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“Natura e provvidenza”

***a cura di
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Nature and Providence

The scientific perception of nature is that of ^{which} a physical world ~~that~~ is rationally beautiful and whose history has been astonishingly fruitful. ^{would want to claim} I claim that these scientific insights are consonant with the religious understanding that the universe is a creation, the expression of the divine mind ^(signalled by the order of the physical world) and purpose. If you grant me all that, it ^{the divine} still falls short of the Christian assertion that the One ^(signalled by the ferocity of cosmic history) whose will is thus expressed is most fittingly to be spoken of in personal terms. Here, you recall, was the sticking point for Einstein, as it is for many other scientists. He was impressed by the universe's wonderful order, and liked to use God as a symbol for it (referring to him in comradely terms as 'the Old One'), but he could not believe in a God who acts, not just in the single great act of holding the world in being, but in some causal way within cosmic history, bringing about things which would not have happened without divine interaction. My question tonight is, Is such an idea of God's action a coherent possibility for those of us who live in a scientific age?

After all, science discerns a universe which is very regular in its operation and there is no doubt that this makes the question of divine agency one that may seem difficult for us to answer positively. Previous generations might pray for rain in times of drought without uneasiness, but 'amen' may well stick in many throats if such prayers are offered in church today. Doesn't the weather just happen?

Yet, the God of Christian theology is a *personal* God. We recognize that human language applied to the divine nature must be being used in some stretched or analogical sense, but if personal language about God is to mean anything at all, it must surely mean that he does particular things in particular circumstances. He is to be addressed as 'Father' and not as 'Force'. Thus a great deal is at stake for Christian theology (and, I think, for that of Judaism and Islam too) in seeing if it is possible, all the difficulties notwithstanding, to answer 'Yes' to my question, whilst still maintaining one's scientific integrity.

You might think that one could cut the Gordian knot of theological perplexity by appealing to the omnipotence of God. Can't he just do what he likes? It is important to recognize what is meant by speaking of God as 'almighty'. He can do what he likes, but he only wills *what is in accordance with his nature*. The very last thing that the utterly consistent and rational God can be is a kind of capricious celestial conjurer. Love works by process, respectful of the other's independence and integrity, and not by overruling magic. That is God's relationship with his creation, to which he has given the gracious gift of being itself. Those very laws of nature, whose regularities are discerned by science, are understood by the theologian to be willed by God and to reflect his continuing faithfulness. God cannot work against the laws of nature, for that would be for him to work against himself. If God acts in the world it will be within the grain of the universe and not against it. He cannot deny himself. Of course, consistency is not a dreary

uniformity. In unprecedented circumstances, totally unexpected things may happen, giving rise to those events which, because of their surprising character, we might call miracles. Such occurrences are to be understood as signs of a deeper divine rationality than we had previously apprehended, just as unexpected physical phenomena, such as superconductivity, are signs of deeper consequences of the laws of physics than we had previously understood.

If God works within the grain of nature, we have to ask whether that grain is in fact sufficiently open to contain the possibility for such particular divine activity? In a mechanical universe, such as people in the eighteenth and nineteenth centuries conceived the world to be, that could scarcely be the case. If the cosmos were a gigantic piece of clockwork, then the only role for God would be the deistic one of the Great Clockmaker, who constructed the machinery, wound it up, and now just lets it tick away. We have always, in fact, known that mechanical picture to be inadequate to our experience, for we have always known, as surely as we know anything at all, that we are not pieces of elaborate clockwork. People might write books with titles like 'Man the Machine', but those who did so took their own writings more seriously than would be appropriate for the scribblings of an automaton.

Twentieth century science has seen the death of a merely mechanical view of the universe. Two blows have delivered it the coup de grâce. The first was the discovery of quantum theory, the astonishing fact that the physical world is cloudy and fitful at its subatomic roots. The quantum world is unpicturable and unpredictable

in detailed behaviour. Fascinating though this discovery is - and I have spent the greater part of my adult life working in quantum physics - I do not think it is of the highest significance for this lecture's topic. When we consider providence, we are talking about events in the everyday world which involve the behaviour of trillions of atoms. Although each atomic event has some degree of randomness in it, the combination of a very large number of such events can, and usually does, produce an overall pattern of great reliability. This is the same principle as that on which the Life Insurance offices work. They do not know when you will die, but the actuaries have a sufficiently good idea of how many people in your cohort will die in the next few years to enable the offices to make money, provided they insure enough people. In the same way, unpredictable microscopic events yield by their sum reliable macroscopic behaviour. I doubt whether God interacts with the world by scrabbling around at its sub-atomic roots.

