Από μια κριτική ιστορία της Τεχνητής Νοημοσύνης στην αντιμετώπιση των προκλήσεων των Ψηφιακών Ανθρωπιστικών Σπουδών

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- Manolis Simos, Konstantinos Konstantis, Konstantinos Sakalis and Aristotle Tympas, "'AI Can Be Analogous to Steam Power' or from the 'Postindustrial Society' to the 'Fourth Industrial Revolution': An Intellectual History of Artificial Intelligence", *ICON: Journal of the International Committee of the History of Technology*, no 1, 97-116 (2022). [Link]
- Aristotle Tympas, "From the Display of a Digital-Masculine Machine to the Concealed Analog-Feminine Labour: The Passage from the History of Technology to Labour and Gender History", *Historein*, 19.1, 2020. [Link]

Wikipedia, 18.2.2023

Digital humanities (**DH**) is an area of scholarly activity at the intersection of computing or digital technologies and the disciplines of the humanities.

…

By producing and using new applications and techniques, DH makes new kinds of teaching possible, while at the same time studying and critiquing how these impact cultural heritage and digital culture.[2] DH is also applied in research. Thus, a distinctive feature of DH is its cultivation of a two-way relationship between the humanities and the digital: the field both employs technology in the pursuit of humanities research and subjects technology to humanistic questioning and interrogation, often simultaneously.

Digital humanities descends from the field of humanities computing, whose origins reach back to 1940s and 50s, in the pioneering work of Jesuit scholar Roberto Busa, which began in 1946, and of English professor Josephine Miles, beginning in the early 1950s. In collaboration with IBM, Busa and his team created a computer-generated concordance to Thomas Aquinas' writings known as the *Index Thomisticus*. Busa's works have been collected and translated by Julianne Nyhan and Marco Passarotti. Other scholars began using mainframe computers to automate tasks like word-searching, sorting, and counting, which was much faster than processing information from texts with handwritten or typed index cards.

PRACTICAL APPLICATIONS
OF THE
PUNCHED CARD METHOD
IN
COLLEGES AND UNIVERSITIES

EDITED BY

G. W. BAEHNE

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WIKIPEDIA
The Free Encyclopedia

Harris Fletcher

Harris Fletcher	
Born	October 23, 1892 Ypsilanti, Michigan, U.S.
Died	July 15, 1979 (aged 86) Champaign, Illinois, U.S.
Alma mater	University of Michigan
Occupation(s)	Academic, author, and authority on the work of John Milton

Harris Francis Fletcher (23 October 1892 – July 1979) was an American academic, professor of English at the University of Illinois for 36 years from 1926 to 1962,[1] an author, and a leading authority on the work of John Milton.

Early life

He was born in Ypsilanti, Michigan. Fletcher received his Ph.D. from the University of Michigan in 1925.

Career

Fletcher was Professor of English at the University of Illinois from 1926 to 1962, and Associate Dean of Liberal Arts and Sciences from 1931 to 1938.[1] Fletcher played a major role in the establishment of the university's Rare Book and Special Collections Library, which now include the largest collection of the works of the poet John Milton in the United States. He died in Champaign, Illinois in 1979.

Selected publications

- John Milton's Complete Poetical Works (1943)[2]
- Milton's Semitic studies and some manifestations of them in his poetry
- Milton's rabbinical readings
- The use of the Bible in Milton's prose
- The intellectual Development of John Milton (two volumes, 1956, 1961)[1]
- Contributions to a Milton bibliography, 1800–1930, being a list of addenda to Stevens's Reference guide to Milton

Personal life

On July 8, 1915, he married Mary Ellen Davis in Ypsilanti, Michigan. Mary Ellen Davis died of influenza in the flu pandemic October 20, 1918. On 22 June 1922, he married Dorothy Bacon in Coldwater, Michigan.

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1. "Harris F. Fletcher Papers, 1926-70, University of Illinois Archives" (http://archives.library.illinois.edu/archon/?p=collections/controlcard&id=1007). *University of Illinois Archives*. The University of Illinois at Urbana-Champaign. Retrieved 4 February 2014.

PART VIII

Applications in Agricultural Research

PART IX

Miscellaneous Research Applications

PART X

Applications of Specific Methods to the Solution of Statistical Problems

PART IX

Miscellaneous Research Applications

CHAPTER IV

Literature

By
H. F. Fletcher
Associate Professor of English and Associate Dean of the College of Liberal Arts and Sciences, University of Illinois

THERE are many problems in the intensive study of literature that call for listing and tabulation. One of these is the problem of index making, especially those time consuming word indexes of an author's works. The usefulness of such indexes is, of course, the usefulness of a tool and like all tools they depend entirely on their reliability. Insofar as machine operations can be substituted for manual operations in index making, the degree of reliability of the finished product can be considerably raised.

For several years the need for a word index of Milton's English prose works has been apparent. Without such an index we know little about his use of the language, and there is no way of being certain of the contents—ideas, proper names, authors used, or nature of the vocabulary—of the thousand or more pages that constitute Milton's English prose writings.

The preparation of word indexes and of concordances involves a great deal of manual labor. The time involved often extends into years. Both of the above factors tend to discourage such works. To overcome these discouragements and to increase the degree of accuracy an investigation was made into the possibility of using the new alphabetic tabulating equipment in connection with index work. This investigation resulted in the adoption of the technique as described in the following pages.

A tabulating card (Fig. 227) is punched for each word of the text. An alphabetic duplicating key punch is used. The card used has fields for the following information:

Word Recurrence, Column 1

A 1 is punched for each word that occurs in the text. If, for example, the explanatory context should take more space than is allotted, a second card is used for the rest of the context. This card has to contain all of the same reference information that the first card contains. This is necessary in order to have it sort with the original card. When a count is made to determine the frequency of a word, the use of the card count would register two for this word. To prevent this 0 is punched in this

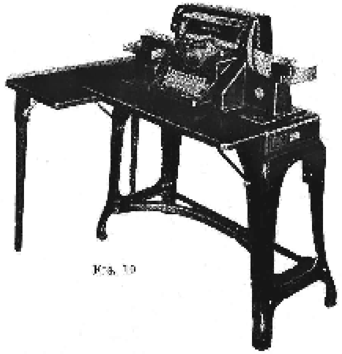


Fig. 10

ALPHABETIC PRINTING PUNCH

The Alphabetic Printing Punch is used to punch both alphabetic and numerical data into a tabulating card so that completely spelled names, descriptive words, etc., together with numbers, can subsequently be printed by an Alphabetic Accounting Machine.

This punch is equipped with a typewriter keyboard (Fig. 10). The depression of a key causes the machine to punch the card and simultaneously print the corresponding letter or figure at the top of the card above the column punched. Checking, filing and reference operations are thereby greatly facilitated.

The familiar typewriter tabular inserts control the skipping of the card to the proper columns to be punched. The cards are automatically fed and ejected.

Another model of the Alphabetic Printing Punch is equipped with a duplicating feature by means of which information common to more than one card can be automatically printed as well as punched on successive cards.

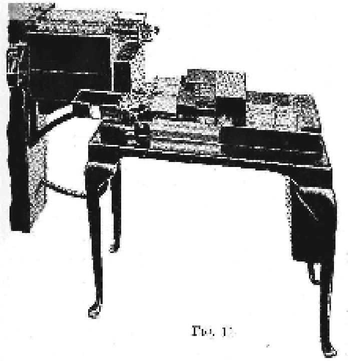


Fig. 11

AUTOMATIC SUMMARY PUNCH

The Automatic Summary Punch (Fig. 11) is used to punch summary or new balance cards during the tabulating process of the accounting machine to which it is attached. The accounting machine stops at every control change; the information appearing in its counters is then electrically transmitted to the Summary Punch and by it recorded on tabulating cards.

In addition to recording classifications and totals received by electrical impulse from the accounting machine, the Summary Punch can also record common data received by electrical impulse from a pre-punched card in the master card rack. It can be converted into a Motor Drive Duplicating Key Punch simply by throwing a switch.

The Automatic Summary Punch provides an exceptionally fast method of obtaining a balance-forward.

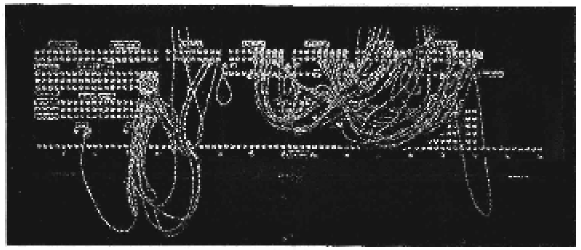


Fig. 6

A TYPICAL TABULATING AND ACCOUNTING MACHINE PLUGBOARD FOR MANUAL WIRING

Because they are operated by electricity rather than by any mechanical means, flexibility is an inherent feature of all electric tabulating and accounting machines. To attain this flexibility the more complex machines employ a plugboard which is similar in principle to a telephone switchboard.

In the plugboard illustrated (Fig. 6) there are two rows of numbered sockets corresponding to the 80 columns on the card (top row of sockets not visible in illustration). After the information to be added or indicated has been determined for any given report, plug wires are inserted to connect the sockets corresponding to the tabulating card fields in which the data are punched, with any desired adding counter or list bank.

By utilizing the second row of sockets and an automatic control device and by having several counters to carry sub-totals, intermediate totals and grand totals, the machine will automatically sense changes in classification, print totals and proceed with the tabulation of the next classification.

Most machines are equipped with various other devices for selecting specific information and rejecting other, for counting the cards going through, for transferring totals, etc. (See Special Device Section pp. 18 and 19.)

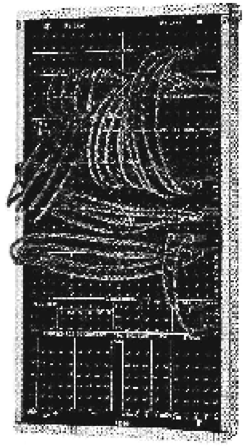


Fig. 7

AUTOMATIC PLUGBOARD ASSEMBLY

The manually operated plugboard illustrated in Fig. 6 is being rapidly superseded by the automatic plugboard assembly (see Fig. 7) which enables a complete change of plugging arrangement to be made in less than a minute.

The use of this assembly speeds production since the only requirement in changing from one form of report to another is the insertion of a pre-plugged Set-up Slide in the machine at the completion of the first report. A Fixed Set-up (permanently wired) is obtainable for routine reports, one for each form or for each of those most frequently used. Another type is the Manual Set-up which can be wired for any report form and kept ready for use.

FIG. 23

A TYPICAL TABULATING MACHINE INSTALLATION (Columbia University Statistical Bureau)

“In their present wonderfully improved form, the Hollerith machines work automatically with such speed and unerring accuracy in complicated statistical manipulations that, to the uninitiated, they seem like uncanny 'robots' of superhuman efficiency”.

Practical Applications of the Punched Card Method in Colleges and Universities
Edited by G. W. Baehne. Pp. xxiii+442. (New York: Columbia University Press; London: Oxford University Press, 1935.) 22s. 6d. net.

THE use of tabulating machines of the Hollerith electric or other types for statistical and recording work of all kinds has increased to a remarkable extent during the past fifty years. It is not, however, generally appreciated how valuable these devices have proved themselves not only in large-scale and intricate accountancy systems but also in actual statistical research in the wide and varied field of social science. The present work describes their use mainly in colleges and universities, for example, in the registrar's and business office and miscellaneous administrative applications, and in psychological, educational, medical, hospital, legal and agricultural research. In their present wonderfully improved form, the Hollerith machines work automatically with such speed and unerring accuracy in complicated statistical manipulations that, to the uninitiated, they seem like uncanny 'robots' of superhuman efficiency.

The experience of the large number of American universities and other institutions here recorded shows that both in the ordinary business routine of a registrar's office and in social research of every kind, such mechanical devices are proving to be increasingly necessary, as essential indeed as mathematics, and are, as the editor rightly insists, the natural outgrowth of the statistical method of approach to modern learning. One writer in the authoritative series of papers here presented from many fields of university and institutional activity expresses the view that, with the statistical approach so perfected by these means, a precision and dependability of research in the social sciences will be secured second only to that of the physical sciences. So far from mechanising thought, the vast reduction in time spent on laborious routine will increase the time available for clear and original thinking and accurate observation.

The Aliphatic Free Radicals
By F. O. Rice and K. K. Rice. Pp. 204. (Baltimore, Md.: Johns Hopkins Press; London: Oxford University Press, 1935.) 21s. net.

THE capture of particles elusive and ephemeral by Paneth and Hofeditz has proved a turning point in the century-old controversy around the question "Do free radicals exist?" In justice to recent developments, the Faraday Society's discussion in September 1933 centred chiefly round entities falling within the definition: "Free radicals are complexes of abnormal valency, which possess additive properties, but do not carry an electrical charge and are not free ions". The book under review is concerned with such radicals, of which "the most striking property is their short life".

The detection and incidental synthetic uses of free methyl, methylene and ethyl are lucidly described, and a hypothesis of thermal decomposition of organic vapours, consistent with many of the data, is based on the intermediate formation of free radicals. The authors are bold enough to prophesy in detail the courses of numerous reactions not yet investigated. Cognate reactions in the liquid phase are briefly discussed, and the hypothesis is extended, with some success, to the decomposition of large non-volatile organic molecules of the recurring-unit type. There are a few slips, such as the description of methyl and ethyl nitrites as "the methyl and ethyl esters of the alkyl nitrites" (p. 136).

Readers interested in the mechanism of reactions will, however, find this a useful, well-produced book with a comprehensive up-to-date bibliography limited by the scope of the title, but the price seems rather high to command a ready sale to individuals.

The Hardness of Metals and its Measurement
By Dr. Hugh O'Neill. Pp. xiv+292+24 plates. (London: Chapman and Hall, Ltd., 1934.) 25s. net.

