

Counting Machines: The Census, Punched Cards, and IBM, 1880-1945

From Apportionment to Classification

Joseph Smith

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Contents

Preface. Constitutional enumeration, 1790-1880	2
Chapter 1. 1880: the clerical ceiling	4
Walker's enlarged schedule	4
Sorted, tallied, resorted	5
What the eight years measured	6
Consequence	6
Chapter 2. 1889-1890: Hollerith's system and the census it tabulated	7
From the Bureau's own clerks	7
The eleventh census	8
What the machine changed, and what it did not	9
Chapter 3. 1896-1905: Patents, leasing, and the Tabulating Machine Company	10
Incorporation	10
The patent position	11
What leasing bought the company	11
The international customer base	11
Consequence	12
Chapter 4. 1907-1924: Powers, competition, and the corporation renamed IBM	12
A Bureau alternative	12
The 1911 merger	13
Watson's arrival	14
The renaming	15
Chapter 5. 1924-1940: commercial and state expansion	15
Three customer segments	15
Social Security	16
Subsidiaries abroad	17
Chapter 6. 1933-1945: harmful uses, considered separately	17
A German subsidiary, a German customer	17
Vichy France	19
Census tabulation and Japanese American incarceration	20

Comparing without equating	20
Coda. From the apportionment clause	21
Bibliography	23

Preface. Constitutional enumeration, 1790-1880

Article I, Section 2 of the Constitution required an enumeration within three years of the first meeting of Congress, and every ten years thereafter, in such manner as Congress should by law direct. The clause fixed the count as a duty of the federal government before the government had a working administrative hand with which to conduct one. It named no bureau and no method. It named a period of years and a purpose: apportionment of representatives, and the reduction of enslaved persons to three-fifths of a whole. The Thirteenth Amendment abolished slavery; Section 2 of the Fourteenth replaced the fractional apportionment rule with a count of whole persons.¹

The first Congress met in New York in the spring of 1789 and moved to Philadelphia the following year. On 1 March 1790 it passed the Act assigning the enumeration to the marshals of the federal judicial districts, officers whose ordinary duties were the service of court process and the custody of federal prisoners. The Act gave the marshals nine months, let them hire assistants at their own discretion, and set six columns for each family: free white males of sixteen years and upward; free white males under sixteen; free white females; all other free persons; slaves; and a total.² The subdivisions the assistants rode were not fixed by statute; the marshals drew them, and the marshals' pay, fixed per hundred persons enumerated, gave no allowance for the distance a subdivision required. The count that began on 2 August 1790 was not finished until November 1791; the returns for South Carolina were not complete before that summer. The total Secretary of State Thomas Jefferson reported to Congress in October 1791 was three million nine hundred and twenty-nine thousand two hundred and fourteen persons. Jefferson and Washington both suspected an undercount, on the reasoning that assistants paid by the head enumerated had no incentive to find the persons a schedule made no provision for; Jefferson put the true figure closer to four million. The House was apportioned on the number returned. The 1790 schedules for Delaware, Georgia, Kentucky, New Jersey, Tennessee, and Virginia did not survive the burning of Washington in 1814; the schedules for the other seven states are held at the National Archives, Record Group 29.³

Congress had appropriated about forty-four thousand dollars for the first census, and the marshals disputed its adequacy almost from the outset. The Act paid one dollar for every hundred and fifty persons enumerated in the compact settlements of the eastern seaboard, one dollar for every seventy-five in districts of middling density, and one dollar for every fifty on the frontier, with the marshal's own compensation set as a percentage of his assistants'

¹Constitution of the United States, Article I, Section 2 (1787).
²"History Program: Decennial Census Publications and Administrative Histories," U.S. Census Bureau, <https://www.census.gov/history>; Margo J. Anderson, *The American Census: A Social History*, 2nd ed. (Yale University Press, 2015).
³"Records of the Bureau of the Census, Record Group 29: Finding Aid," National Archives and Records Administration, <https://www.archives.gov/research/guide-fed-records/groups/029.html>; Anderson, *The American Census: A Social History*.

returns.⁴ The frontier rate paid more per head than the seaboard rate, but not enough to cover the distances an assistant had to ride to find a head to count: the Marshal of the District of Maine petitioned Congress that winter for a supplementary appropriation, arguing that the schedule took no account of the boat travel his assistants needed among the coastal islands, and the Marshal of the Southern District of New York petitioned on the opposite complaint, that the compact-settlement rate did not cover the tenement-house enumeration the density of Manhattan required. Congress declined to reopen the schedule while the count was under way. The practical effect was a bias built into the compensation itself: districts where the rate least matched the difficulty of finding people tended, on Anderson's reading of the returns, to under-enumerate by the widest margins, and the House was apportioned on the totals the marshals returned, uncorrected for that bias.⁵

The six columns showed only half of what the statute did. The other half was what the columns omitted. Native persons within state boundaries but not taxed were excluded by the Constitution's own text, and the 1790 Act inherited the exclusion without amendment. "All other free persons" gathered free Black people and free people of color into a single line. "Slaves" counted enslaved persons by the household of the enslaver; no enslaved person is named on a surviving 1790 schedule, and the household that appears in the tally is the enslaver's. The three-fifths clause is legible in the tally by which the House was apportioned; the absence of any column for tribal nations is legible in the absence. Congress passed the Apportionment Act of 1792 after a prolonged dispute over the divisor and the treatment of remainders, and the resulting House had one hundred and five members, forty more than the Constitution's initial allocation; Virginia's nineteen seats were the largest delegation, Pennsylvania's thirteen and Massachusetts's fourteen followed, and the smallest states received one to eight members each. The count had made the categories operative; the tally had made them political; the apportionment had made them structural.⁶

Two historians read this instrument at different scales. Margo Anderson's *The American Census*, first published in 1988 and reissued in an extended edition in 2015, reads the schedule as an instrument by which the federal government constituted its population as a political object: the compromises of 1787 are visible in the columns the marshals carried, and the columns made those compromises operational. Dan Bouk's *How Our Days Became Numbered* asks a different question at a different scale: how a technique of individual statistical classification, developed chiefly in the insurance and actuarial trades of the later nineteenth century, came to shape and be shaped by government counting. In 1790 there was no American insurance industry of the kind Bouk describes; the schedule's categories answered a constitutional bargain, not yet a commercial one. From the middle of the century forward, and especially after 1880, the two developments run alongside each other, and both scholars' evidence is drawn on as the relevant scale requires: Anderson for the political construction and administration of the census categories, Bouk for the commercial and

⁴Anderson, *The American Census: A Social History*; U.S. Census Bureau, "History Program: Decennial Census Publications and Administrative Histories."

⁵Anderson, *The American Census: A Social History*.

⁶Anderson, *The American Census: A Social History*.

actuarial techniques of individuation that the Bureau increasingly absorbed. They are not answering the same question, and neither needs the other to be wrong.⁷

The schedule Congress set in 1790 held, in its essential form, for forty years. The 1800 count added two age columns; 1810 added a schedule of manufactures; 1820 added occupational categories in agriculture, commerce, and manufactures. The 1850 count named every free person individually rather than tallying households by column, and 1860 extended the mortality, agriculture, and manufactures returns until the enumeration was a complex of linked schedules rather than one form. Each decade's Congress added columns; no decade replaced the marshal, and after 1830 the enumerator, riding house to house with a printed sheet, was the instrument that filled them. By the time Congress authorized the tenth census in 1879, the schedule had grown for eighty years and the method for reducing it to a published count had not grown to match. What that mismatch cost, and what it produced, became plain in 1880.

