# 3 METHOD STUDY

## 3.1 METHOD STUDY

*Method study is the systematic recording and critical examination of existing and proposed ways of doing work, as a means of developing and applying easier and most effective methods and reducing costs.*

## 3.2 OBJECTIVES OF METHOD STUDY

Method study is concerned with finding better ways of doing work. It adds value and increases the efficiency by eliminating unnecessary operations, avoidable delays and other forms of waste. The main objectives of method study are as follow :

1. Improved working processes and standardized procedures.
2. Better work place layout and better working conditions.
3. Less fatigue to workers.
4. Better product quality.
5. Effective utilization of men, materials and machinery.
6. Efficient and fast material handling.
7. Reduced health hazards.
8. Efficient planning of the section.
9. Streamlined working procedures.

## 3.3 PROCEDURE OF METHOD STUDY

The various steps in carrying out a complete method study are as follow :

1. **SELECT** the work to be studied and define the objectives to be achieved. An objective may be to reduce
   (*i*) Manufacturing costs,
   (*ii*) Bottlenecks,
   (*iii*) Fatigue incurred by the workers.
2. **RECORD** all the relevant informations relating to the existing method in details and in the form of a chart to obtain a more clear picture of the same. Recording can be done by:

(*a*) *Process charts* :

(*i*) Outline process chart,

(*ii*) Flow process chart (Man type, material type and equipment type),

(*iii*) Two handed process chart,

(*iv*) Multiple activity chart.

(*b*) *Diagrams :*

(*i*) Flow diagram,

(*ii*) String diagram,

(*iii*) Cycle graph,

(*iv*) Chronocycle graph.

(*c*) *Method and film analysis :*

(*i*) SIMO chart.

(*d*) *Models etc.*

3. **EXAMINE** the recorded events critically and in sequence. Critical examination means answering a number of questions. An activity can be eliminated, simplified or combined with another. The basic questions are :

Purpose – What will be done ?

Person – Who will do it ?

Place – Where will it be done ?

Means – How will it be done ?

Sequence – When will it be done ?

4. **DEVELOP** the best method resulted from critical examination and record it. The developed method should be :

(*i*) Practical and feasible,

(*ii*) Safe and effective,

(*iii*) Economical,

(*iv*) Acceptable to design, production control and quality control.

5. **DEFINE** the new method so that it can always be identified.

6. **INSTALL** the best developed method. It involves three phases :

(*i*) Planning,

(*ii*) Arranging,

(*iii*) Implementing.

7. **MAINTAIN** the new method *i.e.* ensure proper functioning of the installed method by periodic checks and verifications.

## 3.4 INFORMATION COLLECTION AND RECORDING TECHNIQUES

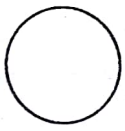
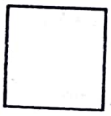
After selecting the work to be studied, the next step in the basic procedure of method study is to record all the relevant informations relating to existing method in details. Recording can be done with the help of following techniques :

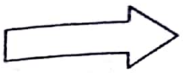
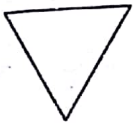
1. **Process Charts :**
   - (*i*) Outline process chart,
   - (*ii*) Flow process chart (man type, material type and equipment type),
   - (*iii*) Two handed process chart,
   - (*iv*) Multiple activity chart.
2. **Diagrams :**
   - (*i*) Flow diagram,
   - (*ii*) String diagram,
   - (*iii*) Cycle graph,
   - (*iv*) Chronocycle graph.
3. **Method and Film Analysis :**
   - (*i*) SIMO chart.
4. Models etc.

## 3.5 PROCESS CHART SYMBOLS

Charts are generally represented with the help of various symbols because symbols produce a better picture and quick understanding of the facts. Process charts use the following symbols to record different types of events.

