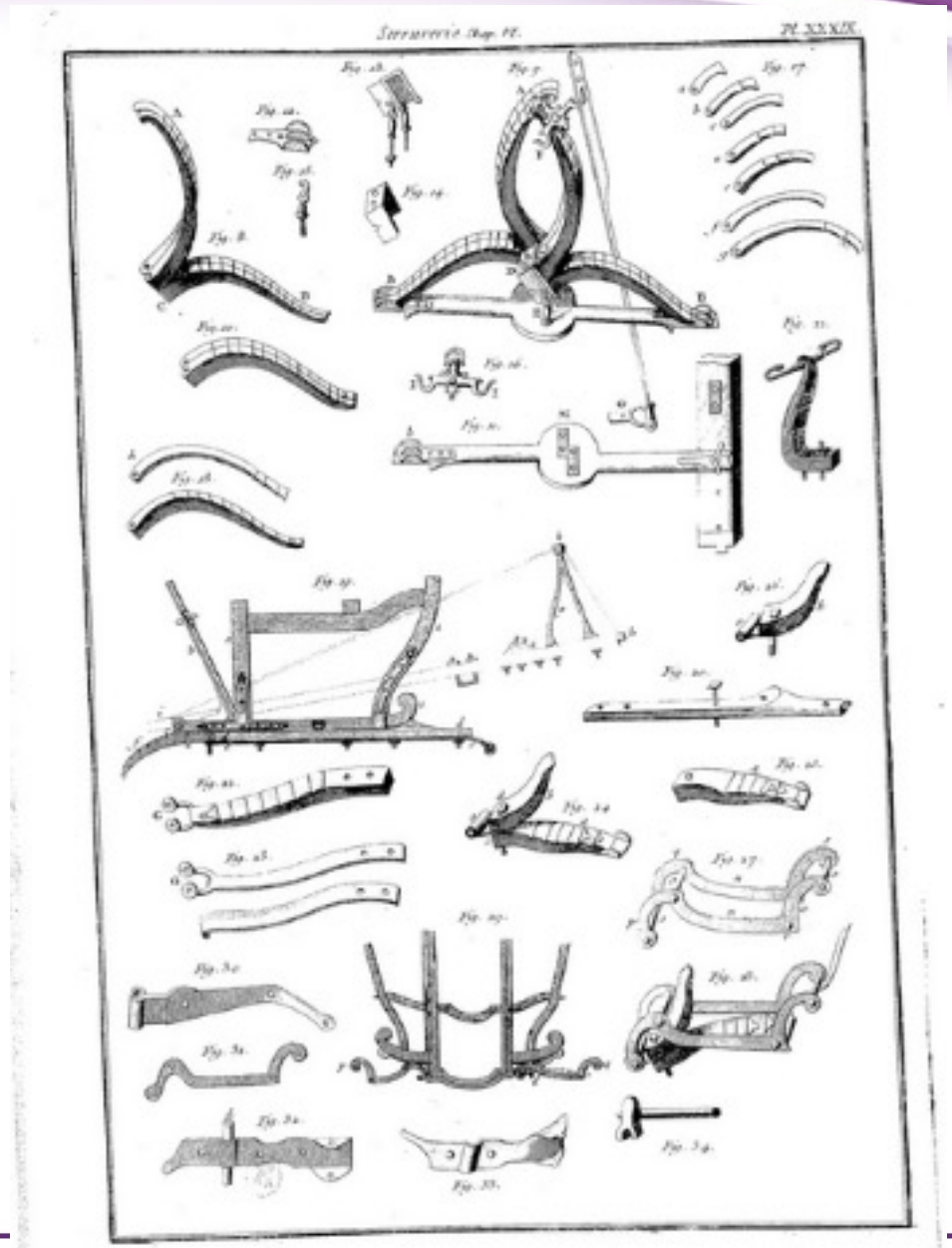

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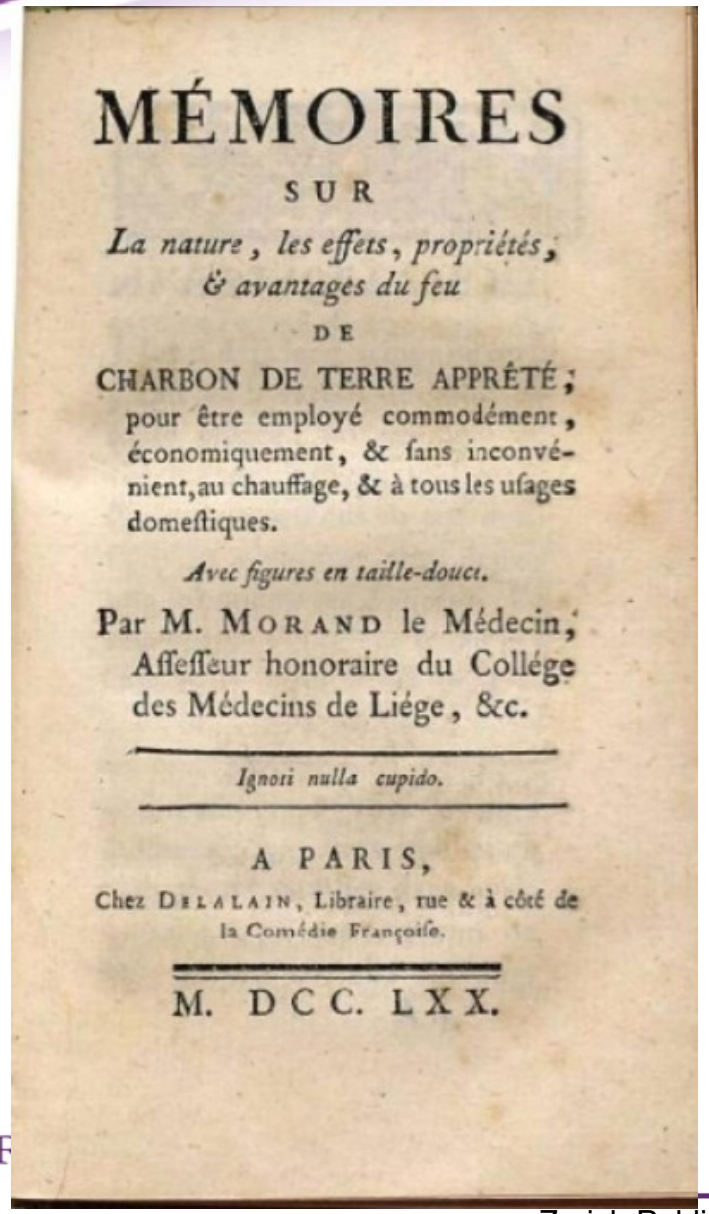

