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Craftsmanship in Modern Industry.

IN the building of the Jewish tabernacle some 3500 years ago a very high order of skill was demanded, and implied not only all manner of workmanship in metals, stones, and wood, every kind of cunning work, but also wisdom, understanding, and knowledge. The spirit of Bezaleel has persisted down to this day, and there are still clever workmen, possibly more in Great Britain than in any other country, unspoiled by excessive specialism, highly trained in hand and brain, and of dependable character. But, as Prof. Marshall has observed, skill is a very elastic and relative term, and has varying standards according to the state of general education among a people, their progress in industrialism, and their gifts of mother-wit or native sagacity.

Of late years the view has rapidly gained ground that skill, as generally understood, is required in modern industry in ever-lessening extent; the demand for it declines at an ever-accelerating pace. That the division of labour, extreme specialism, mass production, and scientific management are predominant features of industry to-day is generally taken for granted, though possibly they are not so predominant as is sometimes imagined; and in the degree to which they have been adopted there is probably no doubt that they have involved an increase in the amount of unskilled and possibly monotonous work, both absolutely and relatively. In any event, we are told that the quicker the whole of industry adopts these principles the better, unless it would perish miserably; and when these principles have been adopted, then skill, as we ordinarily understand it, will have become an anachronism. Perhaps it would be better to perish. Certainly the social effects of any substantial decline in the amount or degree of skill demanded from the whole body of industrial workers, including herein clerks, salesmen, draughtsmen, etc., would be deplorable; and there is no need here to elaborate on the philosophy of work and all that it implies in development of character and much else. The paramount need of work of the right kind for every healthy human being is well understood in all its implications.

Faced with such an apparently dark and perilous outlook, somewhat akin to that portrayed by those who speak glibly of the so-called 'machine terror', the economist and student of industry must make it his business to examine thoroughly such alleged tendencies and impressions, and, avoiding vague generalisation unsupported by tangible evidence,

endeavour to get down to a quantitative basis, secure measurable data, and so place the whole discussion on a strictly scientific footing. If economics is the science it claims to be, it should be able to do this. On the assumption, which cannot always be fully acceded, as will shortly be shown, that skill is rapidly dying out, various remedial suggestions have been made; such, for example, as more frequent change of occupation in the factory—a common practice in the Ford works; also, with or without a shortening of the hours of repetitive work, greater opportunity in leisure hours for some form of handicraft or hobby or ‘satisfying’ recreative work. This latter is certainly in any case a meritorious movement and should be heartily encouraged, as in Italy, where concentrated attention is now being directed to what is called *dopo lavoro*, or after-work occupation.

There are other factors which would militate against the alleged decline in the demand for skill which have not been so much consciously or purposely introduced, but have developed or evolved as industry itself has developed. But to take full advantage of these new growths, it is of course necessary to widen our definition of industrial worker to include not only the men and women in the factory, but also those in the office, for example, the clerks, salesmen, draughtsmen, and other categories. For these must be included if the aggregate amount of skill is in question, and thus at this point we are entitled to emphasise very strongly the fact that these categories have grown enormously of late years, and are constantly growing in proportion as the need for highly trained men in these different spheres becomes more keenly realised. They are characteristic of the modern age: salesmanship and publicity in the olden days were unknown or existed in a very crude form; accountancy, especially costing, the keeping of factory records, and all the multifarious operations involved in the management of a modern factory were formerly almost non-existent, but require to-day large numbers of highly skilled men. Consider also the numbers now employed in the drawing office, the research department, on intelligence and other work, and it will be realised that in the vast complexity and super-organisation of modern industry there are an almost infinite number of openings for highly trained men. The demand for such men, indeed, is often said to exceed the supply.

However, it is not proposed to make too much of these new developments, or to rely on them entirely to refute the common assumption of

decaying skill. They at least entitle one to say that skill is not necessarily reduced in the aggregate, but rather changed in direction. From the point of view of the skilled or cunning workman, in cases where he has not migrated into one of the many new openings noted above, there is no doubt that in the design and manufacture of the wonderful and intricate machinery by which alone mass production is possible, the skilled workman is finding an ever-widening field; and who can say that the present form of mass production, with possibly a maximum utilisation of unskilled labour, is the final form or development of modern industry? All things industrial are in flux and transition. No doubt it is difficult enough sometimes to discern very clearly whither we are travelling. At present, industry has brought about a vast number of opportunities for unskilled work requiring little or no training, and much of this work has been taken over by women who otherwise would not go to work at all, although a few more might go into domestic service than is now the case. The position of the male workers who alone, apart at least from the textile trades, can come into comparison between the present and the past in the matter of skill is to this extent almost unchanged.

