

## 27 Herman Hollerith



### Case description

The founding fathers of the United States of America wrote into the constitution that a census of the population should be conducted every 10 years. The US Census Bureau was established for this purpose and can be considered as a major governmental activity system that has been emulated world-wide.

The first US census was undertaken in 1790. The census was funded by Congress and conducted by assistant federal marshals from 1790 to 1890. During this 100 years all data processing was conducted by hand.

For the 1880 census the Census Office received an increase in funding and was able to employ its own enumerators. Also, formal enumeration districts were defined for the first time. Over time, an increasing range of variables about the US population were collected (age, sex, race, place of birth, occupation etc.). Not surprisingly, it took almost 10 years to complete the data processing by hand for the 1880 census. With increasing population size it was feared that the completion of the next census would overlap with the start of that immediately following.

A technological innovation supplied the solution to this problem. In 1890 the first automated census was conducted successfully due to an invention introduced by Herman Hollerith, known as the tabulating machine.

Herman Hollerith was born in 1860 of German immigrant parentage (Biles, 1989). He graduated from Columbia University School of Mines with a mining engineering degree in 1879 at the age of 19. That year, one of his former professors requested that he work for the US Census Bureau. After three years there, in 1882 Hollerith moved to Boston to teach mechanical engineering at MIT.

In 1886 the first test of Hollerith's tabulating machine took place in Baltimore's Department of Health. The test was conducted on recorded data about the deceased. The machine was then used in various ways such as the Surgeon General's office of the War department and by the US Navy.

Data in the tabulating machine was recorded on punched cards and fed through an electro-mechanical device which sorted the cards according to a 'programmed' characteristic. The use of punched cards for control purposes was originally pioneered in the Jacquard loom, a machine that automated the task of weaving complex patterns. In this loom, pasteboard cards with punched holes were used. Holes in

the cards determined the passage of rods that controlled the operation of the loom.

Despite this history, Hollerith himself claimed that the idea of using punched cards was reputedly suggested when taking a train journey. He observed conductors using their punches to quickly code data about the characteristics of an individual onto a ticket – characteristics such as height, hair colour, size of nose etc. These codes, which were known to other conductors could be used to detect fraudulent use of tickets.

In the tabulating machine, each card recorded data about one individual. The card was made up of a number of columns and rows and holes punched through cells on the card would code data about that individual. Hollerith invented a punch to reduce the strain on operators in the production of punched cards. Each operator was able with this pantograph punch to produce approximately 500 cards per day.

An early version of the tabulating machine consisted of a press consisting of a series of sprung pins. Pins passing through holes made contact with a mercury pan which established a circuit. Eventually the machine incorporated cards passed between a metal drum and a set of wire brushes. The brushes would briefly sweep through the holes making contacts. Relevant circuits would then be activated that would turn a dial – one dial for each variable – enabling automatic tallying. After a certain number of cards were processed the operator took readings off the dials and set them back to zero.

Hollerith eventually improved this process by inventing a sorting machine. By means of switches the operator could instruct the machine to search for certain characteristics (what we would now refer to as a query). For example, the number of engineers living in a particular state that owned their own house and had two children. When a card with this characteristic was detected, the sorting mechanism would gather matching cards into a separate container for inspection.

The utility of using the tabulating machine as an information technology can be demonstrated in terms of the efficiency savings it generated. For the 1890 census an army of 50,000 census takers posed 235 questions. The original information system comprised making tally marks on small squares printed on rolls of paper and then adding the marks together by hand. Using this approach it was estimated that

the 1890 census would take ten years to complete and would cover 62 million Americans.

On July 1<sup>st</sup> 1890 two thousand clerks began processing the US census assisted by Herman Hollerith himself. The use of Hollerith machines for this census brought the time-scale down to three months saving tax-payers five million dollars, which at the time was a third of the census department's budget.

Hollerith combined the roles of inventor, entrepreneur and manager. Hollerith created his first prototype which he patented in 1884. His Tabulating Machine Company was founded in 1890. He established a near world-wide monopoly of his machines by using the business tactic of leasing rather than selling his machines.

Hollerith sold the company in 1911. The Computing-Tabulating-Recording Company was created in 1911 through merger with two other companies. Thomas Watson became president of this company in 1924 and eventually changed its name to International Business Machines (IBM). Under his stewardship IBM became the dominant force in the data processing industry during the 1940s through to the 1980s.

Information systems and information technology can support repugnant as well as munificent human activity systems. Black (2002) documents the way in which IBM machines based on Hollerith's design were used by Hitler's Germany to compile two censuses of the German population in 1933 and 1939. These censuses which effectively could not have taken place without Hollerith technology allowed the Nazi regime to identify Jews and other nominated groups in the population for eventual transmission to the death camps. Tabulating machines were even used in the death camps themselves to process data about the performance of the extermination effort.



### Commentary

Besides its importance as background to the formation of one of the global ICT companies, IBM, this historical case is useful in emphasising a number of things:

- ▶ Early 'information technology' such as the tabulating machine had a massive impact upon government activities such as conducting a census – the activity system. The tabulating machine caused significant improvement in the efficiency of conducting the information-handling

activities characteristic of its activity system. As such, the case can be considered a very early example of electronic government.

- ▶ There is an inherent link between information and statistics. Statistics is fundamentally information collected about the attributes of some given population. Originally, such 'state-istics' were collected solely by governments to aid in policy-making relevant to the nation-state. However, it did not take long for business organisations to recognise the value of collating statistics on populations of relevance to their activities such as customers.
- ▶ ICT can support repugnant as well as munificent human activity systems. Information systems, because of their socio-technical nature embed the values of their encompassing activity system.



### Issues

- ▶ In this case, the same technology, namely the tabulating machine was used both within a beneficent activity system and a malign activity system. In what way then is information and communication technology value-laden?
- ▶ ICT is still critical to the compilation of national censuses. Investigate how organisations such as the UK office of national statistics undertake such information-handling exercises.
- ▶ IBM eventually lost its dominance in the ICT industry. Investigate why.



### Keywords

Historical case	
Information	Statistics
Activity Systems	National census
Information Systems	
ICT	Tabulating machine
ICT Systems	



### References/Sources

- Biles, G. (1989). Herman Hollerith: inventor, manager, entrepreneur – a centennial remembrance. *Journal of Management* 15(4): 603–615.
- Black, E. (2002). IBM and the Holocaust, Time Warner.