JOURNAL OF THE AMERICAN SCIENTIFIC AFFILIATION

An evangelical perspective on science and the Christian faith

"The fear of the Lord is the beginning of Wisdom." Psalm 111:10

VOLUME 24 NUMBER 1 MARCH 1972

MEMBER EVANGELICAL PRESS ASSOCIATION

The American Scientific Affiliation is an association of men and women who have made a personal commitment of themselves and their lives to Jesus Christ as Lord and Savior, and who have made a personal commitment of themselves and their lives to a scientific understanding of the world. The purpose of the Affiliation is to explore any and every area relating Christian faith and science. The *Journal* is one of the means by which the results of such exploration are made known for the benefit and criticism of the Christian community and of the scientific community.

Published Quarterly by the
American Scientific Affiliation
324½ So. Second Street
Mankato, Minnesota 56001

Printed in the
United States of America

The subscription price: one year $6.00; two years $11.00; three years $15.00. *Gift subscriptions*: one year $3.00. Single copies may be purchased at $1.25 each. Second class postage paid at Mankato, Minnesota. Back issues: $1.25 per issue from 1963 to date; $2.00 per volume or 75¢ per single issue before 1963.

INDICES to back issues are published as follows: Vol 1-15 (1949-1963), *Journal ASA*, 15, 126-132 (1963); Vol. 16-19 (1964-1967), *Journal ASA* 19, 126-128 (1967); Vol. 20-22 (1968-1970), *Journal ASA* 22, 157-160 (1970).

Concerning SUBSCRIPTIONS, changes of address, requests for back issues, and other business, address: Executive Secretary, The American Scientiic Affiliation, 324 1/2 So. Second St., Mankato, Minnesota 56001.

Concerning MANUSCRIPTS and COMMUNICATIONS, address the Editor. Non-members as well as members are invited to submit manuscripts, letters, and brief contributions for consideration for publication.

MANUSCRIPTS should be sent to the Editor, typed double-space on good quality 8½ x 11 paper, with references collected at the end of the article, and should be submitted *in duplicate*. An Abstract of not more than 200 words should precede the article. Figures or diagrams should be clear, black and white line ink drawings with a caption provided in type. The opinions and conclusions published in this Journal are those of the authors, and should not be interpreted as representing necessarily the position of The American Scientific Affiliation. Open discussion of all issues is encouraged in the expectation that the pursuit of truth can only be enhanced by exposure to conscientious and honest inquiry.

Concerning BOOK REVIEWS, address the Book Review editor. To avoid duplication in reviews, prospective reviewers should notify the Book Review Editor of their intentions at an early date.

The Journal of the American Scientific Affiliation is indexed in the CHRISTIAN PERIODICAL INDEX.

Present and past issues of *The Journal of the American Scientific Affiliation* are now available in microfilm at nominal cost. The full price to subscribers for Volumes 1-17 (January 1949 - December 1965) is $19.50. For information, write University Microfilms, Inc. 300 North Zeeb Road, Ann Arbor, Michigan 48106.

The *Journal of the American Scientific Affiliation* is a quarterly issued in March, June, September, and December. The office of publication and business office is 324½ So. Second Street, Mankato, Minnesota 56001. The printer is the Lakeland Color Press, 7415 Wayzata Blvd., Minneapolis, Minnesota 55426; the editor is Richard H. Bube, Department of Materials Science, Stanford University, Stanford, California 94305. Total copies printed is 3600, paid circulation is 2630.

JOURNAL OF THE AMERICAN SCIENTIFIC AFFILIATION

MARCH 1972 PRINTED IN THE UNITED STATES OF AMERICA VOLUME 24, NUMBER 1

HOW AND WHY DID IT ALL BEGIN?

CHARLES H. TOWNES

Department of Physics
University of California
Berkeley, California 94720

Two Views of Creation

There have been two distinct, long-standing views of creation—that is, the origin of our universe and of life in it. The first view makes each the result of a unique and special event. The second assumes that the universe and life are more continuous and commonplace events, with no unique moment of origin. These two possibilities do not represent simply the difference between a religious view and a secular view, though they may affect profoundly an individual's outlook. Nor do they correspond to a scientific versus a non-scientific view. Assumptions of a unique and special creation on the one hand, or an inevitable and more commonplace one on the other have been a continuing theme through a great deal of man's thought.

During much of human history, it has been normal to believe that life was created from time to time spontaneously from materials of nature, or perhaps by some more or less capricious supernatural event. A recipe for creating mice during the Middle Ages advises taking an old shirt and putting some grain in it. When stuffed into the corner of a room for a few weeks, mice were sure to be found, created according to the recipe. Such ideas as the commonplace spontaneous creation of life persisted into the nineteenth century and were only disproved after much labor and considerable argument within the scientific community by the great scientist Pasteur. By aseptic techniques, he showed conclusively that all life as we know it comes from other life.

