

adoption of the steam engine as the power unit and many new machines for use in field and barn. But the villager shared relatively little in this improvement. From 1700 until about 1900, when more varied fare became available, the main changes in rural diet were a decrease in the consumption of milk and a heavy increase in that of potatoes.

The two World Wars, with the consequent emphasis on cereal production, the increased rate of technical development and particularly the substitution of tractor- for animal-power have completely changed the farm worker's status. Rural housing still compares unfavourably with that of the towns; but in wages and clothing the farm worker has achieved equality, and his food supply is now superior to that of the urban population.

Mr. Fussell finally suggested that the farmer and farm-worker can only achieve equality with the rest of the community when the emphasis is on cereal and potato production, and the whole population is reduced to a regulated diet.

Dr. R. N. Salaman (president of Section H) said that the modern use of the tractor made deep ploughing possible, and on heavy land this improved drainage and greatly increased yields. The farm labourer is becoming a mechanic; the farmer himself must supply the agricultural knowledge, and is far better equipped in this sense than his ancestors.

B. A. L. CRANSTONE

LIGHTING OF MUSEUMS AND GALLERIES

A DISCUSSION on museum and gallery lighting took place on September 5 during the Birmingham meeting of the British Association under the chairmanship of the president of Section A (Physics and Mathematics), Prof. E. H. Neville.

Mr. W. E. Rawson-Bottom (Ministry of Works) referred in his paper to the demand for better lighting which has come about generally, and to the enhanced public interest in museums. Standardized methods have not been found possible: each case should be individually treated. But whatever the system, attention should be directed naturally to the exhibits, and not to a number of bare lamps or fittings which are themselves objects of high brightness. The aim should be to produce an effect without an apparent cause. Lack of interest sometimes arises from an unduly even level of distribution of illumination over a larger area, although on occasions this is desirable.

Fluorescent lamps are now becoming increasingly available in a number of forms. The 'Daylight' type, functioning at a colour temperature of around 4,500° K., has been found the most effective for general use. 'Warm white' lamps render colour poorly, and moreover they mix badly with natural daylight. Filament lamps still find valuable application in spot-lighting and when brilliance and sparkle are needed.

In order to reduce unpleasant glare, screening of these fluorescent lamps by metal louvres has proved its worth. Showcase lighting is best arranged internally; careful choice of background material and colour will go far to reduce the annoyance of reflexion from the glazing, and keeping it below the nuisance-level.

Experiments have been conducted to do away with the frosted glass top-panels sometimes provided

for show-cases, and to replace them by dark-coloured louvres behind which is an efficient reflector. It is assumed, of course, that shelving is of glass, not wood. The observer is, in general, little conscious of the illumination.

If it is intended to use fluorescent lighting in dioramas, the artist responsible will naturally need to work with light of this character, otherwise his distance and perspective will suffer serious distortion.

A number of slides, illustrative of past and present practice in museum lighting, were shown by Mr. Rawson-Bottom, from which it was clear what advances have been made in all branches of technique for the æsthetic and truthful illumination of exhibits.

Mr. F. I. G. Rawlins (National Gallery, London), in his paper on the lighting of picture galleries, emphasized the close connexion between gallery architecture and systems of illumination. Dealing with buildings not specifically designed for artificial illumination raises considerable difficulties, which of course became less severe when galleries were treated with modern lighting fully in mind. We have now reached the stage when experiment is likely to yield worth-while results. Between the two World Wars, high-wattage lamps were the rule; they were by no means unsuccessful up to a point, partly because many buildings possess marked vertical lines with which lantern fittings could be made to harmonize reasonably well. The intensity, however, was poor, and the colour-correction inadequate. Spot-lighting at that period was not very successful: it produced a depressing gloom above and around which was generally regarded as forbidding.

The arrival of the fluorescent tube marked a great advance. Its colour properties at once showed improvement, and they are likely to reach still better standards. With good positioning for height and distance, some 25 foot-candles can now be obtained at a height of 5 ft. above the floor, compared with about 4 foot-candles fifteen years ago, using 1,500-watt gas-filled lamps.

For pictures, backgrounds are of prime importance, especially when looking at relatively small paintings. Backgrounds should be selected from materials having a low coefficient of reflexion, if distraction is to be avoided. Mr. J. Bickerdike has made tests of a preliminary character, which show that pictures possess reflectivities of around 10, 20, 35 per cent, of which 20 per cent is far the most common. This, then, gives a hint of how backgrounds should be chosen, and it is remarkable how pleasing they are, when of this order of reflectivity. In conclusion, Mr. Rawlins suggested that some variety of light and shade is to be welcomed, in preference to an overall uniformity of brightness-level throughout a picture gallery. A number of slides demonstrated the effect of intensity distribution and backgrounds at the National Gallery, London.

In opening the general discussion, the chairman asked what steps are being taken to eliminate the irritating reflexions arising from the glazing of pictures. He also inquired whether anything is being done to encourage students to study specifically the subject of museum and gallery lighting. The first question raises many difficulties: a partial solution is to avoid windows opposite, and to provide dark walls on that side; but this does not get rid of the reflexion from the spectator's own person. There are, of course, a number of palliatives; but the basic course is to remove the glass altogether, which is

only possible, in British cities, if an air-conditioning and air-washing plant is in operation; and the cost of that is very great.

