

## The Relations of Time Study and Motion Study

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THE AIM of both time study and motion study is to eliminate waste, to enable the worker to increase his production and his wages without increasing his effort, and the employer to provide the conditions necessary for this. Thus, motion study and time study are fundamentally complementary. There may be disputes as to relative importance and overlapping of activities, but the settling of these should furnish no serious problem.

Time study has been defined as a method of finding "how long it takes to do work"; motion study as a method of finding "the best way to do work," that is, how the work should be done. Each supplements the other. It would seem self-evident that one should discover *how* work is to be done before attempting to time it; also, if one has discovered how it should be done, that it should be necessary to find out *how long* it takes to do it in this way, in order to make the proposed method standard and compare it with older or newer methods.

If, then, we take time study and motion study in the broader sense of the terms, their relations must be co-operative, if either is to do good work. Each requires the other. If we take the two terms to signify two competing techniques in method study, we may come to some differences needing to be reconciled. Perhaps an outline of the technique of motion study, with which the writer is better acquainted, will help toward this.

Motion study starts always with a survey. This is useful in any type of problem, whether the work involves many people or few, is repetitive or not, and whatever the kind of activity involved. The first point is to find out some of the factors that enter into possibilities for saving money, time and effort. These all govern the amount of methods investigation that will be profitable. If the work is to be done by many people, if for only a short time; or even by only a few people many times, or if it contains elements of motions which are common to many jobs, then detailed motion study is warranted.

The preliminary survey records, in such detail as may seem advisable, the type of worker being

used, the condition of the work place, surroundings, equipment and tools, and the method being used to do the work. The device used by motion study for this is the process chart, which visualizes the method and includes sketches of the work place and such notes on the workers' characteristics as seem useful. The process chart makes it possible for everyone interested in the study to participate in a group discussion, for it records and visualizes what is going on, and presents specific topics for consideration. Its study suggests operations which may be eliminated, and combinations or simplifications which may be made. It also assists in determining the amount of detailed investigation that each subdivision of the operation deserves. It does not record time, for time is not the determining factor in an efficient work process, though it is important and must be considered later.

If the activity studied is a short time one, if further study is not justified for any other reasons, or if the results of the charting are so satisfactory that no other study is thought necessary at the time, the derived method is timed in any way desired. So far this is, in all essentials, the method used by the "time study" group, though they may use some other device than the process chart, and always use the stop watch for getting the time.

At this point motion study uses the technique of micro-motion study to help find the best method for doing those parts of the activity which justify more refined study. A film is made, using either the large or the small film, which records the special fast moving clock with the activity in the picture. Thus the exact motion cycle, and elements of motions, are recorded with the time to a "wink," or .0005 of a minute.

From these films charts are made that place in comparable form the work and rest motions and the times of the various workers filmed. These simultaneous motion cycle charts present the data from which the one best available method is to be derived. They show the most efficient motion cycles of the most efficient workers—some fast, some lazy, some rhythmic, but all efficient workers. From the records on these charts are selected, after careful comparative study, the elements of motions that are judged best for performing the activity. The selection and combination of these elements into a proposed standard method is the difficult part of micro-motion study and calls for all the natural

aptitude, training and experience of the person making it. It is also, however, the part of micro-motion study that gives the most rigid and worth while training in thinking in motion economy.

The selected motion-element units are combined into a proposed method which is then tested by the rules for motion economy and for developing skills and satisfactions. These rules, which had to do at first only with the application of findings from the field of engineering, that is, mechanics, physics, etc., are now being supplemented by others from the fields of physiology, psychology and psychiatry. The work in this field is just beginning. A group of graduate students in social economy at Bryn Mawr, co-operating with the motion study group, has contributed much this year to work in this field. We hope within a few years to make a progress report, outlining technique and results, that will be of service.

The "one best" method as finally derived and standardized is understood to be only useful so long as the given workers, work place and conditions are maintained. It is, like the usual standard of scientific management, not a formula to be prescribed indiscriminately for everyone, but a norm from which to calculate individual differences. Our skills and satisfactions studies are helping us to understand both the "one best person," given the "one best way," and also the individual differences which make modifications necessary.

The times of the elements of motions, which were recorded on the films and transferred to the simo chart, are essential in distributing the activities to the various parts of the body, and make it possible to check the proposed method with the method it superseded. The new method is almost always, but not necessarily, shorter. It is much more important that it contain a smaller number of "therbligs," or elements of motions, or that the activity be more equally divided and distributed among the different parts of the body, than that it take the shortest possible amount of time. Fatigue and the related skills and satisfactions are much more significant than time. The accurate times are available, however, for use when needed.

The results of the micro-motion study are incorporated in instruction sheets and standing orders and used as material for setting rates. Useful as this micro-motion study is as a device of motion study which makes it possible to get accurate data,

it is still more useful in training the person who makes it to think in terms of motion economy. It is the rigid discipline of this method that makes it possible to get the most value out of such a preliminary motion study survey as was outlined at the beginning of this paper. Through the process of making a micro-motion analysis and synthesis, the person making the study, everyone being studied, and even everyone interested in or observing the study, get a certain amount of experience in methods of motion economy. This is the extensive contribution of micro-motion study just as the data gathered are the intensive contribution.

The uses of motion study are:

1. It assists in selection and placement.
2. It acts as both teaching and methods data.
3. It is a guide for invention.
4. It is a check on machine design, construction and operation.
5. It derives (a) the best available method, given the available workers, work place and tools, and (b) the best possible method, so far as available suggestions at the time can go.
6. It enables every member of the organization using it to have at his disposal a method of thinking in terms of motion economy and better work methods.

It is of course for time study to outline its own technique and to indicate to what extent motion study is used or could be serviceable. We feel that both the study of motions and the study of times are essential to method study or job analysis. Micro-motion study and stop watch time study are two ways of recording work methods and the time that they take. Each has its place. Motion study, as practiced by our group, uses the stop watch where it can do the work adequately. We believe, however, that the film data are more accurate, and more useful for teaching purposes, and therefore that the micro-motion method is advisable in many more cases than are generally recognized. The decreasing cost of films, cameras, etc., often makes the micro-motion record cheaper than the stop watch record. The simo charts and the synthesis work demand both time and effort. The cost is always predetermined, however, and an adequately trained motion study man makes his work pay immediately as well as ultimately.

Whether the films and other devices of motion study are used or not, its methods of studying