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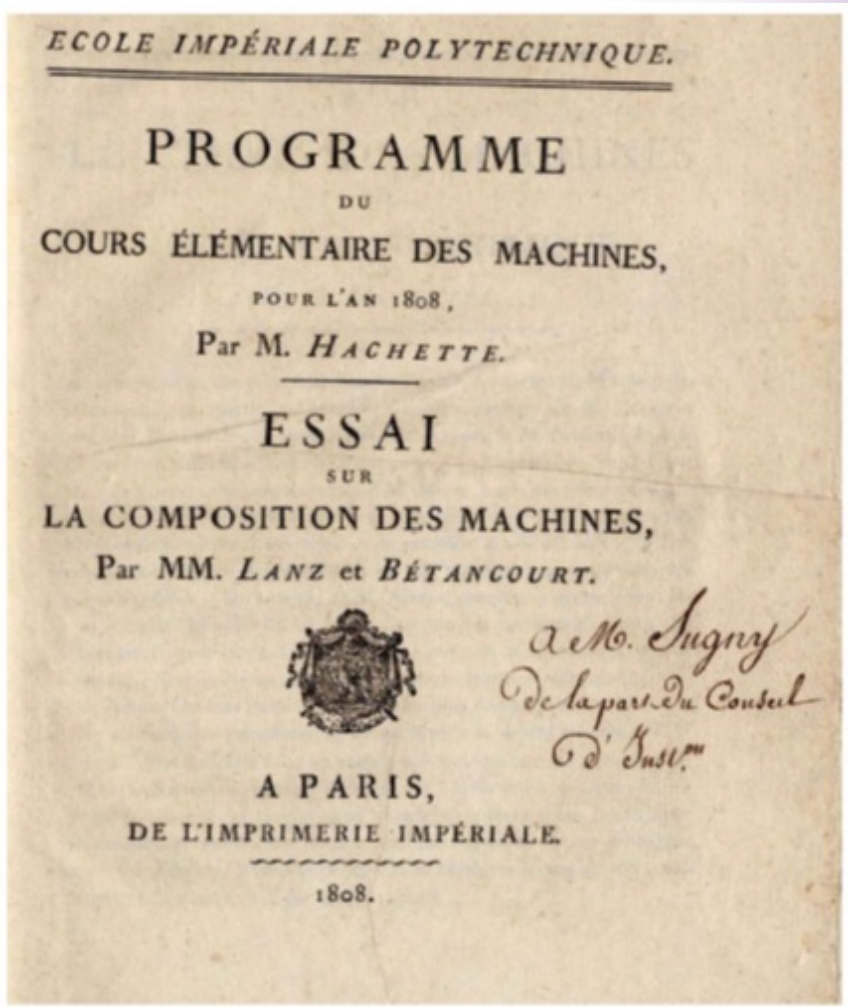

