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THE INFLUENCE OF SCIENCE ON IDEAS OF THE UNIVERSE

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SYNOPSIS

The story of science since Francis Bacon has two threads. One quickly led to an idea of the universe which put the truths of abstraction at odds with the truths of feeling and imagination and undermined the work of the artist and the poet by diminishing the possibility of spiritual vision. The quest of science along this thread is power, and the fate of man is hubris and the destruction which follows it.

The other thread is less predominant but still strong. In it the experience of the scientist is not merely scientific but aesthetic and religious as well; his idea of the universe is at heart biblical and incarnational, and in this universe nature and grace are congruous. The quest of science along this thread is truth and the hope of man is redemption through faith by encounter with God.

This paper attempts to show how these two threads have developed and where, at particular times and sometimes in a particular person, they have been in opposition.

The present requirement for more scientists threatens to alter the balance of the faculties in the universities and with the decay of the liberal tradition the maintenance of a continuing respect for truth in the universities may demand that the will to power is countered within science itself.

Introduction

Professor Heisenberg, one of the scientists pre-eminent in modern physics, came to Cambridge in 1947 and gave two public lectures at the Cavendish Laboratory on atomic physics and quantum mechanics. He was asked also to lecture on his philosophical beliefs but because of language difficulties he preferred to open a discussion on these in private and a meeting for this purpose was arranged at the Vice-Chancellor's lodge.

On that occasion Professor Heisenberg spoke to an audience of Cambridge philosophers and scientists about the idea of the Universe which had been nurtured inside science since the beginning of the seventeenth century and how this model (or level) of reality, as he called it, had come to be at odds with the model of reality with which the artist is concerned.

Professor Heisenberg has also stated his views in a series of lectures which have since been translated into English,[1] and has made it plain that he foresees serious danger in this division.

However, he says, science cannot be stopped and " we have to reconcile ourselves to the fact that it is the destiny of our time to follow to the end of the road along which we have started ".

I intend in this paper to show some of the implications of the way in which these two models of reality have developed into secret, if not open, opposition, and also to point to another idea of the universe which scientists have held and in which the activities of scientist, artist and Christian can be directed towards a common experience and ultimately to a common end.

The present progress of modern physics indicates that science will continue to influence our ideas of the universe. The consistent pursuit of classical physics forced a change in the foundations of physics and it is not now possible to believe fully in a directly-accessible accurately-delineated objective world revealed by science. As Heisenberg says, " Science no longer deals with the world of direct experience but with a dark background of this world brought to light by our experiments ", and in another place " the dangers threatening modern science cannot be averted by more and more experimenting, for our complicated experiments have no longer anything to do with nature in her own right, but with nature changed and transformed by our own cognitive activity ". Dirac puts this in a slightly different form. " Nature's fundamental laws do not govern the world as it appears in our mental picture in any very direct way, but instead they control a substratum of which we cannot form a mental picture without introducing irrelevancies ", and he goes on to say " there is an increasing recognition of the part played by the observer in himself introducing the regularities that appear in his observations ".

It is important that the thinking of scientists about their science should be directed towards understanding the present position. The increasing numbers and impact of scientists in the universities means that in the future the vacuum left by the passing of the liberal tradition will necessarily be filled by whatever changes in human thought and desire are being at this time shaped and encouraged by science.

Francis Bacon and the founding of the Royal Society

To begin the subject-matter of this paper with Francis Bacon and the scientific movement of the seventeenth century is not to imply that this is the beginning of science; there are many scientists from Leonardo da Vinci onwards who could be included with profit. Yet it is with Francis

[1] " Philosophical Problems of Nuclear Science " (Faber and Faber, 1952).

Bacon and the generation who followed him—the pioneers of the new philosophy and the founders of the Royal Society—that scientific ideas began openly to organize men's beliefs about the nature of the universe and provide for the western world a new set of assumptions and a re-orientation of interest and attention.

Bacon was an iconoclast, often secretly and sometimes openly. In his statement of his philosophy he failed to find any place for whatever good there was in the largely sterile scholasticism of the previous centuries; although he claimed " to leave the honour and reverence due to the ancient undisturbed and undiminished " he and his followers made it clear that the opinions of the ancients were no longer to be considered seriously.

