principes de conservation", by Prof. Jean Piaget, "Psychological Factors determining Human Behaviour", by Prof. Charles Gustav Jung, "La force et la faiblesse psychologique", by Prof. Pierre Marie Félix Janet, "Logic", by Prof. Rudolf Carnap, "An Example from the Evidence of History", by President Emeritus Abbott Lawrence Lowell, and finally "Culture as a Determinant of Behaviour", by Prof. Bronislaw Malinowski.

The last of these took the form of an evening lecture. Other public lectures treating of subjects of general interest were by Frank Baldwin Jewett, of the Bell Telephone Laboratories in New York, on "The Social Implications of Scientific Research in Electrical Communication"; by Prof. Wm. Berryman Scott, on "The Laws of Mammalian Evolution"; by Sir Arthur Stanley Eddington, on the "Constitution of the Stars"; by Prof. G. H. Hardy, on "The Indian Mathematician, Ramanujan"; by Prof. E. J. Dent, on "The Historical Approach to Music"; by Prof. Corrado Gini, on "Authority and the Individual during the Different Stages of Evolution of the Nations"; by Prof. John Dewey, on "Authority and Resistance to Social Change"; by Prof. W. E. Rappard, on "Economic Nationalism"; and by Prof. Johan Hjørt, on the "Biology of Whales".

Reviewing the activities of the congress, or such of them as fall within the scope of a biologist, it can only be said that the event far exceeded what

might have been expected of it. It may be doubted whether any congress covering so wide a field has ever succeeded in at once reaching a level so sustained in matter, and in manner so intelligible to those not acquainted with the particular and specialized techniques of those who rose to so high a level.

Lastly, a word as to the hospitality poured with both hands upon the members of the congress. It is difficult to know where to begin or end in treating of it. American hospitality is the high water mark; to say that it reached the highest level of American hospitality is no less than the truth. One item, however, must be mentioned specifically, namely, the orchestral concerts, three in number, given by the Boston Symphony Orchestra. Two were instrumental, in the third the orchestra combined with the chorus of Harvard University and Radcliffe College. All were a sheer delight. At the close of the last concert, just before "Fair Harvard" was sung, President Conant walked up the hall, ascended the platform, shook hands with Dr. S. Koussevitzky, whose skill and enthusiasm as a conductor had been so largely responsible for this feast of pleasure. Dr. Conant said a few words, ending as follows: "I wish to say just two words 'Thank you'." A fitting ending, for there is no delegate who can have left Harvard with any other thought in his mind. Harvard—Thank you!

The Patterns of Experience*

By A. W. Wolters

SUMMING up his important contributions to the psychology of perception, Prof. E. Rubin demonstrated, in a paper devoted to the 'ways of seeing' read before Section J of the British Association at Norwich last year, that perceptual cognition is shot through with suggestions of movement and direction which are not reducible to the geometry of the object. The mind contributes structural principles to its own experience.

Like many scientific theories, this was not new. Many besides Rubin, and many earlier than he, have suggested that the mind, at least in part, makes its own experience. The value of his contribution lies in the beauty of his experimental development of the theme, and in the detailed application of it. But at least one of his demon-

strations at Norwich was so new as to be thrilling. Those who were present will remember vividly how we were brought to recognize that pictures in European art have a definite left-to-right character, upon which their meaning and æsthetic appeal largely depend. I reported this to Mr. Betts, the head of the School of Art in the University of Reading. We went through his stock of lantern slides, and found that in nearly every case Rubin was clearly right. But our most exciting moment was that in which we discovered a drawing in which Rembrandt had gone astray. My colleague suggests that Rembrandt made his sketch from a mirror, a quite usual method, so that having posed his model correctly—that is, as Rubin would have had him do—and being absorbed by the technical problems of his sketch, he overlooked the extraordinary and unpredictable effect of the lateral inversion.

* From the presidential address to Section J (Psychology) of the British Association, delivered at Blackpool on September 11.

It seems clear that there are pre-established manners of seeing, and we must expect the same to hold in the other modalities of sense. It appears that perception can be shaped by factors extrinsic to the material experienced. Under their influence the mind is creating, is actively patterning its experience, so that in some sense and to some degree (the limits being determinable by experiment) the mind makes the world it knows. To speak a little dogmatically, I hold that the mind informs its sensory material, making the percept consistent with certain subjective principles. This implies that the patterns of experience are in some sense already latent in the subject's mind as he confronts the world. Can we say how?

Alas, not very well. We must be content for the present with a small but useful advance to be made along the following path. If one says that perceiving is a response of the organism, meaning what one says, it follows that the distinction between cognition and conation is not an ultimate one. The general utility of the traditional division is not in question, but in the end we have to recognize that the process of coming to know is an activity, a piece of behaviour linked up with and subordinated to other behaviour. Conation *must* be the fundamental concept, because the first duty of every organism is to remain alive, and it needs to manage and control its environment to that end. Let us look for a moment at other forms of behaviour.