Much more significant for our present purpose is a most surprising discovery of twentieth century science which has only been widely appreciated in the last thirty years. It relates to classical physics, the physics of the everyday world. This discovery deals with ideas which would have been familiar to Sir Isaac Newton but shows that they have consequences which would have surprised (and interested) him very much. Those of us who learnt about Newtonian physics did so by considering certain simple systems, such as the steadily-ticking pendulum. These systems are tame and robust. By that I mean that if you disturb them a little, the consequence for

their behaviour is correspondingly slight. They are predictable and controllable. We thought that the everyday physical world was all like that, that it was mechanical in its nature. But now we have discovered that, though there are clocks in the Newtonian world, most of it is made of clouds. By that I mean, systems which are so exquisitely sensitive to circumstance that the smallest disturbance will produce large and ever-growing changes in their behaviour. It will not surprise you to learn that this behaviour came to light in a literally cloudy subject. Ed Lorenz was trying to model the behaviour of the Earth's weather systems. To his intense surprise he found that the smallest variation in the input to his equations produced exponentiatingly-large deviations in the behaviour of his solutions. In the trade this is called the 'butterfly-effect': a butterfly stirring the air with its wings in the African jungle today, will have consequences for the storm systems over ^{Milan} ~~Devonshire~~ in three weeks time. Since we cannot possibly know about all those African butterflies, detailed long-term weather forecasting is never going to work!

This astonishing discovery is so important that I would like to explain it in a bit more detail. For my example I'll take the air in this room. As you know, it consists of lots of little molecules buzzing around. They are not quite miniature billiard balls, but when they collide with each other they behave in the same way that billiard balls do, so we can use that simple model for our present purpose. The molecules are fast moving and fairly close together, so that collisions are frequent. In fact, in only 10^{-10} seconds (one ten thousand millionth of a second) each molecule has on average about

fifty collisions with its neighbours. We now pose the question: how accurately must we know the circumstances of one of these molecules at the beginning, if we are to know with tolerable accuracy in which direction it will be moving 10^{-10} seconds later? The calculation is straightforward. Newton himself solved the problem of how two balls separate after a collision. It is determined exactly by his equations, but the angle at which they separate depends very sensitively on the precise angle at which they collided. Anyone who has played ~~pool~~^{billiards} will know that a small error in cueing the ball produces a large and frustrating error in the subsequent motion after impact. That is so for one collision. If we have fifty successive collisions, these uncertainties mount up very rapidly, in fact they exponentiate. Taking that into account, we reach the following astonishing conclusion: that we shall make a serious error in our prediction if we have failed to take into account an electron (the smallest particle of matter) at the edge of the observable universe (the furthest distance away) interacting with the air molecules in this room through gravity (the weakest of the fundamental forces of nature). So even as simple a system as air in so short a time as the ten thousand millionth of a second, cannot have its detailed behaviour worked out without literally universal knowledge of all that is happening. Here is a cosmic butterfly effect with a vengeance! Since we cannot possibly know about all those electrons in the most distant galaxies, we have in the air in this room a system which is intrinsically unpredictable. It is also intrinsically unisolatable, sensitive to all that happens in the world around it.

The discovery of the widespread existence of these incredibly sensitive systems is called the theory of chaos. The name is not particularly aptly chosen, for their behaviour is not completely random but it has about it a kind of ordered-disorder; there is a pattern to its haphazardness. Chaos theory is an oxymoronic sort of subject. I do not have time to go into detail about strange attractors and the like, because I want to press on to ask what significance we should attribute to this discovery. What all can agree is that these systems are unpredictable in behaviour and unisolatable in their character, because of their extreme vulnerability to any alteration in circumstance. Yet the paradox is that the apparently random behaviour that follows from this sensitivity arises from the solution of completely *deterministic* equations. Which are we to take the more seriously, the behaviour or the equations?

