Out of darkness

IT research and the revival of work practice studies

"Gute Forschung für gute Arbeit"
Siegen, 31 October 2014

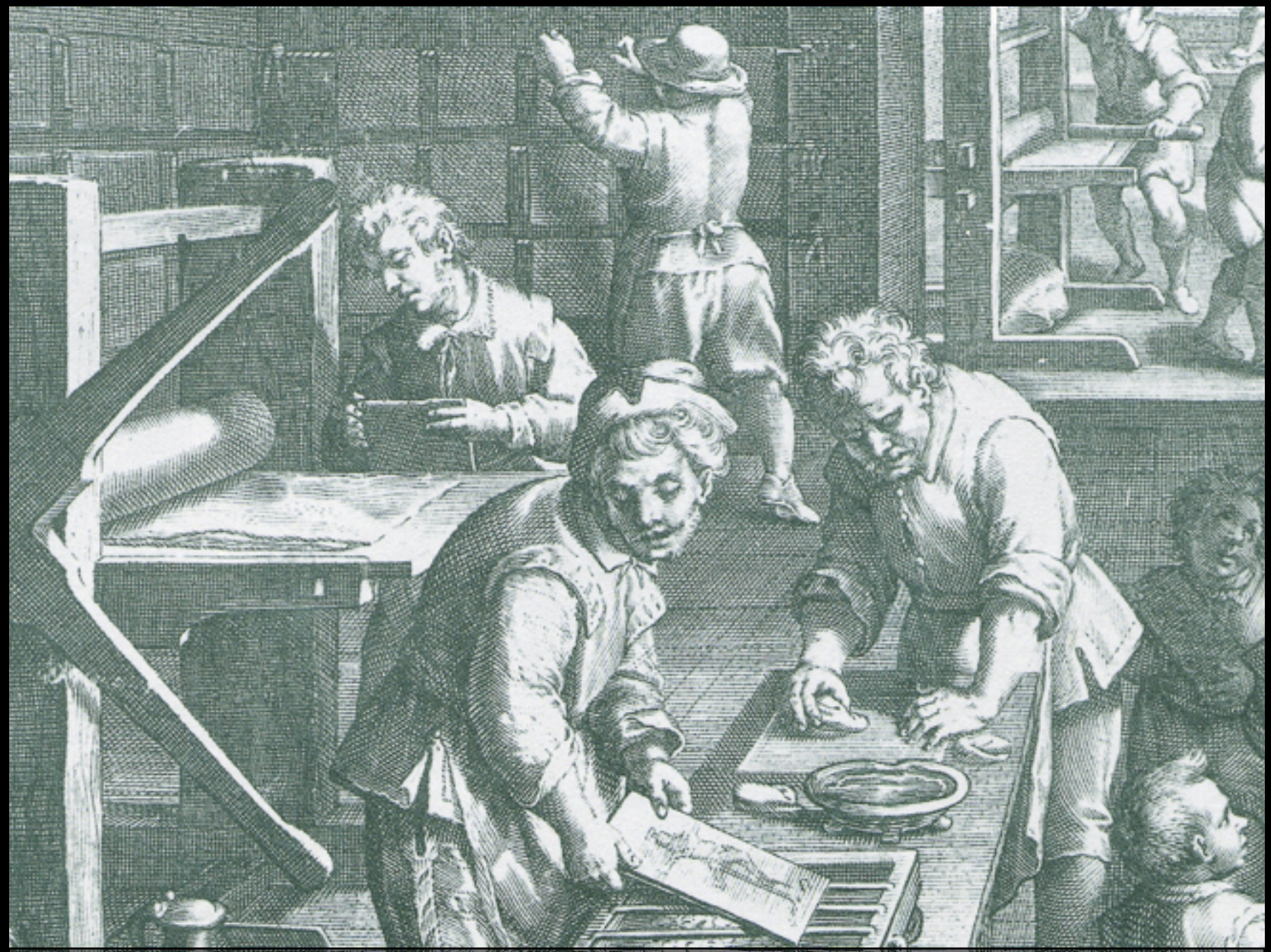
Kjeld Schmidt
Copenhagen Business School

Enlightening work practices

- Out of darkness (I):
  - Work practices are 'born in obscurity' (Académie Royale des Sciences, 1761):
  - Systematic studies are essential for transformative interventions in work practices
- Out of darkness (II):
  - Work practice studies eclipsed during the Industrial Revolution (*c.* 1780 ff.):
  - But with modern computing, systematic studies are a technological necessity

Agenda

- ‘Born in obscurity’: Work practice studies, *c.* 1400-1800
- ‘Darkness at noon’, *c.* 1800-1990
- ‘Out of darkness’, *c.* 1990 ff.



‘Born in obscurity’: Work practice studies, *c.* 1400-1800

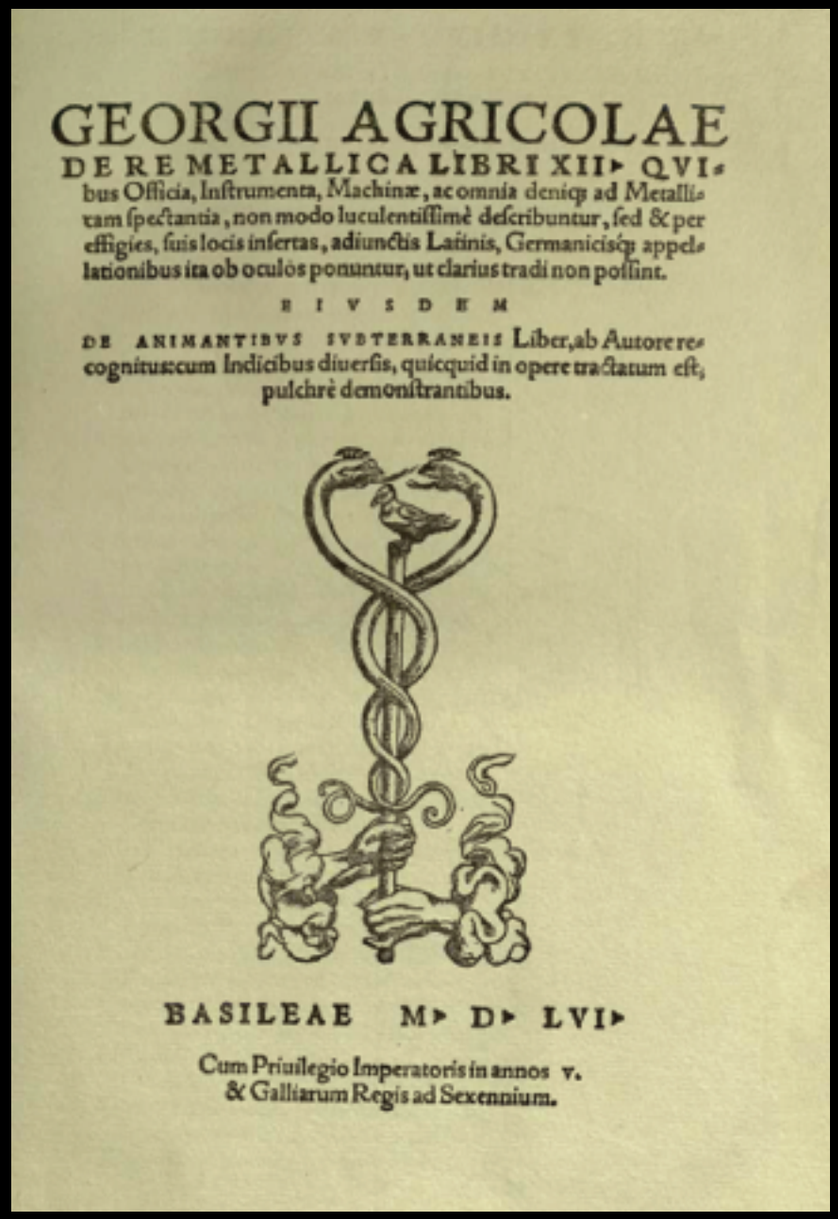
Modern Era (c. 1400 ff.): The rise of capitalist production

Systematic studies of work practices and techniques

- Didactic purposes
- Development of experimental practices in science
- Technological purposes: Rationalization of work practices and techniques

Studies of the work practices of artisans: Didactic purposes

Agricola, *De Re Metallica* (Basel, 1556)



GEORGII AGRICOLAE
DE RE METALLICA LIBRI XII. QVIbus Officia, Instrumenta, Machinæ, ac omnia denique ad Metallicam spectantia, non modo luculentissimè describuntur, sed & per effigies, suis locis insertas, adiunctis Latinis, Germanicisq; appellationibus ita ob oculos ponuntur, ut clarius tradi non possint.

EIVSDEM

DE ANIMANTIBVS SVBTERRANEIS Liber, ab Autore recognitus: cum Indicibus diuersis, quicquid in opere tractatum est, pulchrè demonstrantibus.

BASILEAE M. D. LVI.

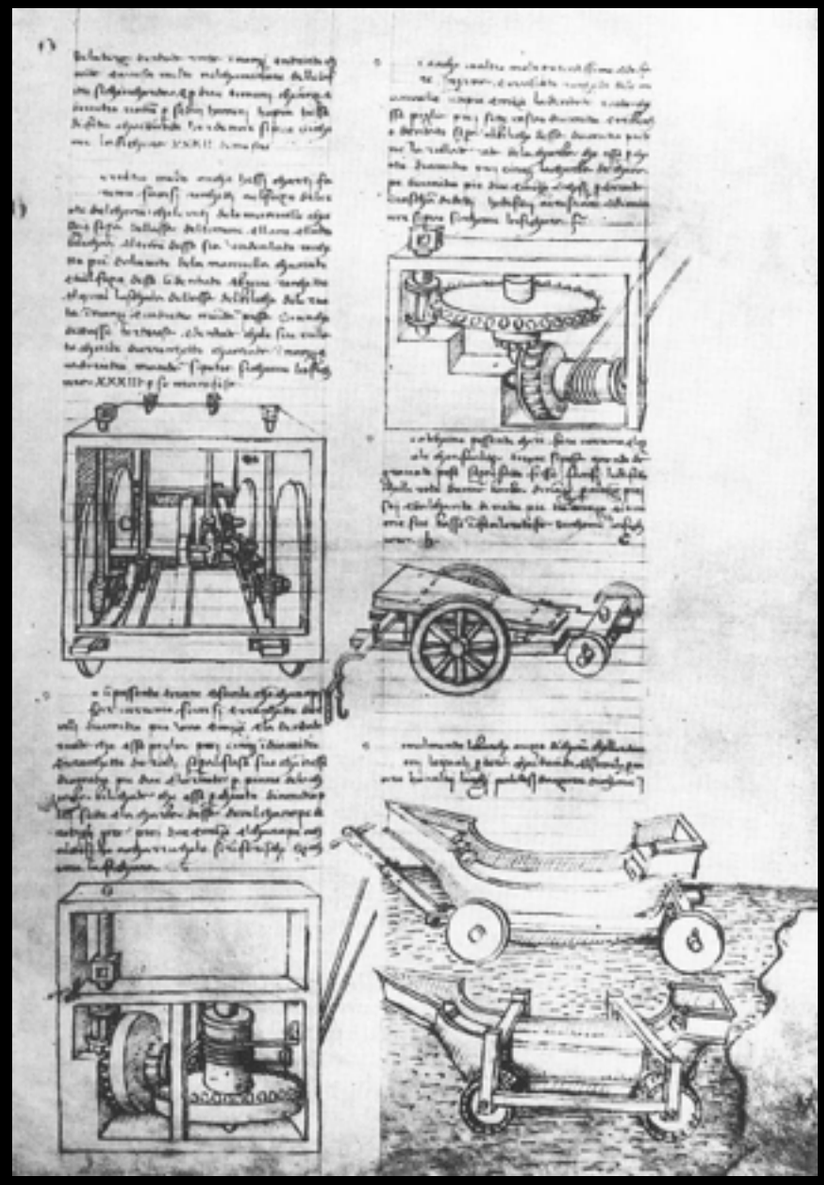
Cum Priuilegio Imperatoris in annos v.
& Galliarum Regis ad Sexennium.

Studies of the work practices of artisans: Didactic purposes

Agricola, *De Re Metallica* (Basel, 1556)

Technical treatises by ‘artisan-engineers’: Didactic purposes

- Leon Battista Alberti
- Francesco di Giorgio Martini
- Leonardo da Vinci
- Albrecht Dürer
- …



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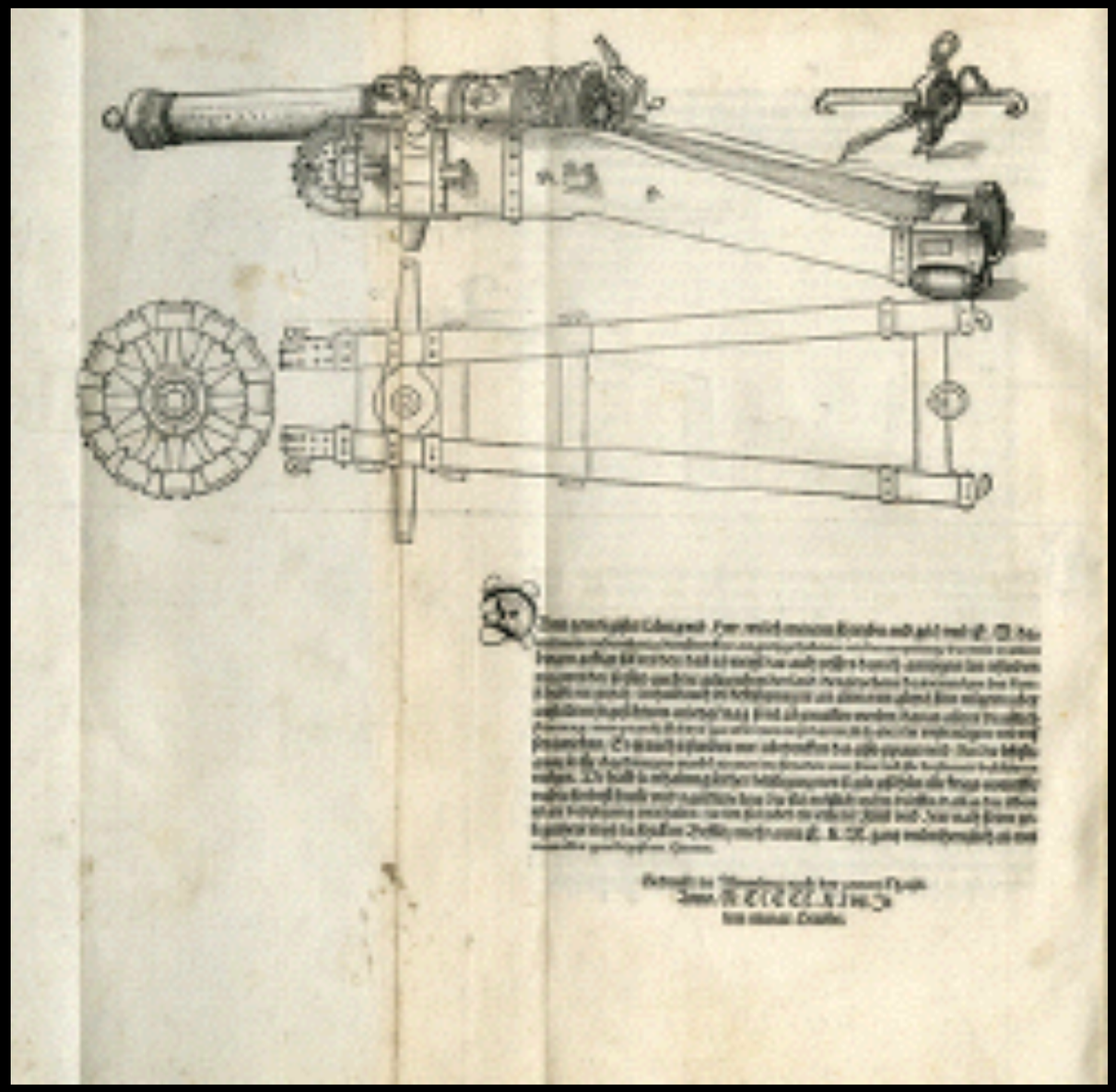


Technical treatises by 'artisan-engineers': Didactic purposes

Lorini, *Delle fortificationi* (1596)

DELLE
FORTIFICATIONI
DI BVONAIVTO LORINI.
NOBILE FIORENTINO.
Libri Cinque.

