



HISTORY OF MOTION AND TIME STUDY

IENG 301

FUNDAMENTALS OF
WORK STUDY AND
ERGONOMICS

[HISTORICAL DEVELOPMENT]

Fredrick W. Taylor



- He is generally conceded to be the founder of modern 'Time Study.' However, Time studies were conducted in Europe many years before Taylor's time. In 1760, Jean Rodolphe Perronet, a french engineer, made extensive Time Studies in manufacturing, while 60 years later, an english economist, Charles W. Babbage, conducted Time Study in manufacturing.

[HISTORICAL DEVELOPMENT]

Fredrick W. Taylor

- Taylor began his Time Study work in 1881 at the Midvale Steel Company in Philadelphia.



- Taylor proposed that the work of each employee be planned out by the Management at least one day in advance. Workers were to receive complete written instructions describing their tasks in detail and noting the means to accomplish them. Each job was to have a Standard Time, determined by Time Studies made by experts.

[HISTORICAL DEVELOPMENT]

Fredrick W. Taylor



- In June 1903, at the Saratoga meeting of the American Society of Mechanical Engineers (ASME), Taylor presented his famous paper, 'Shop Management' which included the elements of scientific management: Time Study, Standardization of all tools and tasks, use of planning department, use of slide rules and similar time saving implements, instruction cards for workers, bonuses for successful performance, differential rates, mnemonic systems for classifying products, routing systems, and modern cost systems.

[HISTORICAL DEVELOPMENT]

Fredrick W. Taylor



- Taylor's technique were well received by many factory managers.
- In 1917, 59 out of 113 plants that installed this 'Scientific Management' were completely successful.
- Taylor died in 1915 at the age of 59.

[HISTORICAL DEVELOPMENT]

Frank and Lilian Gilbreth

- They were the founders of the modern Motion Study Technique, which may be defined as the study of the body motions used in performing an operation, to improve the operation by eliminating unnecessary motions, simplifying necessary motions, and then establishing the most favorable motion sequence for maximum efficiency.



[HISTORICAL DEVELOPMENT]

Frank and Lilian Gilbreth

- They were the founders of the modern Motion Study Technique, which may be defined as the study of the body motions used in performing an operation, to improve the operation by eliminating unnecessary motions, simplifying necessary motions, and then establishing the most favorable motion sequence for maximum efficiency.



[HISTORICAL DEVELOPMENT]

Frank and Lilian Gilbreth

- They studied body motions to increase production, reduce fatigue, and instruct operators in the best method of performing an operation.
- They developed the technique of filming motions to study them, in a technique known as Micro-motion Study.
- Additionally, they developed the Cyclegraphic analysis and Chronocyclegraphic Analysis techniques for studying the motion paths made by an operator.



[HISTORICAL DEVELOPMENT]

Frank and Lilian Gilbreth



- After the death of Gilbreth (at the age of 55), Lilian, who had received a PhD in Psychology and had been a more than equal collaborator, continued on her own, advancing the concept of work simplification especially for the physically handicapped.
- Lilian was dead in 1972 at the age of 93.

[HISTORICAL DEVELOPMENT]

Carl G. Barth

- Developed a production slide rule for determining the most efficient combinations of speeds and feeds for cutting metals of various hardness, considering the depth of cut, size of tool, and life of the tool.
- Investigated also the number of foot-pounds of work a worker could do in a day.

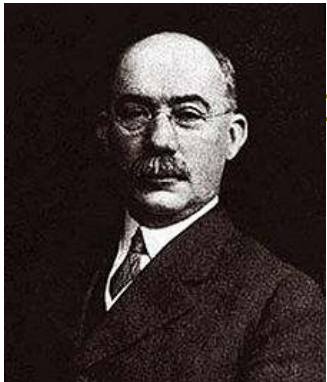
[HISTORICAL DEVELOPMENT]

Harrington Emerson

- Applied scientific methods to work on the Santa Fe Railroad and wrote a book, 'Twelve Principles of Efficiency,' in which he made an effort to inform management of procedures for efficient operation.
- Reorganized the company, integrated its shop procedures, installed standard costs and a bonus plan.
- His effort, resulted in excess of \$1.5 million.
- His effort was recognized as the term 'Efficiency Engineering.'

[HISTORICAL DEVELOPMENT]

Henry Laurence Gantt



- Developed simple graphs that would measure performance while visually showing projected schedules.
- Invented a Wage Payment system that rewarded workers for above-standard performance, eliminated any penalty for failure, and offered the boss a bonus for every worker who performed above standard.
- Emphasized Human Relations and promoted Scientific Management as more than an inhuman 'Speed up' of labor.

