A COMPARISON OF SCIENTIFIC INQUIRY AND RELIGIOUS BELIEF AS CONCEPTUAL SYSTEMS

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Abstract of Honor's Thesis

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Analyses of scientific inquiry and religious belief often concentrate on the verification procedures appropriate to each endeavor. Such analyses highlight the dissimilarities between scientific inquiry and religious belief at the expense of overlooking major similarities. This thesis suggests a different focus of analysis. If scientific inquiry and religious belief are analyzed as possible methods by which man attempts to interpret the world, similarities between the two endeavors can be delineated without obscuring the well-known differences.

The following similarities are discussed: (1) scientific inquiry and religious belief result from man's psychological need to understand himself vis-a-vis the world; (2) the presuppositions of each reflect this need; (3) the presuppositions of each provide broad guidelines for the development of the explanatory apparatus in each area. Parallels and divergences between the two explanatory frameworks are then captured with the aid of Kuhn's concept of the "disciplinary matrix."

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Science and religion have often been viewed by philosophers, by individuals within each field, and by the layman as essentially in opposition, as mutually irrelevant or as so radically different in aims and methods as to be unrelated. Certainly, there are significant differences to be found in the methods of the two fields; the laboratory bears little physical resemblance to the place of worship. Religious language is mystical, personal and subjective; scientific language is straightforward, impersonal and objective. Science seeks to correlate observable facts in the world; religion seeks to guide man's actions within the world. Scientific explanations are concerned with the structure of a thing or with causal explanations; religious explanations are concerned with the purpose of a thing or with ultimate cause. (Note: By "ultimate cause," I have in mind those explanations which postulate an "uncaused cause" or an "unmoved mover.") Above all, religious explanations offer no possibility for objective verification, while scientific explanations are by their very nature verified.

These differences are highlighted at the expense of the similarities within the two fields if an empiricist approach is taken toward philosophy of

science and toward philosophy of religion. An empiricist approach to religious statements, if it grants them any meaning at all, is likely to lead to some such analysis as Braithwaite's: "A religious belief is an intention to behave in a certain way (a moral belief) together with the entertainment of certain stories associated with the intention in the mind of the believer."[1] The thrust of the empiricist's conclusion lies in the characterization of religious belief as an intention, for intentions cannot be subjected to procedures of verification. Popper's criterion of falsifiability provides a good illustration of the empiricist approach to philosophy of science. Under this criterion, science is distinguished from pseudo-science by its procedures of testability. Scientific statements are falsifiable; pseudo-scientific (or non-scientific) statements are not falsifiable.

While these differences do exist between scientific inquiry and religious belief, major

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[1]R. B. Braithwaite, "An Empiricist's View of the Nature of Religious Belief," in Religious Language and the Problem of Religious Knowledge, ed. Ronald E. Santoni (Bloomington, 1968), p. 345.

similarities also exist. However, the similarities cannot be delineated if an empiricist approach is taken. By concentrating on how statements are verified, an empiricist approach is unable to account for the roles played by scientific inquiry and religious belief in individual conceptual systems. For this reason, I would suggest that the focus of analysis should be shifted. If scientific inquiry and religious belief are viewed as conceptual systems by which man interprets the world around him, the resulting conclusions are unlike the conclusions typically drawn by the empiricist analysis. Moreover, this suggested focus of analysis allows delineation of the differences as well as the similarities within scientific inquiry and religious belief. In other words, if scientific inquiry and religious belief are viewed as conceptual systems, it can be shown that the underlying bases and concepts of scientific inquiry and religious belief are quite similar, while the day-to-day functioning of the methods of each reflect the different directions historically taken by scientific inquiry and religious belief.

In order to elaborate these differences and similarities, I will argue that religious belief and

scientific inquiry have the same source. This source is a psychological need within the individual - the need to understand himself vis-a-vis the world in which he lives. If this assertion is correct, then it would be reasonable to expect that religious explanations and scientific explanations should function in a substantially similar fashion for the layman. Further, it would be reasonable to expect that the presuppositions of scientific inquiry and the presuppositions of religious belief should not only reflect this psychological need, but perform similar functions within the respective conceptual systems; moreover, the sets of presuppositions should further reflect the different areas of concentration within the two fields. Thirdly, it would be reasonable to expect that the day-to-day functioning of scientific inquiry and religious belief should reflect not only their common source, but the different directions taken by the two fields.

This paper, then, is divided into three sections. The first elaborates the psychological need that is the source of both religious belief and scientific inquiry, and determines the way in which religious explanations and scientific explanations reflect that need. The

second section delineates the presuppositions of scientific inquiry and religious belief, determines the way in which these presuppositions reflect the psychological need which produces inquiry and belief, and delineates the function of these presuppositions within the conceptual system. The third section explores the day-to-day functioning of scientific inquiry and religious belief by employing T. S. Kuhn's concept of the disciplinary matrix.

I.

One of man's most basic psychological needs is his need to understand himself vis-a-vis the world in which he lives. This need to understand the self vis-a-vis the world involves not only a concept of the workings of the world, but a concept of personal meaning as well. Man needs to understand the world around him in terms of its origin, its mechanical workings, its ultimate end, and its significance. Without some concept of significance within the world, everything (including man) would seem random. With some concept of significance, man can locate himself within an ordered system. Thus, the psychology of many demands

an understanding of the world which addresses itself not only to the workings of the world, but to its significance as well.