NE' QVALI SI MOSTRA CON LE PIV facili regole la Scienza con la Pratica, di Fortificare le Città, & altri luoghi sopra diuersi siti.

CON TVTTI GLI AVVERTIMENTI, CHE PER intelligenza di tal materia possono occorrere.

Et il particolar soggetto di ciascun Libro si dimostra nel rouerscio di quella Carta.

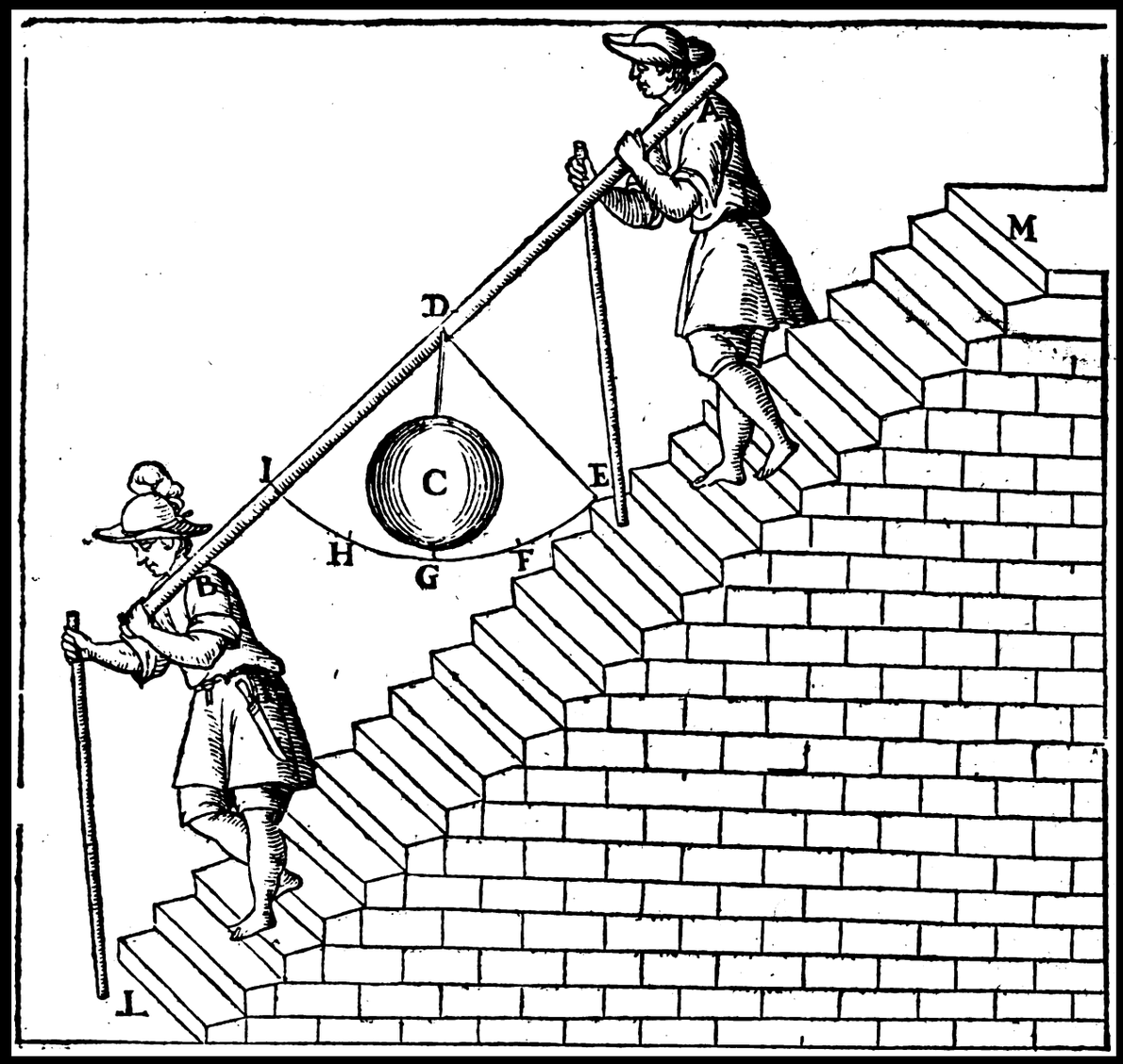
NVOVAMENTE DATI IN LVCE.

Con Priuilegio.

IN VENETIA.
Appresso Gio. Antonio Rampazetto. M D XCVI.

Technical treatises by practitioners: Didactic purposes

Lorini, *Delle fortificationi* (1596)



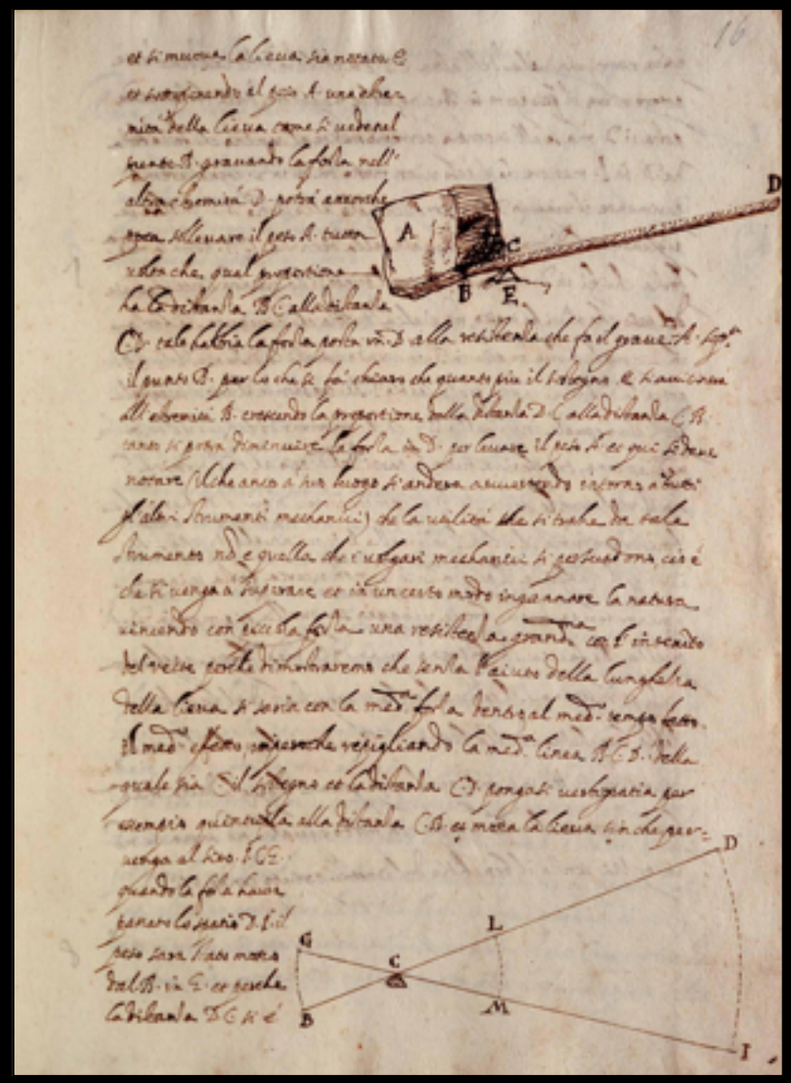
Intervention in practices: Development of experimental practices in science

Arsenal of Venice, 1572

Galilei: *Delle Meccaniche* (1594), *Discorsi e dimostrazioni matematiche* (1638)

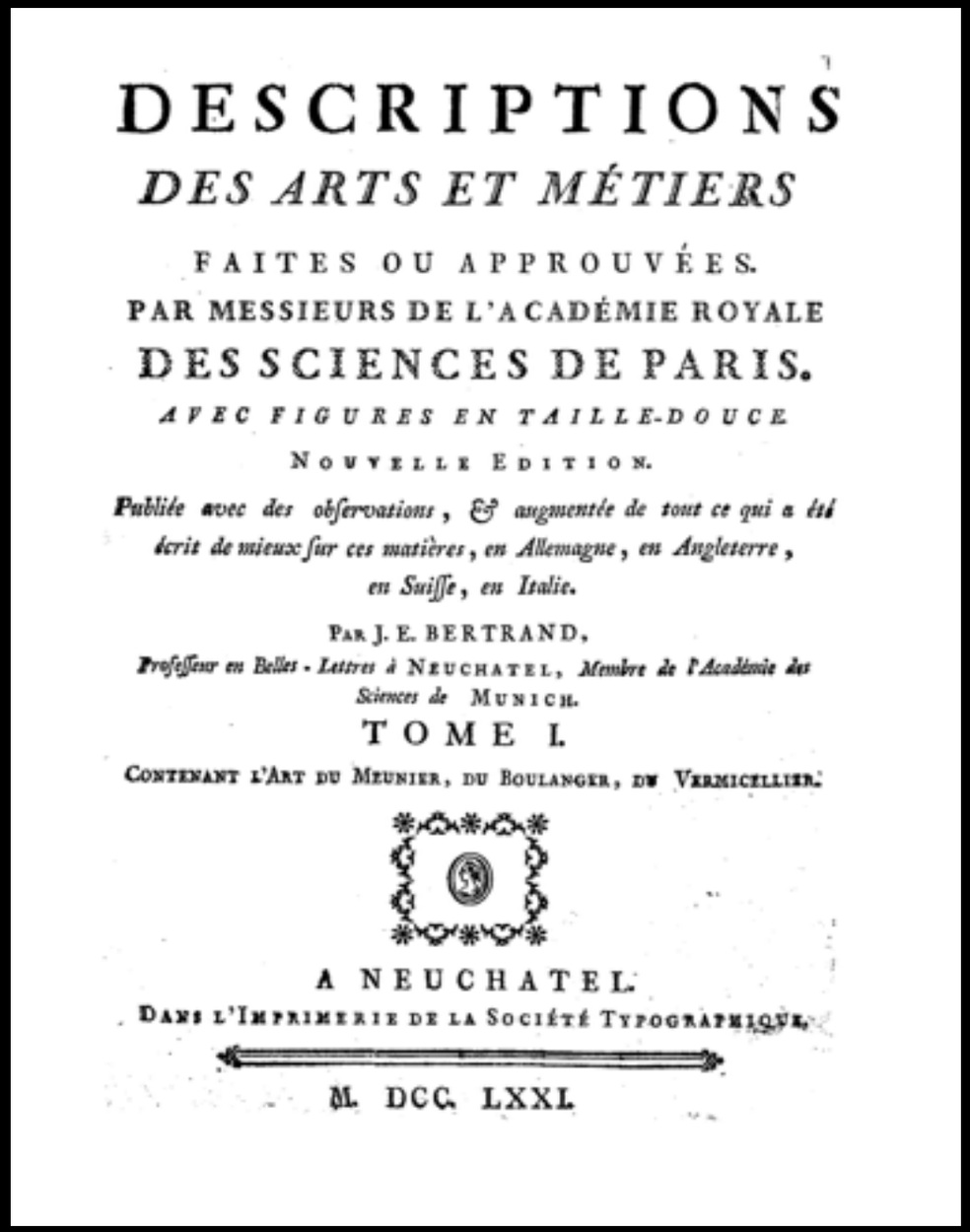
Intervention in work practices & development of experimental techniques in science

Galilei: *Delle Meccaniche* (1594), *Discorsi e dimostrazioni matematiche* (1638)



Studies of work practices and techniques: Technological purposes

Académie de France, *Déscriptions des arts et métiers*, *c.* 100 vols. (1761-1788)



DESCRIPTIONS
DES ARTS ET MÉTIERS
FAITES OU APPROUVÉES.
PAR MESSIEURS DE L'ACADÉMIE ROYALE
DES SCIENCES DE PARIS.
AVEC FIGURES EN TAILLE-DOUCE
NOUVELLE EDITION.
Publiée avec des observations, & augmentée de tout ce qui a été écrit de mieux sur ces matières, en Allemagne, en Angleterre, en Suisse, en Italie.
PAR J. E. BERTRAND,
Professeur en Belles-Lettres à NEUCHATEL, *Membre de l'Académie des Sciences de* MUNICH.
TOME I.
CONTENANT L'ART DU MEUNIER, DU BOULANGER, DU VERMICELLIER.
A NEUCHATEL.
DANS L'IMPRIMERIE DE LA SOCIÉTÉ TYPOGRAPHIQUE.
M. DCC. LXXI.