ALTHOUGH the hardness of a substance is not a physical constant, and cannot be expressed as a function of known physical constants, the idea of hardness is a familiar one, and empirical determinations of hardness play a great part in the study of materials. Methods depending on scratching now take only a subordinate place, and 'resistance to indentation' is the most generally accepted definition of hardness. The Brinell test, in which a hard ball is pressed into the object under a known load, forms the basis of most hardness testing, but the introduction of the diamond pyramid, as in the Vickers test, in place of a steel ball, has given greater precision to the test.

The author of this useful manual has made a special study of hardness, and is known as an investigator of the subject. Besides a clear account of the methods of determining hardness in the laboratory and in the workshop, the book deals fully with the influence of the time factor in deformation and with the relation of Brinell hardness to such mechanical properties as tensile strength and capacity for work hardening. The author emphasises the value of 'Meyer analysis' in the investigation of the latter property. Such subjects as resistance to abrasion and the cutting quality of tools and cutlery are also discussed. The manual will be found of the greatest value as a work of reference. C. H. D.

Esquisse du progrès de la pensée mathématique: Des primitifs au ixe Congrès international des Mathématiciens. Par J. Pelseneer. (Bibliothèque scientifique belge.) Pp. 161. (Paris: Hermann et Cie, 1935.) 15 francs.

IT is not the technical results of mathematical progress, but rather the development in the outlook of mathematicians, which is very ably sketched in this little book. From the primitive attempts of reckoning to the dizzy heights of contemporary mathematics, we thus have before us an ordered and most suggestive exposition of the mathematical atmospheres of the ages. Selected quotations from the leading mathematicians help us to understand the progressive changes in their interests and methods. This is an interesting contribution to the history of science. T. G.

Aristotle Tympas, "From the Display of a Digital-Masculine Machine to the Concealed Analog-Feminine Labour: The Passage from the History of Technology to Labour and Gender History", *Historein*, 19.1, 2020

Radio and the Humanities

By William S. Paley

FAR back in history we may note the coexistence of two divergent concepts of cultural education. Most ancient is the idea that culture is essentially the thought-product of a small class in society, to be handed on in turn to the inheritors of this group's responsibilities and privileges. This concept still molds today's educational systems in most of the nations of modern Europe, to no less degree than it was operative in ancient Alexandria and Athens and Rome. Over wide areas, entrée to the higher culture is still regarded as the privilege of a limited ruling class who alone are equipped to understand, utilize, and conserve it; and this minority is usually empowered to decree the extent and the nature of the education which the less privileged classes are to receive.

It is the American development of democratic government, over an enormously extended and populous area, that has been largely responsible for propagating widely the contrasting concept—which we may well call the democratic concept—of mass culture and education.

Obviously, in a society which the masses govern, order can be preserved and social progress assured only if the masses receive the necessary education to bear their heavy responsibilities. Our Nation has at most epochs seen this quite clearly, ever since its origin. This accounts, of course, for our educational expenditures, which often seem fabulous in comparison with equivalent European outlays, as well as for marked differences in educational evaluations and objectives which the European often does not understand. And it accounts to no less degree for much of the structure of the American system of radio broadcasting and its program direction, both of which differ greatly from the systems in general use abroad.

Mass Education through Radio

It is not the purpose of this paper to offer another defense for the American educational concept, which even today has its attackers; but rather to examine a single one of its numerous implications: its actual application to radio programs. It is difficult, however, to forgo in passing the satisfaction of one observation: The American form of government, rooted in democratic culture and education, has shown during the world's recent tumultuous years a stability, a resourcefulness under changing circumstance, and an immunity to shock of hysteria, which to many other nations has seemed remarkable.

The radio has of course been playing a very large social rôle during this period, in all the civilized countries of the world. It is noteworthy that the United States is the one important nation in which broadcasting has not been made a government monopoly. Here, radio has been from the beginning not an instrument made by government, but rather an instrument for the making of government.

Nor do I refer here solely to radio's great usefulness, during recent political campaigns, for carrying the various issues to the people; nor to its apt service, during such dark periods as the financial crisis of 1933, in bringing the President's reassuring voice within the walls of the people's homes. I am thinking of the fact that our Nation's economic and political thought is connected very

Humanities through Television

Miriam Goldstein

Journal readers may remember that the September 1959 issue carried a review in "The Public Arts" of *An Introduction to the Humanities*, twelve half-hour filmed lessons prepared by the Council for a Television Course in the Humanities under a grant from the Fund for the Advancement of Education. In this article Mrs. Goldstein, whose classes at Newton High School, Newtonville, Massachusetts, used the films, reports on the experience. Her report is relevant not only to a specific experiment but also to television instruction in English generally.

For a long time, television has enriched the study of English at my school. I recall our gathering in the public library to see the coronation of Elizabeth II. I remember our class TV party in a student's home one Sunday afternoon when Hallmark presented *Richard II*. Another Sunday, when *Henry V* was to be telecast in color, a local electronics manufacturer loaned us a set for our school auditorium. But we never needed a set in our classroom because the best in commercial television is available only nights or weekends, and our local educational channel offers nothing in high school English at any time.

Furthermore, the enrichment provided by television at its best was only sporadic; for adapting night telecasts to the day's recitation presents problems of preparation, content, and scheduling. Because I cannot preview, I am totally dependent on the study guides occasionally provided by a producer or sponsor. Usually I must devote hours *after* the night telecast to planning classroom follow-up. Nor can I expect from the entertainment provided by commercial television the continuity, repetition, and progression that insure learning. If viewing alone developed standards of taste and excellence, we teachers would be dodos. It is the rare program that by itself makes intellectual demands of more than the fourteen-year-old intelligence. And when that rare program comes, it usually conflicts with previous commitments or family preferences for another channel's offerings. Even the opportunity to extend the viewing experience through reading the play is rare, for textbooks cannot be obtained on short notice. The demands made on our school library the morning after a good telecast are heartening but symptomatic of interests generated and opportunities lost.

These problems seemed to be eliminated when my school was invited to try out a pilot course consisting of twelve televised half-hour lessons in the humanities. This series, produced by the Council for a Television Course in the Humanities for Secondary Schools, Inc., under a grant from the Ford Foundation's Fund for the Advancement of Education, seemed attractive because for the first time content, preparation, and scheduling were to be adapted to the needs of the

Microphotography and History*

LAWRENCE A. HARPER

IN THE REALM of physical sciences the modern world has moved with such amazing rapidity that the average person is skeptical of virtually nothing in this field. The possibility of splitting the atom, which was a revolutionary theory only fifty years ago, has now become an actuality. Rocket and jet propulsion of planes, hitherto encountered chiefly in the comic strips, has become a commonplace of warfare. Companies have not yet started advertising interplanetary trips, but they are seriously contemplating stratospheric flights.

In the meantime what revolutionary advances has the historian made? To put it bluntly, he has not advanced beyond the horse-and-buggy days. In fact, he is still back in the pack-mule era.

It is, of course, true that the amount of historical knowledge has greatly increased. The volumes which have been printed, the periodicals which have been issued, are troubling the librarians whose shelf space is limited. But the question can be asked whether the mere accumulation of articles and monographs is enough. In all seriousness it may be debated whether the cause of creative scholarship has not, in fact, been hindered by the sheer mass of the material which now exists.

In the second half of the nineteenth century Hubert Howe Bancroft, who had made enough money in his publishing enterprises to undertake historical scholarship on a vast scale, began to write a history of the Pacific slope. He assembled a collection of books and original materials estimated in value from $190,000 to $900,000, thereby saving himself the tedious job, from which most of us suffer, of endeavoring to draw books from the general library. Having assembled his sources he found the task of using the material too great for one man's power. He calculated that if he worked eight hours a day it would require four hundred years to go through his library even superficially. To quote his own words: "If I wished to write fully on the zoölogy, for example, of the Pacific slope, nine tenths of all the books in my library containing reference to the animals of the coast might as well be at the bottom of the ocean as in my possession unless I was prepared to spend fifteen years on this one subject."[1] To achieve his results he employed a corps of assistants whom he set to the task of cataloging and indexing the data he had acquired. The average historian, however, has neither a specially selected library nor a corps of assistants to aid him. The possible options he may pursue in order to tackle the problem are often illusory and never satisfactory.

* A paper read before the San Francisco Bay Area meeting of the *Pacific Coast Branch* of the American Historical Association at *Stanford University*, January 19, 1946. [Editor]

[1] Hubert Howe Bancroft, *Literary Industries* (San Francisco, 1890), p. 232.

The Machine Age in Historical Research[1]

By MURRAY G. LAWSON

College of the City of New York

THE rapidly growing interest in the application of machine techniques to historical research has, undoubtedly, reminded some sceptics of Swift's satirical sketch of the Grand Academy of Lagado. There a group of professors had dedicated themselves to the seemingly utopian task of devising "new rules and methods . . . new instruments and tools" for "putting all arts, sciences, languages, and mechanics upon a new foot." One of the more ingenious of them had even conceived the idea of constructing out of "bits of wood," squares of paper and "slender wires" a "machine," whereby "speculative knowledge" could be so improved by "practical and mechanical operations," that "the most ignorant person" could "write books in philosophy, poetry, politics, law, mathematics, and theology, without the least assistance from genius or study."[2] Although this pioneer attempt to utilize machines in the field of scholarship failed, only the other day the eminent Director of the Office of Scientific Research and Development, Dr. Vannevar Bush, declared that this "noble exalted thought" is now on the very threshold of actuality as the "instruments are at hand which, if properly developed, will give man access to and command over the inherited knowledge of the ages" and the "growing mountain of research."[3]

Leisure time is essential for creative thought. Historians need not be reminded that the idea for that great classic, *The Decline and Fall of Rome*, came to Gibbon as he sat "musing amidst the ruins of the Capitol, while the barefoot friars were singing vespers in the Temple of Jupiter" below.[4] The problem that is now posed for the scholar is how he is to escape becoming mentally enslaved by the very abundance of his materials.[5]

[1] A paper presented at the annual meeting of the American Historical Association, New York, December 28, 1946.

[2] Jonathan Swift, *Gulliver's Travels* . . . , Oxford University Press, (London, 1919), pp. 209-10, 216-17.

[3] Vannevar Bush, "As We May Think," *The Atlantic Monthly*, 176 (1945) 101.

[4] *The Memoirs of the Life of Edward Gibbon*, edited by George B. Hill, (London, 1900), p. 167.

[5] It has been estimated that the Library of Congress is presently increasing at the rate of "almost one book per minute the year round." William H. Carlson, "The Research Worker and the Library," *College and Research Libraries*, 7 (1946) 291.

Presenting-ideologizing computing tools and machines as intelligent, throughout capitalism, was no different from presenting computing labor as unintelligent, unskillful, dispensable, subject to static replacement by computing machines. And, accordingly, presenting those working with them as unskillful machine ‘attendants’, ‘keepers’, ‘operators’ and the like. The histories of the division of labor and artificial intelligence are “intertwined” throughout industrial capitalism, going back to the period of the rhetoric about “mechanical intelligence” and mechanical computing machines (Daston 2017, 11)[1]. And so is the history of the automation, of “seeing machines as autonomous”, as automata, which “has historically meant *not* seeing certain kinds of labor and the people performing it” (Jones-Imhotep 2020, 10)[2].

CALCULATION AND THE DIVISION OF LABOR, 1750-1950

31ST ANNUAL LECTURE OF THE GERMAN HISTORICAL INSTITUTE, WASHINGTON DC, NOVEMBER 9, 2017

Lorraine Daston

MAX PLANCK INSTITUTE FOR THE HISTORY OF SCIENCE, BERLIN

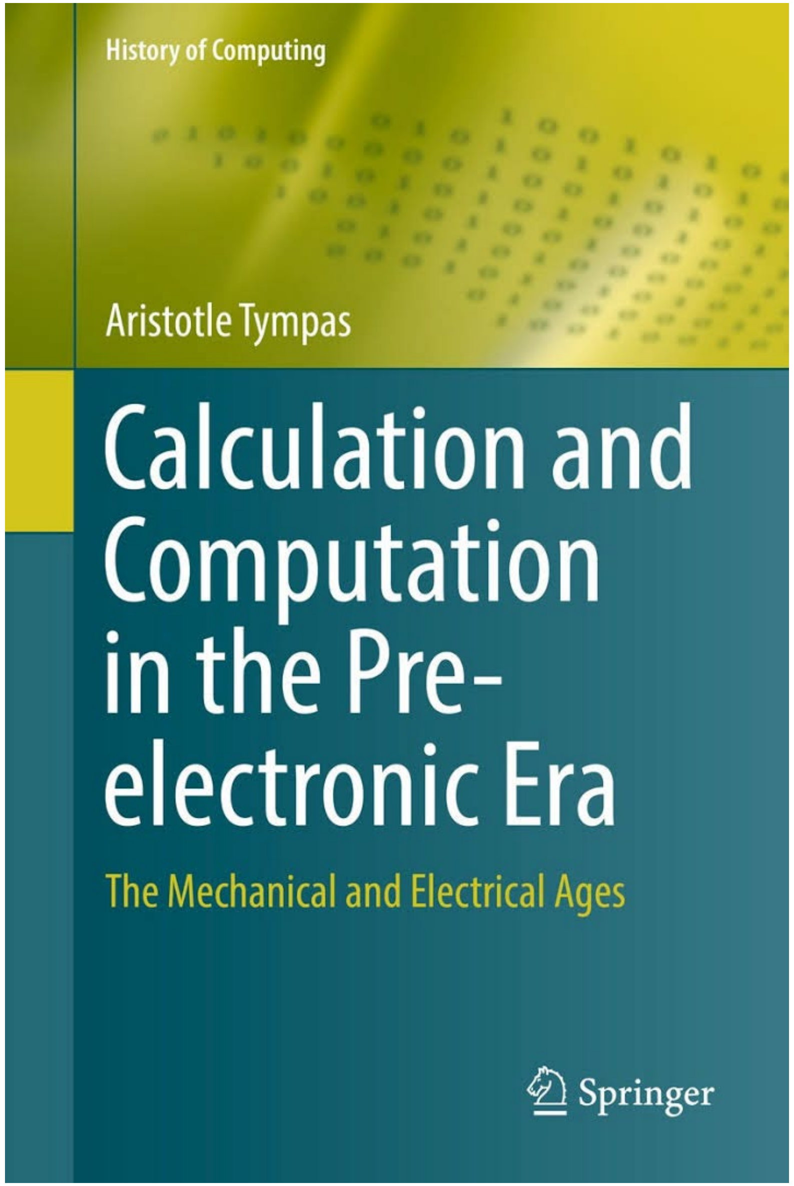
I. The Strange Death of Calculation

The scene is a school room, in almost any epoch and any locale: it might be the house of an ancient Babylonian scribe, in which father taught son in learned lineages that stretched over centuries; or in Song Dynasty China, as students prepared for the imperial civil service examinations; or in fourteenth-century France, where an allegorized *Geometria* instructed cathedral school pupils; or nineteenth-century Prussia, whose schoolmasters had allegedly delivered a military victory over the French in 1870. In all of these classrooms, dispersed over centuries and continents, students would have been taught some version of the three fundamental cultural techniques that underlie all other cognitive practices in literate societies: reading, writing, and calculation. We have rich and vast histories of reading and writing; yet we barely have the rudiments of a history of calculation. Why not? This lecture is an attempt to answer that question.