Man views the world around him as a complex entity. He perceives an infinite universe and an incomprehensible nature. Such perceptions overwhelm him; in the face of infinity and incomprehensibility, man perceives himself as insignificant. Unable to cope psychologically with feelings of insignificance, man yearns for an understanding of self and all that surrounds the self. Partial understandings such as those offered by cause and effect explanations are not sufficient to satisfy this psychological need. For, like the child who continually asks why, man will pursue the chain of cause and effect explanations back to an uncaused cause or an unmoved mover. Only an explanation which produces an overall framework of the world as a coherent, significant entity can satisfy this psychological need, for it is a two-pronged need. On the one hand, the need is for an understanding of the workings of the universe; on the other hand, the need is for an understanding of the significance or purpose of the universe. An explanation which will satisfy such a need must provide an overall framework

by which man can view the world and must include within this framework a concept of purpose or significance. (Note: Some, notably Sartre, seem well able to view the world as meaningless and hence absurd; I think the lack of broad acceptance of existentialism would indicate that most cannot cope with the implications of a meaningless universe.) Given an overall framework by which he can view the world, man can locate himself within the world. Thus, only an explanation which produces a coherent whole will satisfy the psychological need for an understanding of self vis-a-vis the world. This sort of coherent whole results from an explanation of the world which includes reference to purposes and ultimate causes as well as to efficient causes and the structures of things. Unless purpose and ultimate cause are addressed in some fashion, the psychological need for understanding is not satisfied. The explanations offered by religious belief or by scientific inquiry are two possible vehicles by which man seeks this understanding.

If religious belief does in fact stem from this sort of psychological need, then it would be reasonable to expect that religion should address itself to explanations of the world's origin, the mechanical

workings of the world, the significance of the world, and to man's significance within the overall scheme of the world. Ideally, religious belief would provide the understanding which the individual seeks by explicating a concept of the origin of the world, the intermediate workings of the world, and the end of the world as man knows it. In such an ideal explanation, the understanding needed to satisfy the psychological need would be attained. However, attaining such an understanding from religious explanations involves a tacit assumption on the part of the individual. The individual seeking this understanding assumes that knowledge of the origin of the world, the intermediate workings of the world, and the ultimate end of the world as man now knows it would produce an understanding so complete that everything would somehow become comprehensible. Since the individual also seeks to understand his own role in the scheme of the universe, he further assumes that if all were comprehensible, then his own role within the universe would also be comprehensible. Furthermore, because only a concept of significance within the universe can allow any significance to man himself, the individual also assumes that if all were to become comprehensible, then what is of value within the world would become comprehensible. With knowledge of what is

of value within the world, the individual would then know what values to pursue and how to conduct himself in order to attain those values. Thus, the ideal religious explanation would produce a coherent whole which would include explanations regarding cause and effect (usually couched in terms of God's will) and explanations of the structures of things, together with explanations of purpose and ultimate cause. In other words, the individual seeking to satisfy his need for understanding does follow a discernible line of reasoning, though not one which could easily be cast into a logically watertight form. In a reasoned attempt to satisfy the psychological need for understanding, the need itself is strong enough that questionable inferences will be made in order to produce a coherent whole. The reasoning of the individual is as follows:

1. The universe appears infinite.
2. Nature appears incomprehensible.
3. In an infinite universe, amidst an incomprehensible nature, man appears insignificant.
4. Man needs to feel significant.
5. If man could understand the origin of

the universe, the intermediate workings of the universe, and the end of the universe as he now knows it, then all would be understood.

6. If understanding were thus attained, man would then know his own role in the universe as well as what is of value within the universe.

7. If man knew what is of value within the universe, he would then know what values to pursue and how to conduct himself in order to attain those values.

Thus, by explicating a concept of the universe which explains the origin, the middle and the end of the universe as man now knows it, religious explanations provide a framework by which man can comprehend himself as a part of the universe. (Note: None of this is in any way intended to reflect upon the truth or falsity of religious statements, or upon the truth or falsity of any specific religious doctrine. Rather, it is intended only to elaborate the psychological need for understanding which is the source of religious belief.)

This explanatory function must be included in

religious belief in order to satisfy the psychological need from which religious belief stems. Not only does the individual expect such explanations from religion, but religion has historically addressed itself to such explanations. Specifically, this explanatory function is performed in religion by what Braithwaite terms religious myths. Religious myths function as a particularly powerful explanatory mode because they provide the individual with the framework he needs by reference to an ultimate cause; they do so by interpreting the universe according to an ultimate cause and by postulating both a beginning and an end of the universe. The religious myths tell of a sacred history; they relate an event which took place in primordial Time, the fabled time of the "beginnings."[2] "... the myth of creation opens to its followers a certain view of the universe and makes them feel at home in it. In the light of the myth every major event of man's life evokes his descent from his ancestral cosmic origin, and his every major enterprise is undertaken as a rehearsal of the mythical

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[2]Michael Polanyi and Harry Prosch, Meaning (Chicago, 1975), p. 122.

act which first performed such an enterprise."[3] Polanyi's description of the creation myth illustrates how religious myths function to explain the world. First, the individual is given an explanation of how the world came to be; then the individual's every daily action is related to this origin (i.e., the intermediate workings of the world, in terms of the mechanical workings of the world and man's actions within the world, are related to the origin of the world). In this way, the religious myths provide a framework for viewing the world as an entity in which man's significance is assured. The eschatological myths of the coming millenium function for the individual in the same way as the myths of creation, assuring the individual of an eternal role in the scheme of the universe. Thus, an ideal religious explanation might take the following form:

1. God created the universe.
2. God placed man within the universe.
3. God's universe functions according to God's will.
4. God's will includes a coming millenium.

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[3]Ibid., p. 147.

