conclusions of Carter in more detail. For my purposes let me simply summarize Carter's conclusions. The emergence of human civilization has required an extremely fine-tuned combination of physical constants and laws of nature from the very beginning of the universe in a primordial very dense, very hot state and throughout the evolution of the universe. The so-called weak version of the Anthropic Principle simply sees this as an observational effect and, in fact, it would be more meaningful to call this version the Observer Principle. We observe the universe to be fine-tuned because if it were not fine-tuned we would not be here to observe it. In this version the Anthropic Principle simply one of the many selection effects that observers must cope with in evaluating the data they obtain from observations. On the other hand, if one proceeds beyond the recognition of the fine-tuning as a selection effect and dares to ask the question why, one enters into the realm of the so-called strong Anthropic Principle, whereby one seeks to explain the origins of the fine-tuning and the reasons for the precise values of the many fundamental constants and for the laws of nature. As we shall see, it is difficult to do this without entering into a dialogue with philosophical and theological considerations. To present the fundamental constants have, for the most part, only empirically determined values. There is no fundamental physical-mathematical model from which they can be derived. There is no unified theory which explains all of them. They are simply found from observations to have the values that they have and even a slight change in them would exclude the existence of the universe to human civilization. By using the words Anthropic Principle to denominate his conclusions Carter obviously insinuated some kind of finality in the evolution of the universe leading to human civilization. Whatever might be the cosmological model used to explain that finality, real or apparent, we are inevitably invited to philosophical and theological reflections.

3. Response to the Anthropic Principle

Since the Anthropic Principle, at least in the strong version, leads to investigations which strictly transcend the methodology of science, many scientists reject it as not susceptible of scientific enquiry. Others see it as indicating a certain intrinsic finality in nature but without reference to the origins of such a finality. Still others from a religious persuasion see it as indicative of the presence of a Supreme Being who created, among many other possibilities, a universe in which human civilization would emerge. There are those who, prescribing from any philosophical or theological considerations, simply reject the Anthropic Principle as of no value to science, since it cannot predict testable conclusions not assist in the planning of research programmes leading to a further understanding of the universe. While I must c
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code that a predictive character appears to be lacking, the Anthropic Principle has certainly provided an incentive for research in cosmology. Furthermore, and perhaps more importantly, it has reinserted the human person into the continuing search for a total and comprehensive understanding of the universe. While certain aspects of this reinsertion may transcend the strict boundaries of what are the proper object and methods of scientific enquiry, it is not obvious that all aspects may be so excluded. At any rate, the Anthropic Principle certainly provides an invitation for a serious dialogue among scientists, philosophers, and theologians.

4. The Encounter of Theology and Science

As an example of how certain scientific conclusions may influence theological reflections, I would like now to investigate how the various cosmological models proposed in response to the Anthropic Principle might contribute to elaborating the religious concept of God. As an object of religious enquiry and of faith God is the supreme mystery. Nevertheless, the religious person believes that God has spoken of himself to the human race through the prophets, the patriarchs, and for the Christian believer through his Son. This self-revelation of God is found in religious traditions and in the holy books. Theology properly speaking a science (in the wider sense of that word), a way of knowing, with its own rigorous methodology. Through such disciplines as literary analysis, philosophy, linguistics, etc. it studies religious traditions and the holy books in order to discover religious faith and the object of that faith, God. I would like now to confront the concept of God derived by theology with the Anthropic Principle derived from scientific enquiry. To be more specific, I wish to address the question: Among the various cosmological models proposed in response to the Anthropic Principle, is there one which is more consistent with the concept of God derived from theological enquiry? From the very beginning of these reflections it is necessary to establish two points:

1. of the many cosmological models proposed there is none yet which even approaches being definitive;
2. between cosmology and theology we are looking for consistency and not for definitive or determinative concepts or, much less, for proofs.

