

absolute measurement of solar radiation has now reached an accuracy hitherto impossible to achieve, with important results which so far are largely unpublished; secondly, much progress has been made in overcoming the obstacles to the measurement of black-body absorption of solar radiation, notably in estimating or eliminating the adventitious effects of the wind-tunnel installation, set up to counteract the equilibrium disturbances due to small breezes by superposing a known steady wind; thirdly, the energy required to keep a black sphere at  $36\frac{1}{2}^{\circ}\text{C}$ . at atmospheric conditions throughout the day and night is now recorded automatically by an instrument that adds up the hourly totals, and the unexpectedly low average obtained goes some way towards explaining the comparative immunity to chills shown by consumptive patients while they remain at Davos, in spite of the severe winters. R. C. H. YOUNG

<sup>1</sup> See Painter, H. E., *Weather*, 5, 307 (1950).

## ANALYSIS OF HUMAN SKILLS

**I**N an article in a recent issue of *Occupational Psychology* (14, No. 3; July 1950) Prof. C. A. Mace suggests that what may later be regarded as one of the characteristic features of the twentieth century will be the marked acceleration in the progress of social and human sciences. There have been, he says, significant advances in the plan to make a science and an art of human nature—in the growing understanding of basic human skills, of increasing control over human will and in the emergence of a general scientific approach to the study of human emotions and human relations.

A fair amount is now known about the basic human skills. What is called 'physical' skill, for example, is the ability to produce some required effect or group of effects through bodily movement guided by sensory and perceptual cues. There are also intellectual skills in which generalized knowledge and imagination play a more important part, and social skills in which subtle emotional reactions to personality and subtle expression of personality are the chief determinants of the required effect. A skill that is employed for æsthetic ends is called an art; one that is turned to industrial ends a craft. The clerical and allied occupations involve the practice of some of the simpler intellectual skills. The concept of a social skill enters into the analysis of the supervisory functions and into leadership in most of its forms. What are called the 'professions' are distinguished not merely by the factor of social prestige but also, as a rule, by a complex intermixture of various types of skill.

With the physical skills the apparent simplicity of a skilful movement is always deceptive. Many dexterities are dexterities of the hand, and, in consequence, one is apt to speak of skill in terms of co-ordination between hand and eye.

The natural tendency to the dominance of the hand is one of the things which needs to be corrected in the acquisition of skill. In the very simplest of skills the required effects can be produced only by a sequence of patterns of movements, the components of which are precisely timed and adjusted in relation not only to each other but also to a sequence of patterns in the perceptual cues; the skilled brick-layer invites one to admire not the tapping or the buttering of his bricks but the dance which he performs with his feet.

The exercise of skill may become automatic, but it never becomes unconscious. Action is always adjusted to perceived cues. Skill is at its simplest when signals that are easily perceived call for responses that are easily performed—as when, for example, the typist reads a clearly written script and taps the appropriate keys. In the vast majority of cases significant cues have to be singled out from a context of irrelevant information, and in response to these cues new and often difficult movements have to be made. In earlier days, even learning to drive a car was a task of this kind. Significant and possibly ominous sounds from the engine had to be distinguished from irrelevant 'body' noises, and complex cycles of movement carried out with clutch, gears and brake.

Between the physical and the intellectual skills no sharp line can be drawn. The greater the complexity of the skill the larger the part played by the higher cognitive functions. In all but the simplest skills we may distinguish two factors in cognitive control: (1) situational information and (2) general knowledge. The exercise of military skill by those at the higher command depends upon these two kinds of knowledge: a knowledge of what is happening in particular places at particular times and a knowledge of general principles such as those of strategy, tactics and logistics. So it is in all the crafts and the practical professions.

In the workshop the craftsman is taught, *inter alia*, to understand the sensory cues through which his movements are guided. In his lessons in the classroom he is taught the more general principles upon which the versatility of his skill will depend. Science has scarcely begun to explore the extremely complex problems that arise in connexion with the provision of general knowledge required in the exercise of a craft.

Leadership and supervision may be taken as convenient examples of the social skills, the work of the manager or supervisor being quite peculiar. Its essence is to know what requires to be done and then—not to do it—but to see to it that someone else does. The kind of self-control that is required in order not to do oneself what should be delegated is one of the primary virtues in the supervisory office.

On a systematic job-analysis of supervision or leadership, a primary and a secondary function can be distinguished. The primary function is to direct, that is, to give direction to, and to co-ordinate, the activities of others. This function is concerned with the job. The secondary function is to arouse and maintain the motives appropriate to the actions of those who are so directed.

Broadly speaking, the primary function is prominent at the higher levels of management or command, the secondary function more prominent at the lower levels. The supervisor must know what has to be done, decide who shall do it, when, and sometimes how, the thing shall be done. These decisions will find expression in the written or spoken word. Hence the vital importance to his supervisory function of verbal intelligence and special verbal skills.

Although much is not yet known, it is recognized that there is a common structure in the physical, the intellectual and the social skills. In every case skill consists in the ability to produce required effects by executive action guided by relevant information. In the rest of his article Prof. Mace indicates the conditions through which all potential skills issue in performance. T. H. HAWKINS