ECOLE IMPÉRIALE POLYTECHNIQUE.

PROGRAMME

DU

COURS ÉLÉMENTAIRE DES MACHINES,

POUR L'AN 1808,

Par M. *HACHETTE.*

ESSAI

SUR

LA COMPOSITION DES MACHINES,

Par MM. *LANZ* et *BÉTANCOURT.*

à M. Sugny
De la part du Conseil
d'Instr.m

A PARIS,

DE L'IMPRIMERIE IMPÉRIALE.

1808.

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The importance of books for subsequent economic development is supported by the well-know research by Squicciarini and Voigtländer (2015) who pointed to the French *Grande Encyclopedie*'s correlation with the growth of modern industry in France.

Britain had nothing quite like it, but it had lots of books such as this:

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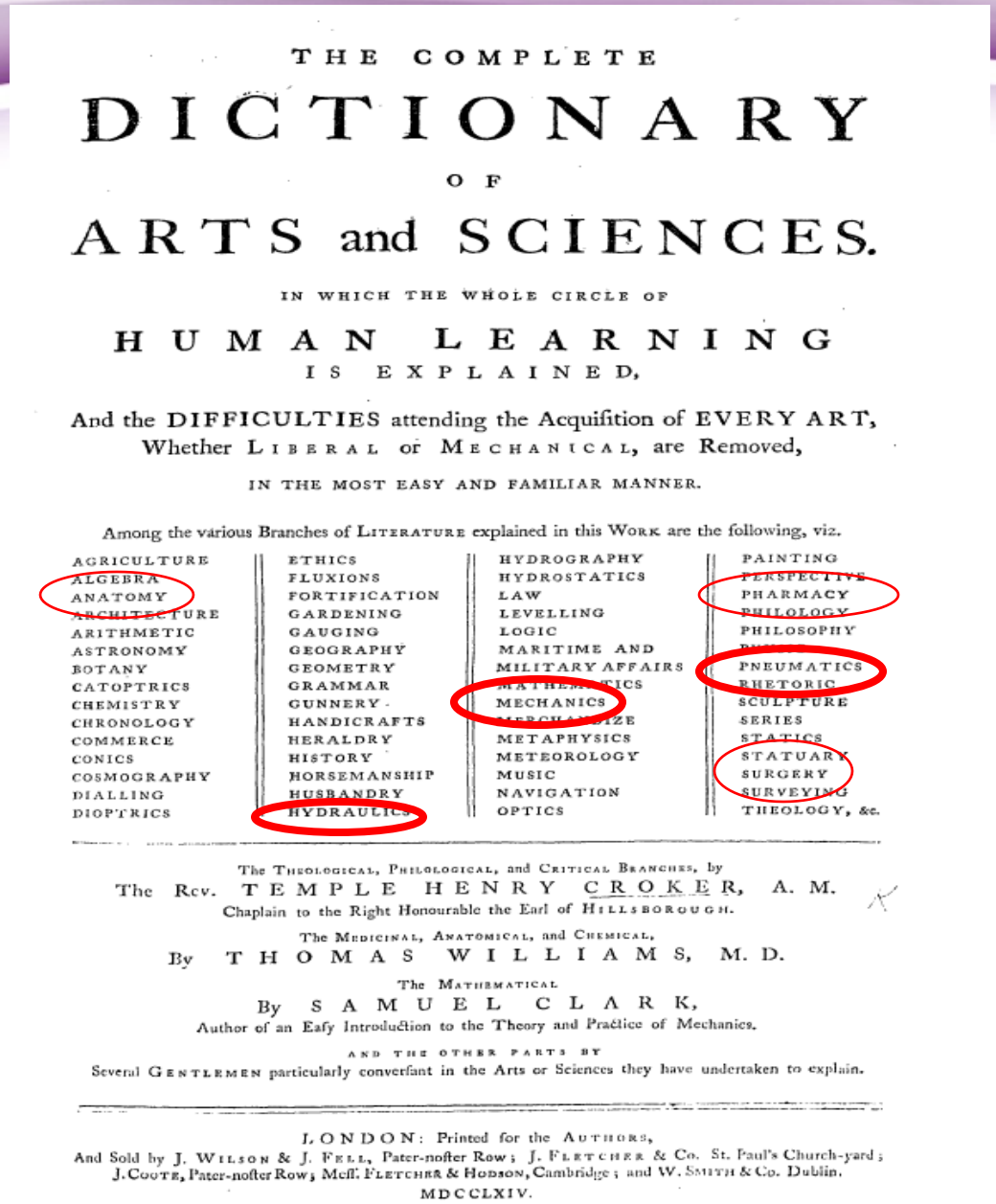
Temple Henry Croker, 1730-90, Anglican priest and intellectual, editor and translator. This dictionary was reputed to have had 1,000 subscribers.