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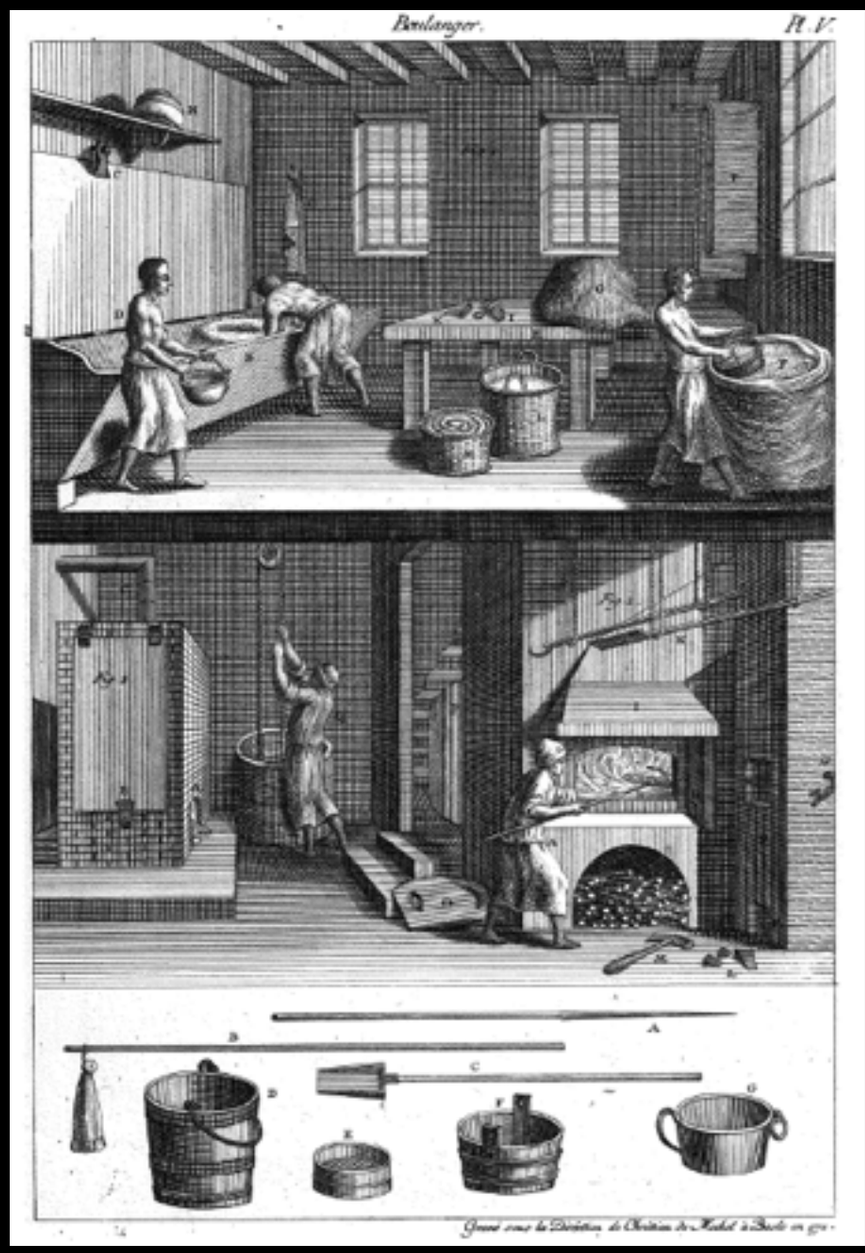
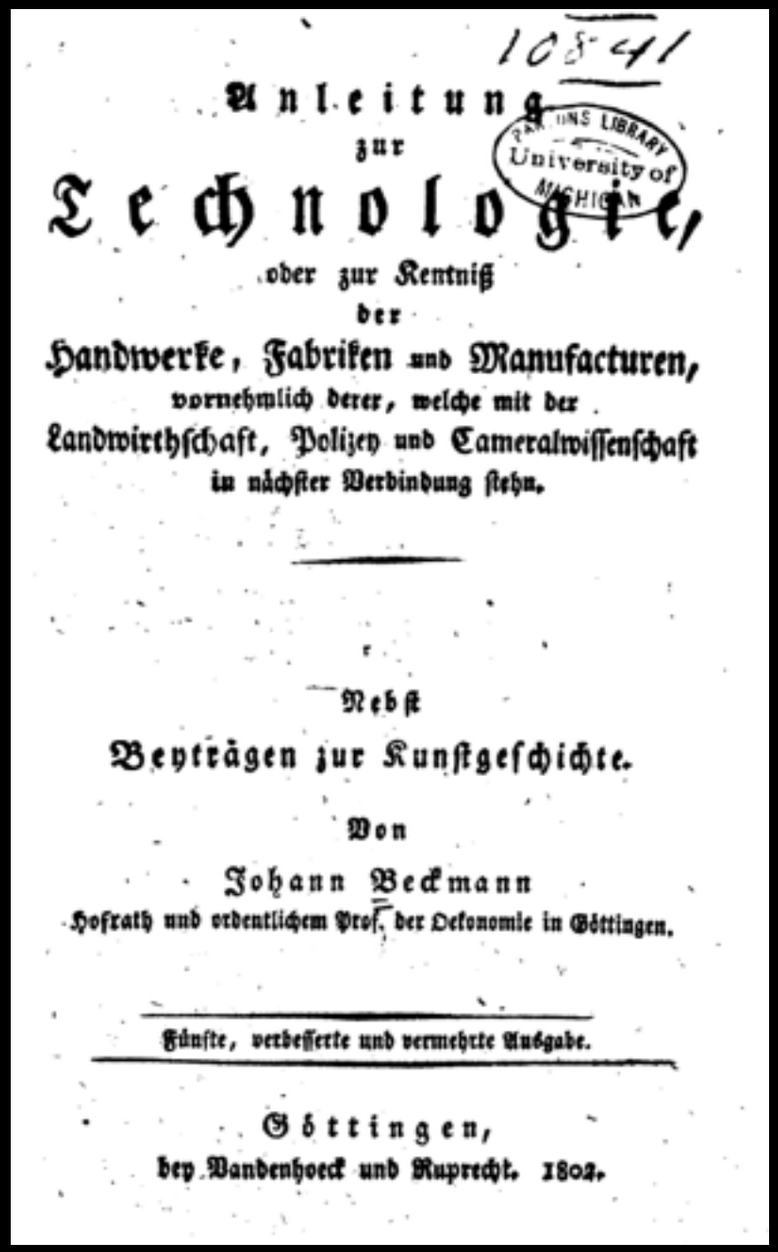


Studies of work practices and techniques: Technological purposes

Johann Beckmann:
Anleitung zur Technologie, oder zur Kenntniß der Handwerke, Fabriken und Manufacturen… (1777)



Anleitung
zur
Technologie,
oder zur Kentniß
der
Handwerke, Fabriken und Manufacturen,
vornehmlich derer, welche mit der
Landwirthschaft, Polizey und Cameralwissenschaft
in nächster Verbindung stehn.

Nebst
Beyträgen zur Kunstgeschichte.

Von
Johann Beckmann
Hofrath und ordentlichem Prof. der Oekonomie in Göttingen.

Fünfte, verbesserte und vermehrte Ausgabe.

Göttingen,
bey Vandenhoeck und Ruprecht. 1802.

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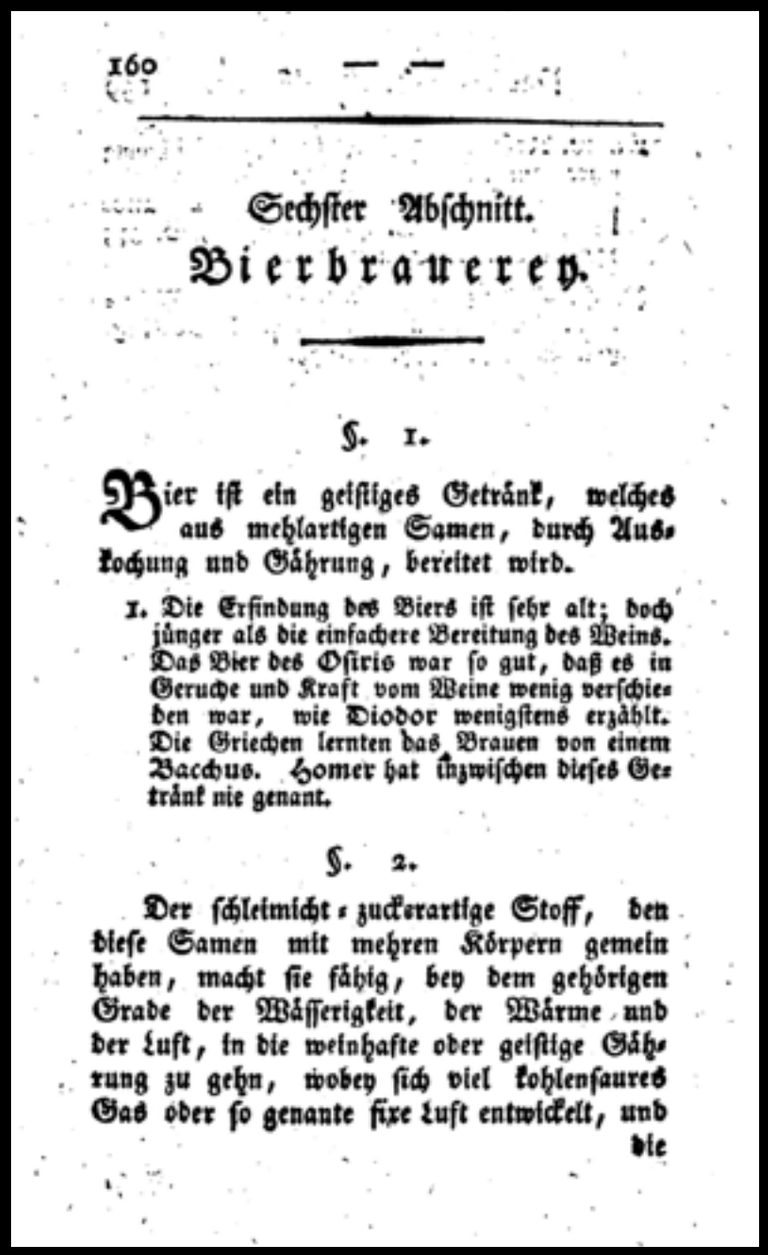

160

Sechster Abschnitt.
Bierbrauerey.

§. 1.

Bier ist ein geistiges Getränk, welches aus mehlartigen Samen, durch Auskochung und Gährung, bereitet wird.

1. Die Erfindung des Biers ist sehr alt; doch jünger als die einfachere Bereitung des Weins. Das Bier des Osiris war so gut, daß es in Geruche und Kraft vom Weine wenig verschieden war, wie Diodor wenigstens erzählt. Die Griechen lernten das Brauen von einem Bacchus. Homer hat inzwischen dieses Getränk nie genant.

§. 2.

Der schleimicht-zuckerartige Stoff, den diese Samen mit mehren Körpern gemein haben, macht sie fähig, bey dem gehörigen Grade der Wässerigkeit, der Wärme und der Luft, in die weinhafte oder geistige Gährung zu gehn, wobey sich viel kohlensaures Gas oder so genante fixe Luft entwickelt, und die

The modern concept of ‘practice’

Reflections on ‘theory’ *vs* ‘practice’

- Bernard Palissy, 1580
- Bonaiuto Lorini, 1596
- Francis Bacon, 1620
- Denis Diderot, 1751
- Immanuel Kant, 1793

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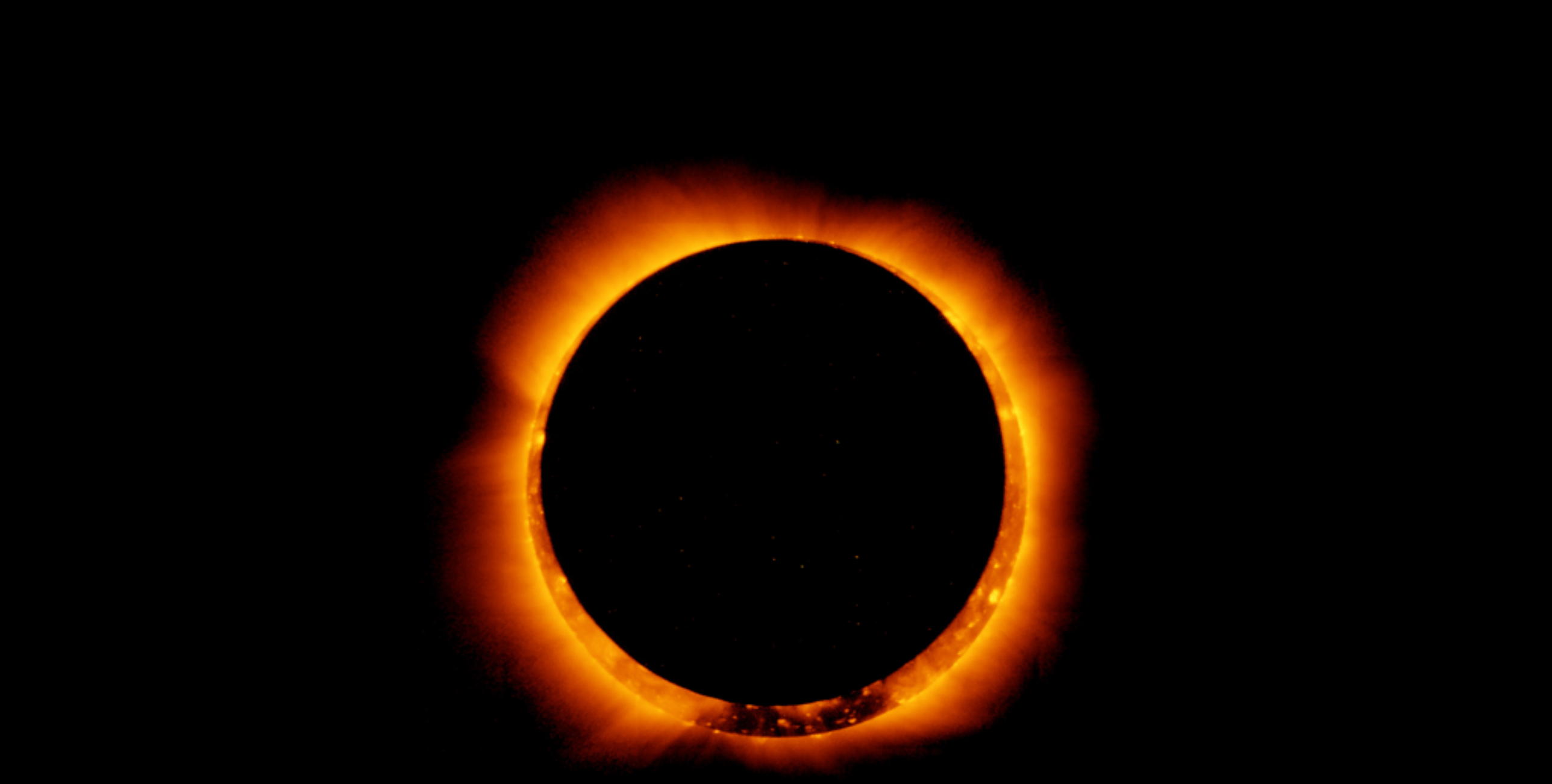
- Denis Diderot, 1751
- Immanuel Kant, 1793