The primary evidence is unevenly available. The Herman Hollerith Papers at the Library of Congress Manuscript Division, LC control number mm73049510, are open for research and comprise thirteen and six-tenths linear feet across thirty-four containers: correspondence, a diary, financial and business papers, patents, blueprints, and a Hollerith punch plate. The Records of the Bureau of the Census, Record Group 29 at the National Archives, hold the agency's administrative papers across its history. The IBM Archives at Armonk describe their holdings on the corporation's own site. Where a claim rests on a specific piece within one of these three collections rather than on published scholarship, that dependence is named where it occurs.⁸

Chapter 1. 1880: the clerical ceiling

Walker's enlarged schedule

Francis Amasa Walker, a career economist who had superintended the ninth census in 1870, took charge of the tenth in the spring of 1880 and resigned within the year to become president of the Massachusetts Institute of Technology; his chief clerk, Charles W. Seaton, ran the tabulation until it closed. Walker's *Compendium of the Tenth Census* appeared in two volumes, 1883 and 1885, though the full run of tabulated volumes did not close until 1888.⁹ Walker had persuaded Congress to enumerate not only inhabitants and occupations but the agricultural product of every farm, the manufacturing output of every factory above a threshold size, the preceding year's mortality by county, illiteracy above age ten, the insane, the "idiotic," the deaf, the blind, paupers on relief, prisoners in custody, and reported crime

⁷Anderson, *The American Census: A Social History*; Dan Bouk, *How Our Days Became Numbered: Risk and the Rise of the Statistical Individual* (University of Chicago Press, 2015).

⁸"Herman Hollerith Papers, 1850-1982: Finding Aid (LC Control Mm73049510)," Library of Congress, Manuscript Division, <https://hdl.loc.gov/loc.mss/eadmss.ms997007>; National Archives and Records Administration, "Records of the Bureau of the Census, Record Group 29: Finding Aid"; "IBM Archives: Corporate Records and Historical Materials," International Business Machines Corporation, <https://www.ibm.com/history>.

⁹United States Census Office, *Compendium of the Tenth Census, June 1, 1880* (Government Printing Office, 1883); U.S. Census Bureau, "History Program: Decennial Census Publications and Administrative Histories."

by state and county.¹⁰ His argument to Congress was that the decennial count was the only nationally uniform federal survey and should answer the range of questions asked of it rather than be replaced by surveys the government could not otherwise fund. Congress agreed and appropriated the money.

The Act of 1879 also replaced the marshals with a corps of enumerators recruited by district supervisors, in smaller subdivisions and at rates tied to the schedules they returned. The reform answered a real complaint: marshals, whose primary duties were judicial, had not given the ninth census the care their assistants owed it, and the frontier and Southern returns had suffered for it. The new corps enumerated more completely. It also enumerated fifty million people at upward of twenty variables each, on schedules that recorded them into hundreds of subclasses.

Sorted, tallied, resorted

Seaton's clerks worked the returns by the method the Bureau had used since 1840. A clerk sorted the individual schedule cards by one variable, tallied the sorted stacks, resorted the same cards by a second variable, tallied again, and produced one table for each cross-classification Walker's schedule called for. The corps reached fifteen hundred clerks at its 1886 peak, seated at long tables on Pennsylvania Avenue and F Street. A full cross-classification of age by year, sex, race, and birthplace would have required roughly six thousand cells for a single county; the Bureau's published tables were compressed well below that, and even the compressed tables took years to sort by hand.

Seaton tried to speed the work. In 1882 he built a wooden frame, about three feet wide and two feet high, fitted with parallel slots; an operator drew paper strips carrying individual returns through the slots with a lever, and a running sum appeared at a window on the far side. The device cut the labor of tallying one variable by roughly a third but did nothing for cross-classification, which consumed most of the clerks' time; the funding Seaton requested in 1884 to expand it was not granted. Seaton had also sketched, that year, a punched-card sorting mechanism modeled on the Jacquard loom, whose readers would have sorted individual returns by combinations of variables rather than one at a time; it was never built, and it anticipated in outline the patents Hollerith would file within months of Seaton's proposal. A full cross-classification by age, sex, race, and birthplace required a tally by age within sex, then by age within sex within race, then by age within sex within race within birthplace, each additional variable multiplying the labor by the number of categories it added; the published tables fell well below what the schedules would have supported, because the corps could not finish the fuller tally in time to publish it.¹¹

By 1888, eight years after the count opened, the last tabulated volumes appeared. Walker told the American Statistical Association that year that the eleventh census, on the same manual method, would not finish its tabulation before 1900. The warning was not abstract:

¹⁰Anderson, *The American Census: A Social History*; United States Census Office, *Compendium of the Tenth Census, June 1, 1880*.

¹¹Geoffrey D. Austrian, *Herman Hollerith: Forgotten Giant of Information Processing* (Columbia University Press, 1982).

the tenth census had cost more than five million dollars in tabulation labor alone, the apportionment of the House had been drawn from returns still being tabulated at the moment of apportionment, and Congress had already begun to press the Bureau for an operational answer before the eleventh census could be authorized.¹²

What the eight years measured

Margo Anderson reads the delay as the state's first collision with the operating limit of its own ambition: Walker's schedule enumerated variables the sorting method was never built to cross-classify, and the ceiling was a mismatch between what Congress asked for and how the Bureau could produce it. Dan Bouk's account of the same schedule notices that the added columns on defect, pauperism, and crime were drawn from the classifying logic the insurance industry had been developing since the 1860s: the Bureau was attempting, on a national population, a kind of classification the actuarial offices had already learned to perform on smaller ones. Congress's motive for the enlarged schedule was its own, stated in the 1879 debates Walker cited; the classifying technique it borrowed had a separate history in the insurance trade. Both are true, and the eight-year delay is evidence of both: an ambitious state schedule, tabulated by clerks whose method belonged to an earlier and narrower census.¹³

Robert P. Porter succeeded Seaton as chief clerk in 1885 and became superintendent of the eleventh census in 1889, appointed by President Benjamin Harrison; a Republican journalist and statistician before his appointment, Porter would sign the Bureau's contract with Hollerith later that year.¹⁴ Congress's approval of his appointment came with an expectation that he would close the eleventh census's tabulation in a fraction of the time the tenth had taken. Congress had authorized a trial of tabulation methods in 1888, before Porter took office, and the Bureau ran it that winter on the mortality returns of the city of Saint Louis for 1888: roughly ten thousand cases, tested for time, cost, and accuracy across three competing systems. Herman Hollerith's electrical card system tabulated the sample in seventy-two hours; a chip-and-slot method proposed by Charles F. Pidgin of the Massachusetts Bureau of Labor Statistics took a hundred and ten hours; a tally-sheet method proposed by the Bureau's own William C. Hunt took a hundred and forty-four. Hollerith's cards could also be re-tabulated at negligible cost to check a suspected error, where the tally-sheet method required starting over. Porter recommended the Hollerith system to the Secretary of the Interior in the spring of 1889, and the appropriation went to leasing machines rather than to hiring more clerks.¹⁵

Consequence

The tenth census had exposed an operating limit the Bureau's own personnel had been the first to name. Seaton's tabulating frame had shown that partial mechanization was possible

¹²Anderson, *The American Census: A Social History*.

¹³Anderson, *The American Census: A Social History*; Bouk, *How Our Days Became Numbered: Risk and the Rise of the Statistical Individual*.

¹⁴Anderson, *The American Census: A Social History*; Austrian, *Herman Hollerith: Forgotten Giant of Information Processing*.