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CONICS
COSMOGRAPHY
DIALLING
DIOPTRICS
ETHICS
FLUXIONS
FORTIFICATION
GARDENING
GAUGING
GEOGRAPHY
GEOMETRY
GRAMMAR
GUNNERY
HANDICRAFTS
HERALDRY
HISTORY
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HYDROSTATICS
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LEVELLING
LOGIC
MARITIME AND MILITARY AFFAIRS
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METAPHYSICS
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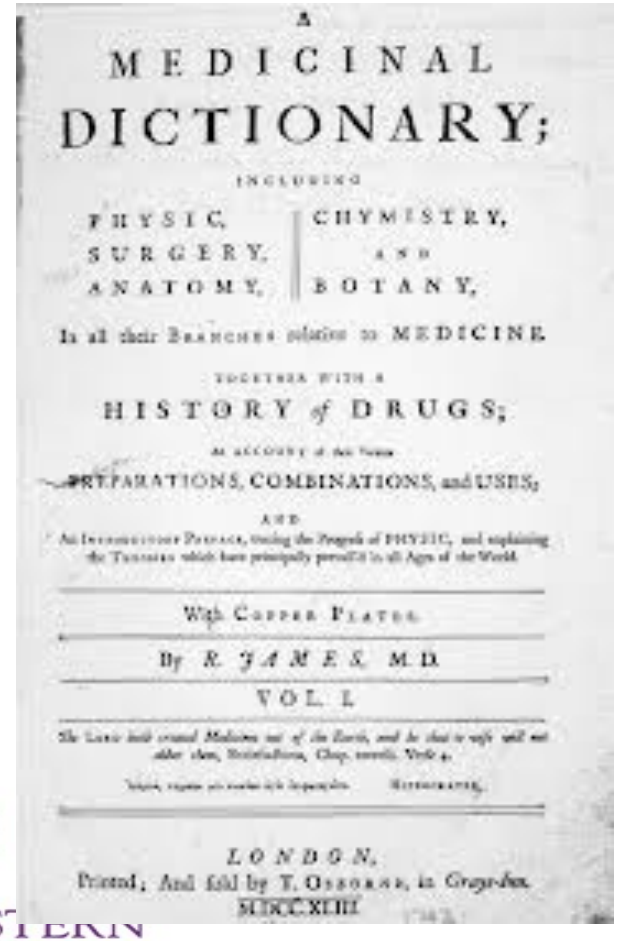
Or in medicine