[GANTT CHART]

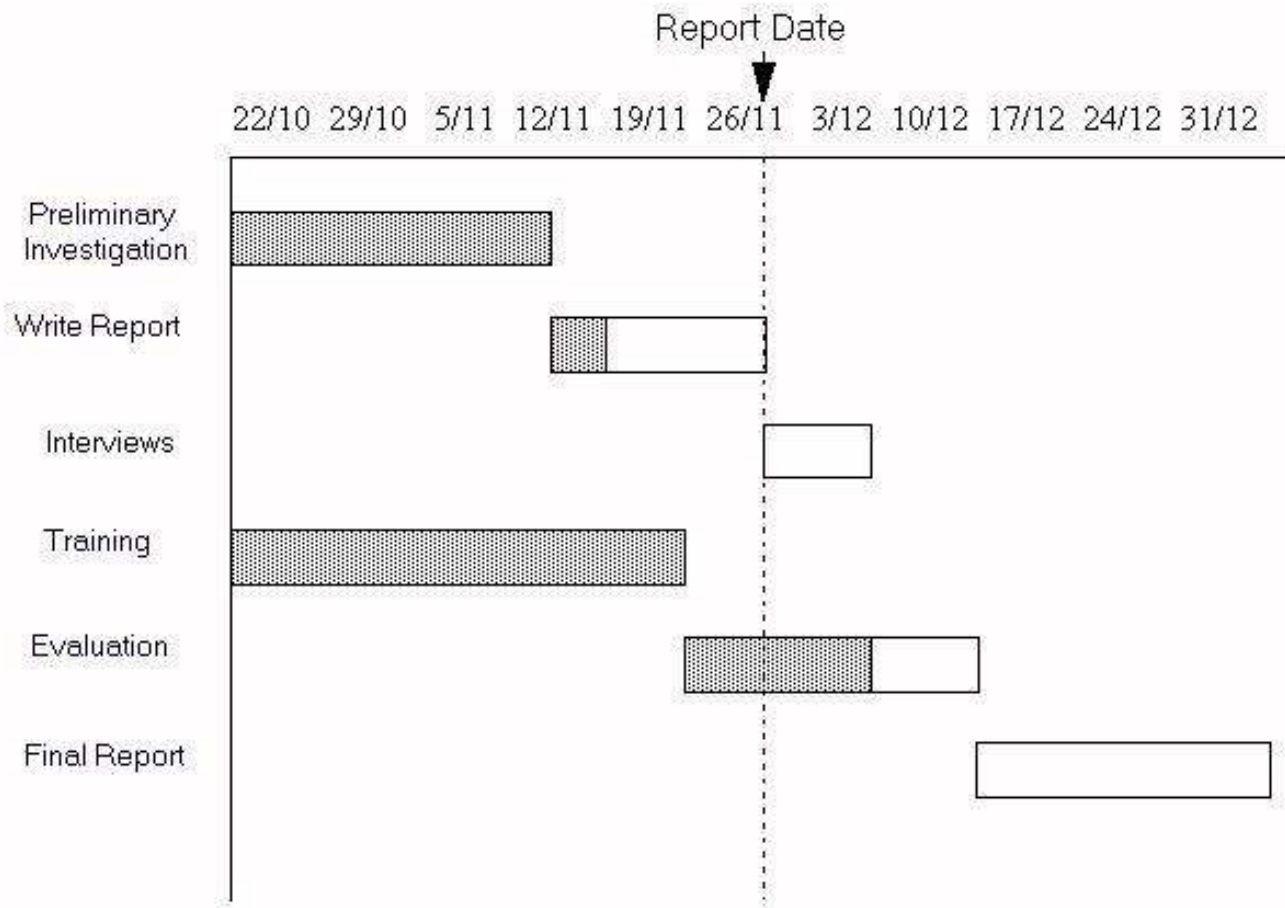


Figure 1: Gantt Chart

[HISTORICAL DEVELOPMENT]

Motion and Time Study received added stimulus during World War II.

[HISTORICAL DEVELOPMENT]

In Summary;

- Frederick W. TAYLOR, originated the **Time study** in year 1881.
- Taylor's real contribution to industry was his scientific method, his substitution of fact-finding for rule of thumb procedure.
- He understood that he was dealing with a human problem as well as with materials and machines. He approached the human side of his investigations with an understanding of its psychological aspects.