5. The Knowledge of God in Religion

How does the theologian arrive at a concept of God? We find ourselves immediately in an epistemological dilemma. By definition God is mystery and un-knowable in himself. The only way that we can approach a concept of God is by the negative way, that is by taking that which we find from our experience to be good, beautiful, and true in ourselves and in the world we, stripping off (denying) the imperfections that we experience as attributing the purified attributes by analogy to God. Furthermore, as mentioned above, God has spoken to us of himself, and so we can in what he has said to us through religious traditions and the holy books is always however used the negative way. The religious traditions have experienced by and handed down by human beings; they are, therefore, fallible. The holy books have been written, handed down, and read by human beings; they are, therefore, fallible. In order to arrive at the source, at the God who spoke, we must study in a rigorous and scientific way those traditions and those writings. We must, in other words, understand the human transmission of what God said in order to arrive at the God who is speaking. We must know the transmission of its human imperfections.

As an example of the negative way let us now consider a funda-

mental attribute of God. He is free and is, in fact, the source and foundation of freedom. From the fullness of his freedom he has created the universe. The moral character of human beings is formed to his own image and likeness; he has loved creation and has chosen to love it. These are the fundamental ingredients of Christian belief in God. On the other hand, the exercise of his freedom God is not arbitrary; arbitrariness is a defect which is absent in goodness. One must, therefore, while preserving the primordial, many times in story form, of God's freedom, purify the present its negative and imperfect characteristics. In brief, one must apply the negative way.

6. God the Creator and Cosmological Models

In religious thinking the concept of God the Creator has always been the risk of presenting God as existent from an arbitrary manner. The creation in the Book of Genesis is a primary example of this. The Genesis stories really intend to present a much more fundamentalistic of God, namely that he is the saving and redeeming God. Generally saying that the same God who saved mankind is the God who created the world, and that, in fact, his creating is a salvific act. Genesis is interested in how God created the world, even though it presents story of them with common origins in other contemporary cultures, to show creating God is loving and salvific. Nevertheless, it is difficult to e
fact that from the presentation in Genesis and throughout religious traditions there is a certain arbitrariness that creeps in to the concept of God-Creator. Let us, therefore, proceed with the task of attempting by the negative way to purify the concept of God-Creator, from a certain inseparable character of arbitrariness by confronting it with the various cosmological models brought forth to explain the Anthropic Principle.

These cosmological models can be divided into two general classes: those which speak of a single universe, in which of course we live; and those which speak of many universes, each of which arises from different initial conditions which determine the values of the constants of nature and the operative physical laws. In this latter case, it is generally supposed that all of those universes which are not self-contradictory (in which the various combinations of constants and physical laws do not defy the principle of contradiction) have actually been realized.

The single-universe cosmologies are several, all of them based on an initial Big Bang, which, in various forms, is up to the present the best explanation of existing observational data. One such cosmological model is that of Stephen Hawking in his book: _A Brief History of Time. From the Big Bang to Black Holes_. From quantum gravity considerations Hawking comes to the conclusion that space-time forms a closed but unbounded surface, and that as such it requires no initial boundary conditions. Hawking says in effect that the only boundary condition is that there are no boundary conditions. Thus the fine-tuned combination of constants of nature and physical laws which eventually led cosmic evolution to the emergence of human civilization is due to nothing other than the inevitable consequences of quantum gravity. Thus, according to Hawking, it is not at all necessary to consider a God-Creator. God is not needed to explain the universe; he does not exist. Leaving aside the purely scientific evaluation of Hawking’s theory (very much contested among cosmologists), it is important that his conclusion be evaluated in terms of the principal argument of this paper, namely the confrontation of science and theology, or more specifically, the dialogue between cosmology and theology arising from considerations of the Anthropic Principle. To deny the existence of the God of religious belief on the basis of a scientific theory is a lamentable confusion of two independent ways of knowing. The God of religious belief is not an initial condition, nor even the initial condition, for the existence of the universe. Should, therefore, such a scientific theory really establish that initial conditions are not required, there would still be grounds for science to either affirm or deny the existence of God.

