

## Following Bill Pollard's Lead: From Providence to Chaos

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'Following Bill Pollard's lead' has a double meaning. In the first place it means that I followed his example in becoming a priest while remaining an active scientist. In the other sense it refers to my involvement in the science-theology dialogue as he did through his publications and lectures. When in 1957 I came to the decision to prepare for ordination, I had read his first two publications *The Cosmic Drama* and *Revelation and Response*, both from 1955.

### 1. Pollard's writings

In *The Cosmic Drama* (1955) Pollard shows that while science can tell us much about the development of the universe after the initial explosion, the big bang, it cannot say much about the origin at  $t = 0$ . Likewise, science can tell us much about the evolution of life, but not about the origin of the first living cell. Theology speaks in both cases about 'creation'. The choice between 'origin' and 'creation', Pollard says, is a very grave decision, to be worked out with fear and trembling.

In *Chance and Providence* (1958) Pollard defines providence as the events in human life seen as manifestations of the work of God. It includes destiny, grace and purpose. It is made manifest in single events, not in multiple tries with probabilities, such as in our scientific experiments. Providence, Pollard concludes, replaces the proud arrogance of achievement with the trusting humility of true greatness.

In *Physicist and Christian* (1962) Pollard dwells much on 'community' and states that the soul of any community is spirit, but that in contemporary thinking (1960) there is almost universal disbelief in the reality of spirit. Unfortunately, the present-day search for 'spirituality' is not leading to more community, because it is an individualistic search, as witnessed by decreasing church membership and attendance in western Europe.

In *Man on a Spaceship* (1967) Pollard foresees the ecological crisis, of which we are now quite aware. He concludes: we "can nevertheless find a basis for hope which is rooted in a transcendent purpose beyond space and time", ...and "feel a strong sense of confidence in the ultimate outcome." An undercooled eschatology!

Pollard's emphasis is on what science cannot tell us for our life of faith. My approach is somewhat different: I look for what our scientific insights can contribute to our theological understanding. This approach is set forth in the next section.

## 2. Approach to the science-theology dialogue

My guidelines for the science-theology dialogue are the following:

- 1) Science and theology provide two worldviews of a single reality: the cosmos in which we live. Both disciplines are God-given in the sense that God not only revealed himself through human minds and hands in Scripture, but also in the scientific insight that God allowed us to develop through our senses and brainpower.
  - 2) Both disciplines seek a rational explanation of basic data, biblical data in the case of theology and observational and experimental data in the case of science.
  - 3) Both disciplines have certain axioms, such as: God reveals himself in Scripture; nothing can both be and not be at the same time and in the same respect.
  - 4) Each discipline has certain limitations: Science can deal with mechanisms, but not with purpose and the supernatural; it answers How?-questions. Theology can tell us about purpose and the supernatural, but little about mechanisms; it answers Why?-questions.
  - 5) Dialogue requires that each discipline is taken in its integrity but be subjected to critical questioning. E.g., when it is found that creationist theory cannot stand up to powerful scientific evidence, the meaning of the 'six days of creation' in Gen.1 should be critically studied.
  - 6) Direct language should be used, and if metaphors are unavoidable, they should be identified as such.
  - 7) The meeting ground for the two disciplines is primarily to be found in creation theology on the one side and cosmic and biological evolution on the other side.
- Following these guidelines I consider some major topics in Christian theology.

## 3. Creation theology

A critical look at the traditional *creatio ex nihilo* doctrine shows that it has five serious difficulties:

- 1) conceptual: nobody can picture absolute nothingness. leading to descriptions of *nihil* that are not truly 'nothing' (e.g., Karl Barth's *das Nichtige*, a strange combination of chaos and evil);
- 2) biblical: creation from *nihil* is not found in the bible; Gen.1 and 2 have creation from primordial chaos;
- 3) scientific: science cannot deal with *nihil*;
- 4) theological: no satisfactory theological explanation of the process of creation from nothing has been given; Jürgen Moltmann tried but failed;
- 5) theodicy: *creatio ex nihilo* does not explain the origin of evil, unless one is willing to make God responsible for it.

This leads me to a revised creation theology, which I call 'chaos theology'. It

can be summed up in four points:

- 1) initial creation from primordial chaos as in Gen.1 and 2.
- 2) continuing creation with a remaining element of chaos (symbolized as 'sea', 22x in the Old Testament and returning 6x in the New Testament). God is shown as battling remaining chaos.
- 3) remaining chaos is abolished in the fulfilment of creation on the last day, as indicated by the words "... *and the sea was no more*" in Rev.21:1. Then there will be no more death, mourning, crying and pain (Rev.21:4).
- 4) both physical and moral evil come forth from remaining chaos.