One could put the issue this way. The property of unpredictability relates to epistemology, what we can *know* about these systems. In fact, we cannot know in detail what their future behaviour will be. Is that to be interpreted simply as a matter of ignorance, or is it a pointer to there being an actual openness about the future for such systems? The latter claim would be concerned with ontology, what is actually the case.

Scientists are instinctive realists. That is to say, they believe that what we can or cannot know is a reliable guide to what is indeed the case. Their motto is 'Epistemology models ontology'. I am

proud to wear from time to time a sweat-shirt my wife gave me with that stirring slogan emblazoned upon it.

You can see how that works by recalling a famous episode in the history of quantum theory. Heisenberg showed that for a quantum entity such as an electron one could not simultaneously know where it was and what it was doing. His analysis proceeded by showing that position and momentum could not both be measured at the same time with arbitrary degrees of accuracy. In other words, his conclusion was initially concerned with epistemology, what could be known about electrons. Yet, within a very short time, he and almost all other physicists, were interpreting the uncertainty principle, not as a principle of ignorance (epistemology), but as a principle of indeterminacy (ontology). If you couldn't establish the values of both position and momentum, then an electron did not actually possess definite values of those two quantities. Epistemology models ontology!

In a similar way, I wish to take the hint from chaos theory, and draw from it the ontological conclusion that the physical world, even at the everyday level, is something more subtle and supple than a merely mechanical universe. Added confidence in this strategy arises from the recognition that it thereby begins to describe a world of which we can conceive ourselves as inhabitants. That is a gain for physics. I do not for one moment suppose that we did not know ourselves not be automata till chaotic dynamics came along to assure us that this is so. It is fundamental to all human rational inquiry that we are more than machines. If we were merely computers made of

meat, what would validate the programmes running in our brains? Doubtless, evolutionary pressures would ensure a certain rough-and-ready adequacy to deal with everyday experience relevant to survival, but the subtlety and capacious grasp of the human intellect vastly exceeds anything that could be justified in that way. Those who affirm a physical reductionist view of humanity saw off the rational branch on which they need to sit while framing their argument.

The present working-out of this open metaphysical picture is necessarily tentative. I believe it will concern us for a very long time ahead. I have made various essays in that direction in my writings and can now only sketch the lines of thought involved. The first question is what one makes of the *deterministic* equations from which the theory of chaos began? I believe that they must be treated as *approximations* to a more supple reality, approximations which arise when we treat the parts making up these complex systems as if their behaviour could be discussed in separation from the environment which surrounds them. Remember that exquisitely sensitive systems are in fact intrinsically unisolatable, even if, for our convenience, we try to treat them as detachable from their surroundings.

In fact there is much in modern physics which resists a particulate, reductionist conception of reality. The universe fights back against such treatment and reasserts a need for holism. Even the atomic world cannot adequately be discussed atomistically. The mysterious quantum mechanical 'togetherness-in-separation', discovered by Einstein, Rosen and Podolsky, and confirmed experimentally by Alain

Aspect, by which two electrons, once they have interacted, retain the power to influence each other instantaneously, however far apart they separate, shows that this is so.

To say that the future is open is not to imply that it comes about as the result of some whimsical lottery. Rather, it means that a 'bottom-up' description in terms of 'isolatable' parts will only partly prescribe what will occur (there is structure in chaotic systems, but not a rigid uniqueness of behaviour) and that the consequent openness of grain towards the future will give space for the operation of additional causal principles of a holistic or *expressing the influence of the total environment.* 'top-down' character in bringing about what actually happens, | When one thinks about what form these principles might take, one sees that the character of their operation is what might be called, in a vague but suggestive phrase, 'active information'. By that I mean that the bottom-up description takes care of questions of energetic interchange between constituents, but in a way that leaves room for additional 'pattern-forming' agency within the range of possibility left open in the terms of the bottom-up description alone. The proliferating possibilities which the future holds for these complex systems are discriminated from each other, not by differences of energy but by *differences of developing pattern.* differences of dynamic structure, | One catches the faintest glimmer of what might prove eventually to be a way of comprehending activity by both matter ('energy') and mind ('information') within a single metaphysical scheme.