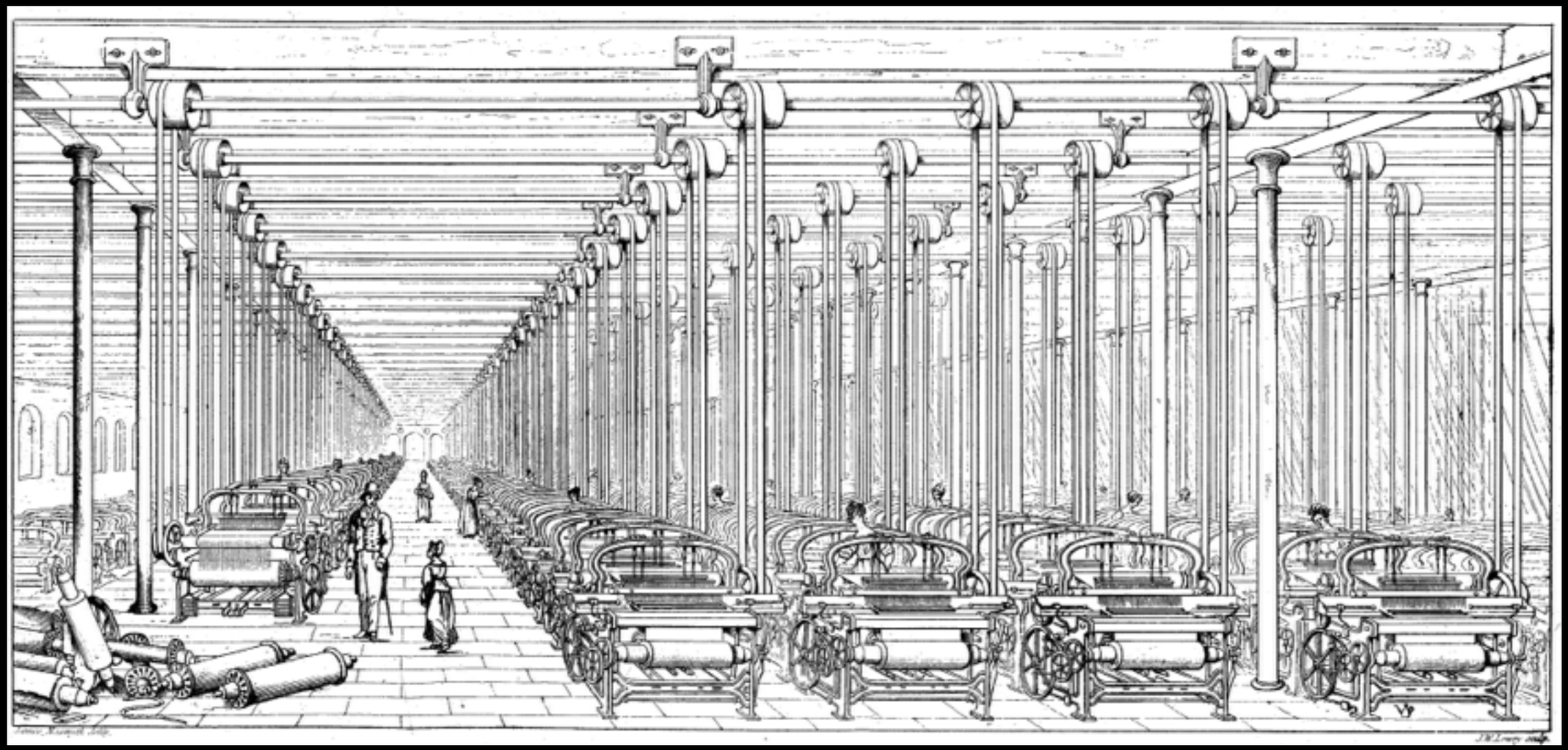
‘I would ask those who [say and maintain that theory begets practice] whether they — having studied fifty years in books on cosmography and navigation on the sea, and having maps of all regions and the chronometer, the compass and astronomical instruments — would undertake to sail a ship to all countries: as will a man who is expert and practical. They dare not place themselves in such danger, whatever theory they may have learned: and when they have long debated, they will be forced to admit that practice has begotten theory.’



‘Darkness at noon’, *c.* 1800-1990: The eclipse of practice studies

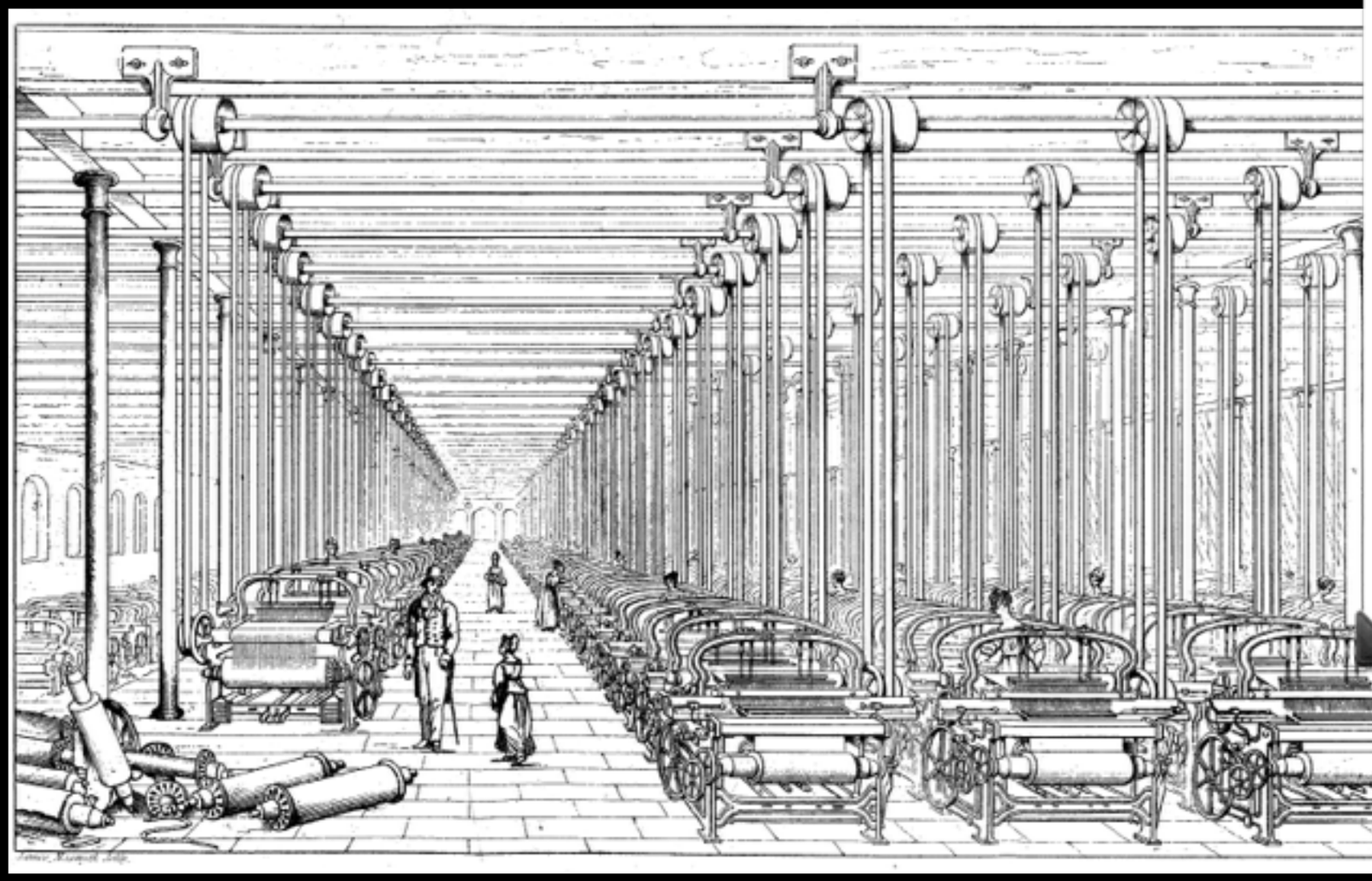
Babbage 1832 & Ure 1835: Shift of focus from work practice to machinery

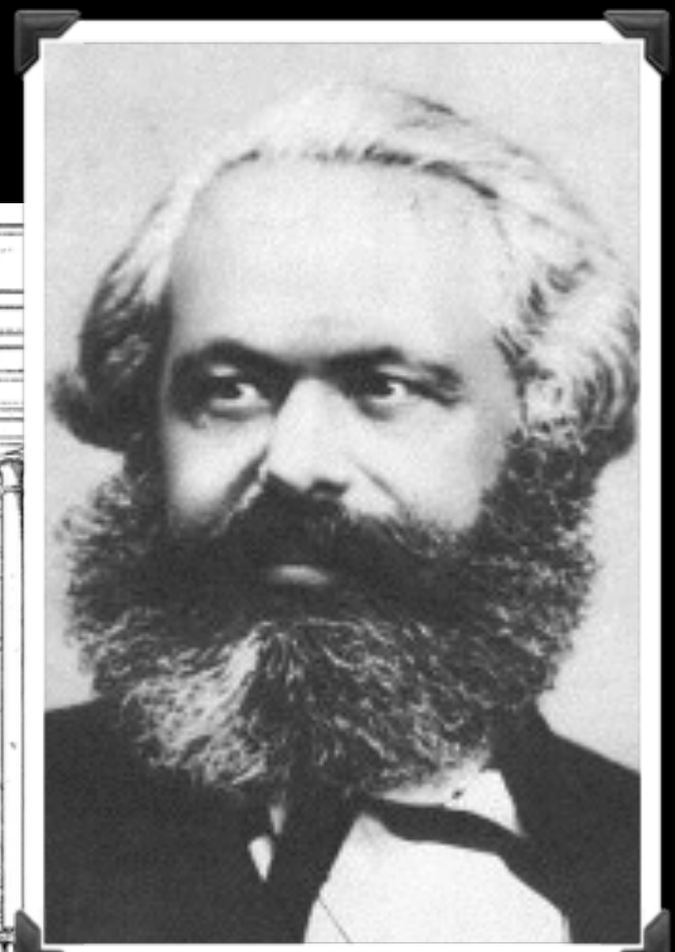
Machinery, according to Ure, 1835



Power Loom Factory, Stockton, *c.* 1835

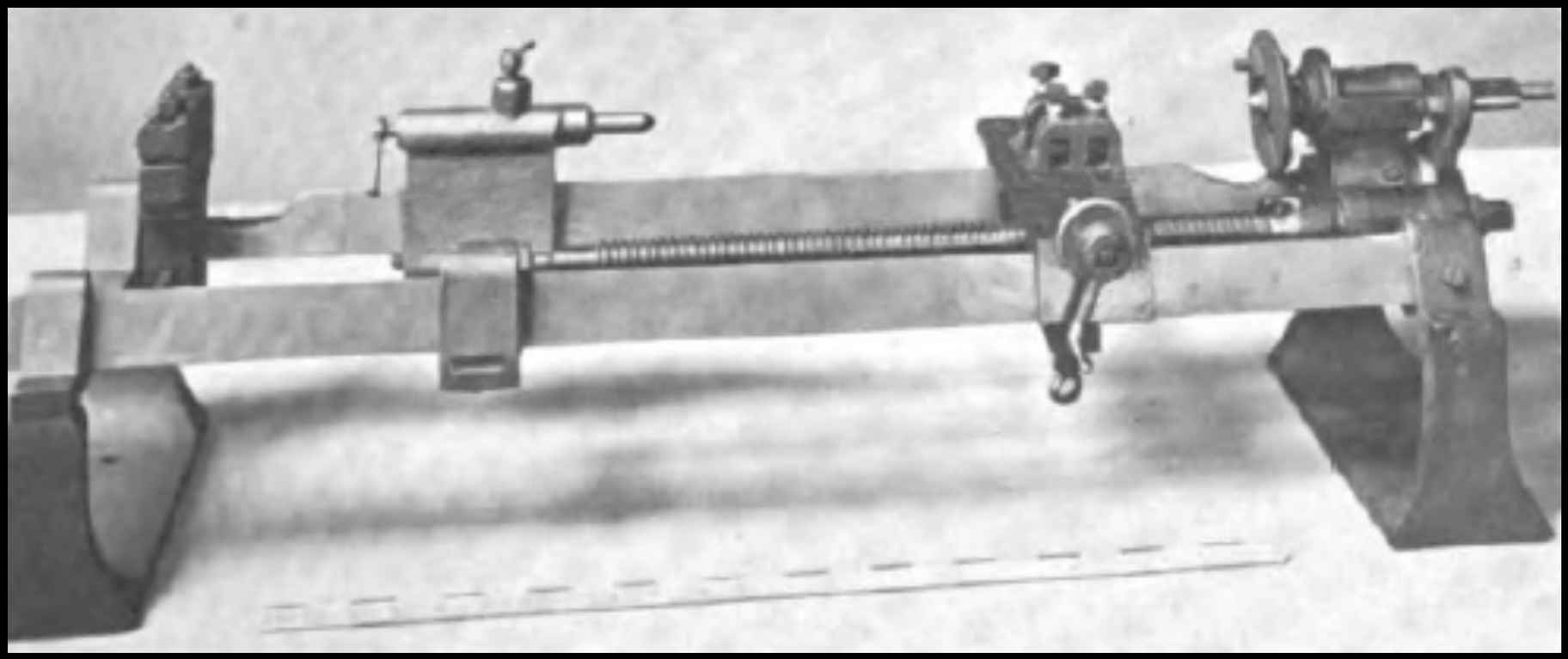
Machinery, according to Ure, 1835





Power Loom Factory, Stockton, *c*. 1835

The reality of machinery (outside the textile industry)