The puzzle of why we lack a history of calculation is deepened by the fact that our oldest evidence for writing systems, for example from ancient Mesopotamia and the Mediterranean, suggests that alphabets are parasitic upon numerals. Somewhat disappointingly, many of the earliest surviving texts in Sumerian (c. 3500 BCE) and other ancient languages record not great epics like the *Gilgamesh* and the *Iliad* but rather what sound like merchants' receipts: five barrels of wine, twenty-two sheepskins, and so on. The earliest use of reading and writing appears to have been to keep track of calculations, mostly for commercial and administrative purposes. Yet today, in the age of hand-held electronic calculators and calculating apps, mental calculation has almost disappeared as a widespread cognitive practice, even from the classroom. Our online lives are dominated by reading and writing to an extent probably unprecedented in world history: these culture techniques have weathered and indeed flourished under successive media revolutions, from printing to digitalization. But calculation, the third pillar of the scribal triumvirate, has almost ceased to count as an intellectual activity. How did this happen?

1. Daston, L. (2017). Calculation and the Division of Labor, 1750-1950. Bulletin of the German Historical Institute, 62 (Spring), 9–30
2. Jones-Imhotep, E. (2020). The ghost factories: histories of automata and artificial life. History and Technology, 36(1), 3–29. https://doi.org/10.1080/07341512.2020.1757972

This ideology appeared in interaction with the emergence of merchant capital (Renaissance to Enlightenment) and became intense with the emergence of industrial capitalism. In the context of arguing that computing tools and machines were indispensable for the emergence and advance of the first (steam) and the second (electricity) industrial revolution, we have further argued that they were also presented as intelligent (Tympas 2017)[3].



3. Tympas, A. (2017). Calculation and Computation in the Pre-electronic Era: The Mechanical and Electrical Ages, Springer

For example, ‘calculating boards’, ‘artificial lines’ and ‘network analyzers’, some state-of-the-art computers from the 1910s-1930s, which represented, at the time of their appearance, the highest ratio of computing capital to computing labor, were ideologized as intelligent/thinking machines. They were used to calculate the rush to lengthen and interconnect electric power transmission lines of the interwar decades (Tympas 1996)[4].

From Digital to Analog and Back: The Ideology of Intelligent Machines in the History of the Electrical Analyzer, 1870s–1960s

ARISTOTLE TYMPAS

The example of the electrical analyzer, a genre of computing artifacts known mainly by their development and use in the context of electrification, is treated as representative of the historical oscillation between analog and digital computing orientations. Artificial electric lines, short-circuit calculating boards, and alternating current network analyzers are discussed as examples of electrical analyzers. Counting on the successful employment of the ideology of intelligent machines in the context of the history of the electrical analyzer, the first part of the article searches for a direct ancestor of the post–World War II computing ideology. The second part of the article proposes to interpret the ideology of intelligent machines as an effect related to the social conditions of the appropriation of computing labor. Overall, the article argues about the historical, i.e., antiessentialist, character of the demarcation of digital from analog orientation.

Introduction

The desire to engineer intelligent machines has both recent[1] and distant protagonists.[2] The historical specificity of the recent history rests on the assumption of several discontinuities between our computing technology and the one before it: digital vs. analog, general- vs. special-purpose (and the related discontinuity between programmable and nonprogrammable), electronic vs. nonelectronic (mechanical or electrical), or the combination of some or all of the above. In this article, I am restricting the focus to the historical effects of the assumption of discontinuity between the analog (technology) and the digital (technology). Theoretical arguments about the continuity between the analog and the digital have been necessary for calling our attention to articulation of ideology and technology.[3] There also exists a historiography that follows the general articulation of ideology and technology before the recent decades.[4] In this article, I am specifically concerned with the articulation of ideology and computing. This articulation is exemplified by the history of the social production and use of the electrical analyzer, a technological genre unanimously considered to belong to the analog.

In order to follow this history, I interpret engineering literature on the electrical analyzer based on some recent suggestions about the integration of textual interpretation into the practice of the historian of technology.[5] From a synchronic perspective, there is an ideological continuity between the analog and the digital in the ideology of the intelligent machine. From a diachronic perspective, one can attribute this ideology to the overdetermination by the desire to obtain a social advantage—by substituting machine intelligence for social intelligence. The term *electrical analyzer* captures the continuity of three couples of hegemonic as well as opposing social tendencies:

- mechanizing and calculating, which brought about the mechanical calculator;
- electrifying and analyzing, which brought about the electrical analyzer; and
- electronifying and computing, which brought about the electronic computer.

Mechanization was not simply a social tendency but was instead the hegemonic social tendency throughout modernity up until the end of the 19th century.[6] From the end of the 19th century until after World War II, electrification was the hegemonic social tendency.[7] From that time on, electronification has been the hegemonic social tendency.[8] Calculating, analyzing, and computing have countered mechanization, electrification, and electronification. According to Thomas Hughes, analyzing was the *reverse salient* of electrifying[9] and computing of electronifying.[10] I consider this functionalist metaphor along with one qualification. In the history of the electrical analyzer, a technological front and its reverse salient were united in continuity, yet in opposition, thus in contradiction. The ideology of the intelligent machine came in order to suppress the contradiction from resulting in dysfunction.

4. Tympas, A. (1996). “From Digital to Analog and Back: The Ideology of Intelligent Machines in the History of the Electrical Analyzer, 1870s -1960s”, IEEE Annals of the History of Computing, Volume 18, Number 4, 42-48

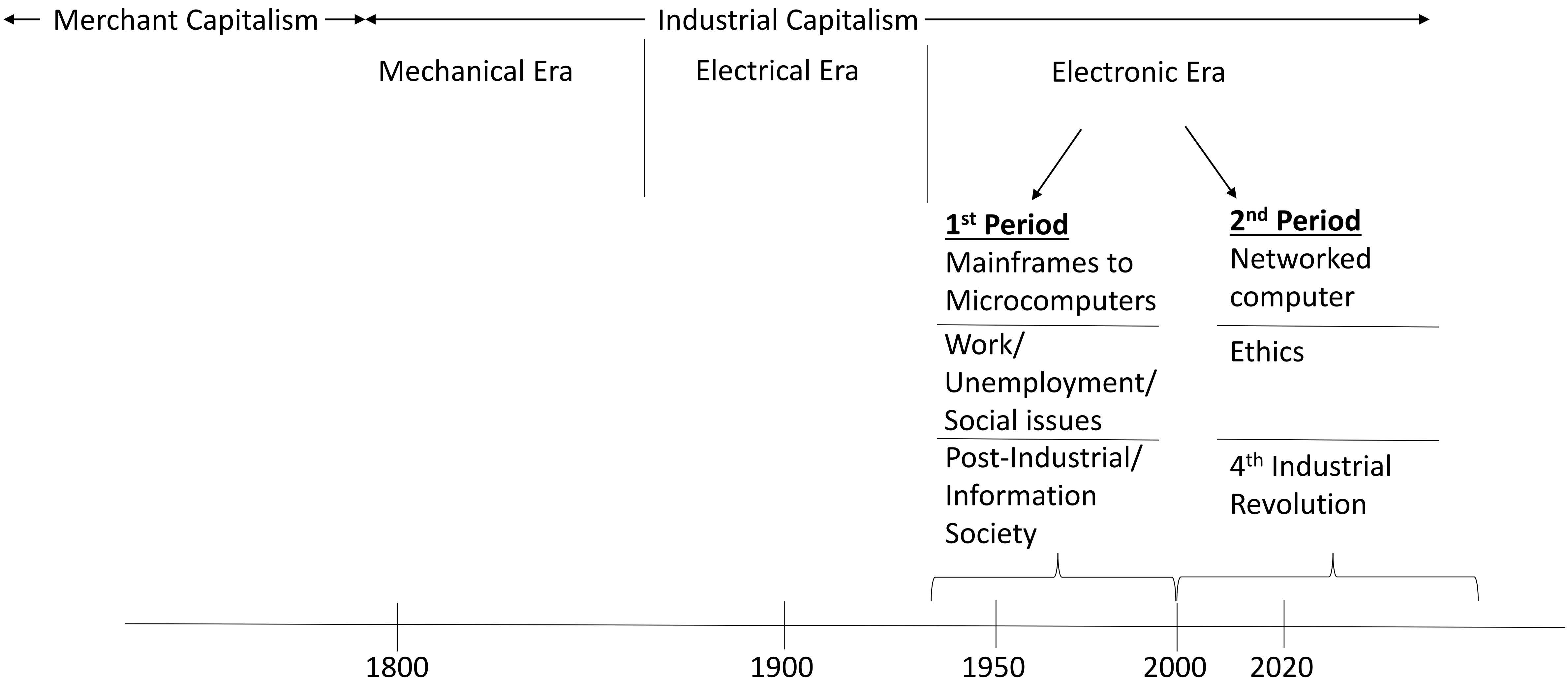


Figure. Periodizing the history of artificial intelligence

The history of artificial intelligence covers the whole of the historical period known as ‘modernity’ or ‘capitalism’, it is not limited to the electronic era.

We propose a historiography of artificial intelligence that aims at understanding the history of artificial intelligence in the electronic era of capitalism by respecting both the differences and the similarities with the history in the mechanical and the electrical era. Most notably, we need both in order to understand why artificial intelligence in the electronic era became initially connected to a rhetoric about a passage to a postindustrial and information society, which means a break from the mechanical and electrical industrial revolutions (steam and electricity), but, eventually to a rhetoric about a new industrial revolution, which cancels this break. Failing to keep in mind both the short run of the electronic history of artificial intelligence and a long run that also includes its mechanical and electrical versions, explains why the available histories of artificial intelligence are stuck to periodization schemes that do not take into account the transition from linking artificial intelligence to postindustrial/information society to that of linking it to one more industrial society.

Within the electronic era, we may differentiate between two sub-periods: one that includes the introduction of 'mainframe computers' and, then, 'microcomputers' ('home computers' and 'personal computers'), and, one that is defined by the expansive use of computers and their simultaneous interconnections that gave the internet, the web and the various social media.

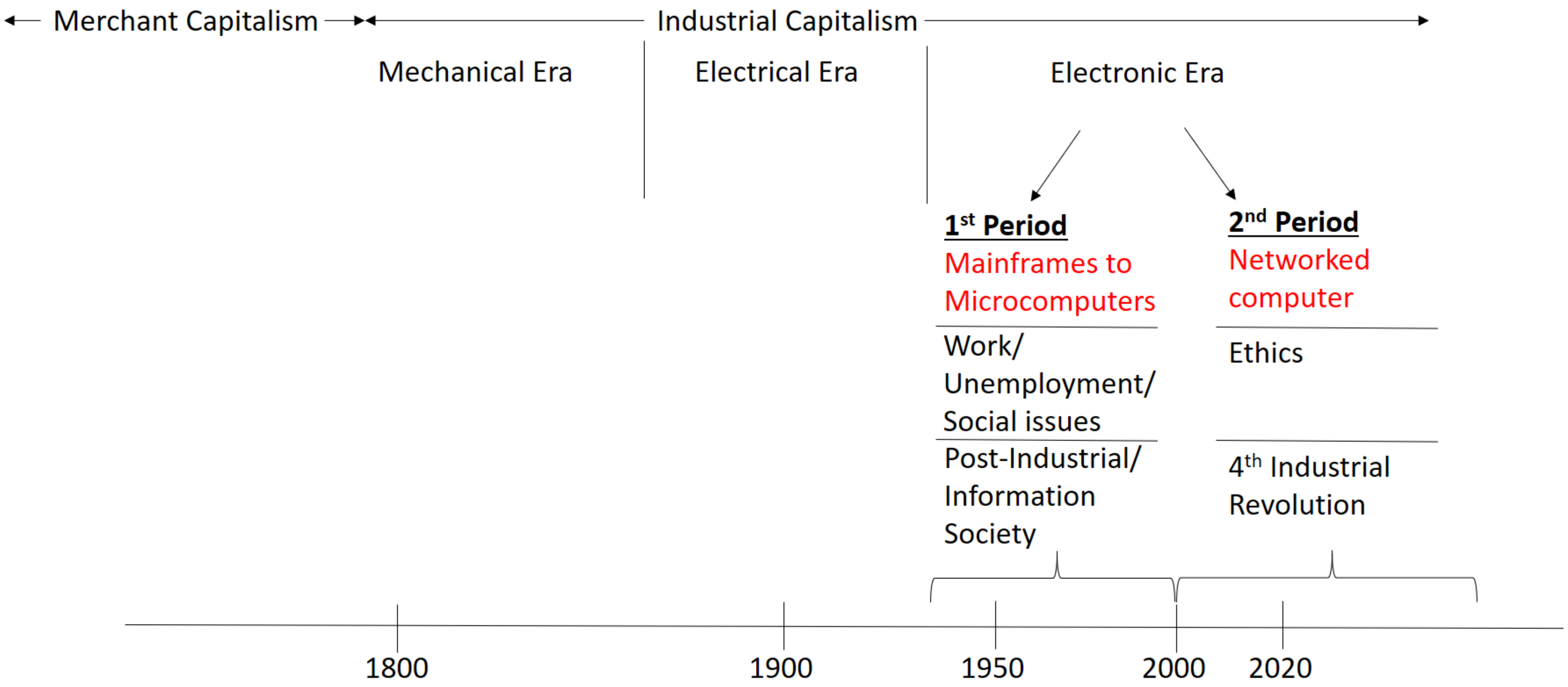


Figure. Periodizing the history of artificial intelligence

The difference is not simply one between relatively unconnected computers that are presented as intelligent (first sub-period) and highly interconnected computers (second sub-period). While in the first sub-period the concept ‘artificial intelligence’ was shaped by the presentation of specific computers as ‘intelligent’, in the second it is defined by the generalized production of ‘data’ that have become ‘big’ and their feeding into ‘algorithms’ that are no longer simply mathematical.