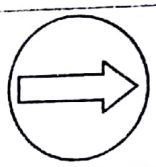
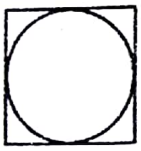
**Table 3.1 : Process Chart Symbols**

| S. No. | Symbol | Event | Description |
|---|---|---|---|
| 1. |  | Operation | Indicates the main steps in a process, method or procedure. Usually, the part material or product concerned is modified or changed during the operation.<br>Examples : Turing, drilling, milling etc.<br>– Welding, brazing and riveting.<br>– Lifting, loading and unloading.<br>– A chemical reaction.<br>– Getting instructions from supervisor.<br>– Taking dictation. |
| 2. |  | Inspection | Indicates an inspection for quality and/or a check for quantity.<br>Examples :<br>– Counting the quantity of incoming material.<br>– Checking the dimensions. |

| S. No. | Symbol | Event | Description |
|---|---|---|---|
| 3. |  | Transportation | Indicates the movement of workers, materials or equipments from place to place.<br>Examples :<br>– Movement of material from one work station to another.<br>– Workers travelling to bring tools. |
| 4. |  | Delay or temporary storage | Indicates a delay in the sequence of events.<br>Examples :<br>– Work waiting between consecutive operations.<br>– Operator waiting for instructions from supervisor. |
| 5. |  | Permanent storage | Indicates a controlled storage in which material is received into or issued from a store under some form of authorisation or an item is retained for reference purpose.<br>Example :<br>– Materials kept in stores to be distributed to various work centres. |



In addition to the above five basic symbols, there are symbols for combined activities also. The important event has the outer symbol.

| | | | |
|---|---|---|---|
| 1. |  | Operation cum-transportation | Example – Articles are being painted while transported by the chain conveyor. |
| 2. |  | Inspection-cum-operation | Example – A powder milk tin is being weighed (inspection) as it is filled. Both the events occur simultaneously and are controlled automatically. |

## 3.6 PROCESS CHARTS

*A chart may be a graph or diagram which gives an overall view of the process. It gives us quick information about the process.* It helps us in visualising various possibilities of improvement or alteration.

*A chart representing a process is called process chart. A process chart records the operations in sequence connected with a process with the help of process chart symbols.* The process charts are of three types :

1. Outline process chart,
2. Flow process chart (Man type, material type and equipment type),

3. Two handed process chart,
4. Multiple activity chart.

### 3.6.1 Outline Process Chart

*An outline process chart gives the bird's eye view of the whole process by recording only the major events sequence-wise. It considers only operations are inspections.* An outline process chart is shown in Fig. 3.1.

| | |
|---|---|
| Task | : Changing refill of a ball point pen. |
| Chart Begins | : Open the cap. |
| Chard Ends | : Close the cap. |
| Charted by | : ..... |
| Date | : ..... |

| Symbols | Description |
|---|---|
| ① | Open the cap of the pen. |
| ② | Unscrew the neck. |
| ③ | Remove the old refill from the barrel. |
| ④ | Insert the new refill |
| ⑤ | Screw the neck |
| 1 | Inspect whether the pen writes |
| ⑥ | Close the cap |

**Summary**

| Event | Frequency |
|---|---|
| ○ | 6 |
| □ | 1 |

**Fig. 3.1 : Outline Process Chart**

## 3.6.2 Flow Process Chart

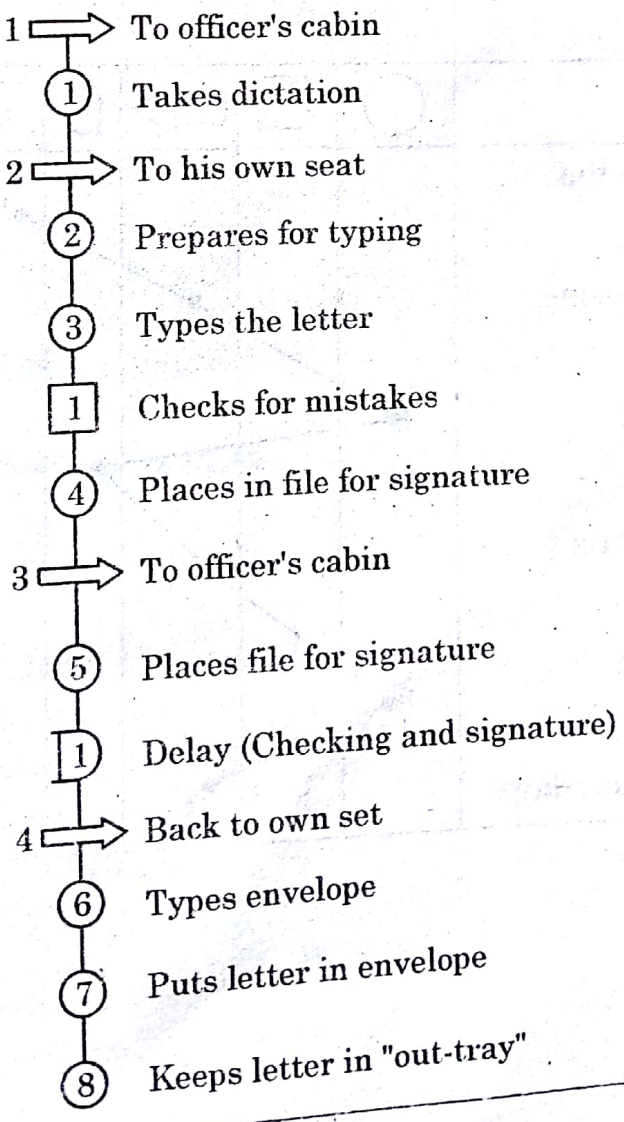
A flow process chart is the detailed version of outline process chart. It includes the information about delay, transportation and storage besides operation and inspection. *Thus flow process chart is the graphical representation of all the events occuring during a process i.e. operation, inspection transportation, delay and storage.* Flow process charts are of three types :