The ontology modelled by the epistemology appropriate to chaos theory is therefore one in which holistic informational agencies can

be at work within the supple confines of the physical world. I suggest that such active principles might take at least three forms:

- (1) There may be holistic laws of nature presently unknown to us but capable of eventual scientific discovery. The amazing drive towards increasing complexification, discernible within the fruitful evolving history of the universe, may well require for its full understanding the operation of such laws.
- (2) As I have already suggested, here also may lie the eventual understanding of how human mental intention finds its realization within the flexible openness of our material bodies. It too is an expression of 'active information', though thought is very much more than the execution of information-processing algorithms.
- (3) It seems entirely possible that God also interacts with his creation through 'information input' into its open physical process. Thus we glimpse in a rudimentary way what might lie behind the theological language, often associated with the work of the Spirit in Christian theology, of God's 'guiding' and 'drawing on' his creation, imminently working on the 'inside' of cosmic process.

I believe that we can take with all seriousness all that science tells us about the workings of the world and still believe that the God who holds it in being has not left himself so impotent that he cannot continuously and consistently interact within cosmic history. Some consequences follow from this picture of the nature of divine action:

- (a) God's action will always be hidden. It will be contained within the cloudy unpredictabilities of what is going on. It may be discernible by faith but it will not be exhibitable by experiment. It will more readily have the character of benign coincidence than of a naked act of power. It will be part of the complex nexus of occurrence from which it cannot be disentangled in some simplistic way that seeks to assert that God did this but nature did that. All forms of agency intertwine.
- (b) Although much of the physical world is cloudy, there are also clockwork parts of what is going on. Their regularity and predictability will be to the believer signs of divine faithfulness. Long ago, Origen recognized that one should not pray for the cool of spring in the heat of summer (however tempting it might ^{have} ~~been~~ to do so in his native Alexandria!). The succession of the seasons is a clockwork part of terrestrial experience and the faithful God will not set that aside for the convenience of those who address him.
- (c) The picture I have given is of an open future in which both human and divine agency play parts in its accomplishment. Christian theology has, at its best, striven to find a way between two unacceptably extreme pictures of God's relationship to his creation. One is that of the Cosmic Tyrant, who brings everything about by his will alone. He ~~is~~ ^{would be} the puppet-master of the universe, pulling every cosmic string and keeping all within his tight control. Such a God

could not be the God of love, for the characteristic gift of love is of freedom to the beloved. In his action of creation God has allowed the other truly to be, in the degree of independence appropriate to each part of it.

In terms of Christian thought, an evolutionary universe is to be understood theologically as one that is allowed by God, within certain limits, to make itself. This gift of freedom is costly, for it carries with it the precariousness inherent in the self-restriction of divine control. Something relevant to the mystery of suffering is contained within this insight.

I believe that God wills neither the act of a murderer nor the incidence of a cancer, but he allows both to happen in a world which is permitted truly to be itself. ^{Yet} ~~Now~~ the God of love cannot be an indifferent spectator either. The detached God of deism, simply watching it all happen, is another extreme, unacceptable to Christian thought. We seek a middle way in which God interacts with his creation without over-ruling it. There are many perplexities in trying to understanding in any detail what this could mean. We encounter the cosmic version of the theological conundrum of the relation of divine grace to human free will.

- (d) It has sometimes been claimed that the view of God's action that I am advocating is a return to the discredited idea of a God of the Gaps. I deny that this is so in the pejorative sense implied by the criticism. I am not invoking God to

explain that which is currently scientifically unexplained, but which is, in principle, scientifically explicable. A God used to plug such gaps of ignorance is a pseudo-deity who will fade away with the advance of knowledge. Yet if there are indeed holistic causal principles (of any kind) at work in the world, there will have to be gaps in the bottom-up description which provide room for their operation. In this *intrinsic* sense, we are quite properly 'people of the gaps' and God is quite properly a God of that kind of gap also.

- (e) I am developing a picture of a world of true becoming in which the dead hand of the Laplacean calculator is relaxed and the future is not a mere rearrangement of what was already there in the past. Such a genuinely temporal world must be known in its temporality, not least by God who knows things as they really are. If that is the case there must be, as the process theologians have suggested, a temporal pole in the divine nature alongside the eternal pole recognised by classical theology. I also believe that in such a world even God does not know the future. That is no imperfection in the divine nature, for the unformed future is not yet there to be known. God possesses a current omniscience (he knows all that can now be known) but not a total omniscience (he does not yet know all that will be knowable). The act of creation involves a voluntary

limitation, not only of divine power in allowing the other to be, but also of divine knowledge.