[HISTORICAL DEVELOPMENT]

- Taylor explained his objectives (known as **Taylor's Principles of Management**) in the following way:
 - **First.** The development of a science for each element of a man's work, thereby replacing the old rule of thumb methods.
 - **Second.** The selection of the best worker for each particular task and then training, teaching, and developing the workman; in place of the former practice of allowing the worker to select his own task and train himself as best he could.

[HISTORICAL DEVELOPMENT]

- **Third.** The development of a spirit of hearty cooperation between the management and the men, in the carrying on of the activities in accordance with the principles of the developed science.
- **Fourth.** The division of the work into almost equal shares between the management and the workers, each department taking over the work for which it is the better fitted; instead of the former condition, in which almost all of the work and the greater part of the responsibility were thrown on the men.

[HISTORICAL DEVELOPMENT]

- FRANK, B. GILBRETH and his wife LILLIAN, M. GILBRETH, originated the **Motion study**.
- Mr. GILBRETH, saw how to make improvement, in methods, by analyzing the motions used by workmen. He substituted shorter and less fatiguing motions for longer and more tiring ones.
- The photographs, he made, for his worker in motion, aided him to investigate the motion study.
- Mr. and Mrs. GILBRETH, developed the technique of **Micromotion study**.

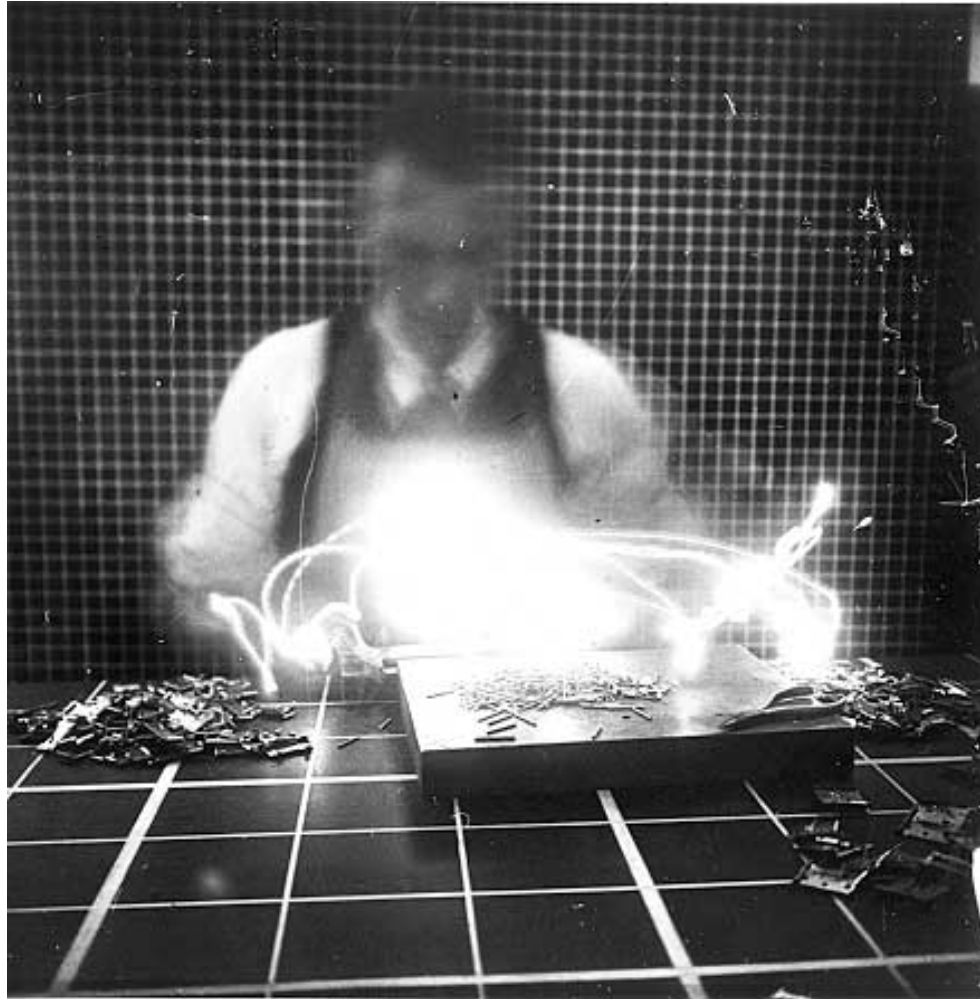
[HISTORICAL DEVELOPMENT]

- **Micromotion study** is the study of the fundamental element or sub-divisions of an operation by means of a motion picture camera and a timing device which accurately indicates the time intervals on the motion picture film.
- GILBRETHs were concentrating on finding the very best way for doing work. They wished to determine the shortest possible time in which the work would be performed.
- They used timing devices of great precision and selected the best operators obtainable as subjects for their studies.