¹⁵Austrian, *Herman Hollerith: Forgotten Giant of Information Processing*; Lars Heide, *Punched-Card Systems and the Early Information Explosion, 1880-1945* (Johns Hopkins University Press, 2009).

but insufficient; the Bureau's own trial, run on its own returns, settled which mechanical system would replace it.

Chapter 2. 1889-1890: Hollerith's system and the census it tabulated

From the Bureau's own clerks

Herman Hollerith joined the Bureau in 1879, at nineteen, as a special agent for the tenth census under John Shaw Billings, the surgeon and statistician then running the vital-statistics returns. Billings remarked to him one evening that winter that there ought to be a machine for tabulating population statistics, "something on the principle of the Jacquard loom"; Hollerith later credited the remark as the origin of his idea. He left the Bureau in 1882 to teach a year at the Massachusetts Institute of Technology, spent 1883 as an examiner in the Patent Office, and opened a private consulting practice in Washington in 1884 to build the system full time.¹⁶

His first application, filed 23 September 1884, was a single combined specification; the Patent Office split it during examination, and three patents issued on 8 January 1889: 395,781, for the combination of a punched card, an electrical reading circuit, and a bank of counters; 395,782, for the punching device that encoded a schedule onto a card; and 395,783, for a sorting box that opened one of several compartments according to a punched position, letting an operator segregate cards by category.¹⁷ Read separately, each patent claimed a narrower invention than popular history later credited to any one of them. Read together, they described a system: the punch encoded a schedule as holes in a card; the reader, a spring-loaded plate suspended over a bath of mercury, closed a circuit and advanced a counter wherever a pin met a hole; the sorting box separated the cards by whatever category the punching had recorded, so that a sub-population could be counted again by any variable without a second hand tally. Any one piece alone did little. A punched card with no reader was no faster tallied than the Bureau's schedules had been since 1840; a reader with no sorting box counted one variable and stopped; a sorting box with no reader was a mechanical accessory to hand counting. Splitting the original 1884 application into three narrower patents, incidentally, gave Hollerith a stronger position against infringement than the broad original claim would have: three claims were harder to design around than one.¹⁸

The system's first live test came before the patents issued. Billings, who had left the Bureau for the Army Surgeon General's Office by 1886, retained an interest in Baltimore's mortality statistics, whose annual tabulation ran chronically late. The city agreed to a trial: a portion of the 1887 mortality returns, punched onto Hollerith's cards and tabulated by

¹⁶Austrian, *Herman Hollerith: Forgotten Giant of Information Processing*.

¹⁷Herman Hollerith, Apparatus for Compiling Statistics, U.S. Patent 395,781, Patent 395,781, issued January 8, 1889; Herman Hollerith, Art of Compiling Statistics, U.S. Patent 395,782, Patent 395,782, issued January 8, 1889; Herman Hollerith, Art of Compiling Statistics, U.S. Patent 395,783, Patent 395,783, issued January 8, 1889; Austrian, *Herman Hollerith: Forgotten Giant of Information Processing*.

¹⁸Austrian, *Herman Hollerith: Forgotten Giant of Information Processing*; Heide, *Punched-Card Systems and the Early Information Explosion, 1880-1945*.

his machines, produced a volume the city health commissioner accepted as publishable. The commissioner's endorsement became one of the documents Hollerith submitted when the Bureau, under its newly appointed superintendent Robert P. Porter, ran its own competitive trial that winter on the Saint Louis mortality returns, against a chip-and-slot method and a tally-sheet method; the Hollerith system finished fastest, and Porter recommended it to the Secretary of the Interior that spring.¹⁹ The formal lease contract followed in September 1889: one cent per card tabulated, a guaranteed minimum quantity that would yield roughly seven hundred and fifty thousand dollars over the census, the machines built by the Western Electric Company under Hollerith's supervision, and title to the machines retained by Hollerith throughout. Machines were rented, not sold; the customer paid for use rather than for ownership, and the model set the pattern the leasing business would keep for the next four decades.²⁰

The eleventh census

The count opened on 2 June 1890 with an enumerator corps of forty-six thousand, larger than the tenth's, returning a schedule designed in consultation with Hollerith so its columns could transfer efficiently to a punched card. For each household member the schedule recorded name, relationship to the household head, sex, a race category (White, Black, Mulatto, Quadroon, Octoroon, Chinese, Japanese, or Indian), age, marital status, birthplace of the person and of each parent, years in the United States, naturalization status, occupation, months unemployed, literacy in English, disability, and whether a prisoner, convict, or pauper. It was, category for category, the most granular schedule the Bureau had yet designed.²¹

A corps of roughly a hundred punch operators, each encoding about seven hundred cards a day, and thirty tabulator operators, working the electrical readers in shifts, processed the returns as they arrived through the summer and autumn of 1890. A national population bulletin appeared on 30 October 1890, less than five months after the count opened: sixty-two million six hundred and twenty-two thousand two hundred and fifty persons, later revised to sixty-two million nine hundred and forty-seven thousand seven hundred and fourteen. The apportionment of the House was completed the following spring and took effect for the Fifty-Second Congress.²² No manual tabulation had ever produced a national total that fast, and the speed was real: it answered exactly the operating limit the tenth census had exposed.²³

The bulletin was not received quietly. The national total was lower than several newspapers had predicted, the growth over 1880 smaller than popular projections had assumed, and the returns for a number of Southern states came in well below what those states' own governments had estimated. Porter defended the count in his annual report as an accurate

¹⁹ Austrian, *Herman Hollerith: Forgotten Giant of Information Processing*; Heide, *Punched-Card Systems and the Early Information Explosion, 1880-1945*.

²⁰ Austrian, *Herman Hollerith: Forgotten Giant of Information Processing*.

²¹ United States Census Office, *Report on Population of the United States at the Eleventh Census: 1890* (Government Printing Office, 1895).

²² United States Census Office, *Report on Population of the United States at the Eleventh Census: 1890*; Anderson, *The American Census: A Social History*.

²³ Austrian, *Herman Hollerith: Forgotten Giant of Information Processing*.

return by the enumerators and an accurate tabulation by the machines. Anderson reads the dispute as evidence of what was politically at stake in a fast count: a lower total meant fewer congressional seats, and the states most aggrieved were the ones with the most to lose from the apportionment the new total would produce. The machines had settled how quickly a number could be produced; they had not settled whether the states that disliked the number would accept it.²⁴

The speed did not answer the whole of what the tenth census had also exposed. The full run of the eleventh census's tabulated volumes, twenty-five in all, appeared between 1892 and 1897: the population volume in 1892, farms and homes in 1894, manufactures and agriculture through 1895, mortality through 1896, and the volumes on the defect, dependent, and delinquent population, on the "colored" population, and on the mineral industries, through 1897. Seven years separated the opening of the count from its last volume, against the tenth census's eight; the machines had shortened the interval, but the difference between the two censuses is not the difference between years and months that a comparison of the 1890 bulletin against the 1880 final volumes would suggest. What the machines compressed was the production of a first national count; what they did not compress, to anything like the same degree, was the preparation, checking, and printing of the full descriptive volumes, which remained years of work whichever method had produced the underlying tallies. The Hollerith machines were withdrawn from the Bureau's building in 1893, once the primary tabulations were complete and the volumes were being written from the resulting tables; the total paid to Hollerith on the contract, about seven hundred and fifty thousand dollars, was, on Porter's own estimate, well below what the equivalent hand tabulation would have cost, though Porter's specific figure of a five-million-dollar saving is Porter's own accounting rather than an independently audited one.²⁵ ²⁶

The 1890 schedules themselves are not available to check any of this against the underlying returns. They were stored at the Commerce Department building after the tabulation closed and were destroyed in the fire of 10 January 1921; what survives is the Bureau's published volumes, its administrative papers at the National Archives, and the Hollerith correspondence with the Bureau held among the Hollerith Papers at the Library of Congress.²⁷

What the machine changed, and what it did not

Anderson reads the 1890 machines as an efficient extension of a category-making instrument whose structure the Bureau, not Hollerith, had designed: the schedule's columns were congressional before they were mechanical, and the machines tabulated what Congress had specified. Bouk reads the same machines as the moment individual punched cards, sortable

²⁴Anderson, *The American Census: A Social History*.