In question and answer form, the ideal religious explanation might take the following form: "Question: How did this world come to be?" "Answer: In the beginning, God created Heaven and Earth." "Question: How did man come to be in the world?" "Answer: God created man in his own image." "Question: But science seems to have verified the fact that man evolved from the ape, who in turn evolved over time from the first organism; did God then create the first organism in his own image?" "Answer: God created the universe and everything in it, according to His plan." "Question: If God created the universe and everything in it according to a plan, why then does the universe appear incomprehensible?" "Answer: The universe may appear incomprehensible, but it works according to God's plan." "Question: If the universe works according to God's plan and man was created in God's image, why then can man not understand God's plan?" "Answer: Man can understand God's plan only through faith; believe in order that you may understand." Religious explanations of this sort produce for the individual the understanding necessary to satisfy the psychological need. The universe is depicted as a coherent whole, moving inexorably along a divine plan toward a universal

millenium, while man's significance within the universe is assured because he himself is part of the divine plan.

Scientific inquiry is another vehicle by which man attempts to satisfy his need to understand himself vis-a-vis the world in which he lives. Again, the universe appears complex, infinite and incomprehensible; and again, in the face of this perception, man appears insignificant. Consequently, the individual seeking understanding may look to scientific inquiry in his search for a framework by which he can view the world. Within this framework, the individual also seeks a concept of significance in order that he may place himself within the world. In other words, the psychological need to understand is again satisfied only by a coherent whole which is similar in nature to the coherent whole produced by religious belief.

If scientific inquiry, like religious belief, is viewed as stemming from man's need to understand, then it would be reasonable to expect that scientific inquiry should address itself to explanations of the world's origin, the mechanical workings of the world, the significance of the world, and the significance of man within the overall scheme of the world. Originally, of

course, scientific inquiry did address itself to such explications. Since the seventeenth century, however, the scientific community has eschewed explanations that appeal to the purposes of things, finding hypotheses concerning their structures, and concerning Humean causal relations among them, more readily confirmable. However, the source of scientific inquiry is reflected not only by its detailed explanations of the mechanical workings of the world, but by the layman's attempt to construct cosmological systems from scientific theories. Perversely, it is the very fact that science deals only with verifiable explanations that so tempts the individual who seeks understanding. The verifiability of scientific statements lends such explanations an air of authority which leaks over into the subsequent metaphysical explanation. In other words, because scientific inquiry stems from the same source as does religious belief, man throughout history has exhibited a chronic inclination to construct cosmological systems from scientific explanations.

In order to attain the understanding he needs, the layman makes the same tacit assumption that is involved in attaining understanding from religious explanations. The individual assumes that a scientific

explication of the origin of the world, the intermediate workings of the world, and the ultimate end of the world as man knows it would produce an understanding so complete that everything would become comprehensible. Since the individual also seeks to understand his own role in the scheme of the universe, he further assumes that if all were comprehensible, then his own role within the universe would also be comprehensible. Furthermore, because only a concept of significance within the universe can allow significance to man himself, the individual also assumes that if all were to become comprehensible, then what is of value within the world would become comprehensible. With knowledge of what is of value within the world, the individual would then know what values to pursue and how to conduct himself in order to achieve those values. Thus, by stretching properly verified scientific statements into metaphysical explanations, the individual produces a coherent whole which satisfies his craving for purposes and ultimate causes.

Again, the individual seeking to satisfy his need for understanding follows a discernible line of reasoning, though not one which could easily be cast into a logically watertight form. In a reasoned attempt

to satisfy the psychological need for understanding, the need itself is strong enough that questionable inferences will be made in order to produce a coherent whole. Indeed, even the fact that scientific verifiability is lost when scientific statements are taken out of context is overridden by the individual's need to understand. The reasoning of the individual is as follows:

1. The universe appears infinite.
2. Nature appears incomprehensible.
3. In an infinite universe, amidst an incomprehensible nature, man appears insignificant.
4. Man needs to feel significant.
5. If man could understand the origin of the universe, the intermediate workings of the universe, and the end of the universe, then all would be understood.
6. If understanding were thus attained, man would then know his own role in the universe as well as what is of value within the universe.
7. If man knew what is of value within

> the universe, he would then know what values to pursue and how to conduct himself in order to attain those values.

Thus, given a scientific explanation of the origin of the universe (e.g., the Big Bang theory), along with an explanation of the mechanical workings of the universe, (e.g., the theory of relativity explains in part how the universe functions), and an explanation of the continual progression of the universe (e.g., the expanding theory of the universe),[4] the individual will integrate the three distinct theories in order to produce a coherent whole. Within this framework, the individual employs further scientific theories to explain values within the universe (e.g., man is the highest form yet evolved in the process of evolution). By assigning value to man, the individual then has knowledge of how he ought to conduct himself (e.g., man should concern himself with survival of the species). In this manner, the individual seeking understanding produces an alternate conceptual system by which he can view the world around him.

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[4]Robert Jastrow, God and the Astronomers (New York, 1978), p. 123.

Thus, an ideal scientific explanation of the universe might take the following form:

1. Twenty billion years ago, the Universe was created in a fiery explosion.[5]
2. Man evolved, through time, by the process of natural selection, and will continue to so evolve.
3. The universe works according to the laws of natural science, and will continue to so work.
4. The universe will continue forever.

In question and answer form, the ideal scientific explanation might take the following form: "Question: How did this world come to be?" "Answer: The universe was created in a fiery explosion." "Question: How did man come to be in the world?" "Answer: Man evolved through time by the evolutionary process of natural selection." "Question: The universe appears complex and incomprehensible; is there an order to the universe?" "Answer: While science cannot yet detail all the workings of the universe, the order apparent in the laws of physics and astronomy, for example,

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[5]Ibid., p. 12.

would tend to indicate that the order of the universe may be found in the laws of natural science." "Question: But many of us have little understanding of the laws of natural science; how then are we to understand the order of the universe?" "Answer: The laws of natural science are verifiable; if you accept them as verified, they will help you to understand the world around you. Further, in this process of application, you will come to a better understanding of the laws of natural science themselves." Such a stringing-together of scientific theories produces for the individual the understanding necessary to satisfy the psychological need. Again, the universe is pictured as a coherent whole, moving along an ordered path of continuous evolutionary progress, while man is assured of personal significance as a part of the laws of natural science. (Note: This significance may be little more than a sort of cog-in-a-wheel significance; but by depicting man as the highest form yet evolved, and by adding that evolution will continue in the future as it has in the past, some significance for man is gleaned.)