Some of his followers found in Bacon's dissociation of science and faith the excuse to lead a life divided between godliness and utilitarianism; they became the first of the utilitarian materialists and foreshadowed parts of the Marxist doctrine of science and some beliefs of modern scientific humanists. Marx certainly acknowledged him as one of the founders of modern materialism. Bacon declared he intended with his new philosophy to " endow the condition and life of man with new works ". The object of learning was to be " the relief of man's estate " and the discoveries of the new science were to " contribute to man's wants and vanquish his miseries ". " Only let the human race recover that right over nature which belongs to it by divine bequest, and let power be given it; the exercise thereof will be governed by sound reason and true religion."

Bacon put poetry outside " the palace of the mind ", and throughout his writings his dissociation of faith and science was accompanied by an implied, though not clearly stated, dissociation of the work of the artist, and all imaginative and aesthetic activity from the plain world of science.

This dissociation became very clearly marked in Bacon's followers. In their enthusiasm to apply Baconian ideas to educational reform they were very sure that scientific knowledge was the only worthwhile knowledge. Noah Biggs set out to remove " the rubbish "—" the frothy lectures, the Latin, the stupendous bulk of blind learning "—from the universities. John Durie was content to leave literary studies " to such as delight in vanityes more than in Truths ". William Petty who was Professor of Anatomy at Oxford and a foundation Fellow of the Royal Society not only sought to replace the old learning (which he declared ought to be suppressed and brought into disgrace and contempt of all men) by instruction in science for the good of the realm, the relief of material wants and the advantage of the pupils, but thought children should be taught to observe things accurately before they could read.

Forty years later the foundation of that body that was to lead science in Europe for nearly a century—the Royal Society—was one of the fruits of the new philosophy. Boyle's Invisible College in London, perhaps stimulated by the visit of Comenius (who was certainly influenced by

Bacon and was invited here by Durie and Hartlib to further their educational aims), obtained the King's approval and the Royal Society came into being. It would be idle to pretend that the founder fellows were all Baconians, and indeed I should point out here that there were some who believed in another kind of model of reality in their work; but even Boyle is known to have seen Bacon's works when he was young, though he does not seem to have been much influenced by them.

By the time Sprat in 1667 wrote his *History of the Royal Society of London for the Improving of Natural Knowledge* he could look on a world subdued, manageable, and untroubled by mystery, and say " The course of things goes quietly along, in its own true channel of Natural Causes and Effects. For this we are beholden to Experiments: which though they have not yet completed the discovery of the true world, yet they have already vanquished those wild inhabitants of the false world, that used to astonish the minds of men ". It remained only for Newton to fill in the details of the model of reality so that it became the ideal stage on which the growth of classical physics could be played out. James Ward puts it in this way. " As soon indeed as the movements of sensible bodies were found to admit of exact description by the science of mechanics the hypothesis at once presented itself that, as Newton expressed it, the other phenomena of nature might be deduced from mechanical principles." For long this mechanical theory was held to furnish us with the knowledge of the empirical reality which our sensible experience was supposed only obscurely to symbolize.[1]

With the development of the necessary mathematical apparatus, physicists saw this mechanical theory become an abstract scheme—a pure science which could only be applied with the help of the calculus. " In place then of the concrete world of sense symbolizing this abstract scheme, it has now become clear that it is the abstract scheme itself which symbolizes the concrete world from which it set out." The abstract scheme became reified into the accepted model of reality, and our idea of the universe has been moulded by it.

Of course the scientists' picture of the world was not stationary. Whitehead in his two lectures on " Nature and Life " has summarized the subsequent history of this model of reality. To trace it here in any detail would make this part of the paper intelligible only to scientists. Instead I wish by way of commentary to examine the position of Goethe and the reasons for his attack on the Newtonian theories; a particular piece of poetry by Wordsworth and W. H. Auden's comment on it; and four books which attempt to show how science has influenced the ideas of the universe held by poets and artists generally.

In conclusion I shall try to show the other thread in the story in which scientists and others have witnessed to a model of reality of a different

[1] *Realm of Ends*, James Ward, p. 4.

kind, and indicate in its light the questions which seem to face Christians and scientists to-day.