²⁵Austrian, *Herman Hollerith: Forgotten Giant of Information Processing*; Anderson, *The American Census: A Social History*.

²⁶United States Census Office, *Report on Population of the United States at the Eleventh Census: 1890*.

²⁷U.S. Census Bureau, "History Program: Decennial Census Publications and Administrative Histories"; National Archives and Records Administration, "Records of the Bureau of the Census, Record Group 29: Finding Aid"; Library of Congress, Manuscript Division, "Herman Hollerith Papers, 1850-1982: Finding Aid (LC Control Mm73049510)."

and re-sortable by any recorded variable, made possible a granularity of statistical individuation that hand tallying could not approach - the beginning of the card as an instrument for describing persons rather than only aggregating them. Both are visible in the 1890 operation. The schedule's categories were the Bureau's; the technique for handling individual cards as separable, re-sortable units was new, and its consequences would appear first in the commercial customers who began leasing the same machines within the decade.²⁸

Chapter 3. 1896-1905: Patents, leasing, and the Tabulating Machine Company

Incorporation

Hollerith incorporated the Tabulating Machine Company in the District of Columbia on 3 December 1896, with a stated purpose of manufacturing, selling, and leasing tabulating, sorting, and counting machinery and the punched cards to run it. Capital stock was one hundred thousand dollars in hundred-dollar shares; Hollerith held the majority; and the machines the Bureau had leased from him personally under the 1889 contract moved onto the new company's books.²⁹ The step was formal more than substantive at first - Hollerith had been running a private tabulating business under his own name since 1889 - but it marked a real shift in ambition, from a single government contractor to a supplier meaning to sell to other governments, insurance companies, railways, and any industrial concern with a large enough tabulation problem.

No domestic competitor reached commercial scale against the Tabulating Machine Company before Powers's system emerged from inside the Bureau itself in the following decade; the patent position secured in 1889, and the absence of a rival able to match the leasing terms, left the company effectively alone in its market through the 1890s. That customer base appeared quickly. By 1900 the company held contracts with the New York Central Railroad for freight-tonnage returns, with the Prudential Insurance Company for policy statistics, with Marshall Field for sales returns, and with several state governments for vital statistics. By 1905 it held contracts with the Russian Empire's Central Statistical Committee, and with the Norwegian and Austrian statistical offices, for their own national censuses; the Reichsstatistisches Amt in Berlin, the French statistical office, and the Italian statistical office would follow within a few years.³⁰ By 1905 the company's revenue from customers other than the Bureau exceeded its Bureau revenue, and its strategic position had become that of a commercial supplier with a founding government customer, not the reverse.³¹

²⁸Anderson, *The American Census: A Social History*; Bouk, *How Our Days Became Numbered: Risk and the Rise of the Statistical Individual*.

²⁹Austrian, *Herman Hollerith: Forgotten Giant of Information Processing*; Library of Congress, Manuscript Division, "Herman Hollerith Papers, 1850-1982: Finding Aid (LC Control Mm73049510)."

³⁰Austrian, *Herman Hollerith: Forgotten Giant of Information Processing*; Heide, *Punched-Card Systems and the Early Information Explosion, 1880-1945*.

³¹Austrian, *Herman Hollerith: Forgotten Giant of Information Processing*.

The patent position

The three patents of January 1889 had issued as narrower claims than Hollerith's original 1884 application, divided by the Patent Office during examination rather than by Hollerith's own drafting. The division turned out to strengthen his commercial position: a competitor attempting to build around one narrow claim still had to clear the other two, where a single broad patent would have offered one target to design past. Hollerith brought infringement suits against smaller tabulating ventures through the 1890s and early 1900s on the strength of the individual claims, and the resulting body of case law, together with the difficulty of matching the leasing terms without an equivalent patent position, kept the field of realistic competitors narrow through the 1890s. The company's pricing power rested on that scarcity as much as on the machines' performance; a customer with only one credible supplier had little room to negotiate the rental rate down.

What leasing bought the company

The commercial model kept the term Hollerith had set with the Bureau in 1889: machines were rented, not sold. A customer paid a monthly rental per machine and bought punched cards from the company at a per-card rate, which produced a second, continuous revenue stream tied to actual use rather than to the size of the original sale. The company maintained the machines and kept title to them throughout the lease. Because a customer's workflow was built around the specific column structure of the company's cards, switching suppliers meant reconfiguring the whole tabulation process, and the cost of that reconfiguration rose with every year a customer stayed on the system. Lars Heide's study of the industry treats the leasing structure, more than any technical advantage in the machines themselves, as the company's central and most durable innovation: it converted a one-time equipment sale into an annuity, and the annuity, once a customer was installed, was difficult to walk away from.³²

The Bureau's own use of Hollerith machines continued through the twelfth census of 1900, on terms close to the 1889 contract but at a somewhat lower per-card rate; the equipment was incrementally faster, the cards cheaper to produce after a decade of manufacturing experience, and the 1900 contract brought the company approximately five hundred thousand dollars over the course of the tabulation.³³ Maintenance was bundled into every lease rather than sold separately, which meant the company's own mechanics, not the customer's staff, served the installed machines; a customer who wanted to leave the system had to replace not only the equipment but the servicing relationship that kept it running, a further cost the per-card rate did not itself disclose.

The international customer base

By 1910 the company's international customer list was extensive. The Central Statistical Committee of the Russian Empire had installed Hollerith machines for the 1897 all-Russian census, tabulated at Saint Petersburg over three years for a population of roughly one hundred and twenty-five million. The Austrian statistical office installed machines for its 1900

³²Heide, *Punched-Card Systems and the Early Information Explosion, 1880-1945*.

³³Austrian, *Herman Hollerith: Forgotten Giant of Information Processing*; Heide, *Punched-Card Systems and the Early Information Explosion, 1880-1945*.

census; Norway and Denmark for their 1900 and 1901 censuses respectively; Italy for 1901; the Canadian Dominion Bureau of Statistics for 1901; and by 1910 the French statistical office and the Reichsstatistisches Amt in Berlin had installed machines for their own decennial counts.³⁴ In most cases the commercial vehicle abroad was a licensing agreement with a local subsidiary or agent, holding national rights to the Hollerith patents under royalty terms set by the American company. The pattern repeated in each country: a decennial census whose categories had outgrown what clerks could cross-tabulate on the statutory calendar, and a tabulating contract that solved the same operating problem the American Bureau had solved in 1889.