It is agreed that behaviour exhibits certain regularities of sequence which entitle us to formulate laws. In describing the phenomena, the phrase which comes most readily to the tongue is that they exhibit patterns. The word has of recent years been very freely used. It requires no technical knowledge to understand the statement that a man's business activities show a constant pattern, no matter how varied the details with which he has to deal at different times. Our insight into the character of acquaintances mainly rests upon the observation of their behaviour patterns. It is very difficult to describe them, and still more difficult to analyse them, but they are easily recognizable. They are, in fact, the constancies without which social life would be impossible.

The outstanding example of patterns of behaviour is presented by the instincts. In them we have themes which can be recognized as essentially the same while the details of the activity vary thoroughly, just as the theme of a symphony can be recognized through its development. But to say this is to apply the term 'pattern' as an objective description, and not as an explanation. Whether in this field you prefer to speak of urges and drives, or of fields of force and closure, is indifferent to the present argument, which requires

only two points conceded to it: first, that these patterns of behaviour are observable, it being in virtue of them that the adjective 'instinctive' is applied, and, secondly, that the character of the organism is among the causes which produce them. We note that the behaviour of the human individual displays patterns which are similar in their outline to those of animals, and which, arguing from them, we must assert to depend upon the connate character of the organism.

To argue the obvious a little more fully, if a pattern is observable in behaviour, it must be dependent either upon the detailed events themselves, or upon the organism. In many cases, such as the behaviour of insects or nest-building in birds, there seems to be no sense in the first alternative, and consequently we take the patterns to be determined by the nature of the organism. This is to assert that the pattern is latent in the organism; but not after the manner of a 'blue-print'. The latent pattern is not open to inspection. It exists, to use an old and respectable term, formally. There is a character of the organism which gives a distinctive pattern to its reactions. But there are also patterns observable in acquired activities, and in this case we have an everyday term to designate the quality of the agent which produces it. We call it a skill, and regard it as inherent in the subject whether he is or is not engaged in the activity at the moment. But once more it is not inspectable as the pattern of the activity is. All we can observe is that *A* by economical and coherent actions consistently achieves success in a given field, while *B* as consistently fails in it. Believing that all phenomena have a cause, we ascribe to *A* a skill which *B* lacks. So far as language goes, we can say either that *A* is skilled, or that he possesses a skill. Both expressions are admissible, but I would suggest that the former is better in psychology, since we can neither observe, nor by deduction describe, a skill in itself. When we attempt to do so we usually find ourselves describing again the pattern of the activity. Let us take a skill to be a character of the individual, a manner in which he has been psychologically shaped by racial or individual experience. To say that a person is skilled means that he is prepared to deal adequately with situations of a particular kind, but prepared in an outline, flexible manner which is sensitive to the varying details of the moment. Skill is in this respect on a higher plane than tropism, reflex or habit. The organism's skill is displayed in controlling and organizing material on the way to achieving a goal.

Now we can return to our original problem of perception. No present-day psychologist can be content to regard perceiving as no more than

reflecting the material world, or as a process to be studied in isolation. It is a preparatory reaction, prior to more far-reaching activities, its immediate goal being the organization of sensory data into manageable forms. So we come to the conclusion that the predetermined 'ways of seeing' of which Rubin spoke belong to the vast family of skills, and can be treated with the others. The range of processes in which the pattern of behaviour, and the pattern resulting from the behaviour, depend upon the mental characteristics of the agent would appear to cover the whole extent of human life.

At the London meeting of the British Association in 1931 I read a paper advancing the hypothesis that what is termed conceptual thinking can be dealt with in terms of skill, saying that what are termed concepts are best considered as outline preparations for response, and not as mental entities. I endeavoured to show that the behaviour of animals displays patterns parallel with those of a higher grade in human beings. I introduced the term schematic preparation, or more shortly 'schema', as a name for this subjective character. Five years later, fortified by the parallel advance of Prof. F. C. Bartlett in another part of the field, I am bold enough to claim that our conception will cover all parts of animal and human psychology, pulling together into a system many heterogeneous results.

Can we apply the outcome of this discussion in the field of social psychology? The term 'social pattern' is in common use, and perhaps is employed with dangerous facility. In the first place, it appears to mean an observable system of relationships between individuals and their activities, constituting a unity of a higher order of complexity than that of any one of its members. Secondly, the social group is a part of the environment of each of its members and of persons who make contact with it from outside. It is a system of facts to which individuals have to adapt their behaviour. In this it is parallel to the inanimate environment, and since the principles of behaviour will resemble those already encountered, the matter may be left for a moment at that level. Thirdly, social groupings present a puzzling combination of determinacy and flux. To live in society is rather like rowing in rough water. Within a quite characteristic pattern of the whole there is an inconvenient mobility of the elements, which requires continual variability of response. The patterns of society are determinate but dynamic, and to react successfully to them demands skill.