The Dilemma of Goethe

Goethe's two scientific works *Metamorphosis of Plants* and *Theory of Colours* were published in 1790 and 1810 respectively; neither of them has had a noticeable influence on the subsequent course of science. Yet Goethe is important if only because he made clear in himself the unbridgeable gulf between his artistic vision and what could be comprehended through the mental manoeuvres of the science of his day. Goethe stands a hundred years after the establishment of the Newtonian scheme, yet he regards it as his scientific mission to " liberate the phenomena once and for all from the gloom of the empirico-mechanico-dogmatic torture chamber ". After him, he hopes, scholars will refer to the Newtonian interlude in science as " the pathology of experimental physics ".[1] His importance is demonstrated by the fact that Heisenberg gives a chapter in his book (referred to above) to explaining the differences between Goethe's and Newton's theories concerning colour, and Heller (referred to below) heads the first chapter of his book " Goethe and the idea of scientific truth ".

In his preface to *Theory of Colours* Goethe compares the Newtonian theory of colours to an old castle " which was at first constructed by its architect with youthful precipitation ".[2] This he proposes to " begin at once to dismantle from gable and roof downwards that the sun may at last shine into the old nest of rats and owls, and exhibit to the eye of the wondering traveller that labyrinthine, incongruous style of building, with its scanty, make-shift contrivances, the result of accident and emergency, its intentional artifice and clumsy repairs. Such an inspection will, however, only be possible when wall after wall, arch after arch, is demolished, the rubbish being at once cleared away as well as it can be ".

This bitterness is only explicable in terms of an inward uncertainty and a dilemma; " the conflict which my scientific efforts had brought into my life was as yet by no means resolved; for my dealings with nature began to make claims on all my inner faculties ". Even the possibility of continuing his poetic work was in question. It was the knowledge of this that not only provided Goethe with an essential theme for his writings but committed him in his science to a campaign (as Heller puts it) " for retaining the balance of power between analytical reason and creative imagination ".

Heisenberg's treatment of Goethe and Newton leads him to examine the background of the two theories. He says it is not clear how far

[1] Quoted from *The Disinherited Mind*, E. Heller, p. 18.

[2] I have used a rather inadequate translation by Eastlake in 1840. Preface, p. xxii.

Newton's work was linked with the realization that an accurate knowledge of physical laws could lead to the technical mastery of nature; but he is sure that the two theories, one appealing to the scientist, the other to the artist, are dealing with two entirely different levels of reality. In the reality with which Goethe is concerned " events are not counted but weighed and past events not explained but interpreted ".[1] Goethe's struggle, says Heisenberg, will have to be continued to-day on an extended front.

Stones and Shells

Near the beginning of the fifth book of *The Prelude* Wordsworth describes the dream of a man who fell asleep while considering poetry and geometric truth. In this dream he sees an Arab who is riding off to bury a stone and a shell " with the fleet waters of the drowning world in chase of him ".

But the Arab has time to explain that the stone is a symbol of abstract geometry and analytical reason and the shell a symbol of imagination and poetic truth. The stone and the shell, the Arab's two treasures of Wordsworth's dream, are just those elements which Goethe fought to reconcile within himself.

In *The Enchafed Flood*, W. H. Auden examines these symbols of the stone and the shell and traces how each taken alone is full of danger. He links these with Blake and the concept of the universe which Blake associated with Newton, regarding it as having disastrous psychological, religious, political and artistic consequences. The development of these symbols is very interesting but it might be questioned how far Wordsworth was himself in sympathy with this interpretation. As much has been written about Wordsworth which shows him to be in favour of science as has been written showing him to be a severe critic of it; and Wordsworth was prolific enough to allow the search for quotations to support either case to be rewarding. But I think Wordsworth understood what he was saying here; in a pamphlet called *The Convention of Cintra* he writes: " While mechanic arts, manufactures, agriculture, commerce and all those products of knowledge which are confined to gross, definite, and tangible objects have with the aid of experimental philosophy been every day putting on more brilliant colours, the splendour of the imagination has been fading ". And he points out that holding all these possessions one may still be " a slave in mind; and if they veil from us this fact, or reconcile us to it, they are worse than worthless ".