While science was thus on the one hand making the creation of life seem rather special, on the other hand it was also busy during the same period detracting from ideas about the unique character of man's existence. Copernicus and Galileo had already removed man from the center of the universe. The study of the vast collections of stars called galaxies, and then of cosmology, extended our view of the universe so enormously that man's being important in it seemed almost unthinkable. Darwin's ideas on evolution, and now modern biochemistry, go a long way towards indicating that life itself was generated by random processes, some might say rather casually and accidentally, on the basis of physical laws which we largely know.

Random Creation

This general view of random creation is, however, by no means a product of recent thought. Lucretius, the Roman poet and a proponent of an atomic theory of matter, made the following remarkably modern-

Dr. Charles H. Townes, University Professor, University of California, Berkeley, received world-wide acclaim in 1964 when he was awarded the Nobel Prize in physics for his work on the maser. He was formerly provost and professor of physics at Massachusetts Institute of Technology, professor of physics at Columbia University, and visiting professor at the Universities of Paris and Tokyo. He is a past president of the American Physical Society. This paper is a portion of a presentation by Dr. Townes to the General Assembly of the United Presbyterian Church, as a part of a program entitled, "Science-Technology—the Creator's Apprentice," Rochester, New York, May 20, 1971.

sounding statement more than 2000 years ago:

> Our world has been made by nature through the spontaneous and casual collision and the random and purposeless congregation and coalescense of atoms where combinations could serve on each occasion as the starting point of substantial constructions—earth and sea and sky and the races of living creatures. You have the same natural force to congregate them in any place precisely as they have been congregated here. You are bound, therefore, to acknowledge that in other regions there are other earths and various races of men and breeds of beasts.

I believe it was Julian Huxley who first used the example of a hundred monkeys pecking randomly at a hundred typewriters in order to suggest the randomness and lack of mystery even in man's intelligence. He noted that the monkeys would in time, entirely by chance, type out all of Shakespeare's works and *The Encyclopedia Brittanica.*

These ideas are certainly cogent to our problem. However, to put this randomness in a little more perspective, we must note the results of quantitative calculation. While it is true that monkeys may randomly turn out *The Encyclopedia Britannica,* a simple calculation shows that one billion monkeys typing randomly as fast as they can 24 hours a day on one billion typewriters for the entire lifetime of the universe as we know it would probably not yet have typed out the correct sequence of letters in the title *The Encyclopedia Brittanica.* Thus, while randomness must have had an important and powerful effect, something other than the simple random juxtaposition of atoms must have been important in the formation of complex life. We seem to need something more systematic, some mold from which the complex patterns of creation could develop. The scientist would assume these patterns have been guided by aspects of the laws of physics and chemistry which we simply have not yet quite grasped; others may assume the hand of God. As our insight becomes more penetrating, how different will these two views really seem?

Insights from Astronomy

Much of the modest amount we know as scientists about our origins comes from astronomy, as guessed by Alexander Pope when he wrote, somewhat overhopefully, of the astronomer:

> He who through vast immensity can pierce
> See worlds on worlds compose one universe
> Observe how system into system runs
> What other planets circle other suns
> What varied being peoples every star
> May tell why Heav'n has made us as we are.

Within the last decade there has been a remarkable discovery of microwaves—that is, short radio-like waves —which uniformly pervade all space. We can presently understand their existence only if they represent radiation left over for us from an initial enormous explosion of the universe. This radiation, more than any other one piece of evidence, seems to lead inevitably to the conclusion that the universe did indeed have a unique moment when it was small, enormously hot, and expanding rapidly—the so called "big bang". Some scientists still doubt such a conclusion, and continue to look for an explanation in terms of an ever-existing, never changing universe. But so far they have been unsuccessful. The microwave radiation we now see must have been created during the first one hundredth of 1% of the lifetime of our universe—a lifetime which from this origin until now must be about fifteen billion years. Thus we have remarkable scientific proof that there was indeed a unique moment in the creation of the universe. In addition, our most powerful telescopes seem recently to have penetrated far enough into our universe to approach its boundaries, and catch a glimpse of how it looked when much younger.