To deal with this problem in a little more detail I turn to another paper read before Section J at Norwich, one by Prof. T. North Whitehead, since

published in *The Human Factor*, 9, 381. A group of five girls working at the same tasks came in time to form a real social group with a complex but readily discernible pattern. An objective record of it was obtained by studying the relations between the output of individuals, and the investigator was able to reduce these to a clear diagrammatic form. Since conversation is the chief instrument of social relationship, the seating arrangements proved largely decisive for the pattern. When an experimental change was made in the seating order, the social and psychological pattern was broken and a new one had to be formed, output being adversely affected during the process.

Prof. Whitehead's interesting report is concerned mainly with the objective study of the group. There are, however, important implications on the subjective side. In the first place, like everything else, society is only apprehended by individuals, whose perception will be shaped in ways analogous to those revealed by Rubin in simpler material. This is the common handicap of all science, and no more need be said of it than to remind ourselves that each person must react to society as *he* sees it. A more important matter is that society, whose dominating influence we realize more and more, has proper significance for psychology only in its impact upon individual lives. It is, indeed, only actualized in those moments. Its components are individuals acting, and their behaviour is informed by the principles studied earlier. Yet their activities form a system, and we have to reconcile that with individual psychology.

A group only exists in virtue of conative tendencies developed by individuals in the course of accommodating their behaviour to each other's. It requires skill to live socially, and I see no reason why we should not treat this as we did others. Social skills are predetermined schematic preparations for adaptive responses to situations presented by the presence of other persons, whose behaviour forms a reciprocally interacting system, and so it is the psychological character of individuals which chiefly determines the social pattern. I should like to adapt a famous conclusion of Rousseau, and say that society becomes a topic for psychology just because it exists immanently in the minds of its members. Whitehead's subjects did not build up a real unified group merely through the seating arrangements. The effects of the removal of the one who had become the leader show this. The unity of the group broke up, and though her successor became even more popular it was never fully reconstituted. So, at least, the writer maintains. But I venture to think that there was formed a new and firmly integrated pattern of a

kind too subtle and intimate to be revealed by the test of correlative fluctuations of output. How otherwise can we account for the odd fact that when the former leader came back to replace her temporary successor the group was entirely broken up through the newly developed hostility to her, formerly the outstanding member of the group?

What the experiment depicts is the gradual orientation of individuals to each other—in other words, their learning ways of living with each other. When the social environment is changed, a new set of behaviour tendencies has to be established, until in the final setting an environment was found to which the girls could not react successfully. But they had done so at an earlier stage, and we must conclude that in the intervening period some change had occurred in the other girls. The earlier objective conditions were repeated, but there was no unity. Can we avoid the conclusion that the unity had existed in the minds of the members, and those minds had changed to such an extent that the old reactions had become impossible? An objectively observable group pattern is a product of the skill-characters, or behaviour schemata, of the constituent members. So a problem of group psychology reduces itself to one of individual psychology.

Social patterns are largely manifested in institutions and current ideas, and often in combinations of the two. The English Common Law provides an excellent example of the last. This remarkable invention of our race has been maliciously described as consisting of a vast body of decisions and pronouncements, all readily deducible from a very few simple and universally accepted principles, though no one knows what they are. I cannot say whether this description is true, but there is no psychological difficulty in it. Common Law principles are the ways of living together developed by English people, and like all skills (for skills they are) they were developed in pursuit of ends which did not include the purpose of inspection.

Pursuing a purpose and thinking about the pursuit are quite different processes. So for a long time, possibly always, they would not be amenable to analysis or description. To describe them necessitates the development of a new skill directed to the material provided by the prior one. This is in essence Bartlett's illuminating distinction between schemata as the instruments of reaction and schemata as objects to which reaction is directed. The Common Law is the expression of the directive tendencies of citizens bent on living together along determinate lines, though they may have never reflected upon them. Probably the majority of Englishmen have never heard of the

Common Law, though it governs their lives in so fundamental a manner. It is quite usual to find that people who evince a great determinateness of behaviour are unaware of the principles which govern them. Why should they pause in the process of achieving their ends, if all is going well, to 'turn round upon the schemata' which are serving them?