The situation of the artist

To demonstrate the wide-spread effects of this model of reality upon the work of the artist and the poet, I have chosen four books which cover

1 Heisenberg, *Philosophical Problems of Nuclear Science*, p. 68.

the ground from several viewpoints and each of these will be considered in turn.

(*a*) " *The Disinherited Mind* "—*E. Heller*

It is Heller's belief that at the end of the Middle Ages " there occurred a radical change in man's idea of reality, in that complex fabric of unconsciously-held convictions about what is real and what is not ".[1] He illustrates this change by reference to Cowley's poem which prefaces Sprat's *History of the Royal Society* to which I have already referred, and asserts that by this change reality and symbol were divorced, leaving the artist in a private world out of communication with the scientific sphere of reality, " that obedient patient under the fingers of man's mind ".[2]

His book, *The Disinherited Mind*, deals with German literature from Goethe to Kafka, and he adds in the preface: " I can hardly think of one major writer or thinker within this period of German literature, whose work would not reflect the situation of mind and spirit which I have tried to describe within the limits of my choice ". The whole book is the story of a progress into desperation and despair, reflected often enough in the author's own style.

Heller quotes a remark of Goethe's in a review: " A man, born and bred in the so-called exact sciences will, on the height of his analytical reason, not easily comprehend that there is also something like an exact concrete imagination ". As we have seen, it is Goethe's attempt to hold together analytical reason and concrete imagination—the stone and the shell—the world of the scientist and the world of the artist—that explains so much of his work. In Nietzche's *Will to Power* the prophecies of Goethe are elaborated into the certainties of nihilism. With Rilke, Kafka and Karl Kraus, the full implications of this nihilism are explored.

Clearly in some part of what I have written in this paper I am in agreement with Heller; he has traced in German literature and stated in an extreme form the consequences, " the potential hubris ", inherent in the scientist's quest. Yet I cannot feel that this simple pessimism does justice to the whole complexity of the story of science. Certainly there appears to be a crisis in scientific method; but a crisis surely implies the need for a decision and the possibility of a choice. And Bacon's wish to keep science pure from religion can never succeed in a world loved by the Father of Christ; God works in history and in science, and matches man's desperation with His greater love.

(*b*) " *The Structure of Poetry* "—*E. Sewell*

Miss Sewell's book is noteworthy here for two reasons; in it she develops a method for the critical appreciation of the poetry of Rimbaud and

[1] *Hazard of Modern Poetry*, E. Heller, p. 13. (Bowes and Bowes, 1952).

[2] *Ibid*, p. 14.

Mallarmé, two French poets who illustrate the extremities of isolation into which poetry can be driven; and her way of thinking about poetry she introduces with the help of ideas drawn from mathematics, logic and physics. Her bibliography includes sixteen books on physics and an equal number on logic and mathematics.

Miss Sewell was surprised to find how much these subjects helped; but one can see that the task of the poet who has to build himself his own poetry universe is likely to have parallels with that of the scientist who has constructed a model of reality and who is still seeking to understand the nature of the abstractions into which he has led himself. " Rimbaud was trying to create a poem-universe that should contain everything, every thing; Mallarmé to create a poem-universe which should contain nothing, no thing ".[1] Rimbaud's efforts were directed to creating a universe divorced from reality and entirely without order—a nightmare; Mallarmé's intentions were to make a world of perfect order and complete abstraction; and both fell into extreme obscurity and encountered great difficulty with the language in which they had to express themselves.

The language we use to-day was well-formed before the dissociation of sensibility and science began; to communicate efficiently, both the scientist and the artist are continually modifying and struggling with words—though with quite different intentions.

Rimbaud and Mallarmé and Miss Sewell's study of them map quite clearly the roads of dissociation from experience, and the one towards abstraction is already known to all scientists. The centre in which poetry and science both belong can only be held, Miss Sewell suggests, with the help of laughter and religion.

(c) " *Science and English Poetry* "—*D. Bush*

This book does not seem to me to be so important as the others discussed in this part of the paper, but I have included it because it gives a straight-forward account of the influence of science upon many English poets from the Elizabethan age to the present. Bush begins by showing how the Elizabethan poets' reactions to traditional problems became from then on largely conditioned by science. In Milton's *Paradise Lost*, " the last great presentation of the traditional concept of one divine and natural order ", the theme is, according to Bush " the violation of divine order in heaven and in earth, the contrast between irreligious pride and religious humility. And this theme is directly related to science, indeed to the whole problem of knowledge which is the great problem of the seventeenth century ".[2]

[1] *The Structure of Poetry*, E. Sewell, p. 102.