My belief is that we can take science with all seriousness, yet not conclude that the fabric of the physical world is so rigid in its structure that there cannot be powers of human and divine agency exercised within its unfolding history. Notice that I have been careful throughout to speak of God's *interaction*. I do so because I believe that he is continually and consistently related to his creation and I eschew the word 'intervention' because I believe that it carries overtones of the fitful and the arbitrary which are theologically unacceptable. The idea of a personal God exercising a special providence is not one that we have to give up. If that is the
~~case, we can go on to inquire whether we can ask such a God to do~~
 particular things. In other words, what are we doing when we pray?

When the scientist prays, he or she knows that they have not been given a blank cheque on a heavenly account. There are great mysteries in the operation of divine providence. Not only are there the clashes of human desire - the *prunt* praying for a fine day for the church fête, the farmer praying for rain for his crops - but there are also the deeper strangenesses of individual human destiny. The English theologian Ian Ramsey told a story of two men crossing the plains of North America in a covered wagon in pioneer days. They are set upon by an Indian band and a hail of arrows descends upon their vehicle. The horses are whipped up and they make their escape. One of the men has survived the attack; his partner has been killed. Ramsey rightly says that if the survivor is to speak of God's providence in his

survival, he must be prepared to speak also of God's providence in the death of his friend. There is no facile way of understanding these matters. After all, Christianity has a cross at the centre of its story.

One might ask, why do we have to pray at all? If God is good, won't he give us what is best for us without our having continually to ask him for it? What is going on then when we pray? Are we persuading God to do something he wouldn't bother to do if we didn't make a fuss about it? Or are we drawing his attention to something he might otherwise have forgotten? Or suggesting a rather clever plan that he hadn't thought of?

Obviously, none of these things can be right. I think, in fact, that we are doing two things when we pray:

- (1) My picture of how the future comes about is that we have some room for manoeuvre in its formation and that God has reserved to himself some room for providential manoeuvre also. I suggest that when we pray, we are offering our room for manoeuvre to be taken by God and used by him together with his room for manoeuvre, to the greatest possible effect. Because I believe that there is an inter-connectivity in things (holism again), I believe that alignment can have consequences for third parties also. In more conventional language, we offer our wills to be aligned with the divine will. A metaphor I often use is that of laser light. What gives laser light its unusual effectiveness is that it is what the physicists call

'coherent'. That means that the waves making up the light are all in step. All the crests come together and add up and all the troughs come together and add down, to the maximum effect. Light which is incoherent has waves out of step; crests and troughs can coincide and cancel each other out. I believe that divine and human coherence in prayer is genuinely instrumental; it can make things possible which would not be so if we and God were at cross-purposes. Two consequences follow from this. One is that prayer is not a substitute for action, but a spur to it. If my elderly neighbour is tiresomely repetitious in the telling of the stories of his youth, I do not absolve myself from the responsibility of patiently listening yet again simply by praying for him. The second consequence of this picture of petitionary prayer is that it makes sense of an intuition we have that corporate prayer is a good idea, that it is appropriate to encourage many people to pray for the same thing. This is not because there are more fists beating on the heavenly door, but because there are more wills to be aligned with the divine will.

- (ii) I owe the understanding of the second thing we are doing when we pray to some helpful thoughts of the Oxford philosopher, John Lucas. He says that when we pray we are called upon to commit ourselves to what it is we really want, in other words, to assign value. Such an assignment will be taken seriously by God, though it is not, of course,

an over-riding obligation upon him, as if he were some heavenly Father Christmas. When the blind man comes to Jesus in the gospel (Mk 10,46-52), the Lord says to him 'What do you want?'. It is perfectly clear what he wants; he wants to regain his sight. But he has to commit himself, to say 'Master, let me receive my sight', before he is healed. In a similar way, we have to say what it is we really wish for. I find that a helpful, if sobering thought.