In the first sub-period, the public discussion was focused on the connection between intelligent machines and work, the control of work by intelligent machines or even unemployment due to the replacement of humans by them; in the second, the discussion is mainly about biases in the algorithms that artificial intelligence is based on. While work remains an issue in the second sub-period, the emphasis has shifted from the 'social impact' to the 'ethics' of artificial intelligence.

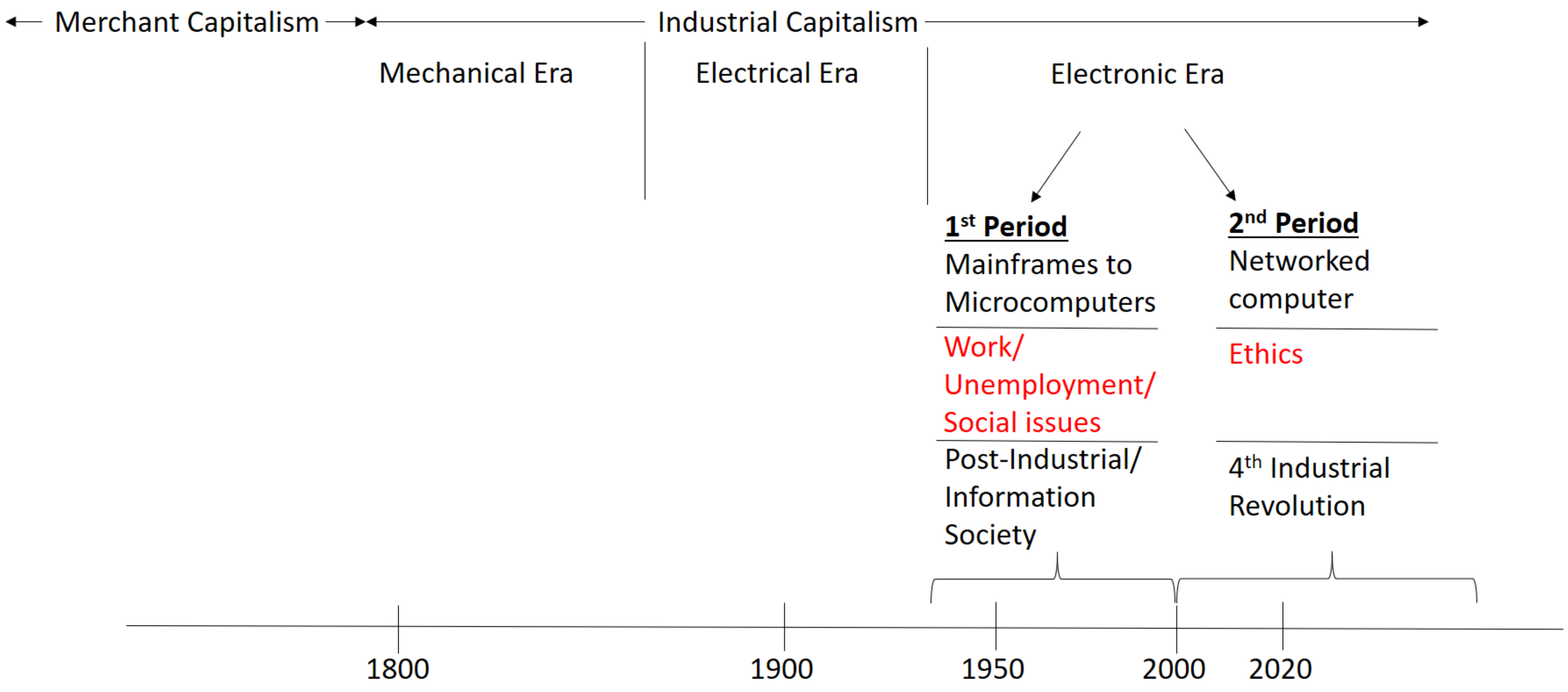


Figure. Periodizing the history of artificial intelligence

In the first sub-period, the concerns about the future of work were addressed by the emergence of a periodization scheme that argued about a passage to a 'postindustrial order' (Brick 1992)[9], to an 'information society' (Kline 2006)[10]. By contrast, the periodization scheme of the second sub-period brings back industrialization by speaking about one more, this time the fourth, industrial revolution. The change came along a weakening of labor next to capital, which stands at the center of the transition from welfare to neoliberal capitalism. The change in regards to artificial intelligence between the first and the second sub-period has been key to the transition from the rhetoric about the passage to a postindustrial (information) society to the rhetoric about the return of industrial revolutions.

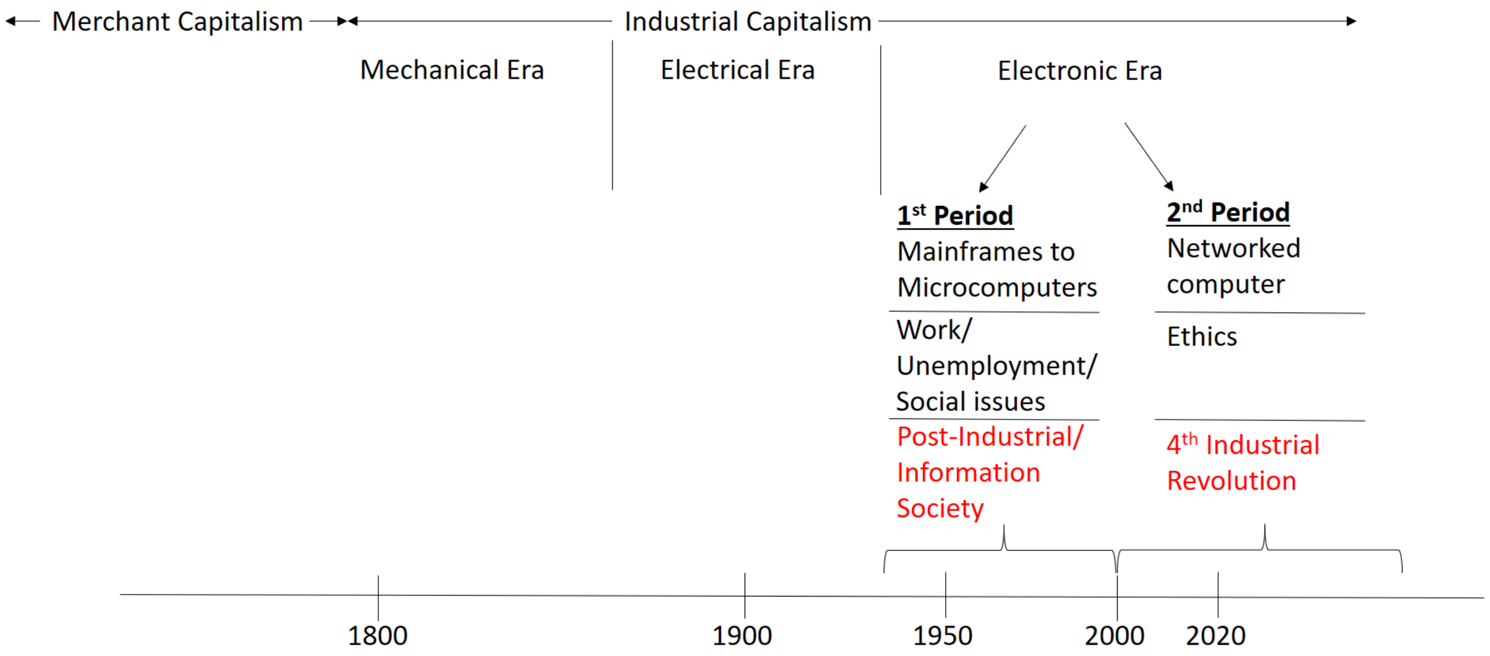


Figure. Periodizing the history of artificial intelligence

9. Brick, H. (1992). Optimism of the Mind: Imagining Postindustrial Society in the 1960s and 1970s. American Quarterly, 44(3), 348–380. https://doi.org/10.2307/2712981
10. Kline, R. R. (2006). Cybernetics, Management Science, and Technology Policy: The Emergence of "Information Technology" as a Keyword, 1948-1985. Technology and Culture, 47(3), 513–535.

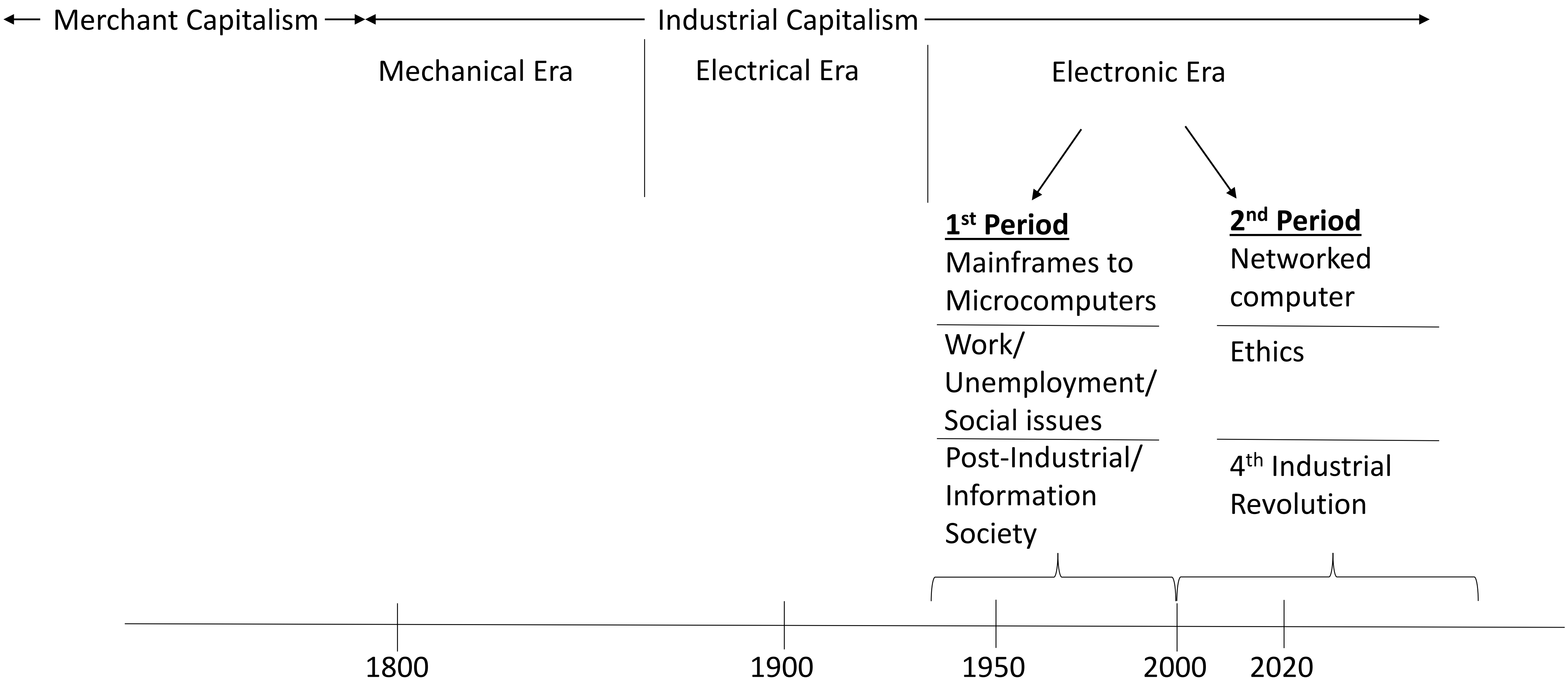


Figure. Periodizing the history of artificial intelligence

SCIENTIFIC AMERICAN MAY 2019

Machine Learning Gets a Bit More Humanlike

How machines could learn creativity and common sense, among other human qualities

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Machine Learning Gets a Bit More Humanlike

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SCIENTIFIC AMERICAN SEPTEMBER 18, 1915

A Thinking Machine, Planning and Theories

Mechanical Reproduction of Mental Processes

By S. Bent Russell

SCIENTIFIC AMERICAN MAY 2019

Machine Learning Gets a Bit More Humanlike

How machines could learn creativity and common sense, among other human qualities

A Thinking Machine, Planning and Theories

Mechanical Reproduction of Mental Processes

By S. Bent-Russell

THE readers of this journal may remember the description of an apparatus designed by the writer that will perform operations exhibiting memory associations. Such associations constitute a large part of mental processes. Most people, indeed, do not realize how great a factor association is in brain work.

There are, however, some forms of behavior that cannot be explained by reference to association alone. Something more must be provided.

May we not venture to speculate on possible modifications of the memory machine, above referred to, which would enable it to imitate these more complex forms of behavior. It is the purpose of this article to suggest some such modifications and what they might accomplish.