1. Man type,
2. Material type,
3. Equipment type.

### 3.6.2.1 Flow Process Chart - Man Type

*It shows the activities performed by man.* It is shown in fig. 3.2.

| | | |
|---|---|---|
| Task | : | Writing a letter |
| Chart begins | : | Typist in his chair in his office |
| Chart ends | : | Typist puts letter in "out tray". |
| Charted by | : | ..... |
| Date | : | ..... |



| Event | ○ | □ | ⇨ | D | ▽ |
|---|---|---|---|---|---|
| Frequency | 08 | 01 | 04 | 01 | – |

**Fig. 3.2 : Flow Process Chart (Man Type)**

### 3.6.2.2 Flow Process Chart-Material Type

*It shows the events which occur with the material.* It only is shown in fig. 3.3.

Task : Making the casting ready for machining.
Chart begins : Casting lying in the foundary store.
Chart ends : Casting ready for machining.
Charted by : .....
Date : .....

| Activity | Operations | Distance moved (*m*) | Time (min.) | Remarks, if any |
|---|---|---|---|---|
| | ○ □ ⇨ D ▽ | | | |
| Casting lying in the foundary store | 1 | – | – | – |
| Moved to gas cutting machine | 1 | 12 | 4 | By trolley |
| Risers cut | 1 | – | 6 | – |
| Wait for trolley | 1 | – | 8 | – |
| M oved to inspection department | 2 | 5 | 2 | By trolley |
| Inspection before machining | 1 | – | 15 | – |
| Moved to machine shop | 3 | 10 | 3 | By trolley |

Summary

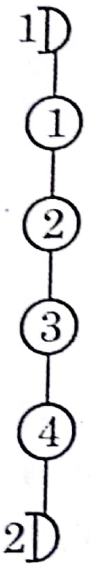
| Event | Frequency | Distance (m) | Time (min.) |
|---|---|---|---|
| ○ | 1 | | 6 |
| □ | 1 | | 15 |
| ⇨ | 3 | 27 | 9 |
| D | 1 | | 8 |
| ▽ | 1 | | – |

**Fig. 3.3 : Flow Process Chart -Material Type**

### 3.6.2.3 Flow Process Chart-Equipment Type

*It shows how equipments are used* ? It is shown in fig. 3.4.

| | | |
|---|---|---|
| Task | : | Machining the component |
| Chart begins | : | Machine idle. |
| Chart ends | : | Machine idle. |
| Charted by | : | ..... |
| Date | : | ..... |



1 D Machine idle

1 Job loaded on the machine

2 Machine starts for operation

3 Machine stops

4 Job unloaded from the machine

2 D Machine idle, job inspected. Wait for next job

**Summary**

| Event | Frequency |
|---|---|
| O | 4 |
| D | 2 |

### 3.6.3 Two Handed Process Chart

*A two handed process chart records the activities of both the hands of the worker in relation to each other.* This chart is generally used for repetitive works of short duration. Fig. 3.5 shows a two handed process chart.