[HISTORICAL DEVELOPMENT]

- F. GILBRETH, also, developed two techniques, **cyclegraphic** and **chronocyclegraphic** analysis, for the study of the motion path of an operator.
- It is possible to record the path of motion of an operator by attaching a small electric light bulb to the finger, hand, or other part of the body and photographing, with a still camera, the path of light as it moves through space. Such a record is called a **cyclegraph**.

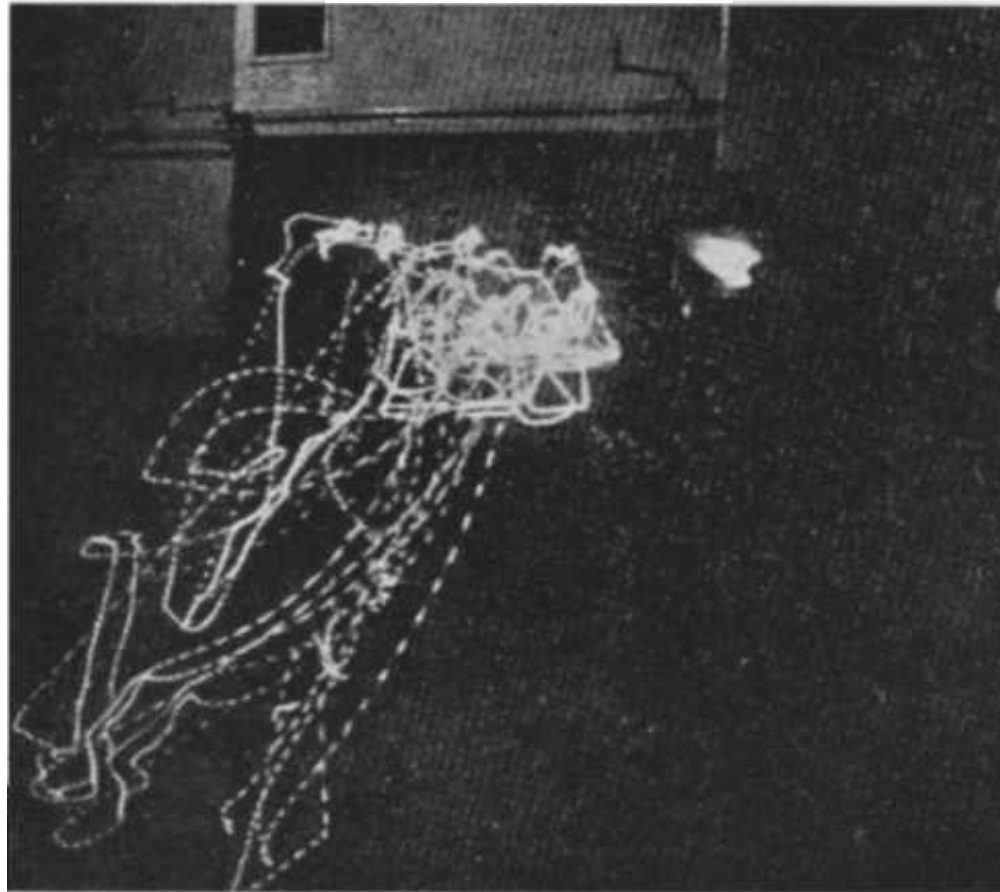
[CYCLEGRAPH]



[HISTORICAL DEVELOPMENT]

- If an interrupter is placed in the electric circuit with the bulb, and if the light is flashed on quickly and off slowly, the path of the bulb will appear as a dotted line with pear-shaped dots indicating the direction of the motion. The spots of light will be spaced according to the speed of the movement, being widely spaced when the operator moves fast and close together when the movement is slow. From this graph it is possible to measure accurately time, speed, acceleration, and retardation, and to show direction and the path of motion in three dimensions. Such a record is called a **chronocyclegraph**.
- From the **chronocyclegraph**, it is possible to construct accurate wire models of the motion paths. GILBRETH used these records to aid in improving methods, to demonstrate correct motions, and to assist in teaching new operators.

[CHRONOCYCLEGRAPH]



(Gilbreth Fatigue Study.)

Typical chronocyclegraph of the motion of a bricklayer, laying three bricks by the old method.