Maudslay's slide rest, c. 1797

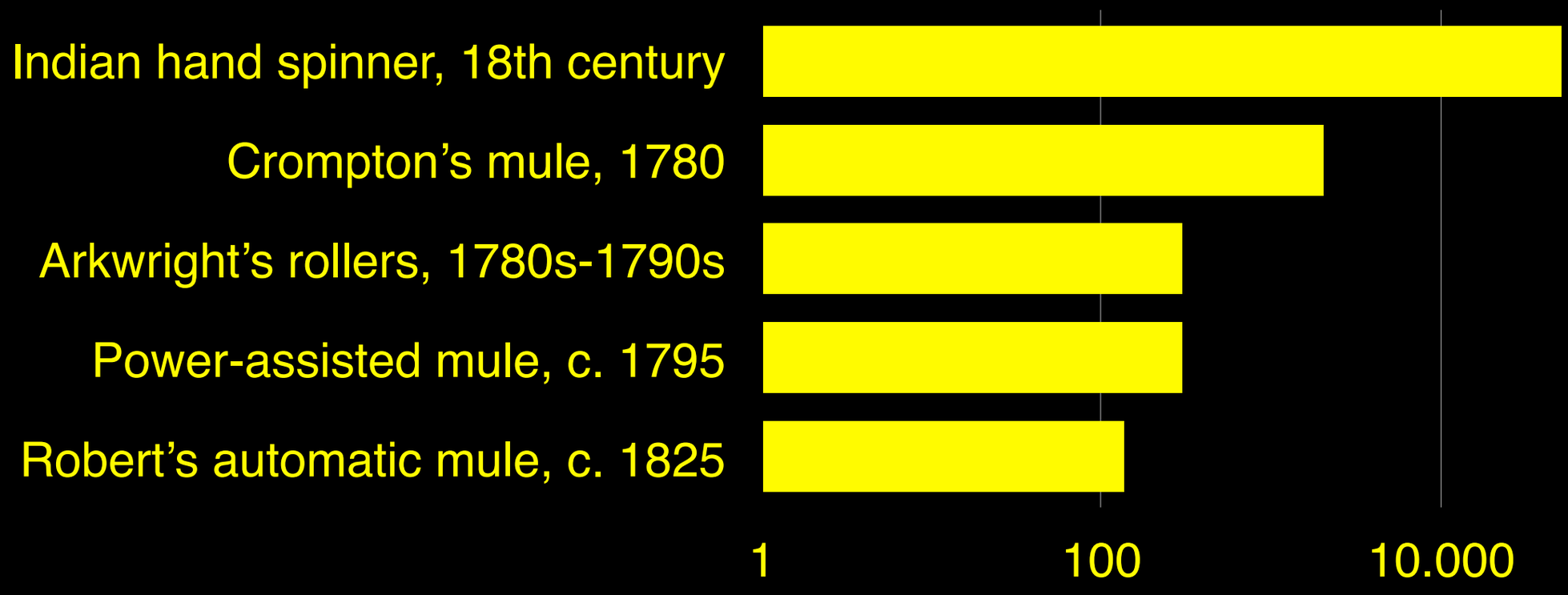
The reality of work: overwhelmingly manual

Foxconn, China, 2010

Why the eclipse? Because managers relied on mechanization

'the combination of an unskilled and untrained labour force and mechanisation tended to blind them. Raw labour could not be expected to be efficient anyway: one must budget with low per capita output. The increase in output due to technical innovation was so vast that it was easy to forget how much greater it might have been with efficient exploitation. "By the aid of mechanical fingers", exclaimed Dr. Ure [1835], "one Englishman at his mule can turn off daily more yam than 200 of the most diligent spinsters of Hindostan." It seemed not to matter that they might have turned out more, because few entrepreneurs realised the potential economies of really efficient labour exploitation.' (Hobsbawm, 1964)

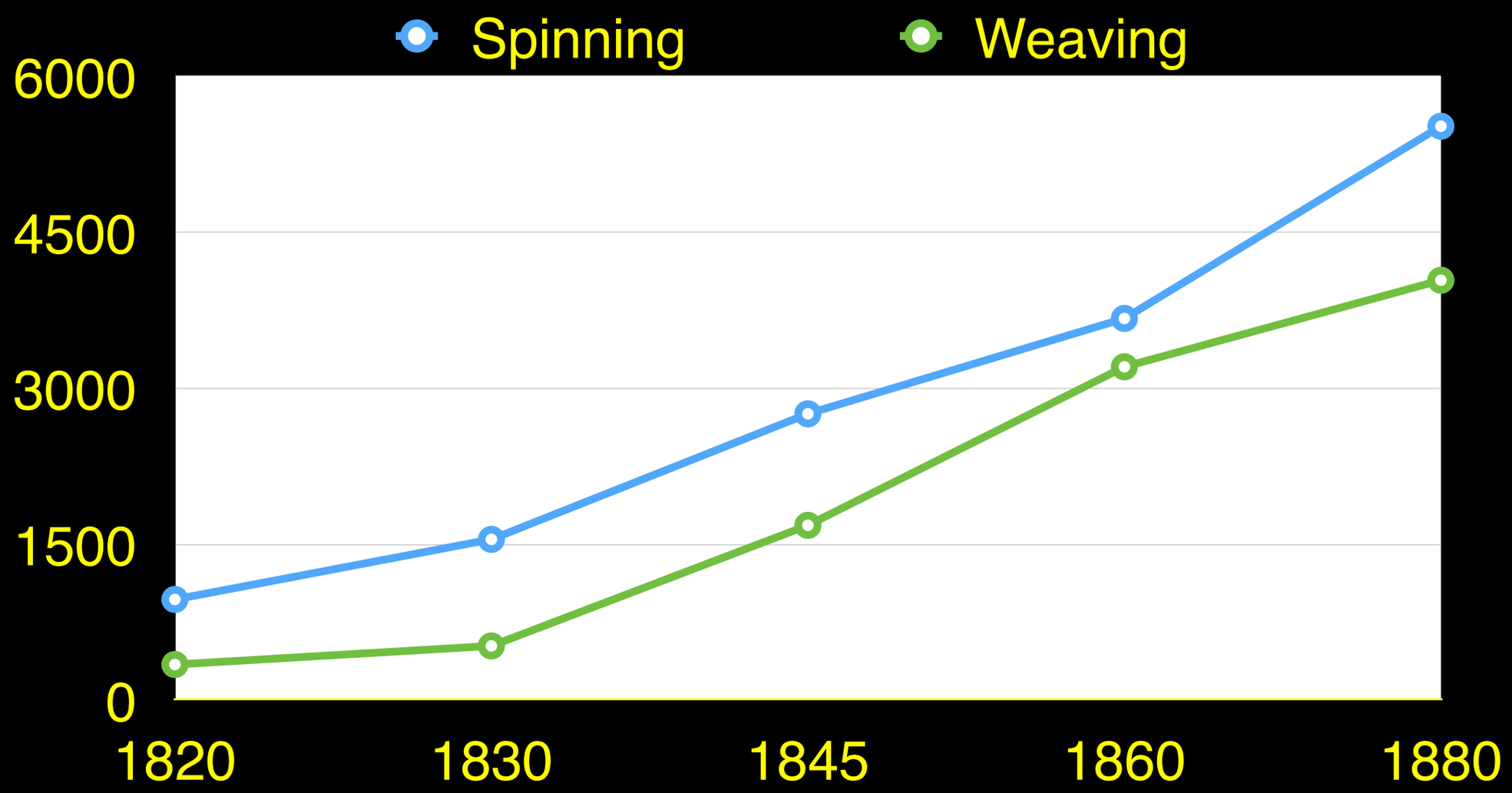
Effect of use of machinery on productivity of spinning, *c*. 1700-1825



Person-hours required to produce 50 kg of cotton, logarithmic scale:
Productivity increased by factor 300 in one century

Pollard,(1981). *Peaceful Conquest: The Industrialization of Europe 1760-1970*

Effect of use of machinery on productivity of spinning, *c*. 1820-1880



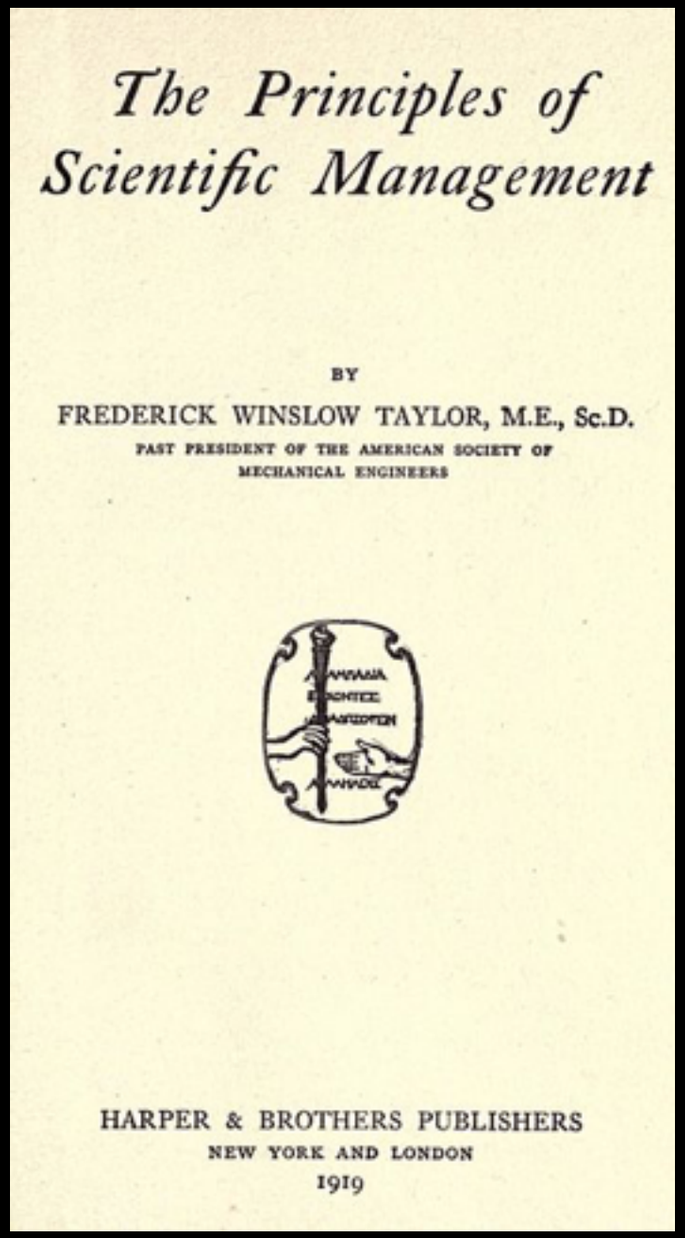
Productivity increased by factor 6 resp. 12 in 60 years

Pollard,(1981). *Peaceful Conquest: The Industrialization of Europe 1760-1970*

Well, only a *partial* eclipse

The Taylorist intervention

- The issue: Workers' 'output restriction'
- Piece-race based on time-and-motion studies
- Stated aim: eliminate practice!
- No studies of actual work practices!


The Principles of Scientific Management

BY

FREDERICK WINSLOW TAYLOR, M.E., Sc.D.

PAST PRESIDENT OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

HARPER & BROTHERS PUBLISHERS

NEW YORK AND LONDON

1919

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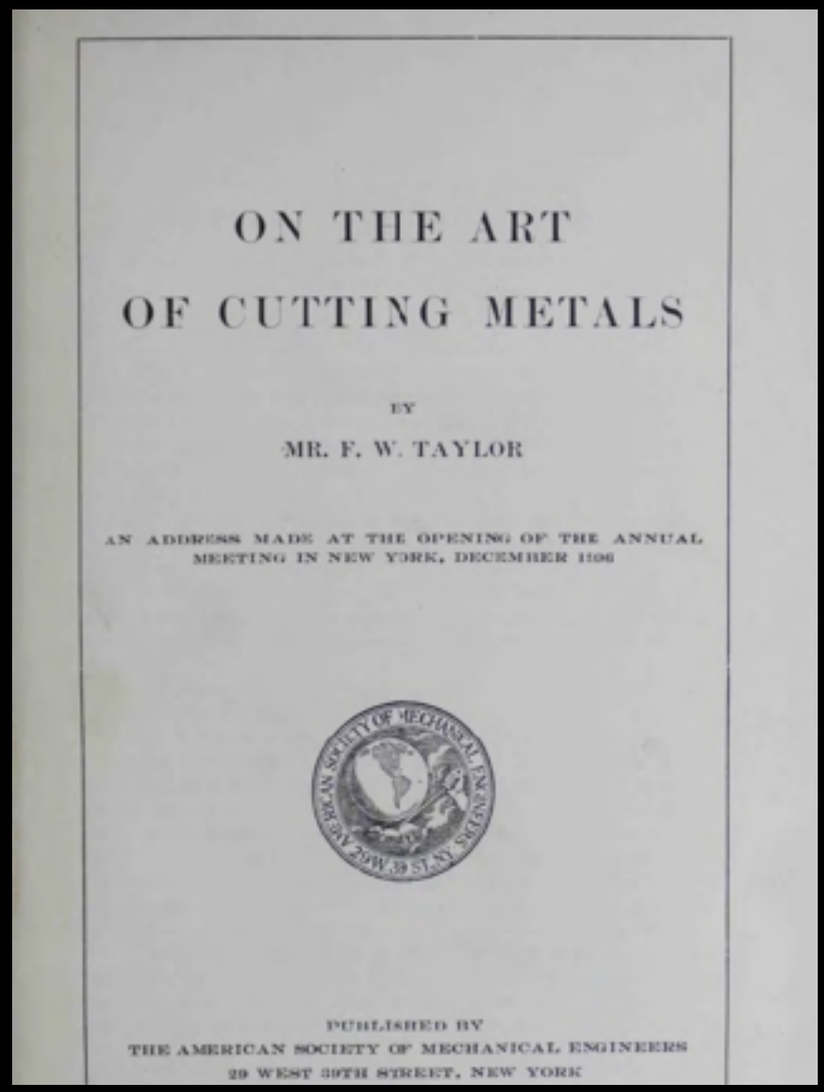