To begin with, let us consider the nature of a routine performance, by which is meant a definite series of muscular movements which is habitually executed in response to a cue given by one or more signals. For example, when a dog is made to "fetch," he goes through a routine performance.

By way of explaining it, we may say that each movement of such a series is excited by afferent impulses from the muscles and other parts affected by the movement that preceded it. These are known as kinaesthetic impulses. By virtue of association in the form sometimes termed substitution, these kinaesthetic impulses, after suitable training, will link the routine movements together. The first diagram, we will say, is a nerve mechanism for a child committing the alphabet to memory. The points *SA*, *SB*, *SC* represent sensory terminals excited by the printed letters while training and the solid lines are the nerve pathways that lead to the motor terminals which give the movements *MA*, *MB*, and *MC* of pronouncing the letters. The dotted lines *MA-b* and *MB-c* show the paths of afferent impulses from the muscles when moving. After proper training, the signal *SA* causes the movement *MA*, which is followed automatically by movement *MB* and then by movement *MC*, etc., all of which is due, of course, to the increased conductivity along *MA-b*—*MB*, and *MB-c*—*MC*, etc.

The question before us is how to modify the memory machine so that it can be trained to execute a routine performance. Let us base our planning on the belief now held by many authorities that mental processes are largely a matter of varying conductivity of the nervous pathways that connect the sense organs and the muscles. Of course many readers will find this a difficult assumption. From any point of view, however, it will be seen that time and movement are the important factors in memorizing.

Mechanical Device.

Let us now consider briefly the memory machine, or mechanical apparatus, that will respond to signals as a nervous system does, i. e., the responses are determined by previous experience. The responses simulate inhibition, association, substitution, etc. It may be described as a hydraulic regulating system.

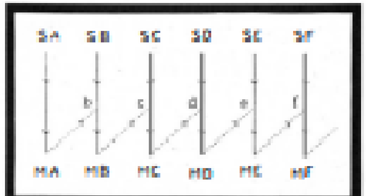
The details of the apparatus have been given in published articles, and the device has been shown to be perfectly practical by the construction and operation of a working model shown in the illustration.

The elements of the apparatus are shown in the next diagram. The vertical lines marked *SS*, SL_1, SL_2, etc., are key rods which are connected by bell cranks as indicated, to rods shown by horizontal lines which act on the transmitters, each of which is indicated by a square with a diagonal line. The connecting lines on the right of the transmitters represent the motor pipes which lead to the hydraulic cylinders shown on the right. A complete apparatus made up of similar elements may be termed a memory machine, but for the sake of a shorter name we will term it a memory gear.

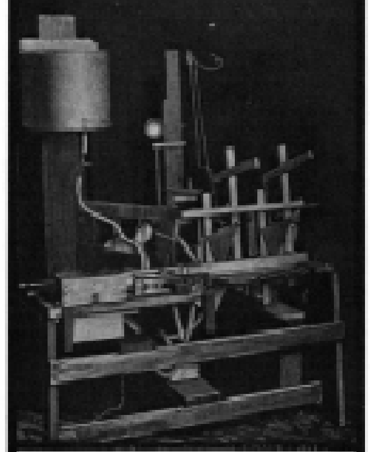
A signal is given by striking a certain key rod. The response may be one of several movements or several

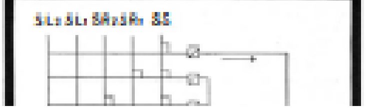
TABLE I.—POINTS OF CORRESPONDENCE.

Nervous System.	Memory Gear.
Sense-organs and fibres leading from it, where the impulse originates.	Key rod and connecting parts, where the impulse originates.
Association brain fibres which change with use and disuse.	Transmitter valves which change with use and disuse.
Nerves which conduct the nervous discharge to the muscles.	Motor pipes which conduct the flow of water to the governing valves of the hydraulic cylinders.
A pair of opposed muscles, each governed by a converging group of nerve fibres coming from the brain. The muscle receiving the greater discharge prevails.	A double acting hydraulic cylinder governed by two end collecting pipes that are fed by the motor pipes coming from the transmitters. The collecting pipe receiving the greater discharge prevails.



MODEL OF MEMORY MACHINE





In the machine the arrangement is such that if two key rods are connected to the same transmitter and the two rods happen to be struck in succession, the transmitter will give a greater discharge thereafter.

The difference in growth of discharge for a transmitter operated twice on each occasion over that for one operated once each time will depend upon the length of the interval. We can consistently assume a certain adjustment of the transmitter and for a case of regular intervals between signals we can compute the effect of double signals. Table II gives such a comparison

TABLE II.—RATE OF INCREASE FOR A TRANSMITTER.

Interval in Minutes.	Gain per Interval.	
	Single Signal.	Double Signal.
40	0	0
20	0	40
15	10	50
10	20	60
5	30	70
0	40	80

and shows the increase in discharge through a transmitter operated at regular intervals of from five to forty minutes.

The values given for gain in rate of discharge are only relative. They are computed on the basis that single signals in rapid succession give an increase of 40 for each and that the decrease between signals is at the rate of two per minute.

In the above described apparatus all signals are from the environment, as it were. But as has previously been shown, to link movements together into a routine performance, there must be counter (or return) signals like the kinaesthetic impulses in an animal. We will term such signals secondary counter signals.

A Compound Memory Gear.

Such signals in the animal do not come from the outside, hence to make our mechanical apparatus correspond, a modification should be made. Let us provide two memory gears so placed that the hydraulic cylinders of the first will operate some of the key rods of the second. When a certain key rod of the first memory gear is struck it will cause one or more movements by the first gear and one or more movements by the second gear. A movement by the latter will be determined by two transmitters in series, one of each gear.

The term "compound memory gear" will be applied to such a combined apparatus where certain (secondary) key rods are moved by hydraulic cylinders governed by other (primary) key rods. Such a memory gear might be so arranged that it could be trained to execute a routine performance so that after a number of lessons a single signal would start a train of movements, like a child repeating the alphabet.

We may observe that every spoken word is a routine series of vocal movements. In a dialogue each speaker makes a series of vocal movements, and gives a starting signal to the other speaker who makes a series in turn. Each vocal movement by means of a nerve impulse excites the next vocal movement. So you see by our first modification of the memory gear we have given it the power of linking responses in series or movement systems. But this is the essential part of language learning, so we have made an important advance, for language is a great factor in mental development.

Thinking.

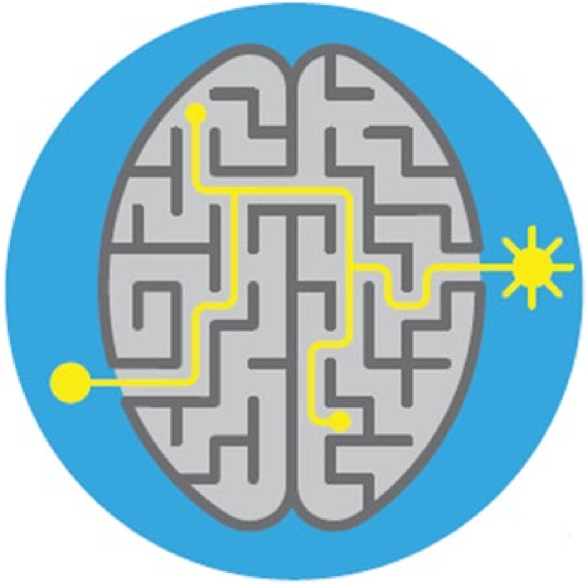
Just as vocal movements can be linked together in a routine performance so can incipient vocal movements be linked together, and thus we get a typical train of thought.

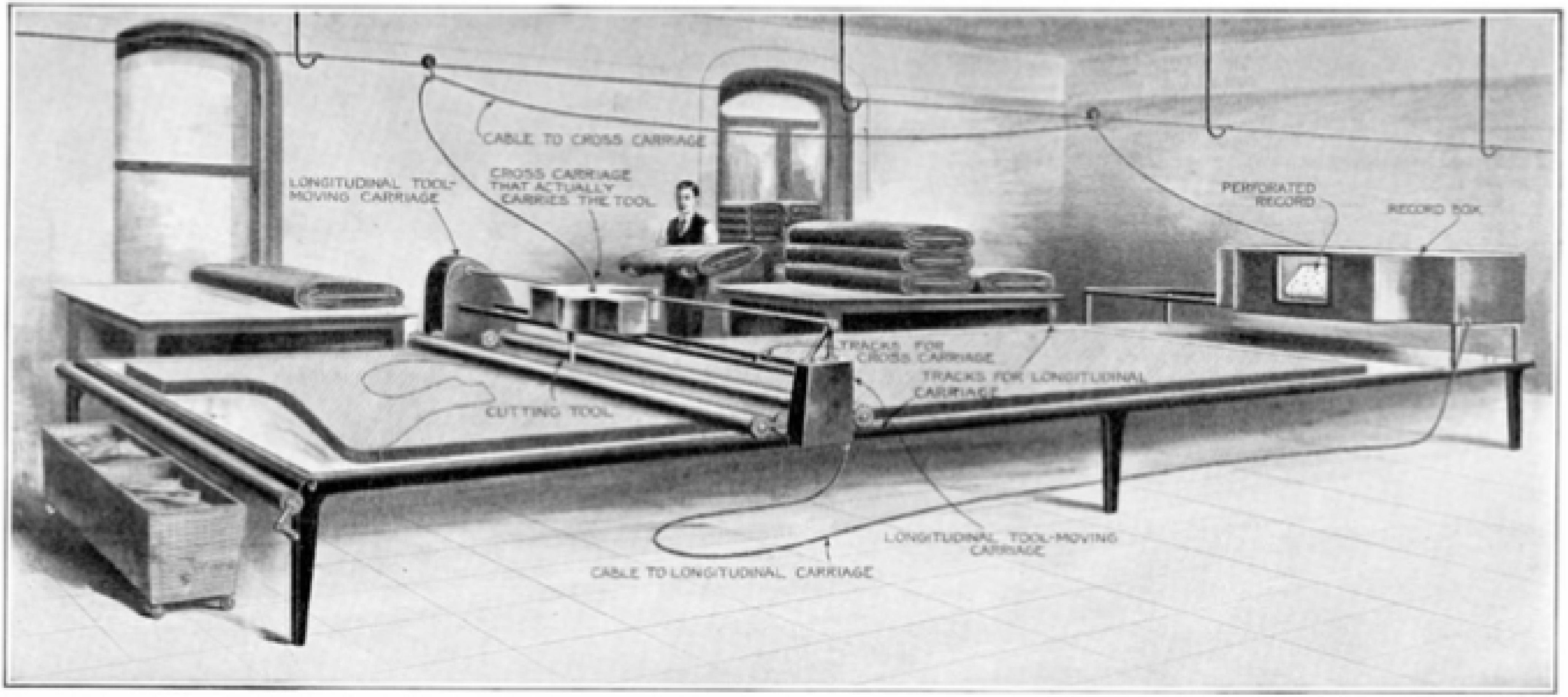
COMPUTING

Artificial Intelligence Is Learning to Keep Learning

A new machine-learning technique mimics the brain's ability to adapt to new circumstances

By Matthew Hutson on November 1, 2018





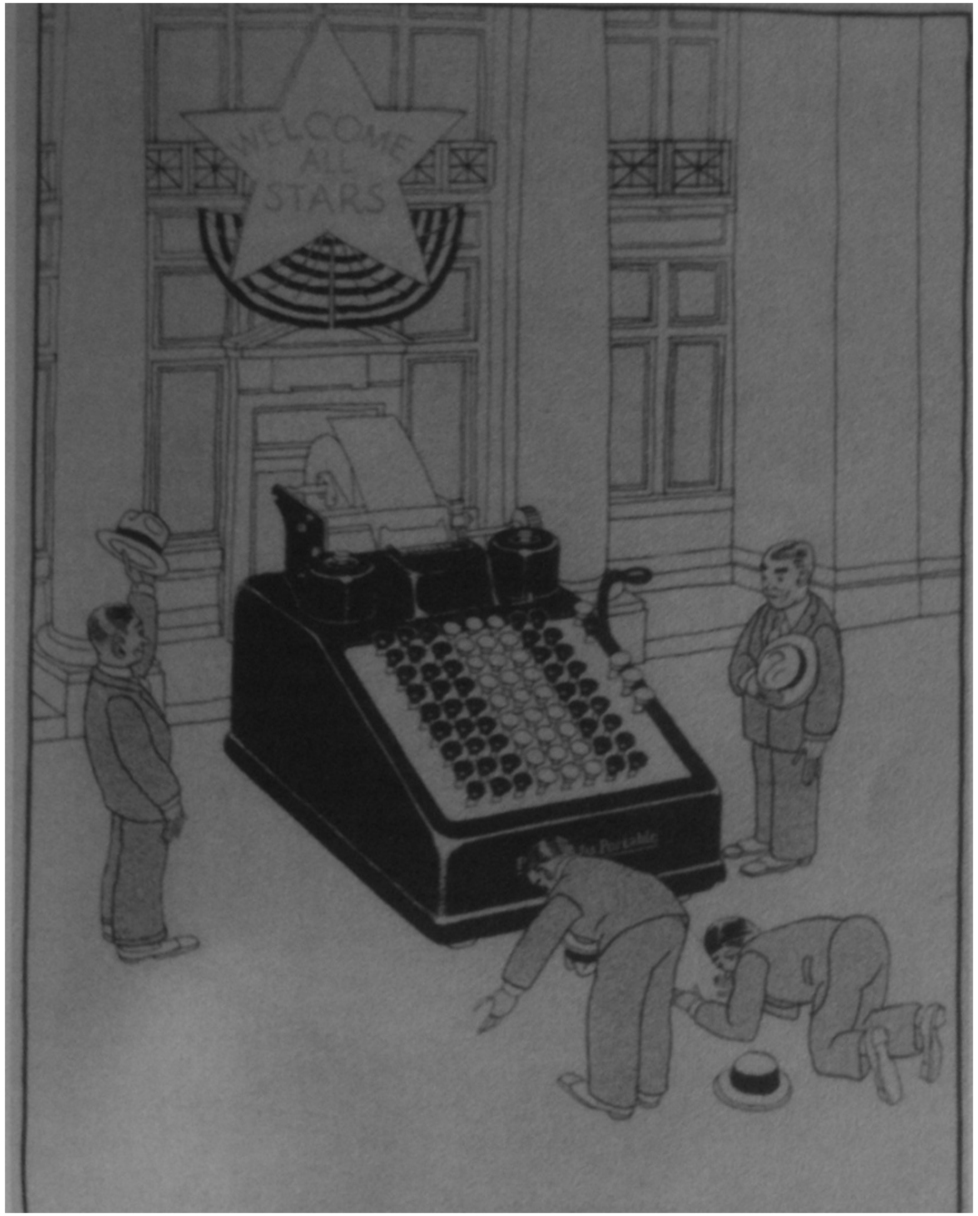
General diagram showing the application of paper-tape control to a machine for cutting cloth