Task : Assembling nut and bolt.
Charted by : .....
Date : .....

| Left Hand | Symbols L.H. R.H. | Right Hand |
|---|---|---|
| Pick up bolt | 1 — 1 | Idle |
| Hold the bolt | 1 — 1 | Pick up nut |
| Hold the bolt | 2 — 1 | To left hand |
| Hold the bolt | 3 — 2 | Assembling the nut on bolt |

**Summary**

| L.H. | | R.H. | |
|---|---|---|---|
| ○ | 1 | ○ | 2 |
| ▽ | 3 | ▽ | – |
| D | – | D | 1 |
| ⇨ | – | ⇨ | 1 |

**Fig. 3.5 : Two Handed Process Chart**

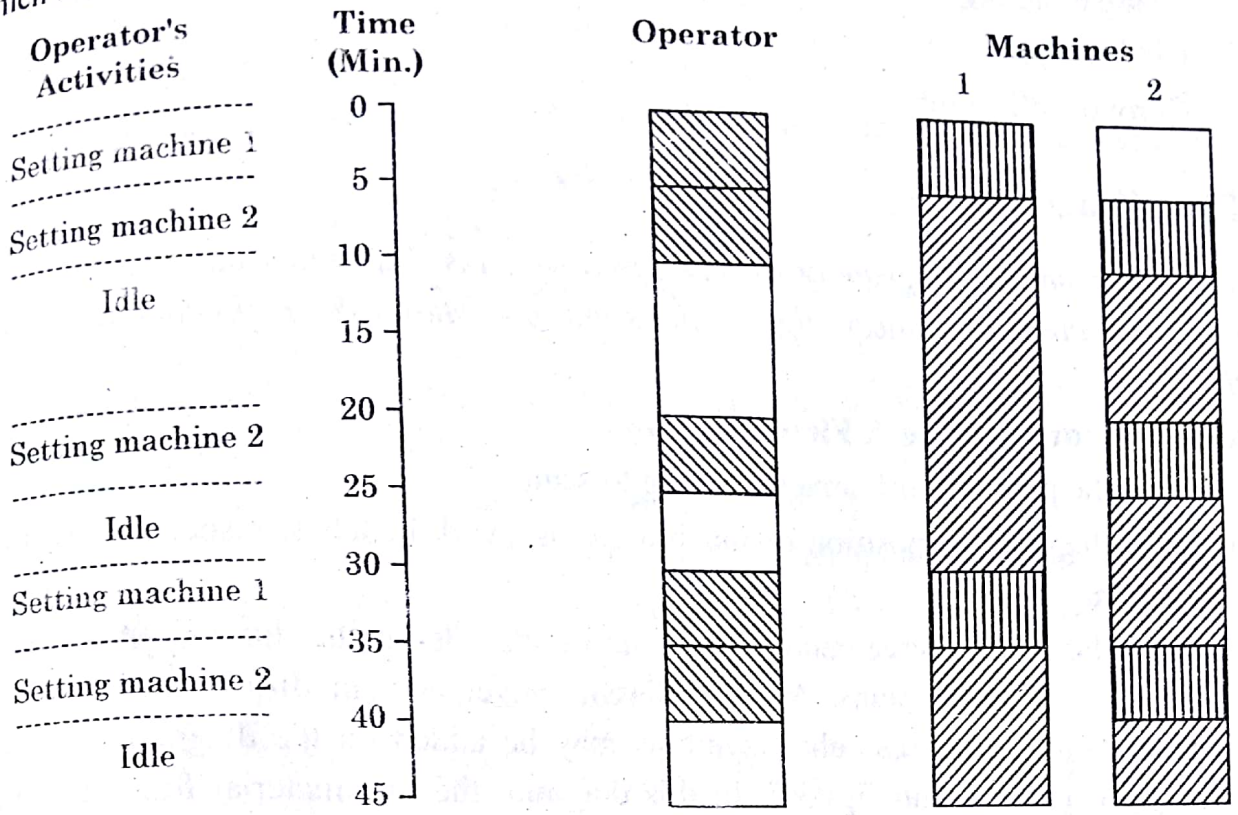
### 3.6.4 Multiple Activity Chart

*It is a chart where activities of more than one worker or equipment are recorded on a common time scale to show their inter-relationship.* The purposes of multiple activity chart are as follow :

1. To study idle time of the man and machine.
2. To determine number of machines which can be handled by one operator.
3. To determine number of operators required in a team to perform the given job.

**Construction :** The multiple activity chart consists of a series of vertical bars (columns) placed against a common time scale. Each subject (machine or operator) is allocated one column and the activities related to the subjects are represented on the respective columns. The common

time scale starts at zero and ends at cycle time of the job. The task to be recorded is broken into smaller elements and time for each element is measured with the help of a stop watch. The activities are then recorded in the chart in their respective columns. Fig. 3.6 shows a man machine chart which is a specialised form of multiple activity chart.