[2] *Science and English Poetry*, D. Bush, p. 47.

In Dryden, Pope, Thomson and Young, with the help of a Deist approach, we find some attempt to reconcile the new philosophy with poetry and with religion. To Blake this was impossible, and indeed even a brief examination of the poets of the late seventeenth and early eighteenth century explains the need for what Bush calls the romantic revolt against rationalism. The madness of Blake had little influence, but in Coleridge and Wordsworth, and later in Byron, Keats and Shelley, " the romantic protest against the mechanistic abstractions of science " was continued declares Bush, but it did not last. " In the nineteenth and twentieth centuries the heritage of romantic optimism passed to the scientists, leaving poets to the contemplation of a great void ".[1]

In the third section of *In Memoriam*, Tennyson writes:

> . . . Nature stands
> . . . A hollow form with empty hands.
>
> And shall I take a thing so blind
> Embrace her as my natural good;
> Or crush her, like a vice of blood,
> Upon the threshold of the mind.

Tennyson had to conquer despair; more modern poets have carried on his battle. Bush concludes his book with a chapter on the poets of our own age; although he seems to have an inadequate grasp of what is now happening in science, he shows quite clearly that the main effects on the poet's vision of the world-view built up in science have been far from welcome.

(d) " *The Dilemma of the Arts* "—*W. Weidle*

The last of the books I wish to examine here is more widespread in its theme and more hopeful, for although Weidlé once proposed the sub-title " A study in Disintegration " for his book, he does find a solution within the Christian faith to the dilemma of the artist.

It is only fair to say that Weidlé does not attribute the titanism of the artist directly to the changes wrought by science. But he does place its upsurge at the Renaissance, and sees its result as a self-enclosure of the artist " within his calling and within the irreducible confines of his own person ".[2] To Weidlé the sickness of art is a sickness of the creative soul itself. " With an anguish, a despair which for a century has not ceased to grow, the artists chase the impossible, covet the extreme, array one against the other the contraries which it was their mission to reconcile,

[1] *Ibid*, p. 108.

[2] *The Dilemma of the Arts*, W. Weidlé, p. 12, trans. by M. Jarrett-Kerr. See also his remarks in criticism of Leonardo da Vinci on p. 15.

and each time sink deeper into the irreversible night of art that is disembodied and slowly disintegrating."[1]

Weidlé reviews many of the arts in turn, architecture, painting and music as well as poetry and literature; all seem to him to be in different ways in the same case—and this, he makes it clear, is a bad case. Yet, unlike Heller and Bush, in the end he sees a clear hope; " the creative imagination cannot work indefinitely in a vacuum without some kind of metaphysical justification, and it is faith alone which can provide it ".[2] In Christian faith Weidlé sees the hope of the creative word returning to the artist. Indeed he would claim that this hope is in a minor way already expressed in poets like Claudel and Eliot, G. M. Hopkins and Charles Williams.

The other thread

If, at this point of the paper, it now seems clear that the idea of the universe with which we have been dealing is such as to undermine the work of the artist and poet, and that such a generally accepted model of reality has by the influence of science come to underlie all the thinking of Western society, we might have good reason to be pessimistic.

But it would be quite wrong to suppose that only this one model of reality has arisen as a result of the influence science has had on men's ideas of the universe. The exploitation of nature and the achievement of power over things, the desire to assume that anything not scientific is of no worth—all these were present in the seventeenth-century beginnings of the modern period of science; but also present was the quest for truth. It is sometimes assumed in science that truth is something we can manipulate, gain power over, or collect. This is not so; and nor can it be identified with the class of all true propositions or with any catalogue of facts. Truth requires an involvement and a trust in experience, a willingness to submit to the test of events in a manner shared by scientist, artist and religious man alike. The Christian consideration of truth begins with Christ's statement " I am the Truth ".