There is a danger in any form of expression which suggests an opposition between social psychology and individual psychology. The field marked out by the former term is one proper for the specialist, but it remains the study of individuals acting socially. It would avoid the risk of over-abstraction, with possibly something of mysticism arising from it, if we were satisfied to speak of the psychology of social behaviour. At bottom it is the study of the development and nature of schemata employed in orientation to other behaving organisms. They, too, act from schemata, and if they are to live together they must effect a considerable degree of uniformity. So the social pressure upon individuals is intensified by the establishment of institutions which are the outward patterns resulting from the psychological characteristics of the members of the group, and in return a potent means of shaping the next generation. Here the vital problem of society resembles that of the individuals (as must be the case); it is that of keeping the outline preparations for adaptive behaviour sufficiently fluid to be sensitive to variations in the problems presented. The Hegelian limit of efficiency is inflexible specific habit, which is a skill so perfectly developed as to become a hindrance.

Now to summarize briefly the thread of this discussion. The subject-matter of psychology is taken to be the activities of the individual organism striving to maintain its full integrity in the universe in which it lives. To obtain control it must organize the presented material of experience into patterns manageable by it, and to this end it develops skills in its activities. Naming these skills by a word not inconvenienced by overmuch usage, we have called them schemata, and the system of a person's schemata embodies all his experience up to the present moment, and determines the direction of his future experiencing. The patterns of experience are formed by them, though not independently of objective conditions. Thus in outline the 'ways of seeing' and the 'ways of living'—whether socially or otherwise—are reducible to a common psychological genus.

The value of this view to me lies in its providing a unitary point of view from which, it is hopefully claimed, one can survey the whole extent of psychological study. At least it may prevent a born eclectic like myself from degenerating into

a kind of scientific jackdaw. So I invite you to regard experience, in the fullest sense of that word, as formed in a complex of patterns largely made by the experimenter, patterns in some cases interlacing, in others forming a hierarchy of increasing generality. Or, to start from the other end, let us

take our science to be the study of all the detailed embroideries upon that most common and most comprehensive of patterns, the formula of which runs: He was born, and strove to master his world for his own safety; he mated, fought for his offspring, and died.

Campbell Swinton and Television

By Dr. J. D. McGee

THE successful inauguration by the British Broadcasting Corporation of the high-definition television transmitting station at Alexandra Palace has focused the attention of the technical world on the successful development of the all-electric, instantaneous system of transmission. The degree of success achieved shows that the cathode ray transmitting tube has at last emerged from the research laboratory to take its place as the complement of the receiving cathode ray tube. The latter is well known, and has been recognized for some years as the most effective means for picture reception, and is now a highly developed commercial product. Modern television technique, which will withstand the criterion of the flickerless talking picture, both from the producing and reception points of view, has only been made possible by the development of the receiving and transmitting cathode ray tubes. This development is the result of improvement in technique brought about by the work of many scientific investigators in research laboratories throughout the world.

The manufacture of the modern cathode ray tube for picture reception has evolved slowly as improvements in vacuum technique, glass manufacture, fluorescent materials have been made, while the transmitting tube inherits also the wealth of developments in photo-electric technique. Besides these key units, the whole television equipment—amplifiers, scanning oscillators, pulse generators, cables, radio transmitters, etc.—have each been improved to a stage where they are capable of dealing with the enormous frequency bands, exacting phase conditions, etc., which are necessary for the production of high-definition flickerless picture. This has been achieved by improvement in valve and circuit technique spread over the last twenty years.

The object of this article is to pay a tribute to the memory of a man who probably thought more deeply, clearly and disinterestedly about television than any other of his time and who, had he but lived six years longer, would, I believe,

have agreed that his life-long dream had at last come true.

The late Mr. A. A. Campbell Swinton was the first to propose¹ an all-electric system of television in 1908, and continued to urge its claims² up until the time of his death in 1930. Sir Richard Gregory has recently reminded us of Campbell Swinton's early suggestions in connexion with television³, but it might not be redundant to show how Campbell Swinton continued to develop his ideas as technical methods advanced during the remaining twenty years of his life. He first suggested the idea in a short letter to NATURE in 1908¹, later explaining and amplifying it in his presidential address to the Röntgen Society on November 7, 1911⁴. This plan of twenty-eight years ago only required the application of modern technique to become the non-mechanical system now installed at Alexandra Palace, and still in course of development in Germany and America.

It is worth while quoting at some length from the published papers of Campbell Swinton in order to emphasize not only the remarkable accuracy with which he visualized his scheme, but also the kindly unassuming manner in which he presented it to the world.

Campbell Swinton's definition of television is worth noting when considering modern developments, in order to appreciate the difference between television proper and telekinematography. He defines television thus⁵: "If you point a photographic camera at any view or object, whatever is in front of the lens is depicted on the ground glass screen, and what I mean by television is some method whereby what is depicted on such a screen, with any motions or other changes that may be taking place, is electrically transmitted to a distance and made reappear instantaneously on a similar screen at the distant station." This conception of television is implicit in all his early publications.

Referring to a letter from Mr. Shelford Bidwell in NATURE of June 4, 1908⁶, in which the difficulty