It should be noted that the scientific community does not intend (nor profess to seek) the type of

understanding which satisfies the psychological need I have described. In Metaphysical Beliefs, Toulmin has pointed out that any cosmology constructed from scientific theories will be constructed at the expense of taking the statements out of their proper context; as such, these cosmologies lie entirely outside the proper scope of scientific inquiry. While Toulmin's point is entirely correct as it applies to the scientific community, it does not alter the fact that laymen have throughout history employed scientific theories in their construction of cosmological systems.

Thus, scientific explanations and religious explanations function in substantially similar fashion for the layman; both are conceptual systems by which man interprets his world. Religious explanations fully mirror the psychological need from which religious belief stems by explaining the world in terms of purpose and ultimate cause, as well as in terms of cause and effect and the structures of things; further, religious explanations readily assign a significance to man within the world. Scientific explanations partially mirror the psychological need from which scientific inquiry stems by giving detailed explanations of the mechanical workings of the world. The

individual seeking understanding then employs scientific theory to construct the coherent and significant whole which will satisfy his need to understand himself vis-a-vis the world. The psychological need which produces both religious belief and scientific inquiry can be satisfied only with the understanding produced by a cosmological scheme. This cosmological scheme may be couched in terms of God's will or in terms of the laws of natural science; either functions for the individual as a conceptual system; either provides the framework which satisfies the psychological need to understand.

II.

If I am correct in taking this psychological need for understanding as the source of both religious belief and scientific inquiry, then it would be reasonable to expect that the presuppositions of both scientific inquiry and religious belief should not only reflect their common source, but should also function in similar fashion within the respective endeavors. I would suggest that the following postulates constitute a set of presuppositions for the broad scope of

scientific inquiry:

1. There is an order and constancy in nature.[6]
2. Facts are correlatable (i.e., stand in relation to one another and cohere in a scheme).[7]
3. Man can understand this correlatable, factual order through the procedures of scientific inquiry.

The first two postulates of the set of presuppositions are taken from Charles Coulson's article "The Similarity of Science and Religion;" the third postulate is a tacit assumption which underlies all scientific inquiry. From this set of presuppositions, specific scientific models are formulated, following the broad guidelines given in the postulates of the set of presuppositions. Harold Schilling's characterization of a specific model in physics, the Kinetic Theory, illustrates the way in which these postulates

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[6]Charles A. Coulson, "The Similarity of Science and Religion," in Science and Religion: New Perspectives on the Dialogue, ed. Ian G. Barbour (New York, 1968), p. 63.

[7]Ibid.

are reformulated into specific models. According to Schilling, the physicist is "not satisfied with having a lot of data about specific properties of gases, or even isolated laws that correlate data."[8] I would suggest that the reason for this dissatisfaction is that isolated laws do not exhibit the order and constancy postulated in the set of presuppositions. Moreover, I would suggest that the dissatisfaction which Schilling mentions stems originally from the psychological need to understand. Schilling's characterization continues, stating that "physicists want a way of correlating the laws so as to get an overall view of the behavior of gases."[9] The desire for an overall view reflects the second postulate of the set of presuppositions which postulates correlatable facts which cohere in a scheme. Here again, the desire for an overall view which correlates many laws reflects the psychological need for a framework by which to view the world. As the illustration of the

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[8]Harold K. Schilling, "The Threefold Nature of Science and Religion," in Science and Religion: New Perspectives on the Dialogue, ed. Ian G. Barbour (New York, 1968), p. 82.

[9]Ibid.

Kinetic Theory shows, specific scientific models reflect the postulates of the set of presuppositions; these postulates in turn reflect man's psychological need to understand. The sequence then is as follows: The psychological need to understand the self vis-a-vis the world results in scientific inquiry; the set of presuppositions for scientific inquiry reflects this psychological need in its postulates. Further, the set of presuppositions provides a set of broad guidelines from which specific scientific models are formulated.

The postulates of the set of presuppositions also provide broad standards for the overall scope of scientific inquiry from which more specific standards can be formulated. The criterion of explanatory relevance as discussed by Hempel and the criterion of simplicity as illustrated in James Watson's The Double Helix illustrate the way in which specific standards are formulated in line with these postulates. Hempel argues that scientific explanations must meet the criterion of explanatory relevance; in order to meet this criterion, the explanation must detail how a particular phenomenon occurs in such a way that the explanation "affords good grounds for believing that

the phenomenon to be explained did, or does, indeed occur."[10] This criterion of scientific explanations reflects the second postulate of the set of presuppositions. If facts were not postulated as schematically coherent, there could be no "grounds by which to expect that the phenomenon does in fact occur." Facts which do not schematically cohere do not lend themselves to a concept of explanatory relevance. The criterion of simplicity by which scientific explanations are sometimes judged reflects the first postulate of the set of presuppositions. In the sense in which the criterion of simplicity is often applied, simplicity is implied by the concept of order. For instance, in The Double Helix, James Watson wrote that when he finally discovered the double helical structure of DNA, he felt sure that "something so simple must truly exist." Having discovered a truly simple structure, Watson seemed to intuitively believe that because it was a simple structure, then it must be the existing order which he sought. (Note: This is not meant to suggest that all simple structures are exemplified in nature; it is only to suggest that a

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[10]Carl G. Hempel, Philosophy of Natural Science (Englewood Cliffs, 1966), p. 43.

concept of simplicity which is implied by the concept of order is used in scientific inquiry as a standard.) In the formulation of such standards as well as in the formulation of specific scientific models, the set of presuppositions reflects the psychological need for a framework by which to view the world; in turn, the set of presuppositions provides the scientific community with a broad ideal from which more specific standards and models are formulated.