Jaspers has said of science in one of his books: " The evil consequences of subjecting science to the will to power, have already shown themselves. They have to be countered with reason and science itself. The source of science is not the will to power over things but the will to truth. The most admirable, selfless and unassuming men, inspired by the human capacity for knowledge, have their place among the great scientists and scholars of the last few centuries (not excluding such figures as Bacon and Descartes who may nevertheless have contributed something to the misinterpretation of science as a product of the will to power). The will to

[1] *Ibid*, p. 35.

[2] *Ibid*, p. 125.

truth, this source of human dignity, is the origin of modern science, and its character ".

There were scientists in the seventeenth century who saw and fought for a different idea of the universe from that held by Bacon and his followers John Ray in *The Wisdom of God manifested in the Works of the Creation* published in 1691 was able to quote Henry More and Ralph Cudworth in his support. More's *Antidote against Atheism* was a reaction to the first pangs of mechanistic sterility, and the pamphlets that surrounded the early years of the Royal Society were expressive of a division, often hidden, sometimes mis-stated, that was to be in the background of the history of science from then on. In our own day Whitehead and Eddington have campaigned for a concept of nature in which understanding and relatedness are more important than precision and prediction. Collingwood[1] suggests " that the scientific movement of the seventeenth century produced a huge outbreak of dichotomies, e.g. (*a*) in metaphysics, between body and mind, (*b*) in cosmology, between nature and God, and (*c*) in epistemology, between rationalism and empiricism. The distortions in the relationship between these have not been improved in the subsequent history of science. It is my opinion that the work of Eddington and Whitehead has begun to remake these relationships, and there is good hope that the sheer need to make sense of modern physics will lead scientists to think again about the nature of the world which has yielded so much power into men's hands.

Conclusion

It is not easy in a world where the production of power is becoming so large a thing and the concern with truth so small a thing to find hope in reality and faith in God. Yet in the beginning man is placed in the garden of earth, which is, as he himself is, God's creation. The Bible speaks of man's relationship to nature in terms of a matrix of grace in which all things are significant because they are created and all things find fulfilment in praise, as the work of Christ in men and in creation is accomplished. It is on biblical grounds that it seems that only a Christian conception of the universe will enable science to exhibit its character as the will to truth.

The spirit of truth is needed in both science and religion, and it is a sign of the spirit of truth in both when they cannot be opposed or even separated. When Simone Weil declares " Scientific investigation is simply a form of religious contemplation " or Professor Coulson " Science is a religious activity ", the ordinary scientist is incredulous. His incredulity derives from the idea of the universe he has, and the concept of truth held not only by scientists but by theologians.

[1] Collingwood, *Idea of Nature*, p. 100. (Oxford University Press, 1945).

The Augustinian-Franciscan principle that God is truth (and, therefore, immediately certain more than anything else, including myself) began to be lost, according to Tillich, when Thomas Aquinas interpreted it in Aristotelian terms and said that God is immediately certain for Himself but not for us. But Hort has declared " It is not too much to say that the Gospel itself can never be fully known till nature as well as man is fully known; and that the manifestation of nature as well as man in Christ is part of His manifestation of God. As the Gospel is the perfect introduction to all truth, so on the other hand it is in itself known only in proportion as it is used for the enlightenment of departments of truth which seem at first sight to be beyond its boundaries ".[1] The Transfiguration of Christ is, as a physical event in Christ's life, a demonstration of the truth about matter. As a spiritual principle it reveals that nothing in science is outside the redemptive work of Christ and that science and any idea of the universe that is part of it are frustrated without the transfiguring power of God.

Seen within the will of God and as part of the quest for truth, science can still provide an integrating force to replace the liberal tradition which in the past did so much to strengthen the universities. It is difficult to see any alternative to science that could prevent the continuing of the process that has already reduced some colleges and universities to a collection of departments uninterested in anything except their own gadgets and concepts. It is easy in the light of past science to be pessimistic about its contribution to human values, however much advantage one attributes to its concerns with technical progress and with social betterment. Yet there may be in the new physics with all its dangers to the survival of man in either body or soul a slowly-forming idea of the universe which may remould the problems to which Collingwood referred, renew the scientists' quest for truth, and reawaken men to the persistent call of God to repentance and redemption.

[1] F. J. A. Hort, *The Way, The Truth, The Life*, p. 83.

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