A
MEDICINAL
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English physician, published
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(3 volumes, over 2,500 pp.).
Immediately translated
into French, remained in use for many
years and still widely read in
nineteenth century (Mark Twain
still ridiculed it in 1890).**

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This is also why patents were important:

The fully codified description of novel techniques had to be deposited at the court of chancery and made accessible to people seeking the knowledge. Bottomley has argued that patent disclosure was actually a valuable channel of diffusion of knowledge, especially because many of the descriptions were subsequently published in various technical magazines.

In other words, the patent system provided *both* an incentive and a means of reducing access costs to an important segment of prescriptive knowledge.

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Evidence?

So, if the narrative case can be made for the Industrial Enlightenment, can it be supported by systematic evidence?

Recent research in testing the importance of the Industrial Enlightenment and formulating its testable implications has made some progress.

Almost all those studies use two proxies for technological progress: patent counts, and the data extracted from industrial exhibitions.

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MIND OVER MATTER:

ACCESS TO KNOWLEDGE AND THE BRITISH INDUSTRIAL REVOLUTION

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A thesis submitted for the degree of *Doctor of Philosophy*
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Knowledge-access institutions

Dowey (2016) collected a number of important datasets in an attempt exploiting cross sectional variation in Britain. His fundamental organizing concept is what he called **KAI's** (Knowledge Access Institutions). His argument is that the data show that these institutions were "a cause of the British Industrial Revolution."

What were these institutions? This infrastructure contained a set of "corporations" (voluntary associations not based on kinship and sharing a common purpose) such as learned societies, mechanics institutes, masonic lodges and public libraries, among other organizations – which, over the course of the eighteenth and early nineteenth centuries, steadily helped reduce the cost of access to useful knowledge for the natural philosophers, inventors, industrialists and technological entrepreneurs engaged in innovation.

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Dowey distinguished between two types of KAI's

Core KAI's: scientific and intellectual societies and academies

Peripheral KAI's: Masonic Lodges, Public Libraries

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Table 4.4: Determinants of patenting by British county-decade, 1761-1851

	(1)	(2)
Data:	County-decade panel 1761-1851 *Pooled Cross Section*	County-decade panel 1761-1851 *Fixed Effects*
Dep Variable:	*Ln Patents*	*Ln Patents*
Ln Core KAIs	0.555***	0.431***
	(0.0802)	(0.0480)
Ln Public Libraries	0.0385	0.106
	(0.0556)	(0.0735)
Ln Booksellers	0.125**	0.0102
	(0.0570)	(0.0513)
Ln Masonic Lodges	0.129	0.190**
	(0.0891)	(0.0884)
Ln Population	0.323***	0.128
	(0.0760)	(0.129)
County Fixed Effects	No	Yes
Decade Fixed Effects	Yes	Yes
Observations	808	808
Counties	*86*	*86*
Years	*10*	*10*
R^2	0.755	0.633

Robust (clustered) standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.$
Welsh counties only included from 1801 onwards due to availability of population data

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Table 4.6: Determinants of patent quality by British counties, 1761 to 1851

	(1)	(2)
Data:	County-decade panel 1761-1851 *Pooled Cross Section*	County-decade panel 1761-1851 *Fixed Effects*
Dep Variable:	*Ln Top Patents*	*Ln Top Patents*
Ln Core KAIs	0.208***	0.239***
	(0.0433)	(0.0448)
Ln Public Libraries	-0.0780***	-0.0734*
	(0.0291)	(0.0436)
Ln Booksellers	0.0121	0.0303
	(0.0266)	(0.0418)
Ln Masonic Lodges	-0.00537	-0.145**
	(0.0335)	(0.0730)
Ln Population	-0.0649**	0.179
	(0.0264)	(0.111)
Ln Patents	0.416***	0.293***
	(0.0474)	(0.0332)
County Fixed Effects	No	Yes
Year Fixed Effects	Yes	Yes
Observations	808	808
Counties	*86*	*86*
Years	*10*	*10*
R^2	0.702	0.523

Clustered standard errors by county in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Welsh counties only included from 1801 onwards due to availability of population data.