Bouk's account of statistical individuation is the more direct guide to this expansion than Anderson's account of the American schedule: the insurance companies, railways, and department stores that leased machines in these same years had their own classifying logic, built in the actuarial and industrial trades rather than borrowed from the census, and the machines' flexibility - any variable could be punched, sorted, and re-sorted - suited a use built for individual accounts as readily as one built for national aggregates. The census had supplied the founding demand and the founding capital; what the commercial customers supplied, from 1897 forward, was a use for the same machines that had nothing to do with apportioning a legislature.³⁵

Consequence

The company Hollerith incorporated with a hundred thousand dollars in 1896 was, within a decade, selling to governments the American Bureau had never dealt with and to companies whose classifying purposes were commercial rather than constitutional. The leasing structure, not any single mechanical advance, was what let a nineteenth-century census contractor become a durable twentieth-century supplier. Inside the Bureau itself, though, the leasing terms were about to become a point of dispute, and a rival system built by one of the Bureau's own engineers was about to give the government leverage it had not had in 1889.

Chapter 4. 1907-1924: Powers, competition, and the corporation renamed IBM

A Bureau alternative

Simon Newton Dexter North became director of the reorganized, now permanent Bureau of the Census in 1903. North judged the Bureau's dependence on a single private supplier for its principal statistical instrument a long-term liability, and he authorized the Bureau's own mechanical division to build an alternative. According to the Census Bureau's own account of the episode, employees led by James Legrand Powers developed that alternative system in the years after the Bureau's dispute with Hollerith over rental terms, arriving at a working mechanical tabulator - reading punched cards by pins and levers rather than by an electrical

³⁴Austrian, *Herman Hollerith: Forgotten Giant of Information Processing*; Heide, *Punched-Card Systems and the Early Information Explosion, 1880-1945*.

³⁵Bouk, *How Our Days Became Numbered: Risk and the Rise of the Statistical Individual*.

circuit closed in a mercury bath - through a development period of roughly 1907 to 1910; the Bureau tested it against the Hollerith machines and adopted the Powers system for the 1910 census.³⁶ Powers left the Bureau in 1911 to found his own company on the strength of the patents that development had produced.

The Tabulating Machine Company's rate quote for the 1910 tabulation, calculated on the earlier per-card model, would have brought in roughly one million two hundred thousand dollars. North rejected it as excessive, and when Hollerith would not reduce it substantially, informed the company that the Bureau would run its own machines instead. The two men's later accounts of the dispute did not agree: Hollerith's correspondence in his own papers argued that the rate matched what commercial customers were already paying; North's official reports argued that the company had held a monopoly position on the earlier contracts and that a working alternative had, for the first time, given the Bureau real leverage.³⁷ Both accounts agree on the outcome: the 1910 tabulation ran on Powers machines, at a cost below what the Hollerith contract would have charged.

The loss of the Bureau's contract mattered to Hollerith without being fatal to the company; the commercial customer base built since 1896 was by 1910 large enough to carry the business. It was, on Austrian's biography, one of several reasons Hollerith began negotiating in 1911 with Charles Ranlett Flint, an industrial promoter who had helped form United States Rubber and the American Chicle Company among other consolidations; failing health at fifty-one and a wish to consolidate his patent position against the Powers system were the others.³⁸

The 1911 merger

Flint proposed combining the Tabulating Machine Company with two firms outside the tabulating business entirely: the Computing Scale Company of Dayton, Ohio, which made mechanical scales for grocers and butchers, and the International Time Recording Company of Endicott, New York, which made industrial time clocks. The three had, in Flint's presentation, overlapping distribution networks whose consolidation would produce efficiencies none of the three could reach alone. The merger closed on 15 June 1911 as the Computing-Tabulating-Recording Company, underwritten by Guaranty Trust and capitalized at roughly fifteen and a half million dollars in common and preferred shares; Flint chaired the board, and Hollerith - paid roughly one million two hundred thousand dollars for his holdings, on a ten-year engineering contract, and retaining an equity stake - was one of its directors.³⁹ IBM's own corporate history likewise describes the 1911 combination as a merger of three companies; where Austrian's biography supplies transaction detail beyond what that

³⁶Austrian, *Herman Hollerith: Forgotten Giant of Information Processing*; Heide, *Punched-Card Systems and the Early Information Explosion, 1880-1945*.

³⁷Library of Congress, Manuscript Division, "Herman Hollerith Papers, 1850-1982: Finding Aid (LC Control Mm73049510)"; National Archives and Records Administration, "Records of the Bureau of the Census, Record Group 29: Finding Aid"; Austrian, *Herman Hollerith: Forgotten Giant of Information Processing*.

³⁸Austrian, *Herman Hollerith: Forgotten Giant of Information Processing*.

³⁹Austrian, *Herman Hollerith: Forgotten Giant of Information Processing*; Heide, *Punched-Card Systems and the Early Information Explosion, 1880-1945*.

corporate account or the independent scholarship confirms, the detail is presented here as Austrian's own reporting rather than as an independently verified fact.⁴⁰

The distribution argument did not hold up in practice. The three companies' customers barely overlapped: grocers bought a single scale on a short sales cycle, factories bought time clocks on a medium one, and census bureaus and insurance companies bought tabulating installations through long, technically demanding negotiations. Revenue growth disappointed the underwriters through 1912 and 1913, and in April 1914 the board hired Thomas J. Watson, forty years old and recently departed from the National Cash Register Company, as general manager.

Hollerith's own part in the merged company was smaller than the sale price might suggest. He served out his ten-year engineering contract, kept a seat on the board, and was consulted on the tabulating division's technical questions, but the operating direction of the company passed to others; his relations with Watson, by several accounts in his own papers, were cordial without being close, the inventor's interest running to the machines' technical refinement and the sales executive's to the size of the customer list.⁴¹ Hollerith retired from active participation in 1921 and died in 1929, having spent the last decade of his working life as a consulting engineer to a division of a company he no longer ran.

Watson's arrival

Watson brought a record his hirers weighed carefully. He had risen at NCR from a sales clerk in 1898 to vice president, in an organization built by John Patterson around an aggressively trained sales force and a company culture close to religious observance. NCR under Patterson was prosecuted under the Sherman Antitrust Act for coordinated pricing and for a used-machine operation designed to remove competitors' equipment from the market; Watson was tried alongside Patterson and twenty-eight other executives, convicted in February 1913, and sentenced to a year in federal prison and a five-thousand-dollar fine, a sentence an appeals court vacated in 1915.⁴² Patterson dismissed Watson in the spring of 1914; Flint's job offer arrived soon after. Some CTR directors objected to hiring a man with an antitrust conviction on his record, vacated or not; Flint's confidence in Watson's sales and organizational ability overrode the objection.

Watson imported the NCR sales model - a large trained sales force, a commission structure built to reward volume, a company sales school - and concentrated his own attention, from the start, on the tabulating division. He judged it the company's largest opportunity: its international and national customer base, its recurring lease and card revenue, and the flexibility of the punched card for problems well beyond a census schedule. Engineering staff and sales headcount both grew fastest in that division through his early tenure, though

⁴⁰International Business Machines Corporation, "IBM Archives: Corporate Records and Historical Materials"; Austrian, *Herman Hollerith: Forgotten Giant of Information Processing*.

⁴¹Library of Congress, Manuscript Division, "Herman Hollerith Papers, 1850-1982: Finding Aid (LC Control Mm73049510)"; Austrian, *Herman Hollerith: Forgotten Giant of Information Processing*.

