

Efficiency or Effectivity?

ONE of the most difficult problems which confronts all investigators who have to deal with man as a worker, is the assessment of his fitness to produce. The accurate determination of the degree of fitness of the man to perform his work has never been satisfactorily elucidated, so that reliance is placed most frequently on the measure of his productiveness as shown, say, by the number of articles produced, the quality of his work, the time taken to perform selected operations, alterations in skill of performance, etc. Further, when it is desired to refer to any alteration, either by way of enhancement or diminution, in the individual's capacity to carry on any particular operation, it is generally said that the man's *efficiency* is increased or diminished.

It is true that modern usage, as indicated by the "New English Dictionary," for example, authorises a definition of the word *efficiency* as "fitness or power to accomplish, or success in accomplishing, the purpose intended"; and as another meaning it gives "efficient powers or capacities." Colloquially the word *efficiency* is commonly used, with perhaps even wider significance, as a synonym for power to perform, for the conduct of business with energy and with the minimum of waste, not only on the part of single individuals but also of groups of workers.

It has, of course, long been recognised that the term *efficiency* is neither a scientific nor, in the light of modern knowledge, an apt one by which to refer to the individual's change in capacity. The engineer has appropriated to his own technical vocabulary a word which had long been in common use, and as a result it has come to have a very definite connotation in engineering, and even in physiological, science. When used by the engineer it is, as a rule, qualified by some adjective indicative of the particular type of efficiency to which he is referring. Thus he may speak of mechanical or thermal or thermodynamic efficiency.

The physiologist, too, has investigated the efficiency—in the engineering sense it would be the over-all thermal efficiency—of the human body and has arrived at very definite results. While it is open to question whether a mode of calculation suitable in the case of the development of energy in a mechanical apparatus, like a steam engine, is applicable to the series of metabolic processes common to the human body, where, it must be remembered, food serves not only for yielding energy but also for the repair of tissue waste, no serious objection can perhaps be taken, provided the limitations of the method are kept in mind.

As an alternative to the displacement of the term *efficiency* from the engineer's vocabulary, a feat which would be practically impossible of accomplishment, we must be prepared either to use the word with a double significance or else find a substitute. It is clear that the common usage of the term in connexion with everyday labour of all kinds cannot be justified. We have no right to refer to the increased or diminished efficiency with which a man performs a specific piece of work if we, at the same time, take no cognisance of the data which must be determined before the actual efficiency of production may be considered. The use of the word *efficiency* is then simply a loose colloquial way of referring to a general condition of human well-being with absolutely no reference whatsoever to the true scientific meaning of the term.

When we speak of efficiency in this general way, what we want to express is, that the individual in question is performing his work in the most effective and useful fashion. In other words, the idea we wish to convey has nothing to do with that other determinable factor involved in man's productive powers,

namely, the ratio of his energy expenditure in the form of useful work to his intake of energy or to his total expenditure of energy, but simply with the degree of effectiveness with which the work is done.

In view, then, of the confusion of ideas which must arise when the same word is employed to define two very different types of phenomena in man, it is suggested that it would be best to employ two words. Let the word *efficiency* be confined, whether fully justified or no, to the ratio of the energy exchange in the performance of work, but in order to cover the much wider field, where there are no special but innumerable general physiological or physical determinants, and where we wish to speak of enhanced or diminished capacity to perform, it is suggested that a word like *effectivity* might be more fitly employed. Such a word commits us to no underlying single series of physiological phenomena, but is perfectly general, and refers merely to the sum total of the factors which lead to effective production, and it can therefore be suitably applied to a wide range of activities of individuals or groups of individuals. The word has been selected as the most suitable from a number of alternatives, all, more or less, expressing the same general idea.

As a practical illustration of the difference between "efficiency" and "effectivity" one of the experiments which I published in conjunction with Prof. F. G. Benedict may be cited. We determined the efficiency of a highly trained subject doing most strenuous work on a bicycle ergometer for more than 4 hours. His efficiency at the start was 23.1 per cent., and in the observation made just before the experiment ended, due to the impending collapse of the subject, it was 21.3 per cent. One can state, then, in this extreme example, that although there was but a small reduction in the subject's efficiency, his effectivity at the end was nil.

It may be remarked in conclusion that certain of the German workers have found the same difficulty, but, so far as I am aware, none of them has suggested a term to cover the idea which it is desired to express. Effectivity, if it find acceptance, might be utilised by German workers as 'Effektivität.'

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The Mechanism of the so-called 'Posterior Sucker' of a Simulium Larva.

THE manner in which a Simulium larva fixes itself to rocks and water weeds in very rapid running water has hitherto been a matter of dispute among naturalists. Some have supposed that the so-called 'posterior sucker' of a Simulium larva functions in the same way as does the sucker of a leech, and it is only recently that Tonnoir (*Ann. Biol. Lacustre*, 11, pp. 163-172; 1923), not finding any muscles inserted in the middle of the disc, doubted its utility as a true sucker and ascribed the function of attachment to the hooks alone. Dr. Puri (*Parasitology*, 17, pp. 295-369; 1925), to whom we are indebted for a monograph, "On the Life-history and Structure of the Early Stages of Simuliidæ" (1925), has demonstrated the presence of fairly strong muscles connected with the centre of the disc, and he has observed "that they contract when the larva fixes itself by its posterior end." But he further points out that "in spite of the presence of these muscles the larva cannot fix itself effectively without the further help of the sticky salivary secretion; a fact which may mean that the saliva helps to fill up the spaces between the hooks and thus to form a complete rim all round."