All of the other models of a single universe require the determination of initial conditions from which a certain combination of constants of nature and physical laws came to be so that human civilization evolved. In all of them it is difficult to escape the notion of an arbitrary choice on the part of God-Creator. It is required, for instance, of God that he has chosen a multitude of precise values for physical constants in such a way that, had he chosen slightly different values for one constant or another, the evolution of human civilization would not have been possible. God would be, to put it in more prosaic and vivid terms, somewhat like a master cook whose pinch of sugar, a pinch of paprika and other ingredients are just right so as to produce the paddlefasts of human civilization. It appears to me that this inevitable inclination to a certain arbitrariness in the religious concept of God-Creator could be removed only if the appropriate cosmological model had built into it all that was necessary to explain scientifically the actual combination of physical laws and constant nature that we observe. God would, in such a model, be needed to set the ingredients. This is apparently what Hawking attempts to accomplish in his model derived from quantum gravity considerations. The religious in this might, of course, be tempted to see this as a threat to the very existence of God, or at least the establishment of a solipsistic God, completely divorced from the universe. This could only be the case if one seeks to find God through science or seeks to understand the universe through religious thought alone. In either case, as we have noted above in criticizing Hawking, there is cross-pollination of epistemologies. On the other hand, if one respects the independence of epistemological methodologies of science and theology, and seeks none the less for a unity in the human understanding of all reality, then it appears to me that the understanding of God’s freedom in the context of single-universe cosmologies is more compatible with the type of model proposed by Hawking.

In considering the many-universe cosmologies it appears that one must strive at an even more profound compatibility between the religious concept of God-Creator and scientific theories of the origins of the universe, in such a way that God would not be seen either as an arbitrary creator or a solipsistic entity with respect to creation. There are two classes of many-universes: those in which the universes exist simultaneously and those in which they exist successively. For the purposes of this paper I wish to describe briefly one type of each of these two classes. The many-universes could have been born from an initial chaotic state from which there was such a rapid inflationary expansion that the various parts are not able to communicate with one another. Since they cannot communicate among themselves, they can justly be called separate universes. Since they have their respective origins in an initial chaotic state, each have a different combination of physical laws and constants of nature. Since there are many, if not an infinity of such universes, it is statistically understandable that human civilization exists in one or more, but not in all of them. Thus the explanation of the Anthropic Principle, even the strongest, requires an intrinsic finality, but has a natural explanation in statistics.
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In conclusion, I believe that it is quite clear from such consideration: above that the Anthropic Principle has not only been a stimulus to reexamine cosmology but that it also provides an exciting point of encounter between theology and the sciences and has surely served to reexamine the human being, which for centuries was excluded from the physical science.

References


7. Analogy is here understood in the scholastic sense of the term; see J. Ranieri, 'La nuova teologia aristotelica-thomistica', in La Ciencia Vol. 24, 1921.

8. In any discussion of the concept of God-Creator one must take into account the rich Scriptural and Patristic tradition of the human being as the image of God. See, F. Pacini, 'L'umanità immagine di Dio (Gen 1, 26-27) nel contesto di Babilonia', in Bibbia e Oriente, Vol. 6, 1964.

9. For an account of recent research on creation in Genesis see: R.J. Clervi, 'Creation in the Hebrew Bible', Physics, Philosophy, and Theology, op. cit.


12. See H. Denzinger, Enchiridion Symbolorum et Definitionum, 26a, Pref. No. 348 for the doctrine of creation in general; Nos. 20 to 24 for the doctrine of the origin of the human soul; Nos. 1919 to 1914 for the doctrine of the body and soul.

7. Further Considerations: Cosmology and Theology

I conclude here, obviously only at the beginning of what could be a rich encounter of theological thought with cosmology. I would like to list, but only as an example, further considerations which might be of interest to those who are much more competent in these areas than I am:

1. How can we express in more detail the concept of God-Creator in terms of either the single-universe or many-universe cosmologies? I have used such words as see, marvel at, love, have special care for, etc. Although we wish to avoid having a God who is either arbitrary or solipsistic, it does not appear that the above considerations are adequate to express the rich concept of to create.

2. How can we preserve the doctrine of a special intervention of God in the creation of the human being without compromising the notion of a free but not arbitrary God in relation to many-universes?

3. If human civilizations exist elsewhere in our universe, or even in other universes, would the Son of God be also incarnate there? Would he have become incarnate among us even if there had not been an original sin? If there were more than one incarnation, how are we to preserve the defined trinitarian and christological doctrines?

4. In the case of a single universe, how are we to understand the relatively limited time span of a human civilization determined by the ageing of the central star of a planetary system?