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LEGEND:

MEM_{ij} : Members of KAI's in region j

EMP_{ij} Employ-ment in secondary sector

DEN : Population density

LIT: Male literacy rate

LOC_COMM: Local exhibition committee in that region

Table 4.9: Determinants of Exhibitors and Prize Winners at the Great Exhibition of 1851, by Industry Sector-British Census Registration District, Negative-Binomial Model

	Count Model (Neg. Binomial)	*Count Model (Neg. Binomial)*	*Count Model (Neg. Binomial)*	*Count Model (Neg. Binomial)*
Dependent Var:	Exhibits in Sector j	Exhibits in Sector j	Prizes in Sector j	Prizes in Sector j
Spatial lag	*No*	*Yes*	*No*	*Yes*
MEM_{ij} *(100 mem)*	.056*** (3.96)	.054*** (3.73)	.064*** (4.16)	.061*** (3.70)
EMP_{ij} *(1,000 emp)*	.062*** (3.40)	.054** (2.44)	.069*** (3.72)	.064*** (2.78)
DEN_i *(1000 cap per km²)*	.049*** (3.60)	.060*** (2.71)	.061*** (3.54)	.063** (2.34)
POP_i *(10,000 cap)*	.32 (0.78)	.37 (0.86)	.56 (0.12)	.14 (0.28)
LIT_i *(%)*	.020*** (4.63)	.021*** (4.89)	.011* (1.66)	.012* (1.86)
LOC_COMM_i *(binary)*	.61*** (7.14)	.61*** (7.15)	.59*** (5.88)	.59*** (5.73)
$MEM_{i-1,j}$ *(100 mem)*		-.016* (-1.71)		-.018 (-1.27)
$EMP_{i-1,j}$ *(1,000 emp)*		.030 (1.27)		.025 (0.75)
DEN_{i-1j} *(1000 cap per km²)*		-.085 (-0.04)		0.023 (0.89)
Industry Fixed Effects	Yes	Yes	Yes	Yes
N	6,520	6,430	6,520	6,430
Pseudo R^2	0.18	0.18	0.21	0.21

Robust registration district-level clustered t-statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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RESEARCH ARTICLE

The Diffusion of Knowledge during the British Industrial Revolution

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The eighteenth century was a century of ever-more intense networking associated with the Enlightenment.

Much like Dowey, Galofré believes that the Industrial Enlightenment consisted of information networks of that time, where people would come in to have a coffee or a drink, share ideas, and get in contact with people from different disciplines.

He, too, is looking for those bridges between those who knew things and those who made things.

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Conclusions

The great divergence in income and living standards may have been (mostly) a recent phenomenon driven by the Industrial Revolution from 1750 on.

But the cultural and institutional roots of the Industrial Revolution go back to the Enlightenment and more indirectly to medieval times (Greif, Mokyr, and Tabellini, 2024, in press).

To understand the Industrial Revolution, we need to deal with the Enlightenment and its deeper historical roots in European intellectual and social history.

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The Centrality of Useful knowledge

Prince Rasselas's philosopher was right: knowledge mattered. But we need to know more about the origins of the growth of useful knowledge to understand why Europeans were able to augment and deploy its useful knowledge so much better than other civilizations, why this process took off when it did, and why it turned out to be self-sustaining and not subject to diminishing returns.

Looking at the institutions that stimulated the creation and diffusion of useful knowledge and the culture behind them shows us why and how the Enlightenment mattered so much to the economic development of Europe but also to wonder where the Enlightenment came from in the first place.

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The soil in which the seeds of the Industrial Revolution were planted was especially fertile in Britain, which provided an environment highly conducive to innovation.

But the Industrial Revolution was not a case of spontaneous generation. The seeds for the many advances in power technology, metals and other materials, chemistry, textiles, food processing, lighting and other areas had to be produced by a system that made innovation happen in eighteenth century Europe (and not just in Britain) at a much higher rate and larger scale than ever before, and that created economic modernity as we know it.

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Thank you.

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