

19. Selections of the records to be used and averaged is left to judgment, not determined by measurement. (Page 12. "The striking out of abnormal values, either excessively higher or lower than the average of all the individual times of the same element, is a detail that calls for fine judgment on the part of the time study man.")

20. While the "curves" given are based on "data from a vast number of time studies" (page 15), the data are all inaccurate. No amount of intricate mathematics and carrying out of results to the n -th decimal point can make the results more accurate than the original data.

21. The preparation time is inaccurate. (Page 16. "The time allowed for performing these operations is standard, being arrived at from previous time study, and, in some cases, is more or less liberal.")

22. The time allowed for probable or possible delays is inaccurate. (Page 16. "To the preparation time an arbitrary allowance of 25 per cent is made to offset any variation, interference, etc.")

23. These are only a few typical objections that can be cited against stop watch time study. They are given here to illustrate the method of this attack. We have already prepared a review of the balance of the entire book in this manner, for future presentation. The reason for criticism will be given later in this paper.

24. Against this method of deriving standards, we place the method of accurate measurement and present a standard from which just and satisfactory allowances will be made for conditions of practice—a standard suitable for the instruction, assistance and profit of those who will actually do the work.¹³ This standard is the *one best way to work*.¹⁴ It is the best method obtainable at present, derived from accurate records that are in every case made by instruments of precision, without either the suspicion or the fact of personal error and that enlist the co-operation of the workers because they are indisputably accurate and fair.

25. Previous indictments of stop watch time study have been largely made from the psychological standpoint, psychology being understood as "the science of human behavior."¹⁵ The early history and records of

stop watch time study show that there was no recognition of the fact that the worker's craft knowledge, craft skill and co-operation were necessary if interchangeable records of permanent value were to result. Frequently records were made not only without the workers' co-operation, but even without his knowing that such records were being made.¹⁶ This is not to discredit the early users of the stop watch method, but is indicative of the state of industry at that time and of a lack of knowledge of the close relation in both theory and practice between the laws of psychology and the problems of successful management.

26. With the gradual appreciation of the laws of psychology and the importance of their application, some few, but not all, of the causes of the psychological objections to stop-watch time study have been gradually disappearing, until today secret stop watch time study, which was once so common, has become practically a thing of the past, and such things as "hidden watches in watch books,"¹⁷ used for secret time study and for spying upon the workers, are obsolete, not only because they were unethical and in many cases unfair to the workers, but also because any time study made without the full co-operation of the worker is not worth the money value of the time it takes to obtain it. It may be well also to call attention to the difference between "full co-operation" of the semi-passive type and the "enthusiastic, hearty co-operation" that exists when workers desire to contribute their craft knowledge and craft skill in detail to fellow workers and coming generations on the permanent photographic record.

27. These statements and others to follow must in no wise be taken as an implied criticism of Mr. Taylor, the great founder of stop watch time study, who was the first to make practical method of predetermining "the time it takes to do work," or in other words the possibility of prophesying "how much work can be done in a given time," by timing the work periods and the rest periods separately, nor of Prof. Wentworth of Phillips Academy, Exeter, from whom Mr. Taylor says that he first got the idea of using a stop watch for timing work.¹⁸

28. The recognition of the importance of timing in

¹³"Shop Management," A. S. M. E., paragraph 332, Harper, page 152. Note that Taylor does not approve of "spying upon the workman."

¹⁴"Shop Management," A. S. M. E., paragraph 332, Harper, page 153.

¹⁵Tuck School Conference.

¹⁶"Applied Motion Study," Chapter IV "Motion Study and Time Study Instruments of Precision."

¹⁷"The One Best Way to Do Work," Society of Industrial Engineers, May, 1920.

¹⁸Edward Thorndike, "Educational Psychology," Volumes I, II and III. Stephen S. Colvin, "The Learning Process," "Human Behavior."

one group, or as one unit, many cycles of motions, which Taylor called "elementary time units," instead of timing "overall" or "elapsed time" or "production studies" for a complete operation as had been commonly done previously, was a milestone in the progress of management.¹⁹ But it must be remembered that these "elementary time units" were elementary only so far as the limitations of the crude method of stop watch timing was concerned. Also, though Taylor realized the importance of timing the smallest units possible, the most that could be done with the stop watch method was to time units consisting of groups of several cycles of motions. These so-called "elementary time units" must not be confused with the sixteen subdivisions of a cycle of motions or with the methods of motion study used in analyzing and measuring them.²⁰

29. The methods used by Mr. Taylor at an early stage in the development of management, the devices used by him early in his career, were the best existing at that stage of the art. The attitude of the management and of the public at large toward the worker was so different then from what it is today that the generation just entering industry can scarcely realize it.

30. One need go back but a few years to find a lack of knowledge of psychology in general and in particular of the laws and phenomena of behavior, of habit formation, and of the phenomena of automaticity, the learning process, especially learning through the eye and the variables of skill study as well as of the effect of the emotions and intellect upon activity to be astounded. It must be remembered, however, that the science of psychology itself has advanced enormously since Taylor's early days.

31. It is less than a decade ago that psychology of management was practically unknown, and often confused by the general public with psychiatry or phrenology or investigations into the field of psychic phenomena. Today the findings of the science of psychology have become tools for thinkers in all lines of endeavor.

32. Most stop watch time study advocates have recognized the justness of many of the psychological

¹⁹"Shop Management," A. S. M. E., paragraph 386, Harper, page 169.

²⁰"Applied Motion Study," Chapter VII "Motion Study for the Handicapped," pages 25-33.

"We have always been and are still unalterably opposed to secret time study and have never practiced it nor permitted our employees to practice it, although our tele-micromotion apparatus will record a man's motions and the times a mile away as easily as a "close up."

criticisms, and have done away with, yes proved away with, "secret" time study.²¹ The stop watch method now, in most cases, includes attempts to enlist the co-operation of the worker, and is gradually coming to acknowledge the necessity of recording behavior when recording time, as well as recording surrounding conditions as variables affecting behavior, fatigue and production.

33. With the stop watch method, behavior cannot be recorded. It is the accurate recording of behavior and the surrounding and influencing conditions that has made motion study a science, and that has made possible the derivation, teaching and perpetuation of the one best way to do work. That the stop watch method can never lead to the one best way can be realized by a moment's consideration of the vast number of possible combinations and permutations of the true "elements" performed in any operation too rapidly for the eye to see. Such consideration will convince anyone that accurate records, fit to serve as a basis of permanent methods and teaching, can be obtained only by motion study. "Motion study," as here used, does not mean the kind of motion study that has been carelessly and erroneously described and written of as being "the same as time study," or "a part of time study." Motion study, as used here, means the science of recording motions, of which "time" is but one of scores of variables.

34. The psychologists have done more than point out the failings, incompleteness and mistakes of the stop watch time study methods. They have indorsed the scientific method of recording the surrounding conditions simultaneously with the motions and the times, with instruments of precision, free from personal error, leaving the motion study man's eyes, mind and attention free for coaching the observed man, that his record may more nearly approach the one best way and be more worthy of the care, skill and film that are used to make the record. They have used such records in their investigations of behavior as affected by habit, fatigue, power of decision and other variables affecting the learning process and the achievement of greatest outputs with least effort.

35. Meanwhile, scientific management has been sneered at and has been the object of constant joking and scorn, because it is perfectly obvious to any scientist that, as often practiced, it has little claim to be called scientific, so long as it depends for its fundamental data upon "averages" of inaccurate stop watch time study that does not record the surrounding conditions at the time that the records are made.