ON THE ART
OF CUTTING METALS

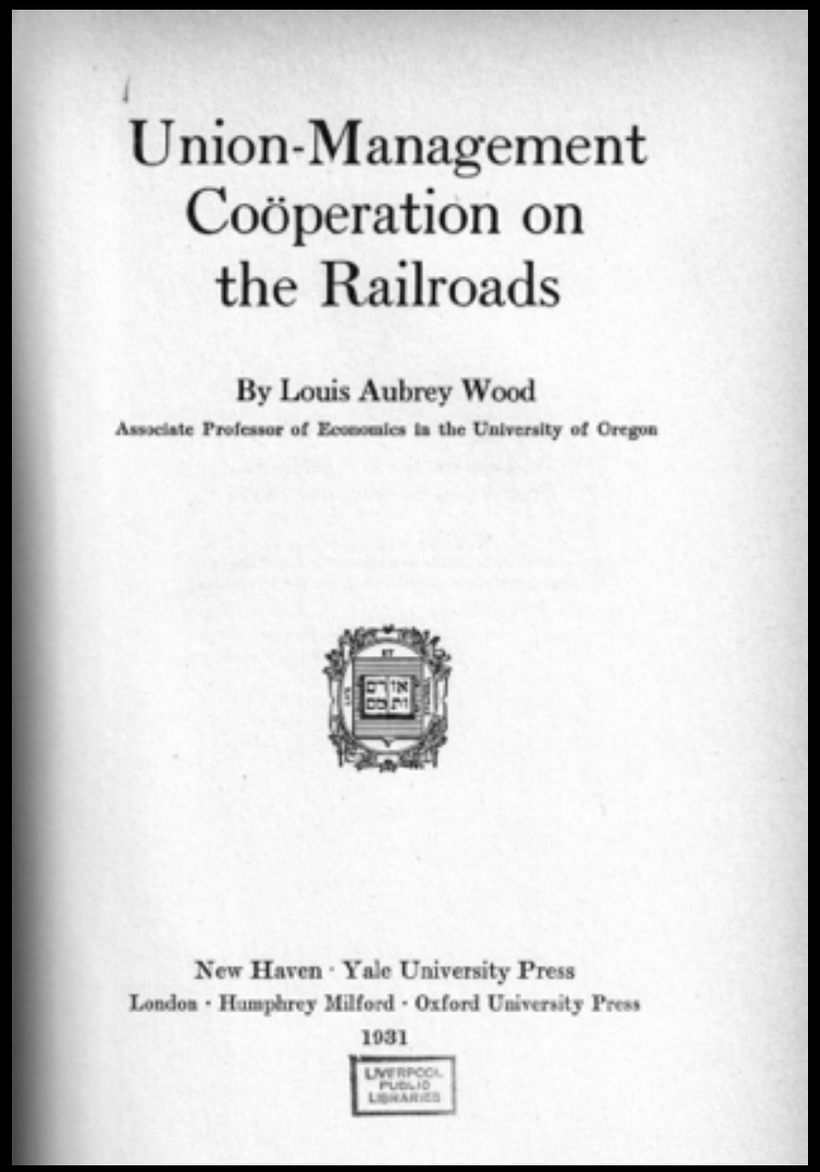
BY

MR. F. W. TAYLOR

AN ADDRESS MADE AT THE OPENING OF THE ANNUAL MEETING IN NEW YORK, DECEMBER 1906

PUBLISHED BY
THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
29 WEST 39TH STREET, NEW YORK

The Taylor Society

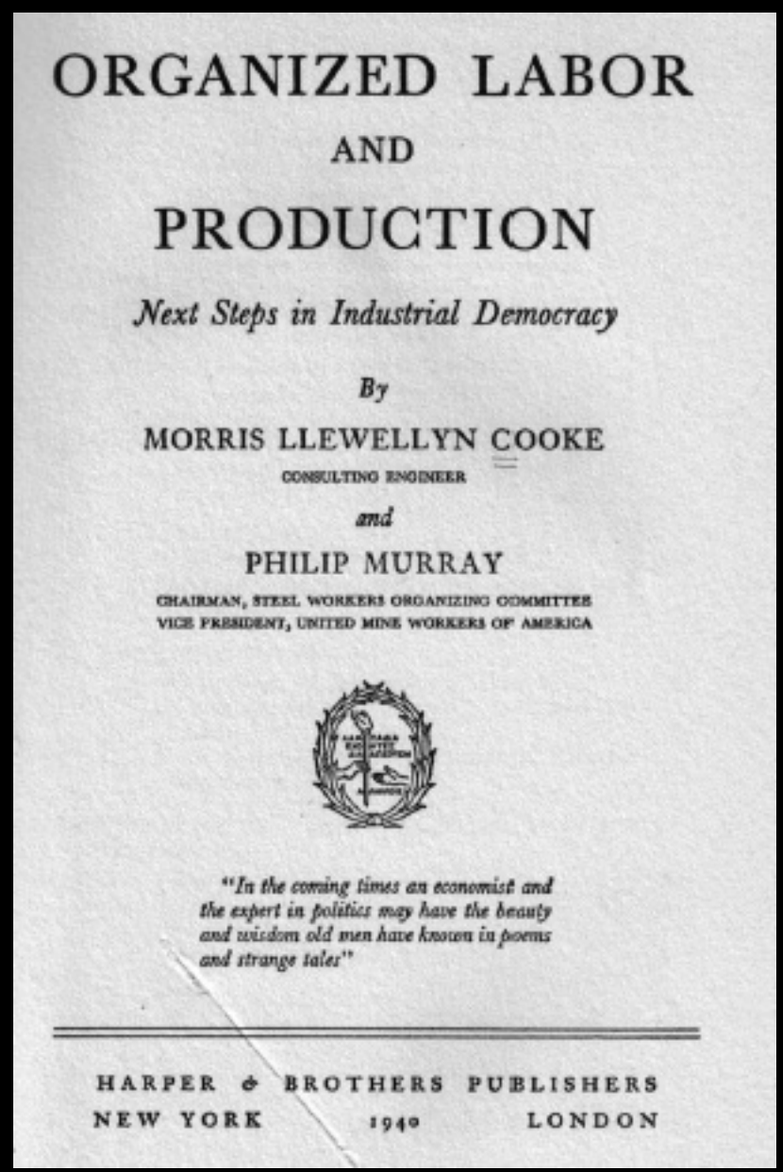


Union-Management
Coöperation on
the Railroads

By Louis Aubrey Wood

Associate Professor of Economics in the University of Oregon

New Haven · Yale University Press
London · Humphrey Milford · Oxford University Press
1931



ORGANIZED LABOR
AND
PRODUCTION

Next Steps in Industrial Democracy

By

MORRIS LLEWELLYN COOKE

CONSULTING ENGINEER

and

PHILIP MURRAY

CHAIRMAN, STEEL WORKERS ORGANIZING COMMITTEE
VICE PRESIDENT, UNITED MINE WORKERS OF AMERICA

"In the coming times an economist and the expert in politics may have the beauty and wisdom old men have known in poems and strange tales"

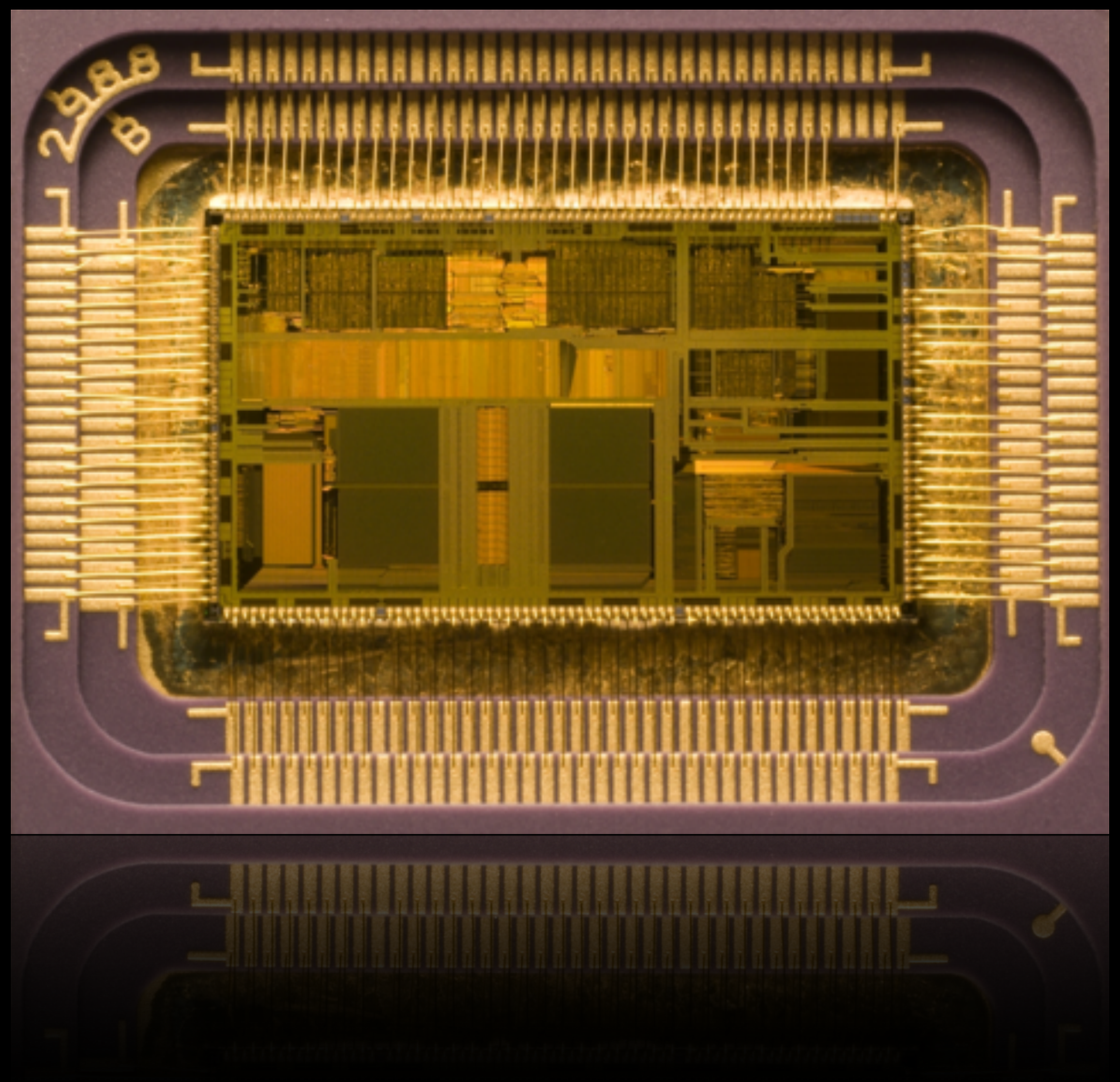
HARPER & BROTHERS PUBLISHERS
NEW YORK 1940 LONDON

The European field study tradition

- Iron and Coal Union: Francophone ergonomics
- The Socio-Technical Tradition: UK, Scandinavia
- Humanisierung der Arbeit: Germany, Sweden
- Human-Machine Systems research: studies of supervisory control: UK, France, Denmark

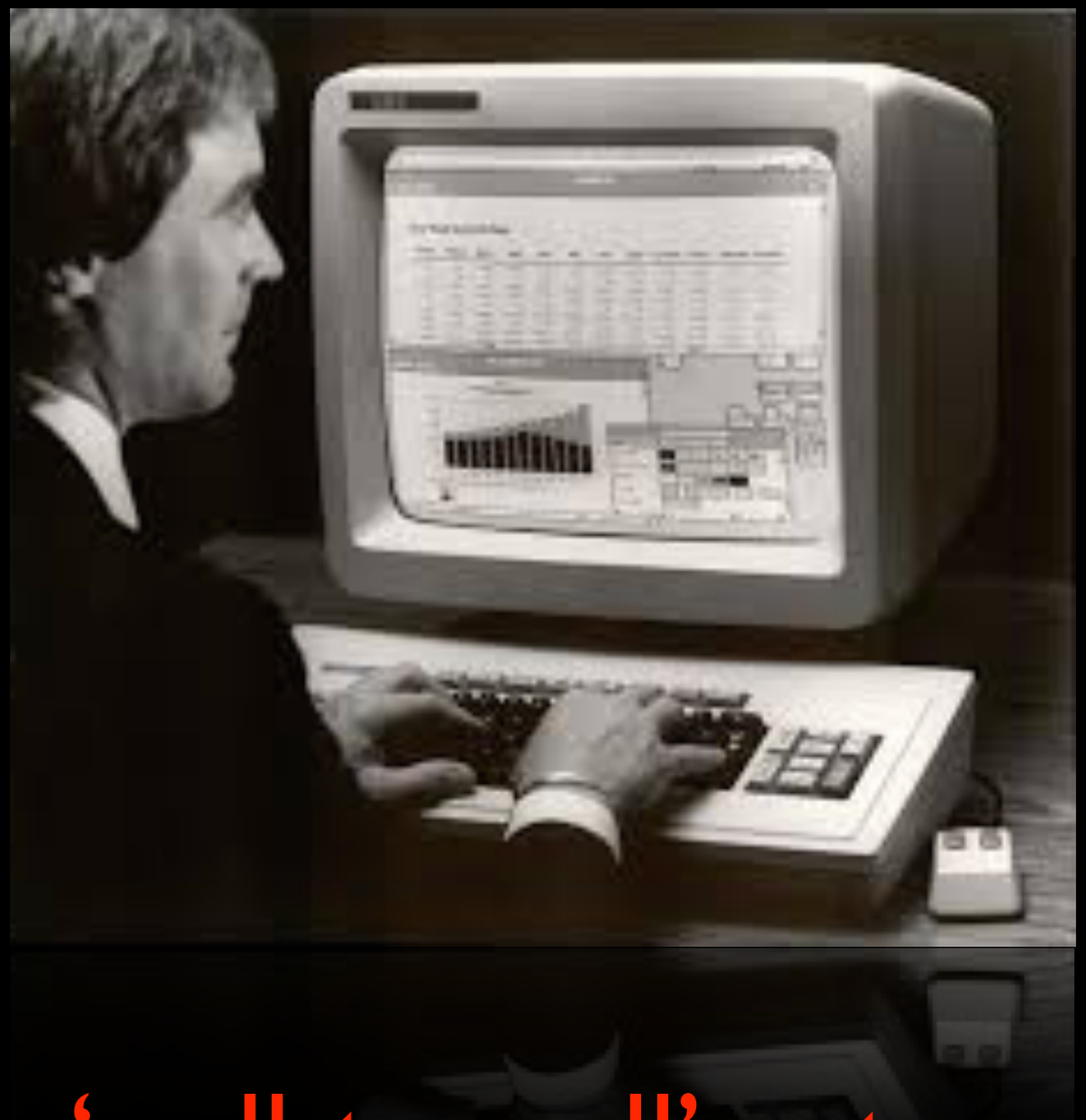
Sociology of work

- One will have to look hard to find studies of actual work in sociology of work
  - Research program: The causes of conflict and adaptation
- Was German sociology of work (from Popitz & Bahrdt to Kern & Schumann) an exception?
  - Research program *Arbeiterbewußtsein*: The political potential of the working class in view of ongoing technological change
  - Research program: Technological change and workers' qualifications
- 'Technology' as 'independent variable'!