When Perforated Paper Goes to Work

How Strips of Paper Can Endow Inanimate Machines with Brains of Their Own

By Emanuel Scheyer

We find this ideology (versions of it) in the history of sizable and celebrated (and, in many cases, idiosyncratic) machines, but, also, in the history of small and humble (and, in several cases, standardized and mass produced) artifacts. The celebrated machines are, for example, some ‘harmonic’, ‘differential’, ‘network’ and other ‘analyzers’ and ‘synthesizers’ of the mechanical and electrical era (Tympas, *Calculation and Computation in the Pre-electronic Era*, Chapter 4). The humble ones are not just some slide rules, but, even non-mechanical artifacts, like computing graphs (this was the case with nomographs/nomograms) (Tympas, *Calculation and Computation in the Pre-electronic Era*, Chapter 5).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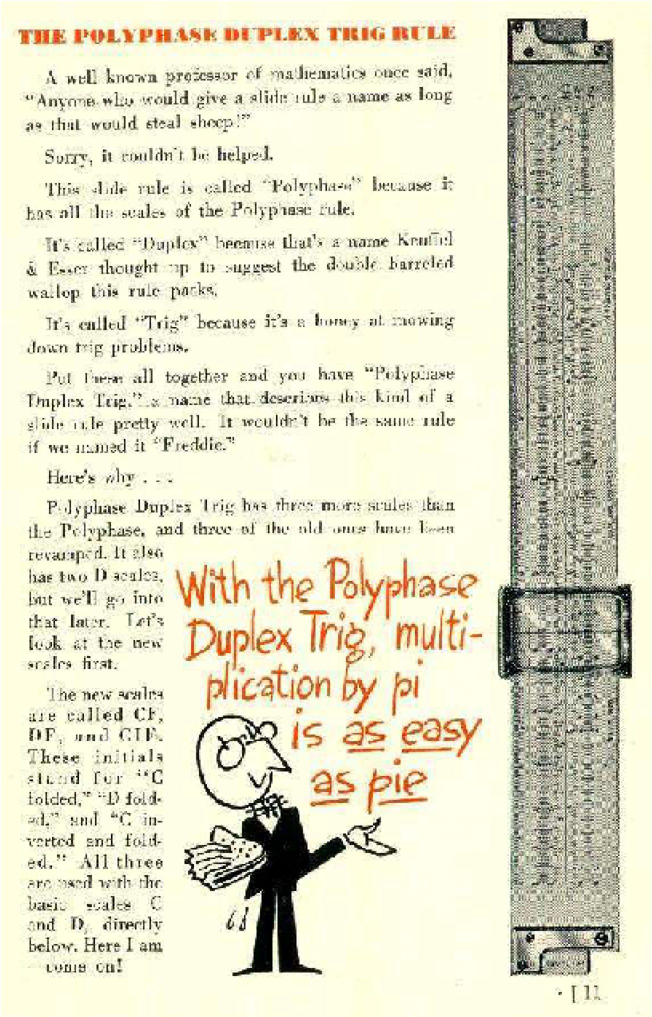
83



THE POLYPHASE DUPLEX TRIG RULE

A well known professor of mathematics once said, "Anyone who would give a slide rule a name as long as that would steal sheep!"

Sorry, it couldn't be helped.

This slide rule is called "Polyphase" because it has all the scales of the Polyphase rule.

It's called "Duplex" because that's a name Keuffel & Esser thought up to suggest the double barreled wallop this rule packs.

It's called "Trig" because it's a honey at mowing down trig problems.

Put these all together and you have "Polyphase Duplex Trig," a name that describes this kind of a slide rule pretty well. It wouldn't be the same rule if we named it "Freddie."

Here's *why* . . .

Polyphase Duplex Trig has three more scales than the Polyphase, and three of the old ones have been revamped. It also has two D scales, but we'll go into that later. Let's look at the new scales first.

The new scales are called CF, DF, and CIF. These initials stand for "C folded," "D folded," and "C inverted and folded." All three are used with the basic scales C and D, directly below. Here I am — come on!

(https://meangreenmath.files.wordpress.com/2013/07/p11.jpg)

A HISTORY

OF THE

LOGARITHMIC SLIDE RULE

AND ALLIED INSTRUMENTS

BY

FLORIAN CAJORI, PH.D.

Professor of Mathematics, and Dean of the School of Engineering,
Colorado College

FIRST EDITION

FIRST THOUSAND

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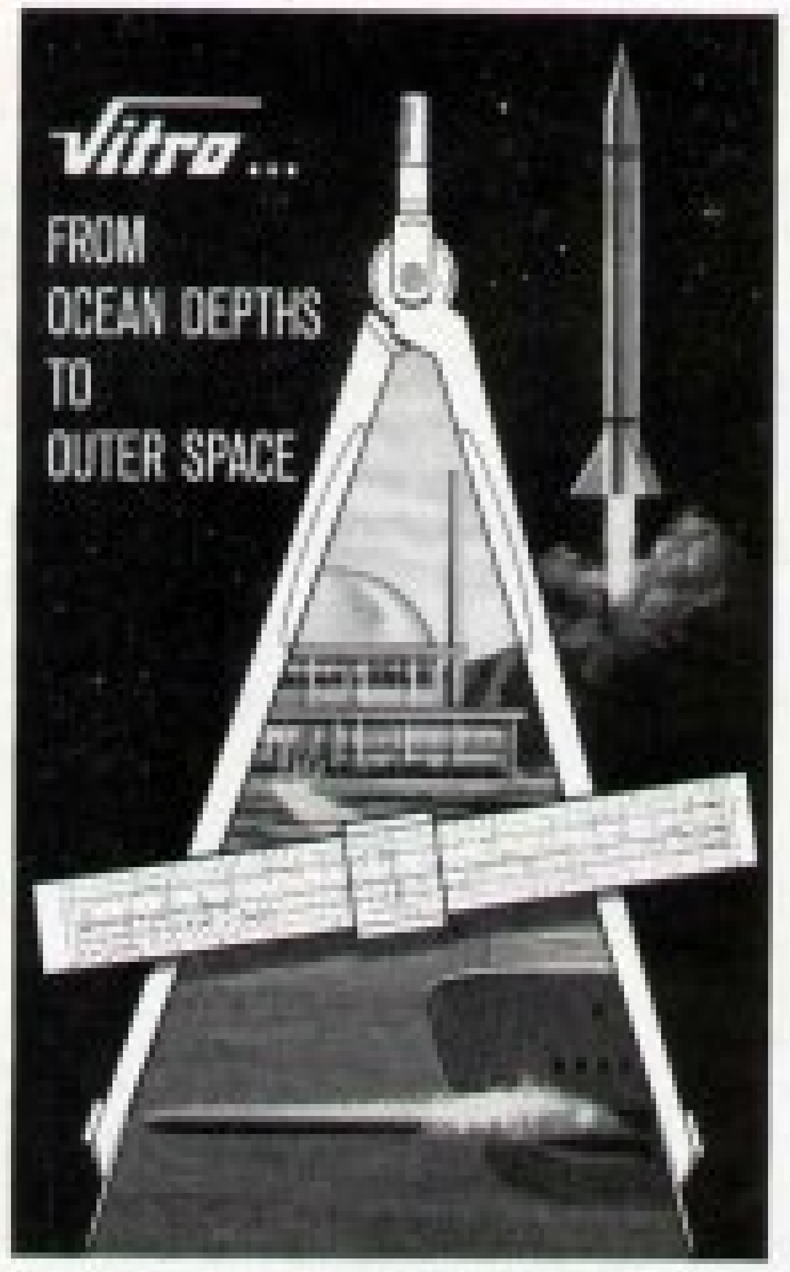
THE ENGINEERING NEWS PUBLISHING COMPANY
LONDON: ARCHIBALD CONSTABLE & CO., LTD.
1909

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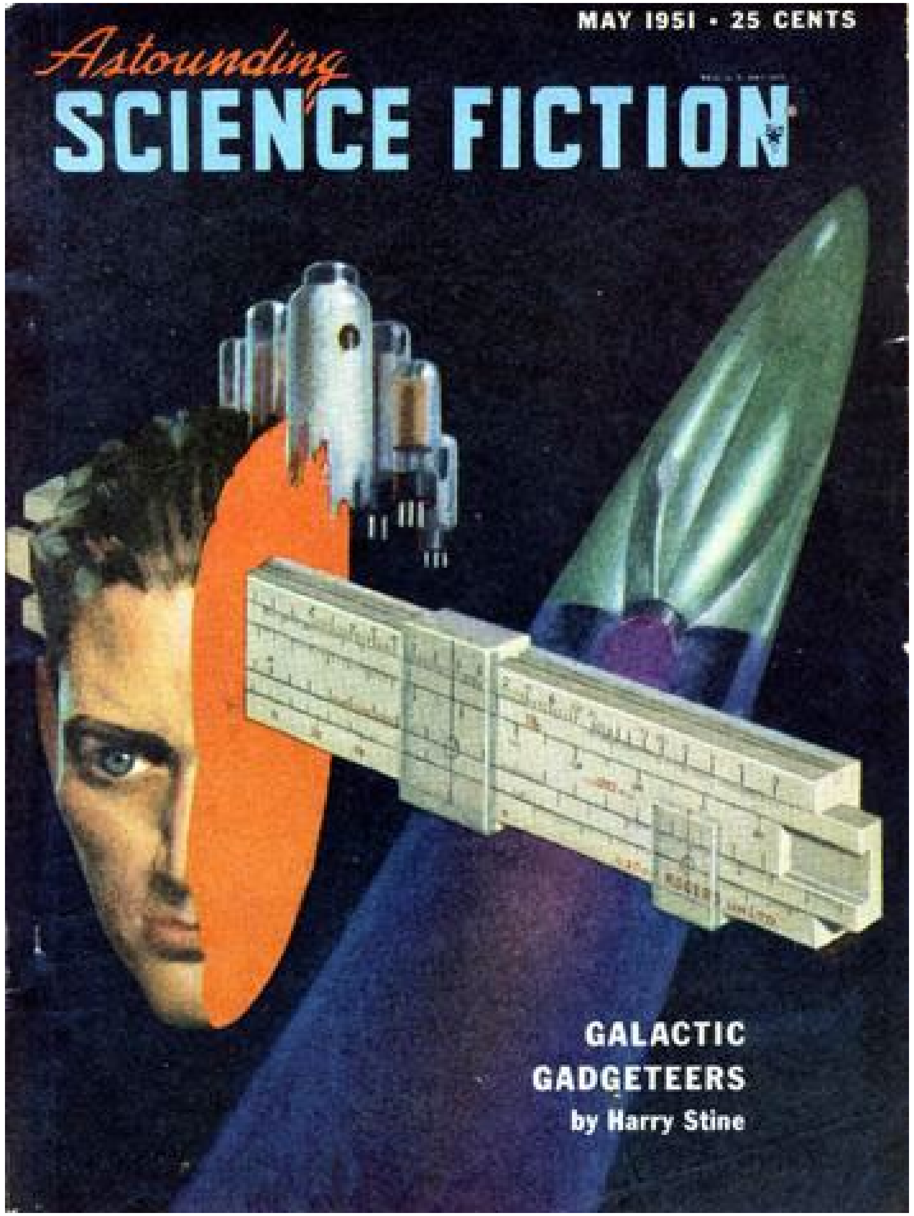
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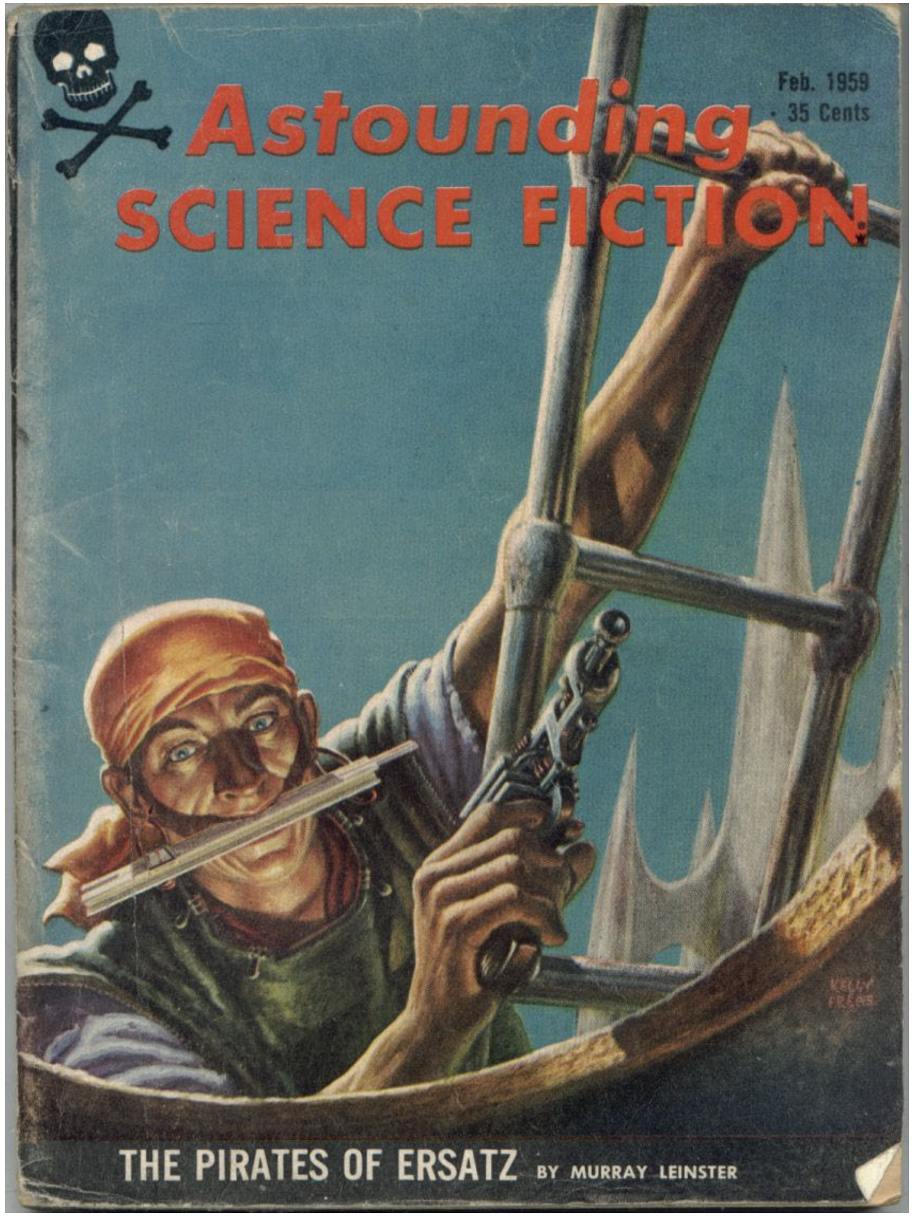
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IMPROVEMENT TO