Remarkable confirmation of this conclusion, so far as it concerns an industry where mass production is predominant, has recently been given by Mr. C. G. Renold, of Messrs. Hans Renold, Ltd., Manchester, in a recent paper in the *Economic Journal*, providing that quantitative basis so much needed in these discussions. The works’ records include an analysis of employees classified according to skill at three different periods—1913, 1927, 1928. Skill is used in an industrial sense and includes the black-coated groups. It implies dexterity, knowledge, judgment, and takes something like two or three years to acquire under actual experience of the job. Tables are given showing, *inter alia*, (1) increase in craftsmen category; (2) reduction in semi-skilled machine operators and unskilled labourers owing to use of more elaborate machinery giving greater output with less manning, the increased use of skilled men on such machines, and more women for unskilled work; (3) less ‘upper staff’ and ‘male clerical’; (4) large increase in number of women employed. Other tables give interesting data as to output per worker in relation to prices and wages, showing large increase in efficiency with consequently reduced costs and higher wages.

On the whole, the outlook for the skilled worker, using this term in the wide sense which is legitimate

for industry to-day, is not nearly so hopeless as might at first sight and on superficial grounds be thought. But it is vitally important not to rest too securely on this conclusion. It is sound enough, perhaps, so far as it goes, but the complexities and reverberations of industry go deeper and further. To the social philosopher it has long been patent that skilled labour is not now quite so satisfying or so intellectually stimulating as in the past, not because it has become less in degree or extent, but because the worker himself has changed and demands more from life. Therefore in weighing the satisfaction or mental stimulus to be derived from work, it is necessary to remember that a more highly educated type of artisan, enjoying all the modern educative facilities of travel, wireless, etc., will be much more sensitive to moral and intellectual influences, prevailing currents of thought and mysteriously floating ideas, than he was in the olden days. The skill and dexterity required of him in his work will be much but not all. But still Bezaleel remains among us: the man who puts his whole heart into his work and asks for nothing more.

### The March of Mathematics.

*Proceedings of the International Mathematical Congress held in Toronto, August 11-16, 1924.* Edited by Prof. J. C. Fields, with the collaboration of an Editorial Committee. Vol. 1: *Report of the Congress; Lectures; Communications to Sections I and II.* Pp. 935. Vol. 2: *Communications to Sections III, IV, V, and VI.* Pp. 1006. (Toronto: The University of Toronto Press, 1928.) n.p.

TWO stately volumes commemorate the meeting of the International Mathematical Congress at Toronto on Aug. 11-16, 1924. Although the receding shadow of the War caused some notable absences, yet thirty-three nations, some of them newly born, from all parts of the earth, sent some 450 mathematicians, who made 249 communications varying over the whole field of mathematical endeavour. Six sections were the basis of the classification, four covering the ordinary range of pure and applied mathematics, and the fifth and sixth devoted to statistics, actuarial science, economics, history, philosophy, and didactics. For myself, I presided at one sitting of one of the sections, and felt strongly the truth of the description (by a distinguished scientific worker) of all such congresses, that they resembled, both in extent of subjects and diversity of tongues, the last stage of the Tower of Babel.

Eight formal lectures, however, gave valuable

surveys of branches of knowledge by savants, becoming rarer every day, capable of envisaging wide fields of mathematical endeavour. The names of the lecturers, Cartan, Dickson, Le Roux, Pierpont, Pincherle, Severi, Størmer, W. H. Young, are sufficient indications of the value of these addresses. It is, perhaps, invidious to select any one of them, but what could be more stimulating and more provocative than the lecture of Dr. W. H. Young on "Some Characteristic Features of Twentieth Century Pure Mathematical Research"? I will mention only two extracts.

"In proportion as knowledge of mathematical theories has increased, the interest in purely formal work has diminished even in England, which may perhaps be said to have been its last refuge. It has begun to be understood all over the world that a mathematician is only a calculator when he must be. He is by nature a creator, a poet, not an artisan, an architect, not a mere builder."

"The question nowhere arises in Pure Mathematics whether there is anything in Nature corresponding even approximately to a mathematical concept."

Perusal of this lecture is strongly recommended both to those who agree and to those who disagree with it. It was perhaps owing to its difficulty that a similar survey of applied mathematics was not possible. To one standing outside the field of pure mathematics, it seems that Fourier's oft-quoted "l'étude approfondie des lois de la Nature est la source la plus féconde des découvertes mathématiques" requires some extension. For while it is true that many branches of pure mathematics have arisen in this way, it is also true to say that many branches seem to languish and almost die until revived by some new physical theory, for example, the impulse given to Riemannian geometry by the theory of relativity, and is it not likely that recent quantum speculations will stimulate the study of matrices, normal functions, characteristic numbers of differential equations, etc.?

Cartan's lecture on "La théorie des groupes et les recherches récentes de géométrie différentielle" may be cited as an example of this statement. In this lecture the application of the theory of groups to non-holonomous spaces must have derived much of its vitality from the relativistic spaces of Weyl and Eddington, a problem which in the last few months has again been attacked by Einstein.

An instructive lecture by Severi on algebraic geometry gave a historical retrospect of this subject, especially from the characteristic Italian point of view, which can best be described in his own words. "On tient toujours en vue le but principal qui est