fuller, richer, and more scientifically exact in statement.[1] Partial, accidental, local and temporal *obscuration* there may be, but when it occurs, it will seldom if ever be possible to attribute it to external catastrophes alone: it will always be at least partly someone's fault. It is this which justifies and renders imperative a discussion of this kind.

To hold tenaciously to the faith one has received, through thick and thin, even under persecution, even to the point of martyrdom, is virtuous: indeed there are circumstances in which that is the only sort of virtue we can practise. But normally we are under obligation to live our faith and to grow in it as far as we can. But the growth may seem to be intermittent: any time-lag between our reception of new scientific data and the full integration of them with our faith, to the enhancement of both, is necessarily a time of trial and temptation. But that is God's own way of making us worthy to enter into a higher contemplation of his inexhaustible Wisdom and Beauty.

1 'Crescat igitur oportet et multum vehementerque proficiat tam singulorum quam omnium, tam unius hominis quam totius ecclesiae, aetatum et saeculorum gradibus, intelligentia, scientia, sapientia, sed in uno dumtaxat genere, in eodem sensu, eademque sententia.' (Vincent of Lerins, *Commonit.* an. 434, ch. 23 RJ 2174.)

SYMBOLS AND THE SCIENTISTS*

DONALD NICHOLL

I WOULD not venture to read a paper on this subject to a gathering of natural scientists did I not hold that the process by which the natural scientist comes to understand the natural world is often analogous to the process of understanding carried out by other scientists, such as historians, for instance. Holding this opinion, I believe that other scientists may have helpful observations to offer to natural scientists on methodology and the basic principles of understanding phenomena.

The three observations I wish to put forward are as follows. That in all our knowing-processes (the natural sciences included)

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we employ images or symbols,[1] through which our mind's eye can see the objects our mind is searching for. Secondly, that the mind's capacity for throwing up symbols is especially vital in the discovery of new truths—or even new techniques. And thirdly, that any scientist intensely concerned with the details of his subject will inevitably be drawn to ask the meaning of that whole universe of which the details are a part; his question and his answer will have to be given in some symbolic form.

The first point is a familiar one, and has long been accepted by many thinkers. Confronted by the mass of colours and feelings recorded by our senses, we should not know how to begin making sense of them at all, how to discern their shapes, relationships and coherence were it not for the image-ing power of our minds. Our present concern does not permit an extensive demonstration of this point but it will be sufficient to refer to the experiments of *Gestalt* psychologists such as David Katz,[2] physiologists such as Kurt Goldstein,[3] and to quote the words of J. Z. Young: 'There is a capacity in the central nervous system which enables the animal to react to a unified "world" instead of to a series of discrete stimuli.'[4] In the animal that is man this capacity for detecting unity amidst the apparent chaos of his impressions is actualized by means of images, or symbols—if we take symbols to mean that which gives coherence to our view of phenomena. By throwing up such images or symbols our minds enable us to see things through them to which we were previously blind; it is as though the mind has a capacity for making windows on all sides of itself to let in the mediating light. At least, that seems to be the explanation most in accordance with the descriptions given by scientists of how their own minds work.

But notice, if we are to follow the descriptions given by scientists, that this function cannot be consciously switched on or off at will. We cannot provide more windows for our minds simply by taking thought, any more than we can add a cubit to

1 I do not attempt a definition of 'symbol' for the very good reason that such a definition cannot be given; if it could, then symbols would not serve the function which they will be seen to serve in the rest of this paper. And if the argument should sometimes seem circular I would ask the reader to remember that not all circles are vicious circles—in fact, the most profound way of reasoning does not follow the linear, activist, syllogistic pattern of formal logic, but that movement towards a truer, more all-embracing centre of experience characteristic of contemplatives, and itself symbolized by a mandala.

2 *Gestalt Psychology*. Methuen, 1951.

3 *Der Aufbau des Organismus*. The Hague, 1934.

4 q.v. Agnes Arber. *The Mind and the Eye*. Cambridge, 1954, p. 103.

our stature by a like process. There is a quite startling, unpremeditated quality about it which betokens the co-operation of unconscious forces. Consider, for instance, how the botanist Agnes Arber had been studying Queen-Anne's-Lace for as much as half a century without noticing a certain configuration of the plant, until one day she grasped it; after this, 'any plant that came under observation was found to show this salient feature so strikingly as to leave the observer bewildered and humiliated at having been totally blind to it year after year'.[5] Similar illustrations could be given almost indefinitely to show how the mind is not simply a passive recorder of sense impressions but is constantly generating its own means of understanding phenomena. Yet at the same time, the mind only achieves its desire with the aid of the unconscious, rather like the archery initiate in Zen Buddhism who can hit the target every time once he has learnt not to aim at it consciously.[6] And the similarity to artistic creativity will also be obvious to anyone who thinks of Leonardo da Vinci patiently sitting before the canvas on which he was to paint the Last Supper and waiting for the face of Christ to form before him—doing nothing, so that observers began to suspect him of defrauding his patrons.

