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Man and Machine.

IN his presidential address to the British Association two years ago, H.R.H. the Prince of Wales gave a comprehensive and illuminating account of the various ways in which the aid of science was being invoked and encouraged to assist in the solution of the industrial and social problems confronting the nation. Not less important are the problems which the advance and application of science are creating in every sphere of national activity. Of fundamental importance is the effect which science is producing in craftsmanship ; and it is peculiarly fitting that this should have been made the theme of the address in Glasgow of this year's president, Sir William Bragg, a consummate artist in a craft of his own creation, of which he is the greatest exponent. The address itself is printed in full in our Supplement (p. 353).

Craftsmanship is the quintessence of happy toil. In its highest form it is the greatest contribution which the individual can make to the happiness of the community. It is at once a wonder, a joy, and an inspiration to others. The elements of which fine craftsmanship is compounded are, as defined by Sir William Bragg, knowledge of materials, imagination, technical skill, perseverance, love of the work itself, sympathy with the use that is to be made of it, and with the user. Thus defined, craftsmanship is identical with citizenship at its best, an identity so aptly emphasised in the address : " The craftsmanship of a nation is its very life . . . the state of a nation's craftsmanship is an index of its national health." It should be the high purpose of a community to conserve its craftsmanship by encouraging the progressive modification of traditional crafts and the creation of new ones, and strive by all means at its command for the preservation against the onslaught of mass production, of beauty in its utilities. The contentment of the user is probably less important than the satisfaction of the maker.

There is a tendency on the part of some people to attribute all the ugliness of present-day life to the advance of science and invention, to regard every fresh application of the genius of man with misgiving as adding to the complexity—and perplexity—of existence. The progressive elimination of starvation, famine, pestilence, the satisfaction of the growing needs of rapidly increasing numbers of people, coupled with their increased leisure and ministrations to that leisure, the enlargement of man's intellectual horizon, all of which have been made possible by the new crafts called into being



by science, are discounted by these regretful obscurantists. It is well for them to be reminded that science can rediscover for mankind most of the beauties of the past, can enable the skill of bygone craftsmen to be regained and even surpassed, at the same time providing man with new outlets for the exercise of his imagination, instinct for adventure, love of beauty, and technical skill.

We are at present, and have been for a century, passing through a transitional stage, the difficulties of transition heightened by the inability or unwillingness of society to adjust its social, political, and economic institutions, and its outlook generally, to meet without catastrophic shock the successive impacts of science on life. We are still far from achieving understanding of the environment which science has created.

Our outlook on craftsmanship is still essentially conservative. We still incline to regard it in its application to time-honoured occupations, forgetful of the fact that, in most of these, modern methods of production no longer provide scope for the exercise of much creative imagination on the part of the workers engaged in them, that the real craftsman in mass production is the individual who creates the machine, and not the operator, that in few of the old crafts has the individual craftsman survived, or if he has survived, his survival is an anachronism. Sentimental regrets for the passing of the single-handed craftsman in the production of utilities are vain. Modern craftsmanship in industry is the outcome of association, in which many minds and "many hands working in an alliance which is often unconscious, are employed in bringing a product to its finished form." It is true that the machine-made product may not always attain the same perfection as the product of the skilled individual craftsman, but the remedy is to be found in a more perfect machine—mastery over new means of production rather than dependence on the old. As Sir William Bragg says: "Let us try in all possible ways to mend its hardships, but in all honesty let us recognise that we live on modern craftsmanship in its modern form."

To us as a nation of craftsmen there are disadvantages attached to the perfection of the machine. Usually, the more perfect it is, the less intelligence is needed for its operation. The transference of a skilled machine to another country is a simpler matter than the transference of skilled craftsmen, and may lead to the partial transference of an industry to other countries where labour is cheaper, markets just as accessible, and the raw

materials of manufacture nearer at hand. The cotton industry is a case in point. Again, the invention of a machine for mass production may result in large numbers of skilled workers being suddenly cut off from their customary means of livelihood, with consequent loss of individual skill. For the first, it is no remedy to reduce the standard of living of the operatives, say, of Lancashire, to that of Indian or Chinese operatives. There should be no room among an educated community for productive processes calling for little intelligence in their working.

The remedy for the first, as for the second, situation is to be found in the full utilisation of the skill of the displaced operatives on new processes, new machines, and in entirely new industries. It is true this postulates a new orientation of outlook in industry for employers and employed, but the nation should profit by it: the old static conceptions of industry and industrial relationships have stood too long in the way of their rationalisation.