‘Out of darkness’, *c.* 1990 ff.

From ‘wall-to-wall’ automation to ‘interactive computing’



Xerox 8010 ‘Star’, 1981

From ‘wall-to-wall’ automation to ‘interactive computing’

Interactive computing

- Whirlwind (1951): real-time online computing
- Cooperation via computational machine system
- Barrier: Coordination
  - Predesigned coordination ('real-time transaction processing')
  - Other coordination: outside of the system (telephone!)
- Heritage: TX-2, Minicomputers (e.g., PDP…)

Whirlwind 1951

Interactive computing

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SAGE 1958

Interactive computing

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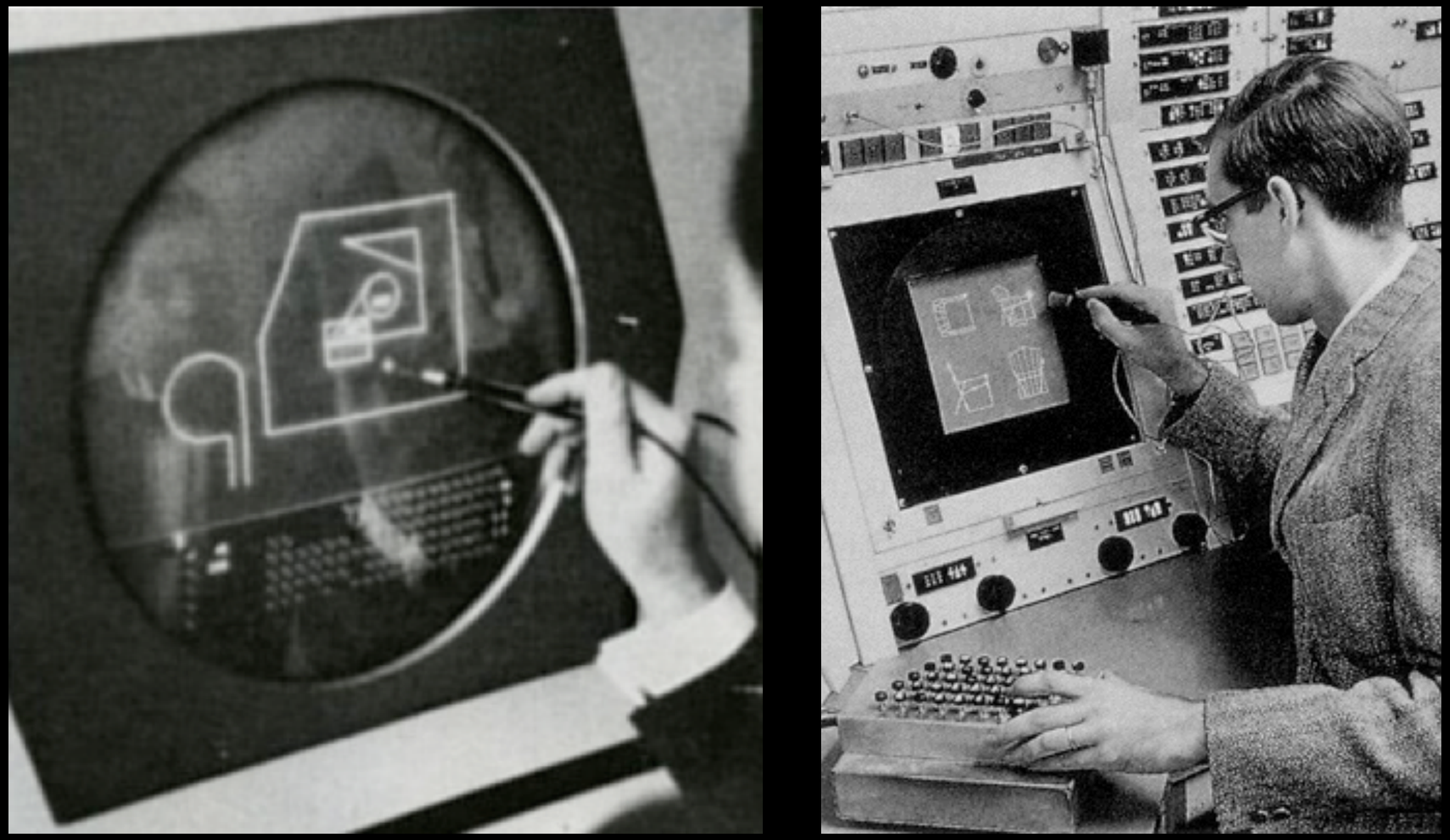
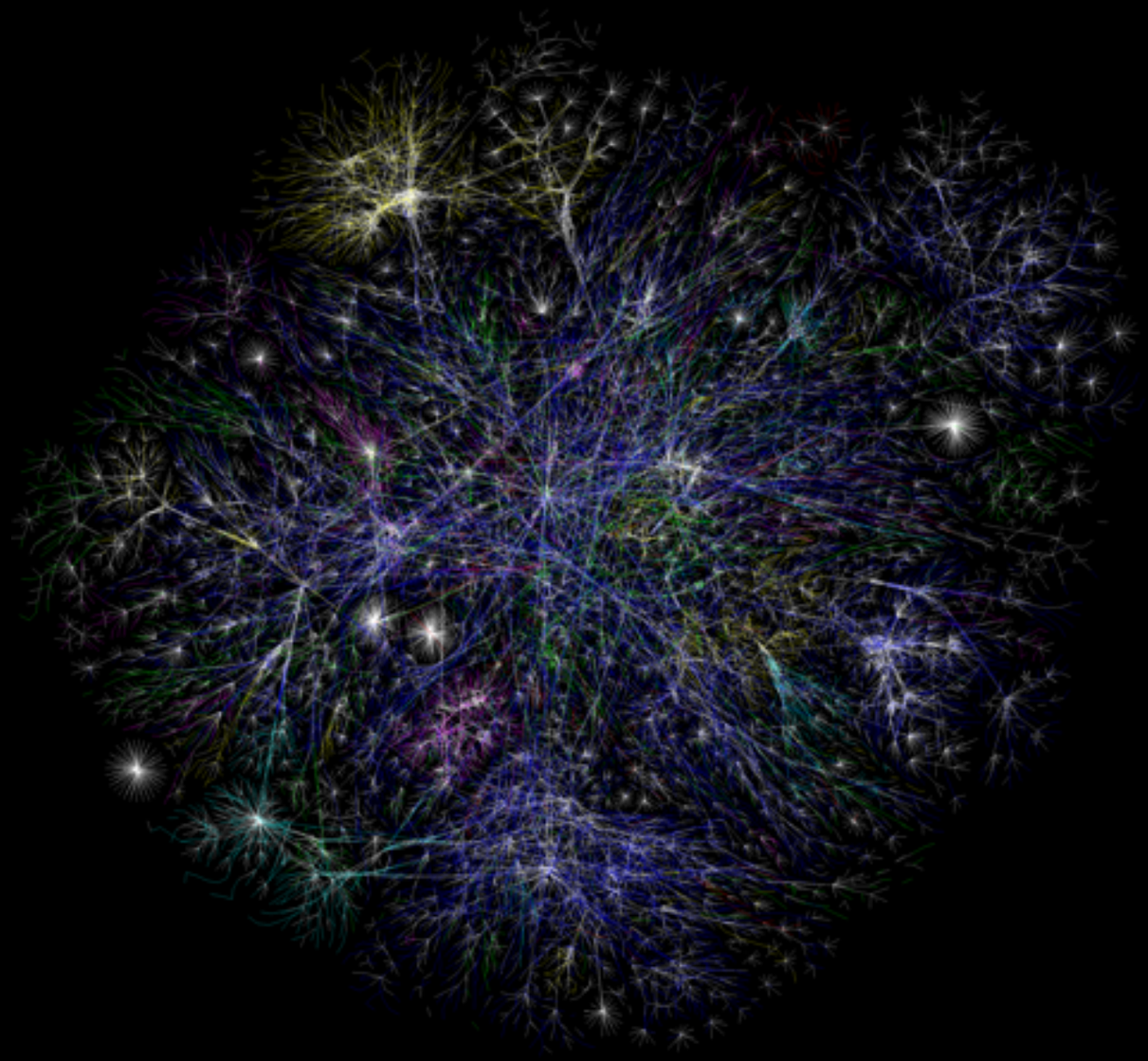
SABRE 1964

Interactive computing

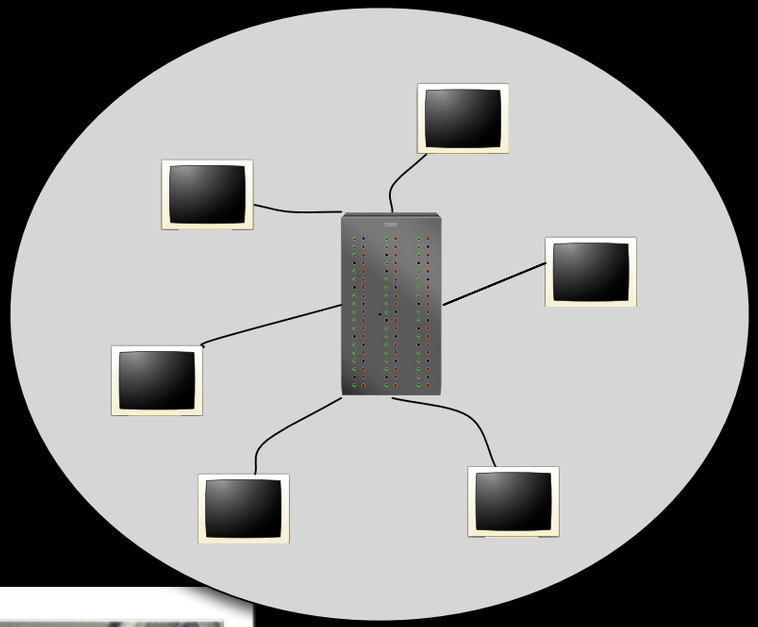


Ivan Sutherland: *Sketchpad*, 1958 (TX-2)



Collaborative computing paradigms

Collaborative computing paradigms



- Facilitation of cooperative work
- Mediation of communication among workers
- Support of coordinative practices

Whirlwind 1951

SABRE 1964

Collaborative computing paradigms

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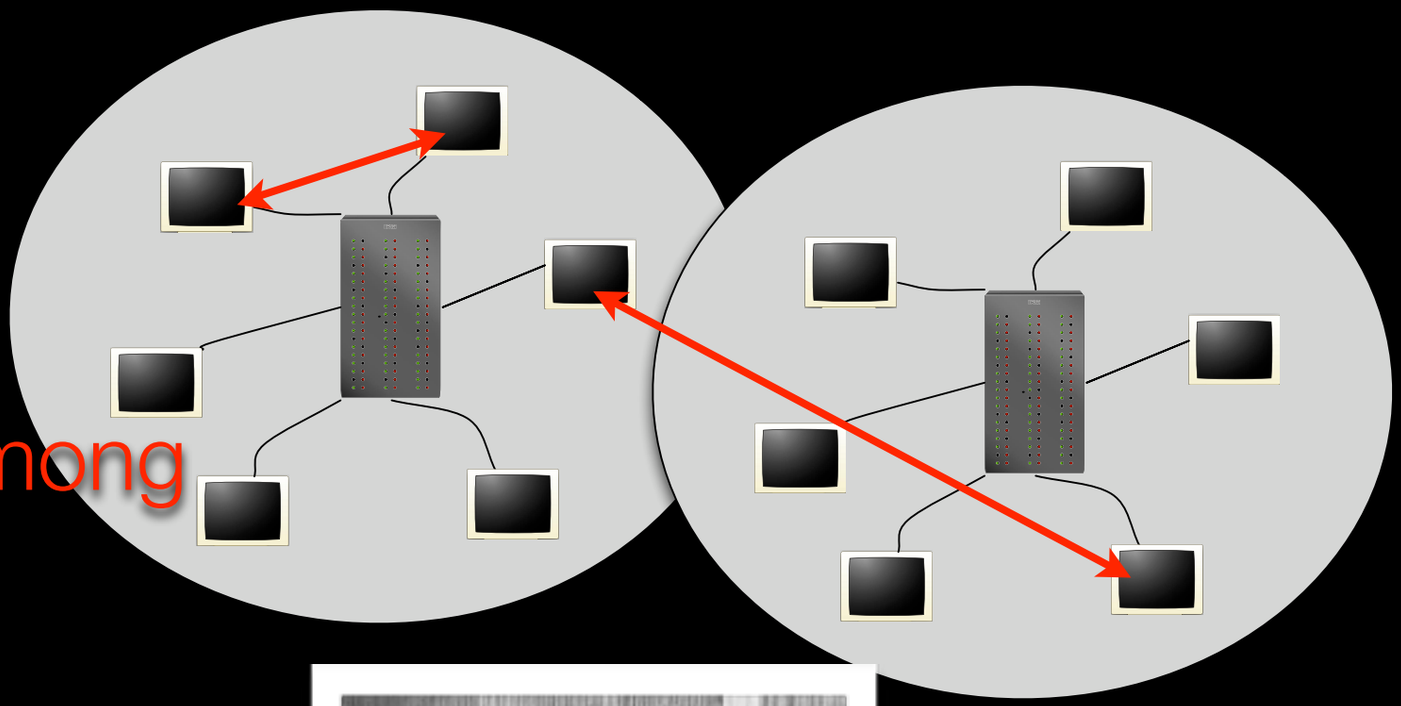
- Mediation of communication among workers
- Support of coordinative practices