The following postulates constitute a set of presuppositions for the broad scope of western religious belief:

1. God created an orderly and uniform universe.
2. God's orderly universe includes a moral order.
3. God created man in his own image; therefore, man can understand God's order through faith.

The first postulate is an accepted postulate of western religious belief; the second postulate is implied by the first; the third postulate is a standard assumption of western religious belief. Again, from this set of presuppositions, specific religious models are

formulated, following the broad guidelines given in the postulates of the set of presuppositions. One standard model employed in western religious belief is the representation of God as the Father. This representation reflects the postulates of the religious set of presuppositions. Certainly if God created man in his own image, then the representation of God the Father is fitting (though like all religious models, not fully adequate). Like the puzzled child who cannot understand his father's will, the children of God do not understand the will of the Father. However, the relation of child to father can be understood through faith. Moreover, as a child of God, the individual Christian assumes a universal order and a moral order which surpasses the perceived family order which a father imposes. As this illustration suggests, specific religious models reflect the postulates of the set of presuppositions; these postulates in turn reflect man's psychological need to understand. Again, the sequence is as follows: The psychological need to understand the self vis-a-vis the world results in both scientific inquiry and religious belief; the set of presuppositions for religious belief reflects this psychological need in its postulates. Further, the

set of presuppositions provides a set of broad guidelines from which specific religious models are formulated.

In the postulates of the respective sets of presuppositions for scientific inquiry and religious belief (as well as in the specific models which are drawn from the sets of presuppositions), the beginnings of the diverging routes followed by scientific inquiry and religious belief can be found. Each set of presuppositions reflects the psychological need which produces both religious belief and scientific inquiry and in turn provides the respective communities with a broad ideal from which to formulate specific models. However, the respective postulates of the sets of presuppositions further reflect the areas of concentration within the two endeavors. The postulates of the scientific set of presuppositions are not couched in terms of ultimate cause as are the postulates of the religious set of presuppositions. The postulates of the scientific set of presuppositions allow no reference to purposes, and thus allow no imputation of significance to things; significance can be derived only if a subsequent specific model permits the implication. On the other hand, the religious set

of presuppositions postulates God as creator of man and universe as well as postulating a moral order. These postulates allow the direct implication that God assigns significance to man and universe. Further, a combination of postulates 2 and 3 would imply that the individual can know this moral order. A combination of postulates 1, 2 and 3 would imply a systematic connection between the individual's moral conduct and his moral destiny. Thus, it is at the point of the sets of presuppositions that the different methods employed by scientific inquiry and religious belief first appear.

These differences in method are further reflected in the day-to-day functioning of scientific inquiry and religious belief. In man's search for understanding, the functioning of the explanatory apparatus is of particular interest. Both the differences and the similarities of the two conceptual systems will be explored in the following section by employing Kuhn's concept of the disciplinary matrix.

III.

In the Postscript to the text of The Structure

of Scientific Revolutions, Kuhn outlines a detailed format by which scientific inquiry proceeds. Kuhn suggests the term "disciplinary matrix" as a substitute for the more global of the two senses of "paradigm" which he now distinguishes. With the concept of a disciplinary matrix, the day-to-day functioning of scientific inquiry can be more easily explored. Further, an analogous concept of a Christian disciplinary matrix can be proposed as a tool for the examination of the functioning of religious belief. It should be stressed that this section is of a tentative and exploratory nature. The purpose is not to offer a definitive account of either scientific inquiry or religious belief, but to see what light may be shed on each by comparing them in the terms used in Kuhn's model.

Kuhn argues that the "shared disciplinary matrix accounts for the relative fullness of professional judgments among a particular community of specialists."[11] Kuhn suggests the term "disciplinary matrix" because "disciplinary" refers to the common possession of the practitioners of a particular

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[11]Thomas S. Kuhn, The Structure of Scientific Revolutions (Chicago, 1970), p. 182.

discipline; he suggests "matrix" because it is composed of ordered elements of various sorts, each requiring further specification. Kuhn lists the following four elements of the disciplinary matrix: (1) symbolic generalizations, (2) shared commitments, (3) values, and (4) exemplars. "Exemplar" is the term Kuhn substitutes for "paradigm" in the second and more crucial of the senses of "paradigm" which he distinguishes in the Postscript.

The symbolic generalizations of the disciplinary matrix are "those expressions, deployed without question or dissent by group members, which can be readily cast in a logical form. They are the formal or formalizable components of the disciplinary matrix."[12] These are the highly abstract elements of the disciplinary matrix; as such, they are subject to varied interpretations and therefore depend on the remaining elements of the matrix for complete interpretation. Symbolic generalizations such as f=ma function in part as laws of nature and in part as definitions of some of the symbols they deploy.

The second element of the disciplinary matrix,

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[12]Ibid.

shared commitments, is the shared beliefs of a specific group in particular models. Kuhn uses the phrase "shared commitment" throughout his discussion of the disciplinary matrix. But in the context, it is clear that "model" is the appropriate name for the second type of element in the disciplinary matrix; the commitments he has in mind are to models. The models to which group members are committed supply the members with preferred or permissible analogies and metaphors. By performing this function, the models help to determine what constitutes an acceptable explanation and what constitutes an acceptable solution. Further, the models function as a means of determining the roster of unsolved scientific puzzles and the evaluation of the importance of each.

