

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 ago<sup>1</sup>. 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 investigations<sup>2</sup> 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

variation in performance to be greater than the variation between individuals within a group—the range being of the order of 2 : 1—which suggested that 'social' effects had a greater impact on productivity than individual ability. In fact, the 2 : 1 ratio corresponded to the difference in the level of expectation between the groups observed. Comparative productivity studies between firms in the boot and shoe, building and cotton industries, undertaken since, confirmed the existence of a ratio of this order.

Dr. W. Baldamus (University of Birmingham) pointed out that variations in productivity are often explained by sociopsychological factors (such as supervision), whereas in fact they are due to differences in type of work. For the past thirty years, both economists and executives have firmly believed that variations in annual labour turnover-rates (number of employees leaving, as a percentage of number employed) between different companies, factories and departments are due chiefly to differences in supervision, leadership and efficiency of personnel management generally. Referring to an inquiry on labour turnover in six Midland companies (1947-49), Dr. Baldamus reported that he discovered this traditional belief to be a fallacy. He found that differences in turnover-rates between different factories of the same company are extraordinarily large, ranging from about 10 per cent to 80 per cent. The true reason revealed itself the moment the data were analysed according to type of work instead of factory units. It appeared then that the lower rates were characteristic of highly skilled jobs (tool-makers, floor moulders, etc.), and the highest rates represented general labourers, crane drivers, enamellers, etc. In all companies the turnover-level of heavy labourers was more than 80 per cent, and in one case as high as 730 per cent. It follows that factories differ in turnover-rates primarily not because of differences in personnel management, but because the proportion of different types of labour, particularly of unskilled labour, varies. Turnover tends to be higher the shorter the work-cycle and the shorter the period of training. Dr. Baldamus believes that motivational factors inherent in the type of work, such as tedium and nervous strain, but also intrinsic satisfactions, are decisive in labour turnover; their importance, however, for increasing labour stability and thus productivity has so far been entirely missed.

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<sup>1</sup> Cf. *Occup. Psych.*, 23, No. 1, 47 (1948).

<sup>2</sup> For example, Mukerji, N. F., *Brit. J. Psych.*, 30, 356 (1940).

## EFFECT OF MOTOR PATROLS ON ACCIDENTS

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THE Road Research Laboratory of the Department of Scientific and Industrial Research is investigating the effects of police activity on road accidents, and, as a part of this work, an investigation has been made into the effects of the experimental motor-patrol scheme originated by the Home Office in conjunction with the Ministry of Transport in 1937. The object of this scheme was to find the effect of an increase of motor-patrol police on road

accidents and road behaviour. The main idea was co-operation and education rather than prosecution. This scheme provided mainly for the augmentation of the existing motor patrols by specially trained men in seven police districts of England, and was in operation in most of these districts from April 1, 1938, to September 3, 1939. The men were trained to set an example by their own driving, to give advice and warnings on the spot, and to teach road safety to all classes of road users. They were trained at various centres, the course being based on a scheme by Lord Cottenham.

The only comprehensive figures published on the effect of the scheme are those given in the report by the House of Lords Select Committee on the Prevention of Road Accidents<sup>1</sup>. This merely states that, in the first six months of the experiment, the road casualties in the participating police districts decreased by the following percentages, as compared with the corresponding six months of the previous year: Lancashire 46, Salford 20, Cheshire 11, Manchester 8, Essex 6, Liverpool 6, and Metropolitan (London) 5 per cent.

The decrease for the whole of England and Wales for this period was 5 per cent, so that some of the above changes do not appear to be outstanding. However, as this 5 per cent includes the large decreases in those districts in which the experiment was tried, a better comparison is with the remainder of the country. No reliable data seem to exist which would make it possible to calculate this; but approx-

Table 1. EFFECT OF SCHEME ON CASUALTIES\*

| Forces not operating the scheme (England only) |                                |  |
|--|--------------------------------|--|
| Change (per cent)                              | No. of county police districts | No. of groups of town and city districts |
| Increase in number of casualties {             | 20 and over                    | 1  |
|  | 15-20                          | 2  |
|  | 10-15                          | 4  |
|  | 5-10                           | 7  |
|  | 0-5                            | 12                                       |
| Decrease in number of casualties {             | 0-5                            | 9  |
|  | 5-10                           | 5  |
|  | 10-15                          | 1  |
|  | 15 and over                    | —  |
| Total number of districts or groups            | 41                             | 37                                       |
| Average of percentage changes                  | 3.0 increase                   | 3.1 increase                             |
| Average change (per cent)                      | 1.7 increase                   | 2.8 increase                             |

(a)

| Forces operating the scheme                        |            |        |                     |
|--|------------|--------|---------------------|
| Districts  | Casualties |        | Decrease (per cent) |
|  | 1937       | 1938   |                     |
| Liverpool  | 4,314      | 4,371  | -1.3                |
| Manchester   | 4,532      | 4,425  | 2.4                 |
| Salford  | 508        | 457    | 10.0                |
| Lancashire   | 7,303      | 4,611  | 36.9                |
| Essex  | 4,779      | 4,473  | 6.4                 |
| Cheshire   | 3,189      | 3,120  | 2.2                 |
| Metropolitan                                       | 57,256     | 50,715 | 1.0                 |
| Total  | 81,881     | 78,172 | 4.5                 |
| Average of percentage changes                      |            |        | 8.2 decrease        |
| Average of percentage changes excluding Lancashire |            |        | 3.3 decrease        |

(b)

\* For consistency all figures are those given in Ministry of Transport publications<sup>2</sup>.