The first three points are biblical, the fourth point is my invention.

The Genesis stories give different and vague descriptions of primordial chaos: 'a lifeless desert' in Gen.2 and 'a formless void and darkness covering the face of the deep, a mighty wind sweeping over the face of the waters' in Gen.1 (where the author P borrowed from the Babylonian *Enuma Elish* story). Physics supplies the concept of a vacuum with quantum fluctuations underlying the cosmos from the beginning. This is an immaterial chaos, unlike the gnostic dualism of a pre-existing evil matter from which an evil demiurge creates. The big bang could then be the result of a mega-quantum fluctuation. Don't ask where the quantum vacuum came from; that is part of the initial mystery that both scientists and the Genesis authors face. Continuing creation comprises the processes of cosmic and biological evolution.

#### 4. God's action in creation

Can science tell us anything about God's action in creation? Three reasons for a negative answer to this question have been given:

- 1) '*God does not intervene in the natural order*': This would bring us back to the deism of Newton's time, a God who creates the world with its physical laws, then sits back and allows the world to take its deterministic course to the goal God has set for it. Chaos theory with its chaos events shows that this cannot be.
- 2) '*Science cannot speak about the actions of the transcendent God*': True, if these actions pertain to the transcendent realm, but actions occurring in our world may be assumed to proceed according to the physical laws laid down by the Creator in the beginning, and which, according to the best scientific knowledge, still operate everywhere in the cosmos.
- 3) '*Speaking about God's action in scientific terms reduces God from being the First Cause to becoming one among many causes*': When God freely determines to intervene in the natural course of events, the initiative is God's and this makes him the First Cause for the ensuing events.

### Initial creation

In the initial creation God created through the *Logos* according to Gen.1. To this Gen.2 adds that God conferred life to his creatures through his breath, the Spirit. Cosmology suggests that a tremendous amount of energy must have been inserted in the quantum vacuum at  $t = 0$  to set off the big bang. Remember that the Jewish philosopher Philo and later Maximilian the Confessor called the *Logos* by the Greek word *energeia*. So I suggest that the *Logos* conferred the energy.

Order must have been brought to the chaotic explosion through the initiation of the physical laws and fundamental constants. This we may consider as a case of information transfer through the Spirit, who operates as God's information carrier. So God created through the *Logos* and the Spirit. This is reminiscent of Irenaeus' saying: "*The Son and the Spirit are the two hands of God by which he created all things*" (Adv. haer.4.20.1, c.190; Son stands for the pre-existent Christ, which is the *Logos*).

Quantum cosmology tells us that insertion of one bit of information requires a minimum surface area of one square Planck distance ( $10^{-35}$  m). This means that the information can only have been inserted a fraction of a second after  $t = 0$ . But it must have occurred just before the start at  $t = 10^{-35}$  sec of the 'inflation' (a brief exponential increase of expansion rate), which determined the further cosmic evolution. Simple calculation from the cosmological data shows that at that moment 10 Gigabits (10,000 average-size books) could have been inserted, which seems plenty for all physical laws and fundamental constants.

### Continuing creation

How does God interact with the universe during continuing creation? It is unlikely that God would do this by changing physical laws or fundamental constants, since this would have catastrophic effects. Three possibilities have been suggested: quantum events, self-organization, and chaos events (see *Creation and Double Chaos*, ch. 7). The first two can be ruled out, but the influencing of chaos events may well be the way used by God. It should, however, be added that God appears to leave the evolving universe and the evolution of life a great degree of freedom, allowing them to proceed as 'trial-and-error' processes, which in the course of time provide optimal results. Only at a moment of crisis would God intervene by influencing a chaos event.

The theory of chaos events tells us that all living organisms, solar systems and the weather are non-linear systems. This means that the development in time of these systems is governed by a non-linear dynamic equation:

$$x_{n+1} = k \cdot x_n(1-x_n)$$

Take as an example the propagation of a moth colony. Then  $n$  and  $n+1$  indicate successive generations, and  $x$  the number of moths in a given generation (normalized to a maximum of 1). The number of insects ( $x_{n+1}$ ) is, of course, proportional to the size of the preceding generation ( $x_n$ ). But in an oversized population starvation and disease will slow propagation, which is expressed by factor  $(1-x_n)$ . The proportionality factor  $k$  may represent the fertility level of the moths, which can slowly change in time by gradual environmental change. When we calculate the equation for  $x$  as a function of  $k$ , we find a curve as shown in Fig.1.