The third element of the disciplinary matrix is values; values "are more widely shared among different communities than either symbolic generalizations or models, and they do provide a sense of community to natural scientists as a whole."[13] The most deeply held values function with regard to predictions; for instance, predictions should be

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[13]Ibid., p. 184.

accurate; quantitative predictions are preferable to qualitative ones; whatever the margin of permissible error, it should be consistently satisfied in a given field; and so on. Values also function to evaluate whole theories; for instance, theories must, first and foremost, permit formulation and solution of scientific puzzles; theories should be simple, self-consistent, plausible and compatible with other currently employed theories.

The fourth element of the disciplinary matrix is exemplars; exemplars are "concrete problem-solutions that students encounter from the start of their scientific education."[14] An instance of a concrete puzzle-solution which Kuhn calls an exemplar would be Newton's derivation of Kepler's laws. "More than other sorts of components of the disciplinary matrix, differences between sets of exemplars provide the community fine-structure of science."[15]

One example Kuhn gives of a symbolic generalization is Newton's Second Law; it is an abstract statement which depends on the remaining elements of

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[14]Ibid., p. 187.

[15]Ibid.

the matrix for complete interpretation. Newton's Second Law functions both as a law of nature and as a definition of force. As a law of nature, f=ma states a discovered relation among force, mass, and acceleration as presently understood. But it, like many of the more fundamental symbolic generalizations, also functions as a definition in that henceforth any "forces" postulated will be required to conform to it; anything that does not will not be called a "force." The importance of abstract, formal or formalizable generalizations is that without them, "there could be no points at which group members could attach the techniques of logical and mathematical manipulation in their puzzle-solving enterprise."[16] In other words, lacking agreement upon certain symbolic generalizations, the scientific community would be unable to proceed in the activities of normal science. (Note: The search for solutions to scientific puzzles constitutes for Kuhn the main business of "normal science".)

The second element of the disciplinary matrix

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[16]Ibid., p. 183.

which Kuhn lists is the shared commitments of a specific group of scientists. These shared commitments are "beliefs in particular models, such as: heat is the kinetic energy of the constituent parts of bodies; all perceptible phenomena are due to the interaction of qualitatively neutral atoms in the void."[17] The models employed by a specific field of science function as theoretical constructs by which experience can be compared and predicted. Kuhn's point is that unless these models are widely accepted ("shared") by a scientific community, the activities of normal science would be stymied. Moreover, by supplying group members with preferred analogies and metaphors, a model helps to determine acceptable explanations and solutions to the puzzles of the field. For instance, an early model in studies of electricity "regarded attraction and frictional generation as the fundamental electrical phenomena."[18] A competing model "took attraction and repulsion to be equally elementary manifestations of electricity."[19]

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[17]Ibid., p. 184.

[18]Ibid., p. 14.

[19]Ibid.

Researchers applying the first model would be unlikely to accept an explanation of electricity which relied on repulsion. As a theoretical construct, the models of the disciplinary matrix function in part to determine acceptable explanations and solutions.

According to Kuhn, the particular importance of values within the scientific disciplinary matrix emerges "when the members of a particular community must identify crisis or, later, choose between incompatible ways of practicing their discipline."[20] Kuhn suggests simplicity, consistency, and plausibility as examples of values, pointing out that "to a greater extent than other sorts of components of the disciplinary matrix, values may be shared by men who differ in their application."[21] Thus, though simplicity, consistency and plausibility are values which are widely shared by the overall scientific community, the application of these values may vary greatly from individual to individual. "What was for Einstein an insupportable inconsistency in the old quantum theory, one that rendered the pursuit of

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[20]Ibid., p. 184.

[21]Ibid., p. 185.

normal science impossible, was for Bohr and others a difficulty that could be expected to work itself out by normal means."[22] That is, it may be supposed that Bohr saw the old quantum theory as simple, consistent and plausible while Einstein saw the same theory as overly complex, inconsistent and implausible. Surely both Einstein and Bohr would agree that simplicity, consistency and plausibility are appropriate values by which to judge theories; it is in the application of the values that they would differ. "In short, though values are widely shared by scientists and though commitment to them is both deep and constitutive of science, the application of values is sometimes considerably affected by the features of individual personality and biography that differentiate the members of the group."[23]

Kuhn again uses Newton's Second Law of Motion in explaining how exemplars guide day-to-day scientific research. In this connection, Newton's Second Law turns out to be a law sketch or law-schema. As the student's scientific education progresses, the

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[22]Ibid.

[23]Ibid.

Second Law of Motion, f=ma, is formulated for the case of free fall as $mg=m\frac{d^2s}{dt^2}$; that is, the formulation of the law is transformed as it is applied to different problems. In other words, as the student's scientific education progresses, he "discovers a way to see his problem is like a problem he has already encountered. Having seen the resemblance, grasped the analogy between two or more distinct problems, he can inter-relate symbols and attach them to nature in the ways that have proved effective before. The law-sketch, say f=ma, has functioned as a tool, informing the student what similarities to look for ..."[24] Thus, exemplars provide the concrete puzzle-solutions by which normal science activities are conducted, while symbolic generalizations help the scientist to formulate his current problem in such a way that its resemblance to an already-solved problem will become apparent.

In general, then, it is the shared disciplinary matrix which accounts for the relative unanimity of professional scientific judgments. That is, the judging of a new theory as correct or incorrect is

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[24]Ibid., p. 189.

accounted for by the accepted disciplinary matrix of the discipline. By accepting the elements of the disciplinary matrix, a particular scientific community is provided with its laws of nature and its definitions, its models, its values, and its solutions. Because they have these these terminologies in common, the members of the scientific community are able to judge the correctness or incorrectness, acceptability or unacceptability of new theories within the field. I believe these are the criteria by which the theories of Velikovsky were judged to be incorrect and unacceptable. That is, Velikovsky's theories violated some or all of the elements of an accepted disciplinary matrix; such violation constitutes unacceptable or inaccurate theory construction. Thus, a general function of a disciplinary matrix is as a criterion for judging new theories.