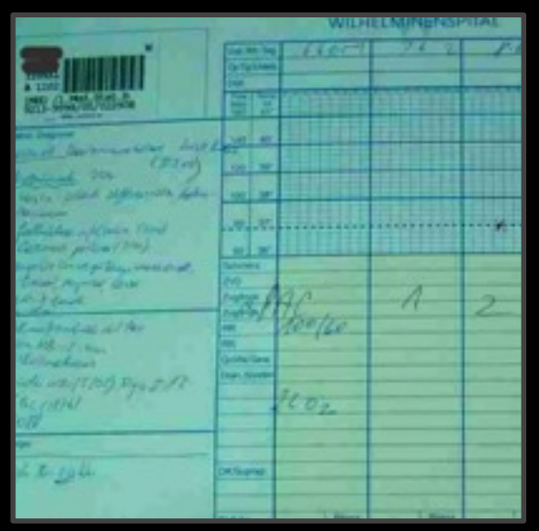
MAILBOX 1965
Network email 1971

Collaborative computing paradigms

- Facilitation of cooperative work
- Mediation of communication among workers
- Support of coordinative practices

Supporting coordinative practices: with great difficulty

- Document management systems
- Workflow management systems
- Production planning and control systems (ERP)
- Electronic patient record systems
- Project management systems



Paradigm shift *c.* 1989: Computer-Supported Cooperative Work (CSCW)

- Pankoke-Babatz et al., 1989:
  - Computational models and architectures must be grounded in 'fundamental understanding of Group Communication processes',
    - This requires contributions from 'sociology, anthropology, economics and political science'
- Greif, 1988:
  - 'Methodologies for testing individual user interfaces don't apply as well to group support systems. As a result, CSCW is looking more to anthropology to find methodologies for studying groups at work in their natural settings'

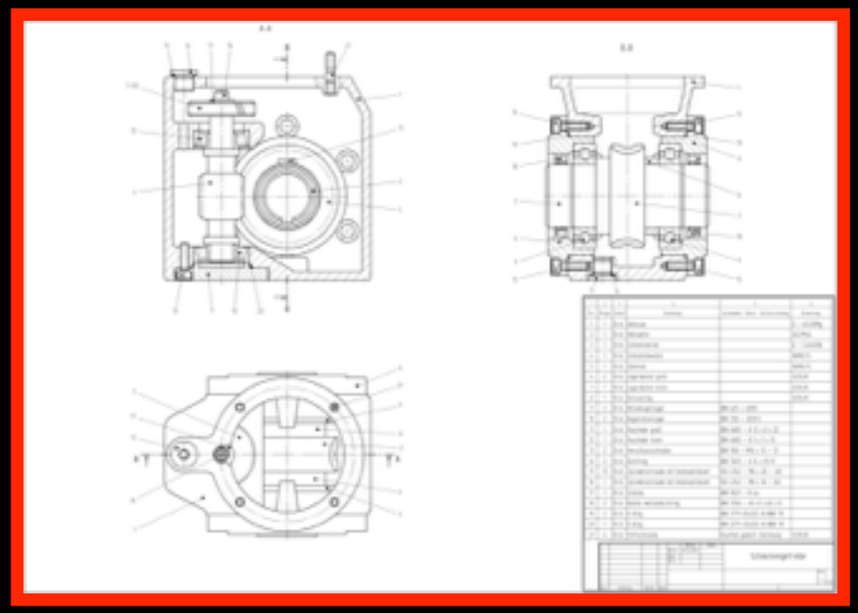
Interplay of ‘work practice’ and ‘computing’

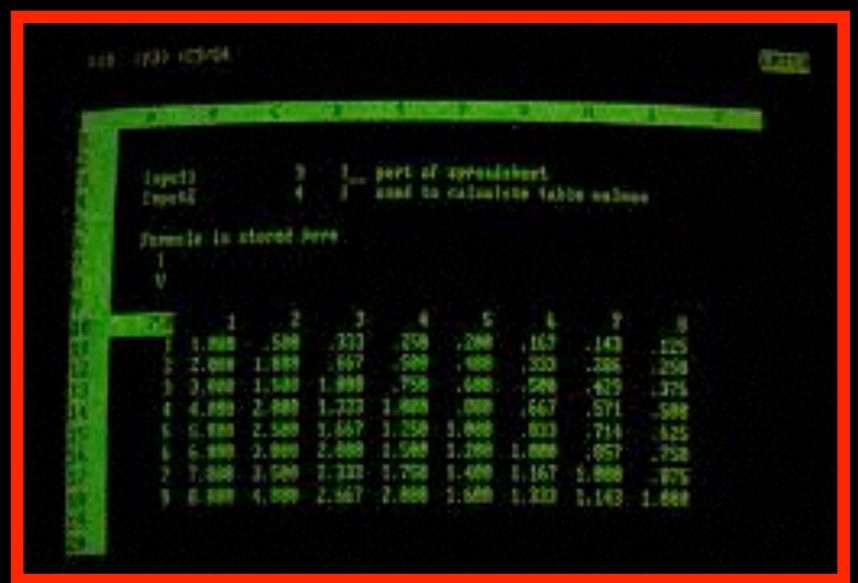
Interplay of ‘work practice’ and ‘computing’

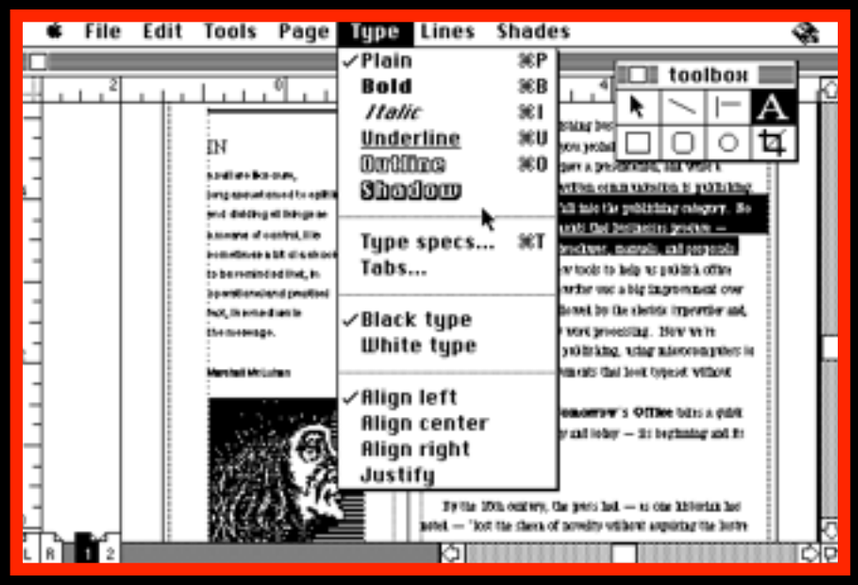
- Design of technology for technicians’ own use:
  - Time-sharing, 1960
  - Email, Instant Messaging, File transfer, 1965 / 1971
  - World Wide Web, 1989

Interplay of ‘practice’ and ‘computing’

- ‘Participatory design’
  - Computer-Aided Design, (automotive industry, 1960s ff.)
  - Spreadsheet (Visicalc, 1979)
  - Desktop Publishing (PageMaker, 1985)

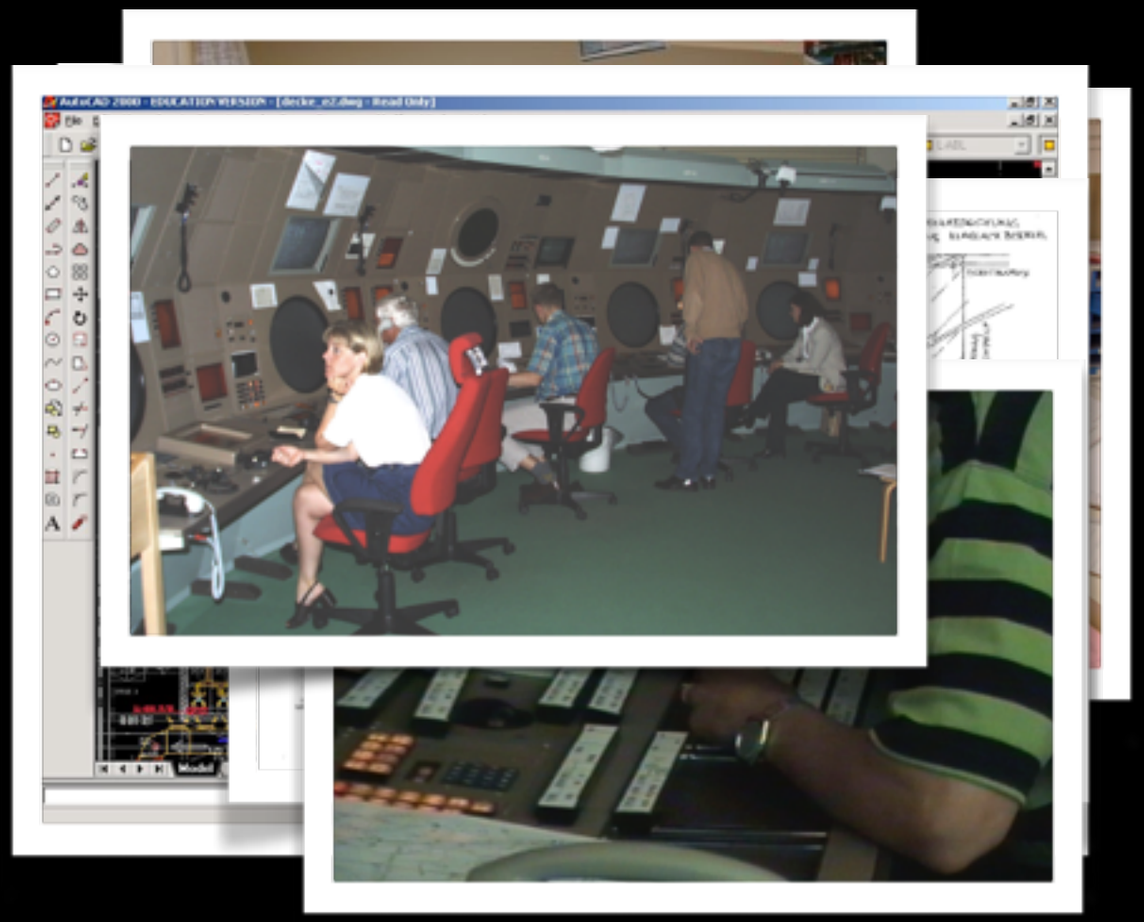






A new interplay of ‘practice’ and ‘computing’

- CSCW: Systematic studies of work practices
  - Health care
  - Design work: software development, architecture
  - Emergency management
  - Air traffic control, urban rapid transit
  - Scientific work
  - …



A new interplay of ‘prac

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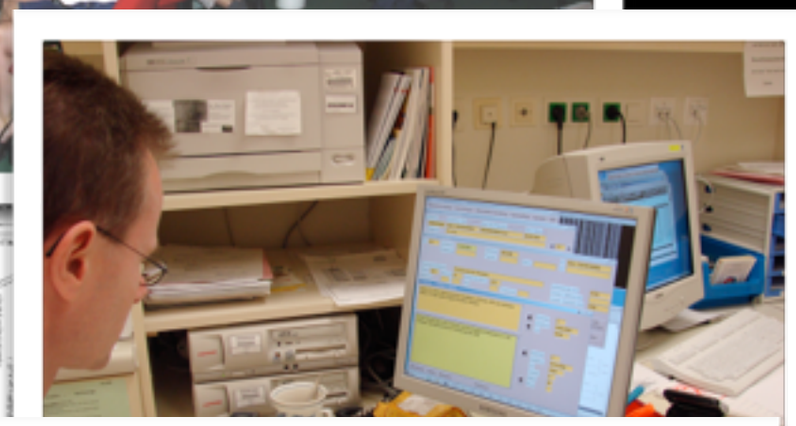

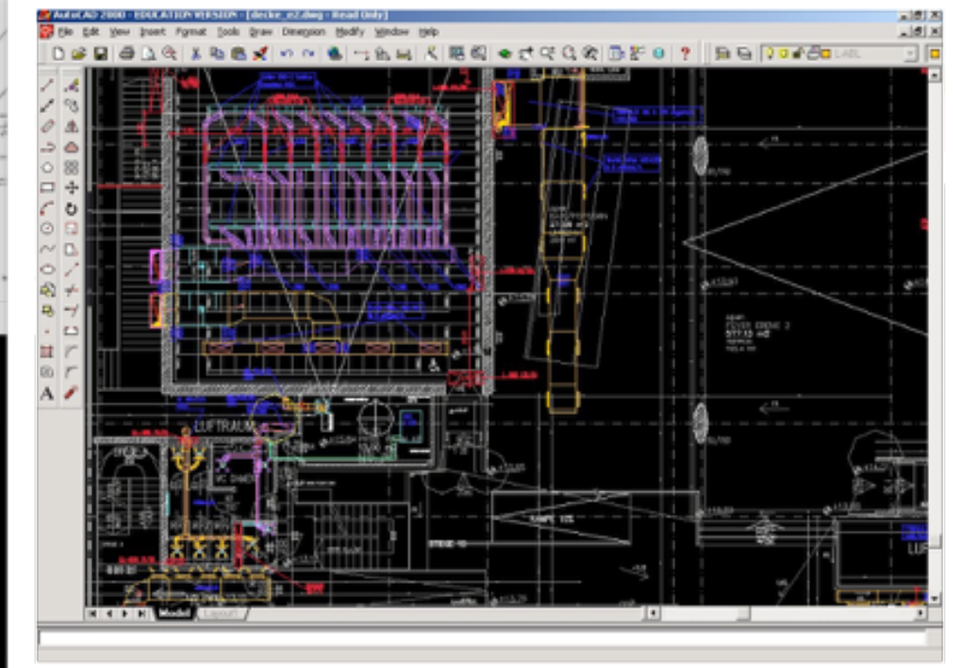

A new interplay of ‘practice’ and ‘computing’

- CSCW: Systematic studies of work practices
- Key issues:
  - ‘Mutual awareness’: cooperative work involves heeding the changing state of affairs in the setting
  - Coordinative practices and artifacts: cooperative work involves designing, applying, and adapting plans and procedures

‘Out of darkness’?

- Complete automation is a technocratic myth
- Challenges:
  - Integration of computational artifacts in actual practices: issues of design, organization, learning
- Requires deep and subtle understanding of our work practices

The end