Fig. 1 Chaos curve

For values of  $k$  from 1 to 3.0 it is a single curved line, but at  $k = 3.0$  the line bifurcates, and at  $k = 3.45$  both legs of the fork bifurcate again, and so on. At  $k = 3.57$  there are an infinite number of bifurcations; the system has become fully chaotic. The computer plot shows that at a bifurcation the population size may go up or down. Obviously, the moth colony cannot both increase and decrease in size; it can only follow one of the legs. Since there is no energy difference between the two legs, they have equal probability. So the system becomes unpredictable for us.

The absence of an energy difference between the legs of a bifurcation means that a minute influence, like the infusion of one bit of information, may 'nudge' the system to follow one leg of the fork rather than the other. This means that God could influence the choice of the leg through information input by the Spirit without violating any physical law. However, it is unlikely that we could ever catch God at doing this: it is a very rapid event ( $10^{-13}$  sec) and the minute amount of energy needed for insertion of a bit of information would lower the immediate surrounding by less than  $10^{-14}$  °C; moreover we wouldn't know when to look for it.

Two cases of human control of chaotic behavior have been reported. The first is the turbulent flow of liquid helium. When helium is cooled to 0.001 °Kelvin, there is no friction, and rotating the vessel in which it is contained will not make the fluid rotate. But when the temperature is lowered by about 0.0003 °K, turbulence occurs, indicating chaotic behavior. The other case is the movement of electrons through a semiconductor device by means of an applied voltage. At certain discrete voltages the diffusion of the electrons becomes chaotic, as indicated by a large increase in current flow. The chaotic diffusion can be abruptly turned on and off by manipulating the voltage.

## 5. The problem of evil

This is the first of four other application of chaos theology. It is no doubt the greatest problem associated with the *creatio ex nihilo* doctrine. If God creates from nothing, then everything in this world is created by him, including evil. For 18 centuries theologians have attempted to solve this enigma. The doctrine of original sin may explain the existence of human sinfulness, but not why humans created in the image of God should be prone to sin. Likewise, free will tells us that we humans have the possibility to sin, but not why we should do so. Augustine's idea that evil is the absence of good does insufficient justice to the reality of evil and its consequences (think of the holocaust and similar later atrocities). Irenaeus' idea that evil exists ultimately within God's good purpose, that God could have created differently but that early humans were too immature to receive and retain perfection, compromises God's omnipotence. 'Soul making', suggesting that suffering from evil is God's way of making us grow spiritually, compromises God's goodness. David Fergusson, after reviewing all these attempts to explain evil in *creatio ex nihilo* context, concludes: *Theodicy attempts to justify the unjustifiable*. Note that all this refers to moral evil only, but that physical evil is omitted from consideration.

In chaos theology I recognize the OT idea that remaining chaos (symbolized as 'sea') is present in continuing creation. God is battling remaining chaos until abolishing it on the last Day: *I saw a new heaven and a new earth .... and the sea was no more* (Rev.21:1), thus completing and perfecting his creation. I propose that remaining chaos is the source of evil, both physical and moral evil. Evil is thus not created, either by God or by a gnostic demiurge, nor does it have to be attributed to the disobedience of the mythical proto-human Adam.

Physical evil is the consequence of the presence of remaining chaos in the created world, expressing itself in chaotic tectonic forces leading to earthquakes and volcanic eruptions, in chaotic behavior of the atmosphere leading to hurricanes, and in random mutations leading to cancer and other diseases. Chaotic behavior refers to the occurrence of chaos events.

Moral evil, I suggest, is the result of 'chaotic thinking', as expressed in the words of Paul: *I do not understand my own actions. For I do not do what I want, but I do the very thing I hate* (Rom.7:15). This is what we call 'temptation'. It is remaining chaos at work in our minds. Yet, knowing the difference between good and evil and having been given freedom of will, we remain fully responsible for our actions.

## 6. Disease: punishment or chaos event?

In the OT health was seen as a divine gift, while disease was regarded as divine

punishment for sin or disobedience (Exod.4:11; Deut.32:39). However, Jesus emphatically rejects the idea that disease is God's punishment, either for personal sins or those of the parents (Jn.9:3). He sees the individual as an essential unity of body and mind, and disease as the result of evil producing an imbalance in the body-mind unity. Hence, in healing the body of the sick, Jesus always pays close attention to their mind and spirit, e.g., in linking healing with forgiveness of sins (Mk.2:2-11). In his encounter with the Samaritan woman (Jn.4:7-26) Jesus turns a casual conversation into a powerful therapeutic analysis of her emotional conflicts and reveals to her the person of the living Christ as the answer to her deepest needs. The healing acts of Jesus are a spontaneous expression of his compassion as well as a sign of the kingdom of God.