Further, a disciplinary matrix functions as a tool for understanding. To return to the general assertions of this paper, man has a basic psychological need to understand himself vis-a-vis the world; scientific inquiry and religious belief are two possible methods by which this understanding can be attained. The presuppositions of scientific inquiry

and religious belief reflect this psychological need; these presuppositions then provide broad ideals for scientific inquiry and religious belief; from these broad ideals, specific models are formulated. Finally, the disciplinary matrix employed by a given field provides the tool by which these models are utilized on a day-to-day basis. In other words, a disciplinary matrix functions as a specific method by which scientific inquiry or religious belief proceed; it acts as the daily tool by which understanding is sought.

Following Kuhn's format, I will argue that a disciplinary matrix functions in religion and that analogies of the four elements which Kuhn delineates in a scientific disciplinary matrix can be enumerated in a Christian disciplinary matrix. (Note: These remarks are not intended to bear upon religion as a whole; they are intended to bear only upon the various Christian denominations.) I would suggest that the statement "God is love" functions as a symbolic generalization for the Christian community; the representations of God as Father or Judge function as models for the Christian community; the value of compassion illustrates the third element of the

matrix; and the New Testament supplies a set of exemplars.

One example of a symbolic generalization in a Christian disciplinary matrix would be the statement, "God is love." Other examples would include any of the traditional attributes of God, such as omniscience, omnipotence, or benevolence. The statement "God is love" is highly abstract and subject to varied interpretations; it therefore depends on the remaining elements of the matrix for complete interpretation. The abstract nature of Christian symbolic generalizations allows the element of mystery to be retained in religious statements. For instance, the model of God as Judge could be taken too literally if it were not for the standing qualifications supplied by the symbolic generalizations of omniscience and omnipotence. The symbolic generalizations function to insure that the element of mystery is not lost in religious statements and to insure that religious models are taken in an appropriate context. Thus, the symbolic generalizations of a Christian disciplinary matrix do not function as laws of nature as do the symbolic generalizations of Kuhn's scientific disciplinary

matrix. Rather, their function is that of providing a set of conditions to which the remaining elements must comply. Nevertheless, the statement "God is love" is an "expression which is deployed without question or dissent by group members." While the meaning of the statement cannot be spelled out with the fullness by which a statement of the sort "Grass is green" can be spelled out, the meaning of the statement "God is love" can be spelled out in some fashion by the individual Christian. Symbolic generalizations have meaning for the Christian because they characterize God in terms of human characteristics such as love, knowledge, power or benevolence. By providing understandable general characterizations of God (qualified so as to preserve the element of mystery), symbolic generalizations provide conditions to which the other elements of the Christian disciplinary matrix must comply. Further, as a symbolic generalization, the statement "God is Love" functions in part as a definition of its own symbols; the statement in one sense defines God and in another sense defines love.

This illustration of a symbolic generalization of a Christian disciplinary matrix brings out the

historic differences of the day-to-day functioning of scientific inquiry and religious belief. As a conceptual system, scientific inquiry employs a disciplinary matrix which applies to observable data. Within this matrix, the scientific symbolic generalizations function as laws of nature. On the other hand, the conceptual system of Christian religious belief employs a disciplinary matrix which applies to appropriate behavior. Within this matrix, the symbolic generalizations function to integrate the diverse activities of worship into a coherent pattern. In this way, the individual confronted with a problem situation is able to pick out the key elements of the problem which will enable him to apply an exemplar in his attempt to solve the problem. For instance, by focusing on the symbolic generalization "God is love," the individual might decide that the problem confronting him involves a question of brotherly love; having determined the key element of the problem in this fashion, he might then select the lesson of the parable of the Good Samaritan as the appropriate solution to his problem. In this way, the symbolic generalizations of a Christian disciplinary matrix function as an element in providing appropriate

solutions to individual behavioral problems, while the symbolic generalizations of the scientific disciplinary matrix function as an element in providing solutions to the puzzles of normal science.

The representations of God as Father or Judge are examples of the second element of a Christian disciplinary matrix. As shared commitments, these representations are beliefs in particular models which are shared by members of the Christian community. As models, they function to supply group members with preferred analogies and metaphors; by supplying these preferred analogies and metaphors, the models help to determine what constitutes an acceptable explanation and what constitutes an acceptable solution. For instance, a devout Christian might debate the question of natural disasters. By employing the models of God as Judge and as Father together with the symbolic generalizations of God's omniscience, omnipotence and benevolence, the individual might conclude that God employs natural disasters to save his children from more severe catastrophes yet to come.

Here again, the illustration brings out the traditional differences in the day-to-day functioning of scientific inquiry and religious belief. The

Christian models of God as Father or as Judge can imply a variety of behavioral dicta. For instance, the individual Christian should adopt a trusting attitude, for God the Father is taking care of him; or, the individual Christian should lead a righteous life, for God the Judge will pass judgment on him. Further, the model of God the Father could be drawn out to the additional implication that if we all have one Father, then we are all brothers; if we are all brothers in this sense, then appropriate Christian conduct would be that of brotherly love toward all men. Again, the accepted models of Christian religious belief function as an element to provide appropriate solutions to individual behavioral problems.