PALMER'S ENDLESS SELF-COMPUTING

SCALE AND KEY;

ADAPTING IT TO THE DIFFERENT PROFESSIONS, WITH EXAMPLES AND ILLUSTRATIONS FOR EACH PROFESSION; AND ALSO TO COLLEGES, ACADEMIES AND SCHOOLS, WITH A

TIME TELEGRAPH,

MAKING, BY UNITING THE TWO, A

COMPUTING TELEGRAPH.

BY JOHN E. FULLER.

NEW-YORK:

PRINTED FOR THE PUBLISHER.

1846.

PALMER'S

ENDLESS SELF-COMPUTING SCALE.

The proprietors of this invaluable work, beg leave to present the public with the following notice.

This Scale (the result of three years' incessant labor) is designed as an assistant in all arithmetical calculations. The simplicity, rapidity, and accuracy of its results, have astonished our best mathematicians. It consists of a logarithmic combination of numbers, arranged in two or more circles, one of which is made to revolve within the other; which process constantly changes the relation of the figures to each other, and solves an infinite variety of problems. Its advantages are,—

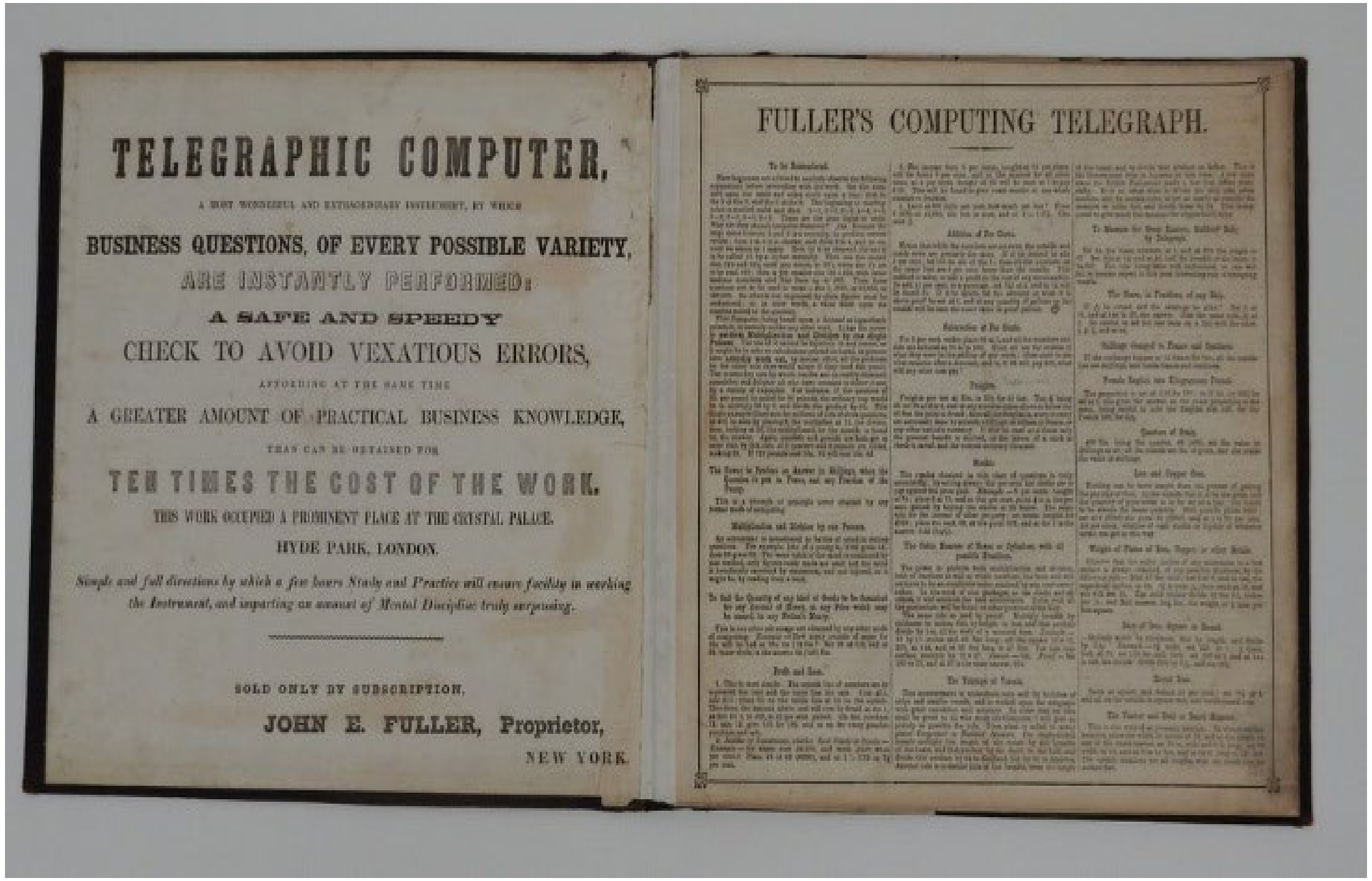
1st. *A complete saving of mental labor;* for, by the use of this Scale, the most intricate calculations are but a pleasurable exercise of the mind.

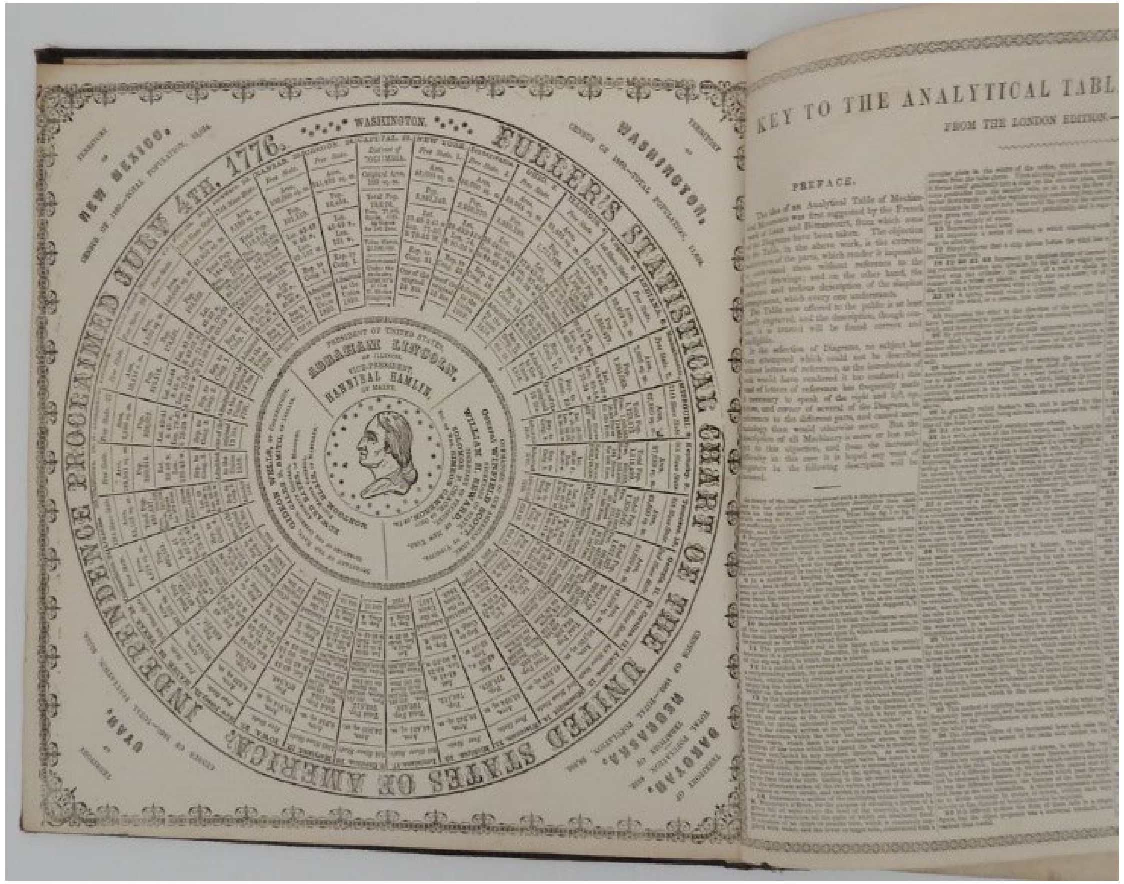
2d. *A great saving of time.* Computations requiring from three to four days, are wrought out by this Scale in the incredible short space of one minute.

3d. *Complete accuracy.* The results of the computations on this Scale, are infallible. Errors are entirely out of the question, except through sheer carelessness.

4th. *Mental improvement.* By this Scale, a knowledge of the philosophy of numbers, and their relation to each other, is soon obtained. So that, in a little time, many of the common calculations are wrought out by the mere exercise of the mind.

Fuller's Computing Telegraph





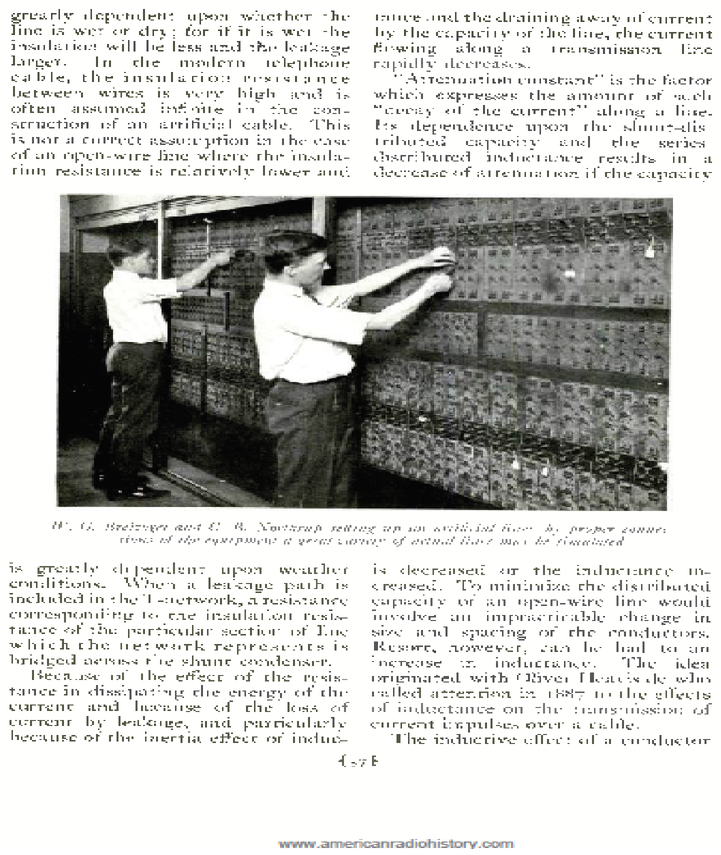
Progressive men of every nation,
To business men in any station,
We bring a true good working scale,
A right good test-it cannot fail.

You men of science, this invention
May well invite your close attention;
A magic rule you here will find;
Well suited ‘tis to train the mind.…

This well known Telegraph Computer
Is learned with ease, without a tutor,
Will trace mistakes with lightning speed—
In this fast age what all men need.[2]

Left: Bell Labs artificial line, 1920s. Left: Hoernel, Paul C. “The Artificial Line.” *Bell Laboratories Record* 1, no. 1 (September 1925): 51-60.

Right: The ENIAC electronic computer, 1940s.



greatly dependent upon whether the line is wet or dry; for if it is wet the insulation will be less and the leakage larger. In the modern telephone cable, the insulation resistance between wires is very high and is often assumed infinite in the construction of an artificial cable. This is not a correct assumption in the case of an open-wire line where the insulation resistance is relatively lower and tance and the draining away of current by the capacity of the line, the current flowing along a transmission line rapidly decreases.