⁴²Austrian, *Herman Hollerith: Forgotten Giant of Information Processing*; Heide, *Punched-Card Systems and the Early Information Explosion, 1880-1945*.

the CTR's public description of itself as a diversified maker of scales, time recorders, and tabulators did not change for years.⁴³

American entry into the World War in April 1917 accelerated the shift. Selective Service registration required national-scale tabulation, run on CTR machinery under contract with the War Department; the Army's ordnance branch, the Navy, and the Fuel Administration installed CTR equipment for their own statistical and inventory work. The Bureau's own 1920 decennial tabulation ran on Powers machines under North's successor, Sam L. Rogers, though the Bureau leased Hollerith equipment again for special wartime surveys.⁴⁴ By the war's end the tabulating division's share of CTR's total revenue had grown from about a quarter at the 1911 merger to more than a third, its employment from roughly six hundred to roughly eighteen hundred, and its product line had grown to include an alphabetical tabulator in 1919 and a printing tabulator in 1920. The Computing Scale division would be divested in 1934; the time-recording division would be kept but would matter less to the company's revenue every year from this point forward.⁴⁵

The renaming

Watson proposed to the board in January 1924 that the parent corporation take the name already used, since 1917, by CTR's Canadian subsidiary - International Business Machines Corporation - and the board approved it without significant opposition; the change took effect by charter amendment on 14 February 1924.⁴⁶ Nothing in the corporate structure or the divisions changed that day. What changed was a name that described an ambition the tabulating division's growth had already made real: by 1930 that division would produce more than half the corporation's revenue, by 1935 more than two-thirds, and by 1940 the scale division would be gone and the time-recording division would be a minor contributor. The name Watson chose in 1924 was, in that narrow sense, accurate before it was fully true.

Powers's own company did not disappear from the competition. It merged into the Remington Rand Corporation in 1927 and remained IBM's principal domestic rival in tabulating machinery through the interwar decades, alongside a smaller challenge from Burroughs. The rivalry that had begun as a Bureau engineer's answer to a rental dispute became, over three decades, the shape of the American tabulating-machine industry.

Chapter 5. 1924-1940: commercial and state expansion

Three customer segments

IBM's interwar market rested on three kinds of buyer: government statistical offices, insurance companies, and industrial concerns whose accounting had outgrown hand book-

⁴³Austrian, *Herman Hollerith: Forgotten Giant of Information Processing*; Heide, *Punched-Card Systems and the Early Information Explosion, 1880-1945*.

⁴⁴Austrian, *Herman Hollerith: Forgotten Giant of Information Processing*; Heide, *Punched-Card Systems and the Early Information Explosion, 1880-1945*.

⁴⁵Heide, *Punched-Card Systems and the Early Information Explosion, 1880-1945*.

⁴⁶Austrian, *Herman Hollerith: Forgotten Giant of Information Processing*; Heide, *Punched-Card Systems and the Early Information Explosion, 1880-1945*; International Business Machines Corporation, "IBM Archives: Corporate Records and Historical Materials."

keeping. The government segment included the Bureau of the Census, which returned to Hollerith-descended machinery for the 1930 census after the Powers system had run into operational trouble on the 1920 count; the newly established Social Security Board after 1935; and a growing number of state governments. The insurance segment included Prudential, Metropolitan Life, New York Life, and Aetna. The industrial segment included railroads, utilities, oil companies, and large manufacturers.⁴⁷ Revenue rose from about eleven million dollars in 1924 to about forty-two million in 1935, through the years the rest of American manufacturing was contracting; the tabulating division's share of that revenue rose from about forty percent to about seventy over the same period.⁴⁸

The leasing structure Hollerith had set in 1889 was, on Heide's account, the mechanism behind that resilience. A company that had already built its accounting workflow around a punched-card installation could not easily defer the monthly rental or the card purchases that kept the workflow running, even in a year it deferred new equipment; competitors - Remington Rand, which had acquired the Powers system in 1927, and Burroughs, whose own tabulators became commercially serious in the 1930s - faced a switching cost that grew with every year a customer stayed installed. By the end of the 1930s IBM held something close to a natural monopoly in American punched-card tabulation, with an estimated eighty percent of the domestic installed base and a comparable share internationally outside the Soviet and German markets.⁴⁹

By 1940 the corporation's total revenue from tabulating leases and card sales exceeded fifty million dollars, a substantial share of it earned outside the United States. Watson pursued the international side of the business personally: he traveled repeatedly to the European subsidiaries through the 1920s and 1930s, met the senior officials of the statistical offices and industrial concerns that were becoming customers, and treated the relationships he built on those visits as an asset the New York office could not replicate by correspondence. The Bureau of the Census, meanwhile, had not stayed with the Powers system it adopted in 1910. The fourteenth census of 1920 ran into operational difficulty on Powers-descended equipment whose sorting speed had not kept pace with Hollerith's improved machines, and the Bureau returned to Hollerith-descended tabulators, by then IBM's, for the fifteenth census of 1930.⁵⁰ The switch meant the government that had once forced better lease terms from Hollerith by threatening to build its own alternative was, twenty years later, back to leasing from his successor company, on the same structural terms Hollerith had set in 1889.⁵¹

Social Security

The largest single interwar contract followed the Social Security Act of 1935, which required the federal government to maintain a covered earnings account for every worker in the pro-

⁴⁷ Austrian, *Herman Hollerith: Forgotten Giant of Information Processing*; Heide, *Punched-Card Systems and the Early Information Explosion, 1880-1945*.

⁴⁸ Heide, *Punched-Card Systems and the Early Information Explosion, 1880-1945*.

⁴⁹ Heide, *Punched-Card Systems and the Early Information Explosion, 1880-1945*.

⁵⁰ Austrian, *Herman Hollerith: Forgotten Giant of Information Processing*; Heide, *Punched-Card Systems and the Early Information Explosion, 1880-1945*.

⁵¹ Heide, *Punched-Card Systems and the Early Information Explosion, 1880-1945*.

gram - an estimated thirty million accounts at the start, projected to reach fifty million within a decade. IBM installed the tabulating equipment at the Social Security Board's headquarters in Baltimore: hundreds of tabulators, sorters, and card punches, staffed by a workforce that grew to several thousand within the program's first years, reportedly the largest punched-card installation in the world at the time. The account it produced was individual rather than aggregate: each card carried one worker's earnings history, sorted and re-sorted to calculate a retirement benefit for that worker rather than to describe a population. Before the war, no other installation showed as clearly what Bouk calls the individuating use of the punched card, operating at a scale only a national government could fund, alongside the aggregating, category-counting use the census had always made of the same machines⁵².⁵³

Subsidiaries abroad

Watson expanded IBM's subsidiary network through France, Germany, Britain, Italy, Sweden, the Netherlands, Poland, and Czechoslovakia over the 1920s. Each subsidiary held or licensed local rights to the Hollerith patents, hired local staff, priced its leases in local currency, negotiated with local government and commercial customers without contract-by-contract approval from New York, and paid royalties to the American parent on a periodic rather than a per-contract basis. The German subsidiary, Deutsche Hollerith Maschinen Gesellschaft - Dehomag, incorporated in Berlin in 1910 - became IBM's largest subsidiary in Europe; its factory at Berlin-Lichterfelde built tabulating machines to the American design under license, and its principal government customer through the Weimar years was the Reichsstatistisches Amt, the German national statistical office, an Amt that had been a Hollerith customer since the 1910 German census. What Dehomag's equipment did after the National Socialist government took power in January 1933, what the German government and its subsidiary each decided to do with it, and what the American parent knew or controlled, are best considered separately, on their own terms, because the evidence for each does not run together.⁵⁴

Chapter 6. 1933-1945: harmful uses, considered separately

A German subsidiary, a German customer

The Reichsstatistisches Amt, Germany's national statistical office since 1872, had leased Hollerith machinery for the 1910 German census and continued through the Weimar years as a customer of Deutsche Hollerith Maschinen Gesellschaft - Dehomag - the German subsidiary IBM's predecessor company had incorporated in Berlin in 1910. Dehomag built machines to the American design under license at its Berlin-Lichterfelde factory, served customers across German industry, insurance, and government, and was, by the early 1930s, IBM's largest subsidiary in Europe, with its own board, its own workforce of several thousand, and majority American ownership held through IBM's European holding structure. The National

⁵²Bouk, *How Our Days Became Numbered: Risk and the Rise of the Statistical Individual*; Heide, *Punched-Card Systems and the Early Information Explosion, 1880-1945*.