At present, no deliberate effort is made to attract recruits to the special study of museum and gallery lighting. It is, however, one of the subjects which the recently incorporated International Institute for the Conservation of Museum Objects hopes to include in its syllabus of training.

In connexion with colour correction problems, Mr. Rawson-Bottom explained that, in general, the standard daylight fluorescent lamp is satisfactory for most situations. In special cases where colour rendering is of particular importance, the 'colour-matching' fluorescent lamp is used, but he emphasized the necessity of providing sufficient intensity when using this type of lamp.

SOCIO-PSYCHOLOGICAL FACTORS IN PRODUCTIVITY

A SYMPOSIUM on "Socio-psychological Factors in Productivity", arranged by Sections F (Economics) and J (Psychology) of the British Association, was held at Birmingham on September 4.

The problem jointly selected by the four speakers was the question of the relative strength of the pecuniary and non-pecuniary incentives to work. Each of them discussed the *general* complexity of the problem and emphasized the multitude and variety of the motivational factors involved. While on this point there was general agreement, each paper presented its own contribution derived from research on *specific* aspects of the problem.

Prof. P. Sargant Florence (University of Birmingham) opened the discussion with a brief survey of the variety of incentives. It is essential to distinguish between incentives or 'attractives' to move from one job to another, and incentives to perform a given job. The former kind refers to labour mobility, and economists have put forward a frame of reference which comprises, besides the wage-level, such factors as bodily and mental fatigue and social environment. As to productivity on a given job, it is of the greatest importance to measure the relative strength of pecuniary and non-pecuniary incentives. Psychologists, though often paying lip-service to the incentive power of the wage and the method of paying wages, in practice neglect the subject. A balanced inquiry should not only weigh factors in isolation but should also see whether economic factors *plus* certain socio-psychological factors (for example, changes in supervision, or changes in goods and services the worker can buy) might not increase productivity more than the sum of each factor taken separately. Prof. Florence recalled that during the First World War the Health of Munition Workers Committee in Britain and the U.S. Public Health Service (Bull. 106, published in 1920) showed statistics of output, spoilt work and accidents hour by hour throughout the working day which fell into standard patterns of 'work curves'. These curves were fairly generally interpreted as manifestations of practice effect, fatigue and boredom. For one type of curve, that of accidents, two patterns were obtained. The curve of night-shift accidents fell at first hour by hour, and interpreting this phenomenon, Dr. H. M. Vernon stressed the importance of disturbance due to excitement previous to coming to work; the day-shift

accident curve, however, rose throughout the two spells, and this was explained by Prof. Florence chiefly as a symptom of fatigue. The controversy began in 1923-24, but the relative importance of fatigue and excitement has never been resolved. The facts seem assured and have since been confirmed with regard to the day-shift accident curve. What is wanted is an interpretation; socio-psychologists, however, have so far not been forthcoming with it, although this would clearly have been within their sphere.

Among the more specific points raised by the three other speakers were the following: Mr. R. Marriott (Medical Research Council) discussed the effect of group-size on productivity, referring to an investigation made two years ago¹. Indirect measures of output based on the payment systems could be obtained for two factories. In factory *A* there were 4,500 workers distributed among 153 groups of different size and they were studied in five consecutive quarterly periods. In factory *B* there were 1,000 workers with an average of 90 groups. In this study, groups of fewer than ten men, 10-19, 20-29 and so on, and more than 50 men were combined. Mr. Marriott demonstrated with a diagram that in both factories productivity decreased as the size of the groups increased up to the 49-level. The output averages for the smallest groups were 5-17 per cent higher than the averages for the groups containing between 40 and 49 men. The correlations were low (between -0.2 and -0.5 per cent), but this inverse relationship was consistent and statistically significant for each period in both factories. It is difficult to account for the rise in output in the groups with 50 and more men. One explanation is the effect of power-driven conveyors, which were used mainly in the larger groups. Evidence from this and other investigations² suggests that the inverse relationship between group-size and productivity is the result of greater cohesion in small teams because men know each other better, can see each other at work and consequently are less suspicious and require less supervision. One important point to note is that group-size seems to be independent of other factors, for there was much evidence that productivity was higher in factory *A*.

Mr. R. G. Stansfield directed attention to a factor the importance of which is usually overlooked, namely, the 'level of expectation' in productivity, that is, the customs which settle what is taken naturally as the proper output. In productivity just as in other matters of behaviour, what a person does is, in the short run, determined by what he is accustomed to do. By analogy with physical science, an incentive can be regarded as a force applied to a person to make him work harder; as a physical body can be subjected to a force, so a person has his inertia in work and in social behaviour, and what a person is 'accustomed' to do corresponds to the 'momentum' of the body. Paraphrasing Newton, Mr. Stansfield suggested as the First Law of Socio-Psychological Motion: "Every person continues in his state of rest, or of uniform work in a straight line, unless he is compelled by impressed incentives to change his state". The expectation of the persons immediately around is one of the most powerful incentives, and the 'climate of opinion' which is the aggregate of these expectations shows an inertia adding to the inertia of the person subject to the 'climate'. Quoting from his own wartime observations of the performance of groups of persons plotting aircraft movements, Mr. Stansfield said that evidence showed the average group-to-group