"Attenuation constant" is the factor which expresses the amount of such "decay of the current" along a line. Its dependence upon the shunt-distributed capacity and the series distributed inductance results in a decrease of attenuation if the capacity

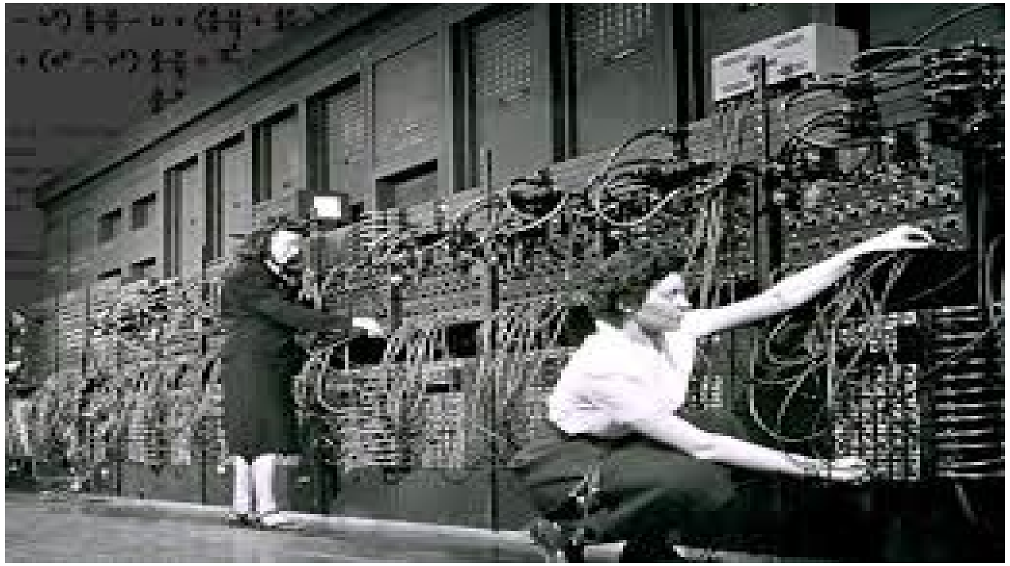
W. G. Breizeger and C. B. Northrup setting up an artificial line. By proper connections of the equipment a great variety of actual lines may be simulated

is greatly dependent upon weather conditions. When a leakage path is included in the T-network, a resistance corresponding to the insulation resistance of the particular section of line which the network represents is bridged across the shunt condenser.

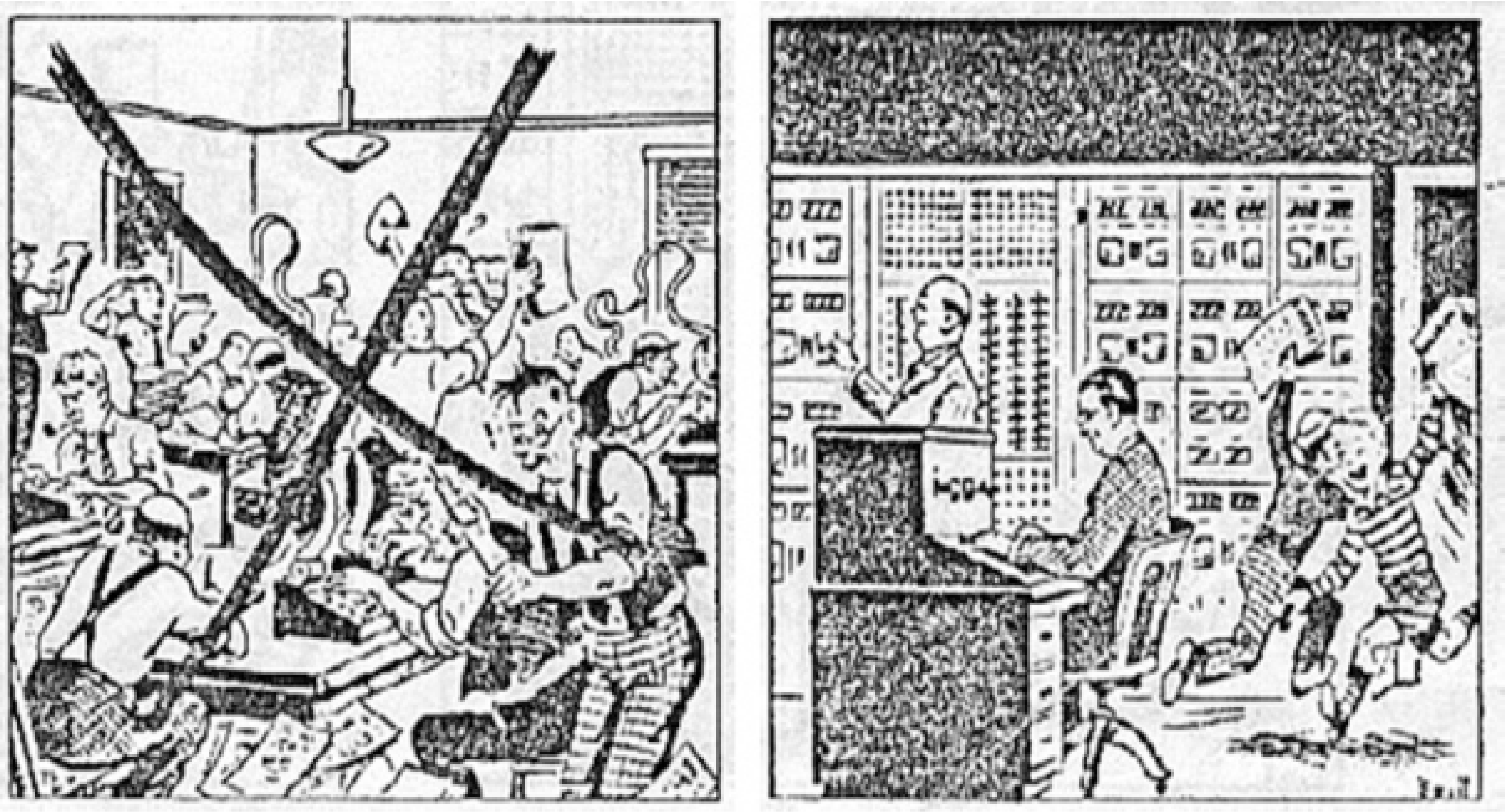
Because of the effect of the resistance in dissipating the energy of the current and because of the loss of current by leakage, and particularly because of the inertia effect of induc- is decreased or the inductance increased. To minimize the distributed capacity of an open-wire line would involve an impracticable change in size and spacing of the conductors. Resort, however, can be had to an increase in inductance. The idea originated with Oliver Heaviside who called attention in 1887 to the effects of inductance on the transmission of current impulses over a cable.

The inductive effect of a conductor

{ 57 }



"Mathematician …par excellence"
Westinghouse Engineer, 1944 Editorial

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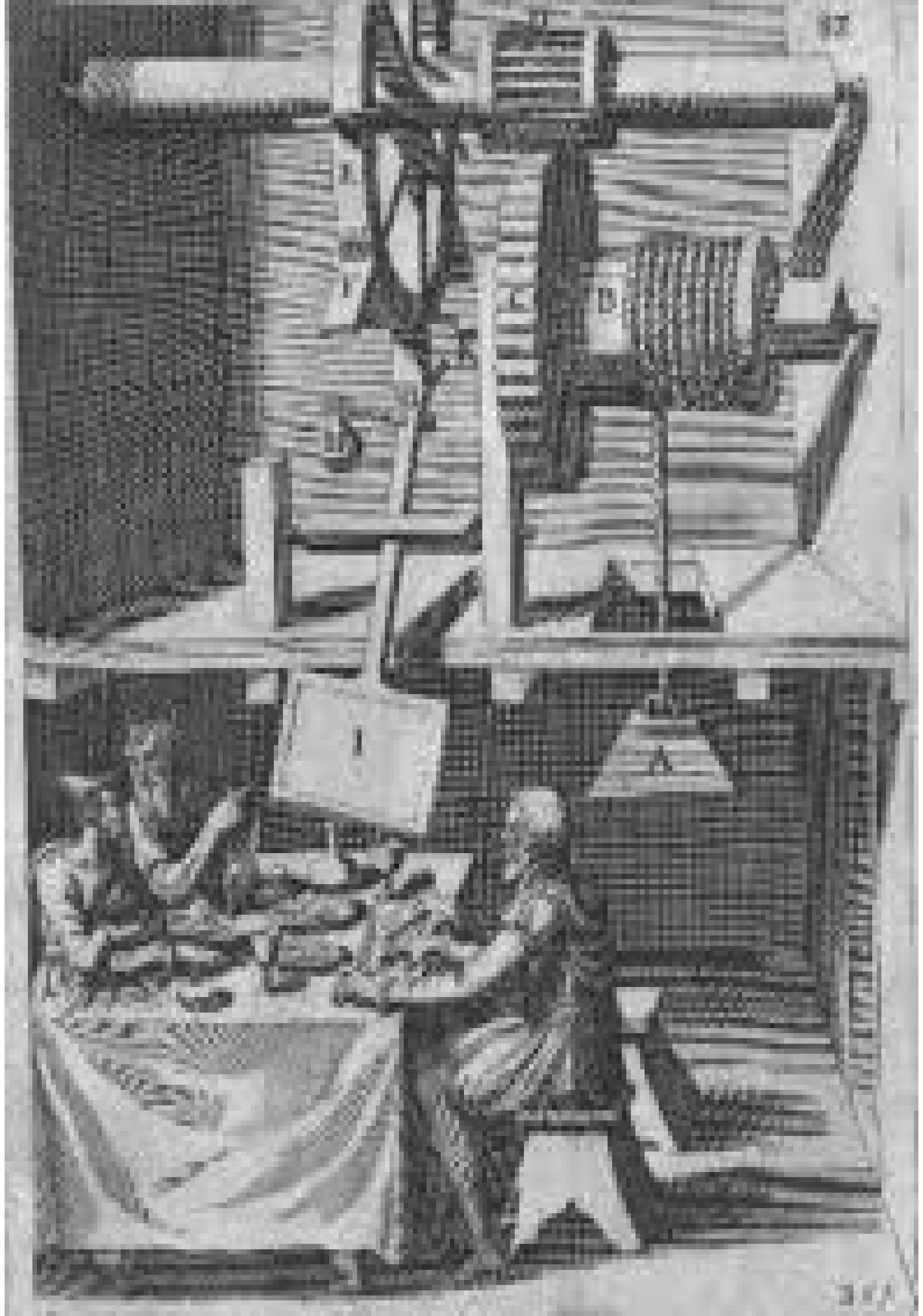
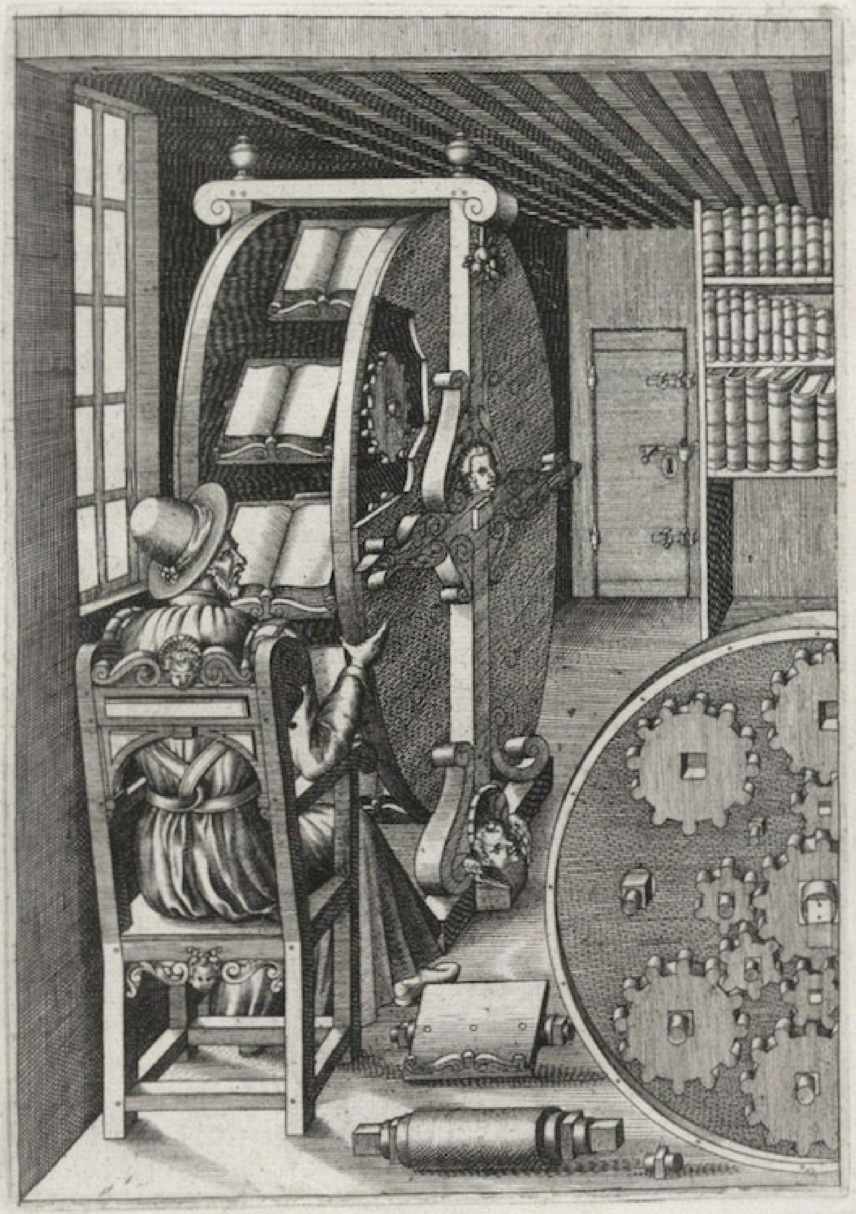


FIGVRE CLXXXVIII.



Λόρενς Στερν
(σελίδες 2 και 3 από το παρακάτω βιβλίο)