This stress upon what I would loosely call the creative activity of the mind in the normal process of knowing makes it easier to understand the part played by image-ing and symbol-making in the discovery of new truths and new techniques. For we must insist that truths are generally discovered not so much on account of new evidence appearing as on account of the evidence being seen against the background of a symbol which gives coherence to what had previously seemed chaos. Newton was not the first to see an apple falling, but he was the first to see the falling apple against the background of the stars; and it was his conviction of the orderliness holding together the apples and the stars which enabled him to formulate the law of gravity. Indeed, it would seem that evidence only yields what can be properly described as 'facts' when that evidence has been interpreted in terms of some all-embracing symbol. As Cassirer puts it, 'We must refer our observations to a system of well-ordered symbols in order to make them coherent and interpretable in terms of scientific concepts.'[7]

5 *The Mind and the Eye*, p. 117.
6 cf. Henigel. *Archery in the Art of Zen*. Kegan Paul, 1953.
7 *Essay on Man*, p. 217.

Evidence only acquires factual status when it has been interpreted against the background of some convincing symbol. This feature of our knowing may go far to explain some of the impasses in which scientific thinking is so frequently found. The impasse in regard to psi phenomena, for example: no matter how much evidence of psi phenomena is brought forward sceptics refuse to accept it, and will continue to do so because they cannot fit the evidence into any system acceptable to their minds. It is not the evidence which is lacking but the adequate symbol through which the evidence is seen to hang together. Presumably if a sceptic's mind were to generate such a symbol he would describe this happening very much as Agnes Arber describes her realization of plant-configuration—and then, for the first time, he would be justified in describing psi phenomena in factual terms.

It would seem, then, as if the emergence of symbols through which new knowledge is mediated cannot be deliberately provoked. Apparently it is a gift and certain individuals or families are granted an extraordinary share of this imaginative insight. The Hopkins family, for instance, has given us Gerard Manley Hopkins, and the poet's own father, as well as Sir Frederick Gowland Hopkins and his daughter Jacquetta Hawkes, each of whom has enriched our understanding of the universe in one way or another. Of the natural scientist in this family succession a leading biochemist has written: 'Frederick Gowland Hopkins, the instaurator of biochemistry in modern Britain, was possessed of a particularly penetrating gift of imagination, which enabled him to visualize the protoplasm of the cell as a kind of chemical factory, where a large number of reactions were able to proceed in close contiguity without becoming disorganized.'[8] And it is the same imaginative gifts that have quickened the archaeological work of his daughter so finely displayed in *A Land*.

At this point I should presumably turn the argument and maintain that the emergence of appropriate symbols, far from being outside our control, can be directly traced to religious inspiration. And there are respectable thinkers who do seem to maintain just this. Mircea Éliade, for example, Professor of Comparative Religion at Paris, asserts that the relationship between science and religion has been seen topsey-turvey; that the myths of fertility gods are not an extrapolation of man's view of natural forces;

8 J. H. Needham, in *Aspects of Form*, ed. L. L. Whyte, p. 83.

rather it was through the fertility myths that men came to understand the cycle of the life, death and rebirth of vegetation.[9] Similarly, André Varagnac has argued that the invention of the wheel and the chariot were first made in a religious context; that the use of the symbolic wheel of fire in association with the sacred horse precedes their use for secular purposes.[10] Only in terms of the supernatural do natural processes become intelligible.

But whilst I would not go so far as this, and maintain that the Christian heritage of symbols directly produces the appropriate means of understanding the natural world, I do believe that it does so indirectly. For if there is one thing taught us by the history of science, it is that discoveries are seldom made in isolation; they are made when the level of imagination in the community reaches such a pitch of intensity and richness that it lifts the individual thinker onto the very crest of his own powers. And at no time in history has this pitch of intensity so often been reached as during those periods when communities have been swept into the richness of the Christian faith, as the witness of Christian artists, poets, musicians and scientists proves. The great age of modern science begins with a typically Christian sentiment expressing a conviction of the European community: 'There are more things in heaven and earth than are dreamt of in our philosophies.' And perhaps that great age has come to an end now that the faith has ebbed so low, and a modern biologist finds himself sadly compelled to exclaim, 'There are fewer things in heaven and earth than are dreamt of in our philosophies.'[11] For it is inconceivable that men to whom the universe has become a dull grey meaningless accident should retain the spiritual energy to penetrate ever further into what their predecessors termed 'the wonders of nature'.