**Summary**

| | Working Time (Min.) | Idle Time (Mins.) |
|---|---|---|
| Operator | 25 | 20 |
| Machine 1 | 45 | – |
| Machine 2 | 40 | 5 |

Operator working
Idle time
Machine being set
Machine working

**Fig. 3.6 : Man Machine Chart**

The multiple activity chart is extremely useful in organising teams of operatives on mass production work. It is used to determine the number of machines which an operator can handle. It is useful in :

1. Reducing idle time of machines and operators.
2. Combine or eliminate some of the operations.
3. To explore ways to increase utilisation of men and machines.

## 3.7 DIAGRAMS

The process charts show the sequence and nature of movements, but do not clearly show the path of movements. For planning an ideal plant layout, it is necessary to visualise the movements

of men and materials. Certain diagrams are helpful to indicate the path of movements which are as follow :

1. Flow diagram,
2. String diagram,
3. Cycle graph,
4. Chronocycle graph.

## 3.7.1 Flow Diagram

*A flow diagram is a diagram of working area which is drawn to scale. It shows the relative position of production machinery, jigs, fixtures etc. and shows the paths followed by men and materials.*

**Procedure For Drawing A Flow Diagram :**

1. Draw the plan of work area according to scale.
2. Mark the relative position of machine tools, work benches, inspection booths, stores, racks etc.
3. Mark the actual movements of men and materials on the diagram. Also indicate the direction of movements. Mark different movements in different colours for better understanding. Process chart symbols may be added on the diagram. A simple flow diagram is shown in fig. 3.7. In this diagram, the raw material from store moves to station P where an operation is carried out to convert it into semi-finished product. The semi-finished product moves to station Q where another operation is carried out. It then moves to station R for inspection and finally, moves to bench S where it halts for a short while and ultimately, goes out of the factory.

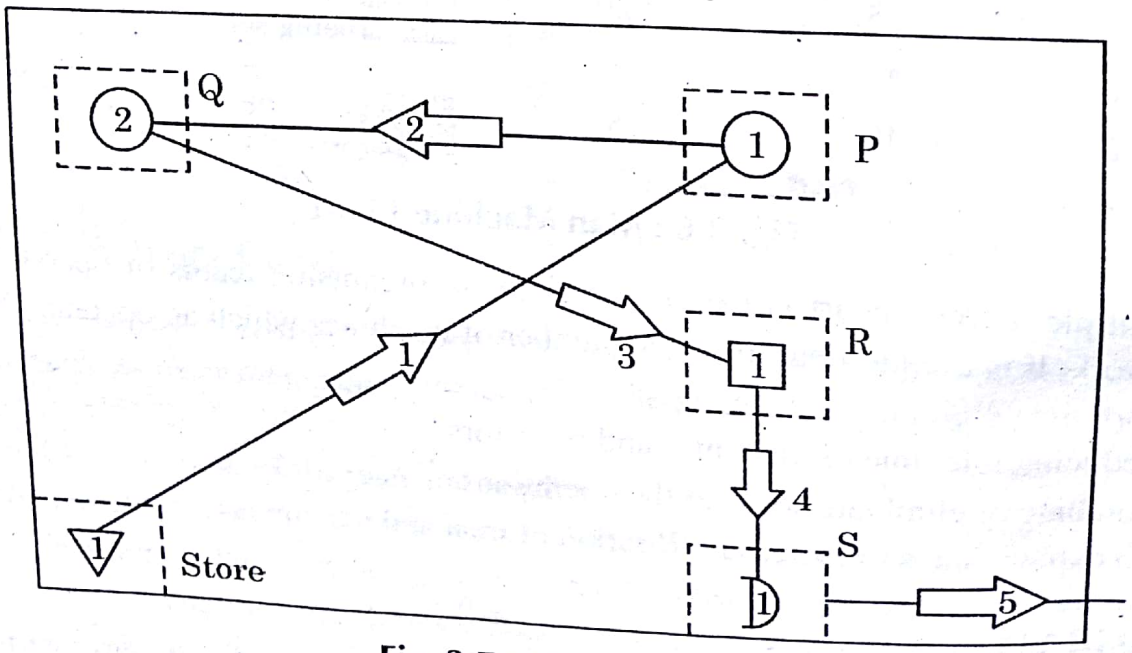



**Fig. 3.7 : Flow Diagram**

### 3.7.2 String Diagram

*String diagram shows the movements of men and material during the production process with the help of strings.* It is a diagram which is drawn to scale. Every machine or equipment is marked on the diagram and a peg or pin is struck in the area showing a facility. A continuous coloured string traces the path followed by men or materials while performing a particular operation. This diagram is useful when the movements of men and materials are many and repetitive and flow diagram becomes congested which is very difficult to understand.