⁵³Heide, *Punched-Card Systems and the Early Information Explosion, 1880-1945*.

⁵⁴Heide, *Punched-Card Systems and the Early Information Explosion, 1880-1945*.

Socialist government took power in January 1933. Its statistical bureaucracy did not build new machines to carry out its racial policy; it turned an existing commercial installation, already leased to the German state for ordinary census work since 1910, to a new purpose. Six questions have to be kept apart, because the existing scholarship does not answer them with the same degree of confidence, and a moral judgment about IBM's American parent depends on which one is being asked.⁵⁵

What punched-card systems could do. A Hollerith-descended installation could sort a population by any category punched onto its cards, cross-tabulate those categories at a speed no hand method could match, and reproduce a sorted list from any subset of the punched categories at negligible additional cost. It could, in other words, turn a defined set of questions - asked of every person in a census, an occupational registration, or any comparable enumeration - into a retrievable list of the people who answered them a given way. This was true of the same machines when they tabulated crop yields for the Bureau of the Census, and it was true of them in Germany. The capability was general; nothing about the machine itself specified who would be listed or why.

What German statistical and security offices decided to collect. The decisions were the Reich's own. The Reichsstatistisches Amt ran a supplementary census in 1933, an occupational census in 1935, and a full population census in 1939, each under a revised schedule; the 1939 schedule added a supplementary card, the *Ergänzungskarte*, on which every household reported each member's ancestral religious affiliation across two generations - whether each of four grandparents had been of the Jewish faith at birth.⁵⁶ The categories matched the ancestry definitions the Nuremberg Laws had already fixed in statute: full Jew, first-degree Mischling, second-degree Mischling, non-Jew. Choosing to ask the question, in this form, at this scale, was a decision of the German statistical and security bureaucracy, not of the company that built the machine that tabulated the answers.

What Dehomag supplied and serviced. Aly and Roth's study of the 1939 census, drawn from the Reichsstatistisches Amt's own papers at the Bundesarchiv, documents that the *Ergänzungskarten* were tabulated on Dehomag-supplied and Dehomag-serviced machinery installed at the Amt and at the Reichssicherheitshauptamt, the Reich's central security office, and that the resulting lists were used after 1939 in identifying individuals for deportation and in sorting ghetto populations. Dehomag also supplied and serviced installations for the Reich Chamber of Culture's professional licensing, the Reich Labour Service's worker assignments, and, after 1940, the classification of forced-labor populations in occupied territory.⁵⁷ The equipment and the servicing relationship are documented at the level of the Reich office that used them; that documentation does not, by itself, establish what any individual at Dehomag

⁵⁵Heide, *Punched-Card Systems and the Early Information Explosion, 1880-1945*.

⁵⁶Götz Aly and Karl Heinz Roth, *The Nazi Census: Identification and Control in the Third Reich*, trans. Edwin Black and Assenka Oosterhuis (Temple University Press, 2004); Heide, *Punched-Card Systems and the Early Information Explosion, 1880-1945*.

⁵⁷Aly and Roth, *The Nazi Census: Identification and Control in the Third Reich*; Edwin Black, *IBM and the Holocaust: The Strategic Alliance Between Nazi Germany and America's Most Powerful Corporation* (Crown Publishers, 2001).

understood about a given installation's downstream use.⁵⁸

What the German subsidiary knew. Dehomag serviced the machines it had supplied, which means its technicians had operational visibility into the categories the Ergänzungskarte punched and which German offices the resulting lists went to - the Amt and the Reichssicherheitshauptamt are both named as customers in the Bundesarchiv record Aly and Roth cite. What individual Dehomag officers understood about the lists' ultimate use in deportation is a narrower claim than the fact of the servicing relationship. The surviving German-side documentation establishes supply and service more directly than it establishes any individual officer's understanding of the lists' ultimate use.

What IBM's American parent knew. This is where the three principal accounts diverge, and the divergence is not resolved by the evidence gathered here. Edwin Black's *IBM and the Holocaust* argues that the American parent was aware, through its European management structure and subsidiary reporting, of the substance of what Dehomag was doing for the Reich, and cites Dehomag corporate records and IBM correspondence for the claim. Heide's account treats the parent's relationship to Dehomag as financial and licensing oversight, exercised at a distance, and does not find in the same body of evidence grounds for a claim of operational awareness at the American end. The evidence cited by Black and Heide does not support a single conclusion about what the American parent knew or when it knew it; the disagreement remains material to any allocation of responsibility.⁵⁹

What operational control the parent exercised. The structural facts are better established than the state-of-knowledge question. Dehomag, like IBM's other European subsidiaries, operated under a combination of majority equity ownership, patent licensing, and periodic financial reporting to New York; it hired its own staff, priced its own leases, and negotiated individual contracts with German government customers without contract-by-contract approval from the American parent. That structure means day-to-day contracting authority sat in Berlin, not New York. It does not by itself answer whether the parent could have withheld patents, machines, or replacement parts and chose not to, nor whether it did so. Corporate ownership and operational control therefore remain distinct findings.⁶⁰

Vichy France

After the armistice of 1940 the Vichy government took over the French Third Republic's statistical operations, and its new statistical service was directed by René Carmille, an advocate of mechanized tabulation who had worked toward it since the 1930s. Carmille's office collected a population inventory under Vichy's laws targeting persons of Jewish ancestry, using tabulating equipment supplied through the occupation-era French distributor associated with Compagnie des Machines Bull.⁶¹ The relationship among IBM, Bull, and the Service

⁵⁸Aly and Roth, *The Nazi Census: Identification and Control in the Third Reich*.

⁵⁹Black, *IBM and the Holocaust: The Strategic Alliance Between Nazi Germany and America's Most Powerful Corporation*; Heide, *Punched-Card Systems and the Early Information Explosion, 1880-1945*.

⁶⁰Heide, *Punched-Card Systems and the Early Information Explosion, 1880-1945*.

⁶¹Heide, *Punched-Card Systems and the Early Information Explosion, 1880-1945*; Black, *IBM and the Holocaust: The Strategic Alliance Between Nazi Germany and America's Most Powerful Corporation*.

national des statistiques in this period remains contested among historians. Carmille's own account, given before his death in the camp system in 1945, testified that he had sabotaged the tabulation by punching categories in ways that produced uninformative returns; the scholarly literature does not agree on how effective that sabotage was, and the question is left at that level of disagreement rather than resolved in either direction.⁶²

Census tabulation and Japanese American incarceration

The Bureau of the Census operated on IBM machinery at scale through the sixteenth census of 1940, and its schedule asked about race, ancestral origin, and immigration status in a comparable level of detail, and in comparably fine categories, to what European statistical offices were asking in the same years. What the Bureau's tabulations did with those answers, in the incarceration of Japanese Americans that followed Executive Order 9066 in 1942, requires more care than a general statement that the census "produced the lists." The Bureau's own tabulations, run through 1940 and 1941, generated small-area population data - block- and tract-level counts of persons of Japanese ancestry, aggregated by geography rather than reported as individual names and addresses. The identification of specific individuals and households for removal drew on other sources as well: the Bureau's own personnel and equipment supported the wartime statistical effort, but the operational work of locating and removing people rested substantially on other federal and local records and on the War Relocation Authority's own administration, established to run the incarceration program once the small-area population data had identified where Japanese American communities were concentrated.⁶³ The later confidentiality history does not settle whether individual-level Bureau data crossed into the removal process, so the claim here remains confined to documented aggregate geographic tabulation.