I hope that you will feel that the discourse of this lecture has been sober and reasonable. Of course, it has also been speculative, but in our present state of ignorance no account of agency (whether human or divine) can avoid that being the case. I have tried in my thought to take both science and prayer seriously (as I do in my life) and to strive for a harmonious and integrated account. Yet you may feel that I have been dodging the main difficulty. It is all very well to talk of continuously acting divine providence hidden within the cloudy unpredictability of complex physical process, but does not religion trade also in terms of shockingly discontinuous claims for divine intervention? Not to put too fine a point upon it, what about miracle? Aren't these acts which by their very definition are asserted to be *against* the grain of nature? Don't we here see the embarrassing and incredible spectacle of God conceived as acting like a celestial conjurer?

Etymologically, a miracle is something totally unexpected, something that evokes astonishment. A number of radically different

kinds of events might be so classified. There might be the exercise of natural, but highly unusual or normally suppressed, powers of agency. A psychosomatic account of healing miracles would correspond to this idea. Some people do seem to have special healing gifts and I am prepared to believe that Jesus possessed them pre-eminently. There might be significant coincidences (perhaps brought about by divine providence) of a kind which many of us feel we have experienced. It is possible to think of some of the nature miracles, like the stilling of the storm in the gospels, in this way. These events might be called miraculous, but they easily fit into our earlier account, being understood as unexpected providences in unusual circumstances. But there remain radically unnatural claims, such as water into wine or making five loaves and two fishes feed thousands. Our assessment here is complicated by the fact that such incidents described in the gospels carry a very strong symbolic significance (the difference that Jesus makes), so that they might be inspirational stories which got into the record as if they were actual events. Christians will not all agree about how to assess these cases, but I cannot see that one could claim them as being central to Christian belief. What is central to such belief is the resurrection of Jesus on the first Easter day. Here we have the assertion of an event wholly contrary to natural expectation and experience, but one which any candid reading of the New Testament shows was an indispensable foundational belief of the early Christian movement. Do we face here an incredible belief in a Celestial Conjuror, or do we instead encounter an event wholly unexpected because it was possible only in a wholly unprecedented

circumstance, and which by its nature makes known a deeper level of divine consistency than had been revealed before? Delusion or deliverance? A mighty act of God or the creation of human wishful thinking? That is a vital question - *for orthodox Christian belief.* I can do no more than sketch an answer. Its character must be to show that belief in the resurrection is coherent because it points in act of God, not as an arbitrary act of power, but as fittingly consistent with the nature of those involved.

The first question to ask is:

Is there something about ^{Jesus} ~~him~~ which made it fitting that God should raise him from the dead? Did his life end in failure or was he vindicated after death? *I believe that his life did not deserve to end in apparent failure.* Yet the resurrection, if it happened, would not only be the vindication of Jesus. It would also be the vindication of God: that he did not abandon the one man who wholly trusted himself to him. Moreover, we begin to see here some glimmer of a divine response to

I believe that God was present in him in a unique way which led to unique phenomena

the problem of evil. If Good Friday testifies to the reality of the power of evil, Easter Day shows that the last word lies with God.

Finally, the resurrection of Jesus is the vindication of our human hopes. We shall all die with our lives to a greater or lesser extent incomplete, unfulfilled, unhealed. Yet there is a profound and widespread human intuition that in the end all will be well. As someone once said, there is a wistful longing that the murderer should not triumph over his innocent victim. The resurrection of Jesus is the sign that such human hope is not delusory. It is part of Christian understanding that what happened to Jesus within history is a foretaste and guarantee of what will await all of us beyond history. 'For as in Adam all die, so also in Christ shall all be made alive' (1 Cor. 15, 22). All these considerations indicate to me that the resurrection of Jesus makes sense. It fits in with who he was and who God is and who we are.

Thus, I conclude my lecture. I wish to take absolutely seriously what science can tell us about the nature of the physical world. But I do not think that science drives its counsel not so rightly that we should be driven to deny our basic human experience of agency. And if the physical world is one in which we can act, then it is open to divine action also. Neither can science, from its exploration of general repeatable experience, exclude the possibility of unique and uniquely significant events, provided they can be accommodated within some more consistent account, such as belief in divine providence itself requires. There are, indeed, more things in heaven and earth than are dreamed of in natural philosophy alone.