**Procedure for Drawing a String Diagram :**

1. Draw the plan of work area according to scale.
2. Mark the relative position of machine tools, work benches, inspection booths, stores, racks etc.
3. Mount this drawing on a soft board and strike pegs or pins at all the places which form the path of men and materials.
4. A continuous coloured string is wound from the first to last peg to show the path followed by men or materials. The thread when measured gives the total distance approximately travelled by men or materials. Fig. 3.8 shows a string diagram.

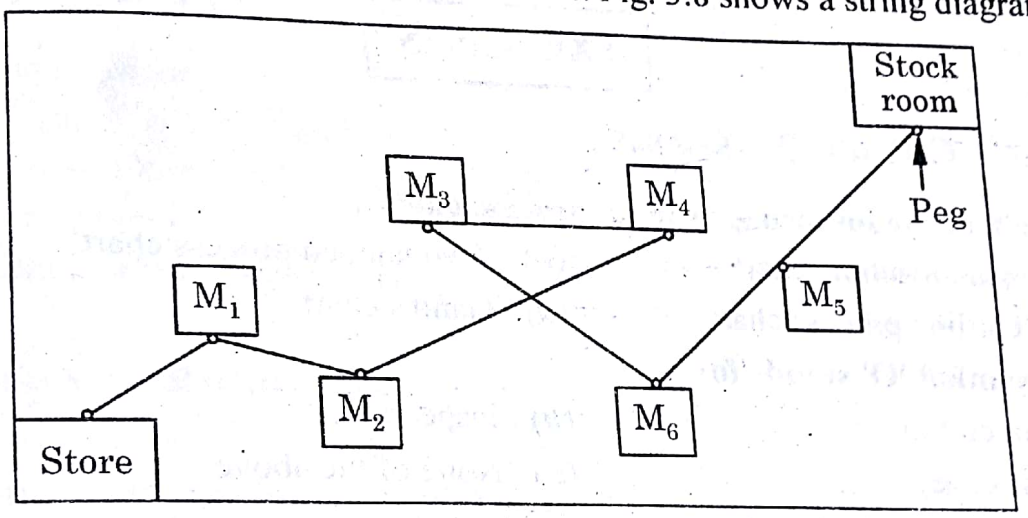



**Fig. 3.8 : String Diagram**

### 3.7.3 Cycle Graph

*This is the technique of analysing the path of motion made by an operator* and was originally developed by Gilbreth. To make a cycle graph, a small electric bulb is attached to the finger, hand or any other part of the body whose motion is to be recorded. By using still photography, the path of light of bulb (in other words, that of the body member) as it moves through space for one complete cycle is photographed. The working area is kept relatively less illuminated while photograph is being taken. More than one camera may be used in different planes to get more details. After the film is developed, the resulting picture (cycle graph) shows a permanent record of the motion pattern employed in the form of a closed loop of white continuous line with the working area in the background. A cycle graph does not indicate the direction or speed of motion

It can be used for

1. Improving the motion pattern,
2. Training purposes in which two cycle graphs may be shown with one indicating a better motion pattern than the other.

### 3.7.4 Chronocycle Graph

The chronocycle graph is similar to the cyclegraph, but the power supply to the bulb is interrupted regularly by using an electric circuit. The bulb is thus made to flash. The procedure for taking photograph remains the same. The resulting picture (chronocycle graph), instead of showing continuous line of motion pattern, shows short dashes of line spaced in proportion to the speed of the body member photographed. Wide spacing would represent fast moves while close spacing would represent slow moves. The jumbling of dots at one point would indicate hesitation of the body member. A chronocycle graph can thus be used to study the motion pattern as well as to compute velocity, acceleration and retardation experienced by the body member at different locations.

The world of sports has extensively used this analysis tool, updated to video, for the purpose of training in the development of skill.