Neuroscientific research confirms the close interaction between mind and body. The so-called hypothalamic-pituitary-adrenal axis (HPA axis) plays a key role: neuronal impulses from the cerebral cortex go to the hypothalamus, which then secretes certain compounds to the pituitary, which in turn releases certain hormones that stimulate the adrenals to secrete other hormones. In this way our mind influences various physiological functions, e.g., certain types of stress affect the immune system. It is thought that an inadequate immune function may allow cancer cells to escape detection and destruction, thus enhancing onset or progress of cancer. Psychotherapy, in addition to conventional medical treatment (surgery, radiation, chemotherapy), may extend life or at least ameliorate the patient's condition. Removing false ideas of the patient that the disease constitutes divine punishment for past sins may be part of psychotherapy. Receiving the laying on of hands with prayer, as recommended in the epistle of James, may also be beneficial in this respect.

We now know that the first step in cancer is the mutation of an oncogene or a tumor suppressor gene which turns a normal body cell into a malignant cell. If not recognised and destroyed by the immune system, the malignant cell will through uncontrolled division and inhibition of apoptosis (programmed cell death) form a tumor. Activation of angiogenesis (blood vessel formation) permits continued tumor growth. Activation of a particular enzyme permits tumor cells to penetrate a blood vessel wall and slip into the blood stream, leading to the formation of new tumors elsewhere (metastasis). Once the tumors disrupt essential organ functions, the patient dies. The gene mutation that turns a normal into a malignant cell can be considered to be a chaos event, and thus a case of physical evil emerging from remaining chaos. Thus, Jesus' insight, our scientific insights and chaos theology all fit in our understanding of a disease such as cancer.

## 7. The cosmic Christ and reconciliation

On biblical, theological and scientific grounds (*Creation and Double Chaos*, pp. 13-14) I consider John's account of the incarnation of the Logos in Jesus of Nazareth (Jn.1:1-14) to provide a more satisfactory christology than the Virgin Birth stories in the gospels of Matthew and Luke (Mt.1:16-25; Lk.1:26-38).

Over the centuries popular Christian belief has regrettably narrowed down the significance of the incarnation to being merely the prelude to human salvation, with blithe disregard for the fate of all other creatures. However, Paul recognized in Jesus the cosmic Christ, when saying: *in Christ God was reconciling the world (Gk.kosmos) to himself* (2 Cor.5:19). Likewise, John writes: *that the world (Gk.kosmos) might be saved through him* (Jn.3:17).

The idea of Jesus as the cosmic Christ is supported by our knowledge of cosmic evolution. The hydrogen and helium, resulting from the big bang, condensed into stars, which through nuclear fusion produced the heavier chemical elements. After the exhaustion of their nuclear fuel these stars turned into supernovae, which exploded and ejected these elements into the interstellar space as 'cosmic dust'. Eventually, Sun and Earth were formed through condensation and accretion of these elements from a cloud of cosmic dust. In the prebiotic evolution living cells were formed from these elements, and in the biological evolution all living beings, including humans, are formed from them through the uptake of food. As it is said: 'We are made of stardust'. This means that we humans are united with the entire cosmos. The human Jesus also shares in this cosmic union, and thus through the incarnation he becomes the cosmic Christ. This has decisive consequences for our understanding of his reconciling work.

In chaos theology I hold that God in his continuing creation is involved in an ongoing battle against remaining chaos, for 13.7 billion years already, in which humans have existed only during the last 200,000 years. So this is not only a human predicament, but a cosmic drama. Paul senses this, when he says: *the whole creation has been groaning in travail together until now* (Rom. 8:22) in expectation of liberation. The entire creation with all its creatures, not only humans, is being reconciled by the cosmic Christ. Of course, it is not a trivial matter that God's top creatures, his image bearers, have succumbed to the remaining chaos element and become habitual sinners. Remaining chaos 'in a desperate effort' leads humans to kill Christ. However, God turns the apparent defeat against chaos into victory by the resurrection of Christ. This is an initial victory, which will become definitive on the last day, when God will banish the remaining chaos element for ever (Rev.21:1). The only difference between humans and all other creatures is that only humans can distinguish between good and evil and have the freedom of will

to make the right choice, thus bearing the responsibility for making wrong choices. Crucial for us humans is our acceptance of the freely offered reconciliation in and through faith, so as to share in the benefits of Christ's cosmic reconciling work (Rom.4:1-16).

This theology of reconciliation integrates crucifixion with incarnation and resurrection, and places reconciliation in the continuing creation on its way to fulfilment on the last day. Briefly put: Jesus died *through* our sins rather than *for* our sins; he effects reconciliation through his *resurrection* rather than through his *death*.