Comparing without equating

The Nazi genocide of European Jews, the deportation of Jews from occupied and Vichy France, and the incarceration of Japanese Americans are not the same event, and they stand together here only because each intersected, at some point in its administrative chain, with Hollerith-descended tabulating equipment. The differences are the substance of the comparison, not a qualification of it. The legal regimes differed: statutory genocide under a totalitarian government that had already suspended constitutional protection for the group it targeted, in Germany; deportation under an occupation and a collaborating administration, in France; and a wartime executive order issued by a constitutional government against citizens and resident immigrants under its authority, without the sanction of any statute naming Japanese ancestry as a category for removal, in the United States. The target definitions differed: ancestry defined by statute to four generations of grandparents, in Germany; a comparable ancestry test applied under occupation, in France; national origin and residence, undifferentiated by any individual determination, in the United States. The data sources differed: individual-level ancestry declarations on a supplementary census card, in Germany;

⁶²Heide, *Punched-Card Systems and the Early Information Explosion, 1880-1945*; Black, *IBM and the Holocaust: The Strategic Alliance Between Nazi Germany and America's Most Powerful Corporation*.

⁶³Anderson, *The American Census: A Social History*; Heide, *Punched-Card Systems and the Early Information Explosion, 1880-1945*.

a population inventory of contested completeness, in France; small-area aggregate counts supplemented by other federal and local records, in the United States. The institutional chains differed: a national statistical office and a dedicated security office running an extermination program, in Germany; a statistical service operating under occupation and a collaborating government, in France; a temporary war-relocation agency operating under a democratic government's own executive order, in the United States. The coercive outcomes differed in kind as well as scale: extermination, in Germany; deportation to occupied territory and, for many, to the German camp system, in France; forced removal and confinement without individual charge, for the duration of a war, in the United States. IBM's corporate role differed in the confidence with which it can be stated: a licensed subsidiary supplying and servicing equipment to its own national government, at a minimum, in Germany, with the American parent's knowledge and control unresolved; a contested supply relationship in France; and, in the United States, a government contractor tabulating a census whose design Congress had authorized and whose wartime uses the Bureau did not control. The scale differed by orders of magnitude: six million Jewish dead across Europe; a smaller but substantial number of French Jews deported, most of them murdered; and roughly a hundred and twenty thousand Japanese Americans confined without a death toll comparable to either.

Shared use of a tabulating machine is not evidence that the three events belong to one causal chain, and it is not evidence that they belong to none. A machine that can sort a population by category served three governments that made three different decisions about what to do with the resulting list, under three different degrees of legal constraint, and produced three different outcomes. What is common across the three is narrower than a single mechanism of atrocity: each government found, in a punched-card installation, a tool that could sort and list a population by a classification it had already chosen, faster and more completely than a clerk with a tally sheet could have managed. The decision to make that classification, and to act on the list it produced, and the political and legal order that allowed or compelled the decision, sit with the governments that made them. What the machine contributed was speed and completeness in carrying the decision out, not the decision itself.

Coda. From the apportionment clause

The Constitution required an enumeration within three years of the first Congress and every ten years after. The Act of 1 March 1790 gave the count to the marshals and set six columns for the schedule. Ninety years and several enlargements of that schedule later, the tenth census outran the clerks who tabulated it by hand; Hollerith's patents of January 1889 answered the operating limit those clerks had hit, and the Bureau's contract that September set the terms - leasing, not sale - on which a tabulating industry would be built. Hollerith incorporated that industry's first firm in 1896. A rival built inside the Bureau itself, under James Powers, took the 1910 census contract away from him. Charles Flint merged Hollerith's company with two others in 1911; Thomas Watson renamed the result International Business Machines in 1924. By 1940 the corporation's machines tabulated censuses, insurance books, payrolls, and Social Security accounts across three continents, and among the governments that leased them were the Reich that murdered six million European Jews and the United States government

that confined roughly 120,000 people of Japanese ancestry, nearly two-thirds of them U.S. citizens, without individual charge.

None of that sequence was determined by the clause that started it. The three-fifths compromise of 1787 fixed a category of persons to be counted at a fraction of a whole; it did not fix what a punched card would someday do, in another country, under another government, with a category of persons defined by ancestry rather than by enslavement. Nothing in the documentary evidence from 1790 to 1889 required that the mechanical answer to a Bureau's tabulation backlog become, within half a century, a multinational corporation whose subsidiary supplied the security office of a genocidal state. The corporation's growth was driven by leasing economics, patent strategy, and Watson's own sales ambition, each documented on its own terms. Reading the whole sequence backward, from Auschwitz to Article I, produces a tidier story than the evidence supports, and a less honest one.

That does not make the sequence morally neutral, and it should not be described as neutral. The Reichsstatistisches Amt and the Reichssicherheitshauptamt decided to collect ancestry data to four generations and to use the resulting lists in deportation and extermination; that decision, and the officials who made it, bear the weight the historical evidence assigns them, without qualification. The government of the United States decided, by executive order and without individual charge, to confine roughly 120,000 people of Japanese ancestry, nearly two-thirds of them U.S. citizens. That decision was a grave injustice under a different legal regime, with a different coercive purpose and outcome. Dehomag supplied and serviced the machines the Reich's offices used, under a license from its American parent, and that fact is established. What the American parent knew about the use its subsidiary was being put to, and what it could have withheld and chose not to withhold, is not established by the evidence assembled here, and it is not resolved by assertion in either direction; it is a question for archival access and specialist review that a general history cannot substitute for. The machines themselves decided nothing. They executed, faster and more completely than a clerk with a tally sheet could have executed, classification judgments that human officials had already made. Holding the machine responsible would relieve the officials of a weight only they can bear; holding the officials responsible does not relieve IBM's subsidiary of the narrower, established fact of its supply and service, nor does it settle what the American parent is owed of that responsibility.

Margo Anderson and Dan Bouk answer different questions at different scales: the political construction of the census schedule and the commercial development of individual statistical classification. Responsibility for the uses made of tabulating systems after 1933 belongs to the distinct scholarships of the Holocaust, Vichy France, IBM and Dehomag, and Japanese American incarceration. Keeping those bodies of evidence separate prevents a shared machine from becoming a false single cause.

What happened to the corporation afterward is another history. IBM's postwar transformation into the principal supplier of electronic computation, its dominance of commercial data processing through the 1950s and 1960s, and its later role in enterprise computing belong to a substantial literature of their own; the ethical reckoning ends here at 1945. The leasing

structure Hollerith set in 1889, extended and generalized across those decades, remained the operational basis of the company's commercial position well past the punched card's own working life; the machines changed more than once, and the business built around renting rather than selling them did not.

The apportionment clause remains in force. The decennial count still runs on the constitutional calendar Congress fixed in 1790, on categories Congress still writes and revises, using instruments that have changed from the marshal's ledger to the punched card to the electronic database and will change again. The instrument is not the judgment. It never was. What a nation chooses to count, and what it then chooses to do with the count, remain two different decisions, made by different people, and the evidence gathered here has tried to keep them apart rather than let the second stand as an indictment of the first.

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