An example of the third element of a Christian disciplinary matrix would be the value of compassion. As in the scientific disciplinary matrix, these values are more widely shared among different Christian communities than either symbolic generalizations or models. Despite the widespread agreement upon values, however, there may be disagreement concerning the application of a value. For instance, euthanasia might be considered as compassionate by one devout Christian; another equally devout Christian might consider it

murder. The same differences in application might apply to abortion; yet both individuals would readily agree that compassion is an important value of Christian religious belief. Again this illustration brings out the behavioral emphasis of a Christian disciplinary matrix.

The parables given by Christ and the events surrounding his life as cited in the New Testament constitute a central set of exemplars for a Christian disciplinary matrix. Indeed, it is the only set of exemplars common to all Christian denominations. The Old Testament also acts in some instances as a set of exemplars, but a large degree of selectivity is applied by Christian denominations to usage of the Old Testament. It is this selectivity concerning a denomination's accepted exemplars which provides the "community fine-structure" of Christian denominations. As exemplars, the Scriptures provide the individual with "concrete problem-solutions" on which he can model his behavior. The individual becomes familiar with Scriptural passages from the beginning of his religious training. As his religious training develops, the applications of the Scriptural passages change as they are applied to different situations.

That is, the individual "discovers a way to see his problem is like a problem he has already encountered." At first, the parable of the sower may seem little more than an interesting story; later, the individual may come to appreciate the metaphorical content of the parable; finally, the individual may apply the lesson of the parable to his own life. In this way, the exemplars "signal the gestalt" in which a situation is to be seen.[25] As exemplars, the Scriptural passages provide the individual with problem-solutions that apply to behavior, as do all elements of a Christian disciplinary matrix.

In general, then, it is the shared disciplinary matrix which accounts for the relative unanimity of Christian judgments made by various denominations. Each illustration of the elements of the disciplinary matrix would be accepted by a Christian of any denomination. Though accepted, their interpretations might differ according to the specific set of exemplars. Kuhn mentions this interpretative difference as it applies to the scientific disciplinary matrix. "An investigator ... asked a distinguished

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[25]Ibid.

physicist and an eminent chemist whether a single atom of helium was or was not a molecule. For the chemist the atom of helium was a molecule because it behaved like one with respect to the kinetic theory of gases. For the physicist, on the other hand, the helium atom was not a molecule because it displayed no molecular spectrum."[26] This sort of interpretative difference accounts for the "community fine-structure" differences among the assorted specialized fields of science. A similar sort of interpretative difference accounts for some of the doctrinal differences among Christian denominations and subgroups thereof. For example, among denominations which regard gambling as a clear example of unchristian behavior, some have generalized the prohibition to include all card games, while others have regarded a no-stakes game of bridge as an innocent pastime. While these doctrinal variations occur, each of the illustrations given above as elements of a Christian disciplinary matrix would be accepted by any Christian denomination.

In general, then, the Christian disciplinary matrix provides the whole of Christianity with its

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[26] Ibid., p. 50.

laws, its definitions, its models, its values and its solutions. Employing the Christian disciplinary matrix, the Christian community is able to judge the rightness or wrongness of individual behavior, with a relative degree of unanimity existing across denominational lines. For example, the sins of Christianity are similarly defined regardless of denomination; the fine-line interpretative differences between types of sin (e.g., mortal sins or venial sins in Catholicism) are a function of the specific set of exemplars employed within each denomination. The wide acceptance of the Christian disciplinary matrix provides the Christian community with a set of criteria by which the life of an individual Christian may be judged in terms of his behavior. The Christian disciplinary matrix is the specific method by which religious belief proceeds; it acts as the daily tool by which understanding is ultimately sought.

In conclusion, then, I would argue that any analysis which is unable to account for both the similarities and the dissimilarities of scientific inquiry and religious belief is incomplete. Moreover, I would suggest that any analysis which does not account for the roles played by scientific inquiry and

religious belief in individual conceptual schemes will emphasize the dissimilarities of scientific inquiry and religious belief at the expense of the similarities. By focusing on scientific inquiry and religious belief as two possible methods by which the individual attempts to interpret himself vis-a-vis the world in which he lives, the following similarities can be delineated: (1) scientific inquiry and religious belief both result from man's psychological need to understand himself vis-a-vis the world; (2) the respective sets of presuppositions within each field reflect this psychological need; (3) the respective sets of presuppositions within each field provide a set of broad guidelines from which specific models are formulated; (4) the respective disciplinary matrices function as the specific frameworks within which understanding is sought. This same focus of analysis delineates the following dissimilarities: (1) the sets of presuppositions within the two fields reflect the different directions followed by scientific inquiry and religious belief since the seventeenth century. That is, the postulates of the scientific set of presuppositions are not couched in terms of ultimate cause while the postulates of the religious

set of presuppositions rely on God as an uncaused cause. Further, the postulates of the scientific set of presuppositions allow no direct imputation of significance while the religious set of presuppositions postulates a moral order and allows a direct imputation of significance. (2) These traditional differences are further reflected in the respective disciplinary matrices of scientific inquiry and Christian religious belief. That is, the elements of the scientific disciplinary matrix apply to observable data while the elements of the Christian disciplinary matrix apply to individual behavioral problems. Thus, if scientific inquiry and religious belief are viewed as two possible methods by which man attempts to interpret himself vis-a-vis the world, the traditional dissimilarities of scientific inquiry and religious belief are preserved without the expense of overlooking some of the major similarities of the two endeavors. As Ian Barbour put it, "if religion, like science, is the human interpretation of experience, then the gulf between the methods of the two fields has been

narrowed from both sides."[27] An analysis which accounts for the similarities and the dissimilarities of scientific inquiry and religious belief may provide one link in bridging the gulf to which Barbour refers.

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[27]Ian G. Barbour, "Science and Religion Today," in Science and Religion: New Perspectives on the Dialogue, ed. Ian G. Barbour (New York, 1968), p. 20.

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