## 8. Eschatology

It seems appropriate to end with the topic of 'the last things', with eschatology, and the scientific ideas about the future of the universe. Here the two disciplines present quite opposite accounts that seem to be entirely irreconcilable. Let us first take the scientific account.

The cosmos is expected to go to complete degradation in some 24 billion years from now, when its accelerating expansion due to the so-called dark energy is taken into account. Rather than collapsing in a 'big crunch', the universe is now expected to fly apart in a 'big rip'. Galactic clusters will drift apart ever faster, in the final billion years galaxies and solar systems will break up, in the final 30 min stars and planets will disintegrate, in the final split-second molecules and atoms will tear apart and their constituent particles will 'evaporate', leaving only a cold, dark, lifeless and matterless cloud of photons, the vacuum with quantum fluctuations. Much earlier, some 5 billion years from now, our Sun will exhaust its nuclear fuel and expand into a 'red giant'. It will become so large that it will touch the Earth, raising the surface temperature of the Earth to about 1300 °C with the extinction of all life on Earth. Any life on an extrasolar planet will suffer a similar fate when its star turns into a red giant. And there is nothing that we or our descendants can do about this. This bleak picture of the future of the universe made the non-believing cosmologist Steven Weinberg exclaim: "*The more I understand the universe, the more it seems to me to be pointless.*"

In sharp contrast to the somber view that science offers us, the biblical view of the future is hopeful. Here future becomes destiny, the end of our time, the last day. The creation in its present state is seen as threatened by remaining chaos symbolized as 'sea'. But nowhere, not even in the apocalyptic writings, is there an indication of a complete disintegration of the cosmos, as science predicts. There may be catastrophes, desolation of the land, drought, starvation, disease, warfare. Here we may think of the effects of global warming that we are beginning to

experience. But the Lord says: *Yet I will not make a full end* (Jer.4:28). Isaiah proclaims the message of a new creation: *I am about to do a new thing; now it springs forth, do you not perceive it?* (Isa.43:19). He speaks about the new heaven and the new earth that God will produce (Isa.66:22). There will come a Messiah, who brings healing to broken humanity and the entire universe.

In the NT Christ is proclaimed as the Messiah who will appear on the last day and play a crucial role in establishing the new kingdom. This is mentioned in all four gospels, often expressed by Paul, also by James and Peter, and in Revelation. Christ stands at the beginning of creation as the creative Logos, and at the end as the inaugurator of the new creation: *Alpha and Omega*. The central NT message is that the resurrection of Jesus is a promise of the new heaven and the new earth, where there will be no more evil and death: *Then I saw a new heaven and a new earth; for the first heaven and the first earth had passed away, and the sea was no more* (Rev.21:1). The 'sea' symbolizes remaining chaos that will then be abolished.

When will this come about? Jesus says: *...about that day or hour no one knows, neither the angels in heaven, nor the Son, but only the Father* (Mk.13:32). So although it is not given to us to know the time, I think we can safely assume that God will establish the new kingdom before our universe disintegrates and before all life will be destroyed by the Sun becoming a red giant or by ecological catastrophes of our making. Is this 'pie-in-the-sky' thinking? No, for the simple reason that it is unthinkable that God would allow this universe, which he created out of love in a marvelous and extensive process of cosmic and biological evolution, to disintegrate fully before bringing about his new kingdom. That would amount to declaring the first creation a failure, necessitating a second creation.

Why such opposing views of the future in science and theology? The simple answer to this question is that science, observing only this world, sees the universe as a thermodynamically closed system without any external input of energy and information. According to the second law of thermodynamics, the universe must then wind down and eventually return to maximal entropy, to utter chaos. The biblical view, on the other hand, assumes that the Creator will remain in interaction with the universe, making it a thermodynamically open system. At the moment of his choosing God will send energy through Christ, the incarnate Logos, and information through the Spirit to achieve a state of full order in which there is no remaining chaos. For us, as the only beings created in the likeness of God, there is the challenge to believe this and thus to become part of the perfected creation. It should be noted that (1) the perfection of the creation is God's work, not that of humans, (2) it will not be an evolutionary transition, but a revolutionary transformation; (3) we humans, as God's co-creators, are called to erect signs of the

coming kingdom by fighting global warming, injustice and armed conflicts. And at our resurrection on the last day, we only need to say Yes! to the question whether we want to be part of the new kingdom and live eternally in God's presence.

At the end of this lecture I express the hope that I have given account of where following Bill Pollard's lead has brought me.