And such men will be in a yet more hopeless position if we turn to them for our final question and ask them if they can enlighten us on the meaning of the whole universe. The question, to them, is nonsensical since their *a priori* dictum of despair decrees questions to be meaningless which they cannot prove to be answerable. (As if human beings have ever known what could be done until they have tried! On such *a priori* grounds Columbus was a fool to sail for America.) But any scientist who looks into the book of nature for its meaning, and not simply for its lettering, will find

9 *Traité de l'histoire des religions.*
10 *Civilization Traditionelle et Genus de Vie.* Paris, 1947.
11 The French biologist, Jean Rostand.

himself echoing the voice of Jacquetta Hawkes as she speaks of the coming of spring to this world of ours:

'It came suddenly. About one hundred million years ago, when the chalk of our present downs was slowly settling on the floors of warm, clear seas, and when dinosaurs, fantastic as man's imagined dragons, had possession of the land, the ancient evergreen vegetation rapidly made way for flowering plants and deciduous trees. Already there were varieties of fig, magnolia, poplar and plane, and many honey-bearing flowers. Indeed, it may have been the discovery of the benefits and pleasures to be exchanged between pollen-carrying bees and honeyed blossoms which excited the sudden burgeoning of vegetation and the birth of the spring season.

'From that time onwards, spring has always been present on earth, yet it was long before it achieved the variety and perfection we enjoy; long before the song-birds came to add their celebrations to those of the plants. It has, in fact, taken unimaginable stretches of time to create the youthful season from the ancient stuff of our planet.

'It is impossible for us to interpret symbols composed on so god-like a scale. Yet it seems to me that there must be some meaning for humanity in this history, in this vision of life growing younger and younger. Is not something of the same sort happening within the human mind? Sometimes we feel old, decadent even, but looking with a deeper sense of perspective can we not see our imaginative powers burgeoning like our earthly spring? Surely there is some message of hope written in letters too vast for our comprehension.'[12]

That quotation provides us, I think, with the general mood and disposition that should animate the natural scientist as he begins to ask himself this ultimate, all-embracing question. But, being couched in general terms, it does not bring out the unique urgency with which the natural scientist is brought face to face—in the inescapable, concrete details of his work. As an expression of this urgency I can do no better than cite some sentences from a scientist who has devoted his life to the study of parasites. To him I leave the last word:

'If the bird on the bough sing clearly of Heaven, the predatory carnivore, stealing upon it to strike it down, exhibits no less than

12 *Sunday Times*, April 18, 1953.

its victim the lineaments of God. The parasitic animal, following its ways in the body of either of these creatures, must also reveal these lineaments as does also the man who observes, with anger and despair, its destruction of the beauty he adores.

'The dilemma, then, is this. We try, in our human pride and self-centredness, to find a God who shall have made a universe suited to our ideas. . . . The way out is the way of the great objective artist . . . of conquering the self and entering into the souls of the objects which we perceive. . . . The attempt to do this, to enter into the non-human, whether it be living or not, and to recreate it, when it is understood, for the contemplation of our fellow-men, is the task of the saint, the artist and the philosopher rather than that of the biologist. He is, however, a poor biologist who does not try to be something of a seeker after God as well.'[13]

[13] G. Lapage. *Parasitic Animals.* Cambridge, 1951, pp. 333-4.

THE SCIENTIST'S INTEGRITY*

LAURENCE BRIGHT, O.P.

I RECENTLY attended the meeting of the British Association at Oxford, at which a number of distinguished scientists emerged from the mysterious shadows of their laboratories and tried to give the general public an idea of what they had been doing—with varying degrees of success, since science has travelled far from the time when it was readily comprehensible to all educated people. One of the things that struck me was the number of times that the speakers went out of their way to emphasize that there was no longer any conflict—indeed, any possibility of conflict—between science and religion. It was natural enough, at an Oxford meeting, to recall the celebrated dispute which took place there in 1860 between Huxley and Bishop Wilberforce over the question of evolution. Tempers on that occasion ran very high. Nowadays, as was pointed out, such a scene is unthinkable. The

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