The eloquent tribute which Sir William Bragg paid to the qualities characterising our craftsmen, not the least important of which are pride in their work and their adaptability to changing conditions, was well deserved. The obstacle to industrial progress is to be found not among them but in out-worn policy, the incapacity of those who shape it to do more than frame panic measures for the protection of threatened industries, instead of concentrating upon those which, by putting the greatest strain upon our resources of knowledge, ingenuity, and skill, quicken the national intelligence, and thereby enable us to stand pre-eminent by virtue of our capacity to assimilate and apply scientific knowledge, new ideas, new processes, and to devise new machines. "The most active of our modern industries are those which are founded on recent scientific research." The only hope for older industries to gain their former position in the world is for their leaders to encourage and to look to scientific research for salvation and to comply with its precepts, even if this involves the ruthless scrapping of antiquated plant and the adoption of entirely new methods of production.

Not less important than the change from single-handed to associative craftsmanship which science has effected, and the consequent changes which this has involved in industrial organisation, is the introduction of a new factor in industry, namely, university-trained scientific research workers. The social and political significance of this introduction of scientific workers into industry is apt to be disregarded, so that it is particularly pleasing to



find that Sir William Bragg's address deals with the influence which they can be expected to exert, not merely by bringing scientific knowledge and infusing a scientific spirit into craftsmanship, but also, what is of even greater importance, by bridging that dangerous gulf which has been ever widening between so-called capital and labour. "They can speak with the employer as men also trained in university and college, exchanging thought with ease and accuracy, and at the same time they are fellow-workers with those in the shops, and can bring back there some of the interest and enthusiasm which springs from the understanding of purposes and methods." By bringing the interest and outlook of scientific inquiry into touch with both employer and employed, they may prove to be the flux that will make them run together.

It is not a polite exaggeration to assert that the country should be grateful to Sir William Bragg, not only for choosing for his presidential address a subject which exercises so many minds to-day, but also for the way in which he has raised it above the level of the factious controversy, and for the hope which it inspires. The feat is the more remarkable because he shirks none of the issues involved. Fortunately, the attitude of the press towards the British Association meeting ensures the dissemination of his views among millions of our countrymen.

### Scientific Calvinism.

*William Bateson, F.R.S., Naturalist: his Essays and Addresses; together with a Short Account of his Life.* By Beatrice Bateson. Pp. ix + 473 + 4 plates. (Cambridge: At the University Press, 1928.) 21s. net.

THE book before us falls into three parts. The memoir is followed by twenty-two essays, which for various reasons are not to be included in Bateson's collected scientific papers. Some of these, such as the lecture to the Royal Horticultural Society, which contains the first English account of Mendelism, are mainly of interest from the historical point of view, as illustrating the growth of the science of genetics, and of Bateson's own ideas. Others, in particular his Herbert Spencer lecture on "Biological Fact and the Structure of Society," contain his views on social problems.

The memoir shows us a man who must have impressed his contemporaries even had he never made any serious contributions to knowledge. He formed definite opinions on a number of subjects,

from the Sistine Madonna and compulsory Greek to nationalism and natural selection. But the processes by which he arrived at them make it clear that he was one of those radically abnormal phenomena, men who think for themselves. Hence, the life and letters are worth reading, not only by those who knew Bateson himself, or wish to follow the history of genetics, but also by all who desire to study the workings of a certain type of scientific mind. Even in his scientific writings, and still more markedly in his correspondence, Bateson was never afraid of 'thinking aloud.' Some of his ideas have not found any application, some perhaps never will, but others may yet be developed. In particular, no biologist who is interested in the problem of periodic structure, whether it be the segmentation of an arthropod or the striping of a zebra, can afford to neglect his point of view on this subject.

Bateson was of course in advance of his time with regard both to teaching and research. His applications for the chairs of zoology at Oxford and Cambridge (neither successful) contain programmes of study which are to some extent being adopted at the present time. He had the utmost difficulty in obtaining any facilities for research in genetics, and was only able to carry on at a critical period by means of private benefactions. Even NATURE on more than one occasion refused him publication! If we are to measure his success by the impression which he made on his compatriots, Bateson was a failure. In spite of the fact that the British Empire produces more animal and vegetable products than any other state, it boasts of exactly two professors of genetics at the present day, and the geneticists of the U.S.A. and U.S.S.R. are undertaking programmes of research beyond the resources of any British institution, programmes in which Bateson's personal influence can often be traced.

The first two of the addresses show how Bateson came to take up Mendelism. In 1899 he was speaking to the Royal Horticultural Society from his own experience on the effects of crossing various types of plants and poultry. He pointed out the universal occurrence of discontinuous variation as the result of such crossing, and described a case of what is now called dominance. In 1900 he was to read another paper to the same Society on "Problems of Heredity as a Subject for Horticultural Investigation." In the train to London he first read Mendel's paper on inheritance in peas. So completely did it fit in with his own experience and deductions that he incorporated an account of