Why all this lapse of time from the origin of the universe, about fifteen billion years ago, until the creation of man, whose existence on the earth surely isn't much older than a few million years? Are we a random afterthought? Hardly that, for we understand now that before complex life could be created, materials of the universe had to be properly cooked and processed. Stars were formed, and went through their cycle of billions of years of life until, with a majestic display, they exploded and spewed out the heavy chemical elements it was their destiny to produce from the materials available in the new-born universe. Elements which they emitted were gathered together into new stars, the so-called second generation stars of which our sun is one. Thus the sun and its satellite the earth can contain some of the needed heavy chemical elements such as iron for blood, calcium for bones, and iodine for metabolic chemistry, without which our life would be difficult to imagine. Just these preparatory processes would require, from the nature of

A strong basic science is a necessary condition for a strong economy, a livable environment, and a tolerable society. But it is by no means a sufficient condition. That a vital science is an indispensable tool of human welfare in the present stage of evolution of man on the planet does not mean that it is the only tool or that it cannot also produce the opposite. Indeed, there seems almost to be a complementarity between the power for good and the power for evil inherent in science. Nuclear energy poses the possibility of nuclear holocaust, but is indispensable to a continuing supply of energy after fossil fuels run out. The computer threatens us with "big brother," but seems indispensable to the rational management of our complex social structures. Molecular genetics could be used for frightful purposes, but opens up the prospect of the final conquest of human disease and food supply. Drugs which control human behavior have opened up frightful possibilities for abuse and self-destruction, but they also offer the hope of conquest of mental illness. What I have referred to are really technologies, not science, but science is needed to use them wisely, although it will not guarantee their wise use.

Harvey Brooks
"Can Science Survive in the Modern Age?" *Science* 174, 21-30, October 1, 1971.

physical laws they followed, almost half the life-span of the universe.

About four and a half billion years ago, shortly after the formation of our second, or possibly third-generation star which is the sun, materials of the earth solidified. One and a half billion years later, that is about three billion years ago, life began on it and we can trace from that time its steady and fairly orderly development.

Are We Alone?

Was this development, eventually producing man, peculiar and unique? Are we alone in the universe, or is our planet one among billions which support sensitive and intelligent life? The total number of stars in our galaxy, each of which might possibly support life around it, is about one hundred billion. But ours is only one of ten billion such galaxies within the universe. Hence, with one hundred billion times ten billions of different stars within the universe, it is natural to conclude that our existence is insignificant, and that life must have developed myriads of times, with some forms much superior to our own. However, as in the case of the monkeys typing randomly, something more may have been needed than just all those random chances.

We do not know just how planets are formed, nor hence the chance of a star having a planet such as ours. Recently geophysicists have discovered that there was an enormous stellar explosion in the immediate vicinity of our star the sun just before the planets were formed. Is some special circumstance like this required? The nature of a planet on which life can begin clearly is rather specific and circumscribed. How likely is it that conditions as favorable as those on earth occur in other planets? If there did happen to be a planet of the right qualities, would appropriate molecules inevitably come together to form the complex assemblages which life seems to require? What is the nature of the step from apes to man, producing a mind which conceives of astronomy, or of studying its own origins? We know a great deal and yet little of such matters.

A simple calculation shows that one billion monkeys typing randomly as fast as they can 24 hours a day on one billion typewriters for the entire lifetime of the universe as we know it would probably not yet have typed out the correct sequence of letters in the title *The Encyclopedia Brittanica.*

Biochemists have made convincing arguments about what kinds of molecules might initiate the life processes. Recently radio astronomers have learned that all of the simple molecules which biochemists believe are needed for a start in the process of building life—all of those needed for the reproduction of the simplest polypeptides or protein-like substances—can be found in dust clouds in interstellar space, even before these clouds gather into stars and planets. But now, given these materials, scientists are still groping to see how they might have built up the complex forms needed for reproductive life.

What definite hope can we have of knowing whether we are alone, or our civilization is repeated and surpassed billions of times among the stars? Even the possibilities of knowing are impossible to state, because the most important scientific discoveries are frequently unimagined until they surprise us. For the moment, our best hope of knowledge of other life is to leave the laboratory and go exploring. Some civilization, perhaps only a few hundred years more advanced than ours, might have already guessed at our existence and be trying to signal us. What would it mean to man's perspective if suddenly we received messages and wisdom from other worlds? We've listened very carefully, guessing what kind of signal might be used, and heard nothing.

Advances in Space Work

Advances in space work have considerably enlarged our explorations. It has been commonly thought that on some of our sister planets, such as Mars, Venus, or even the Moon in an early state when it might have had an atmosphere, other life could exist. While the Moon now has no atmosphere, it is marked by rills and valleys which are difficult to explain except as due to a running fluid, such as water, sometime in the past. Unfortunately, while our explorations there continue to intrigue us with information about the early history of the moon and the solar system, the Apollo flights have show that water and organic materials are rare enough on the lunar surface to dash most hopes of finding traces even of past life there. Recent measurements also show that the surface of Venus is overwhelmingly hot: 600° Fahrenheit and far above the boiling point of water. Such temperatures are quite inimicable to any form of life we can presently imagine. Could there be life possibly in the cooler upper atmosphere of its clouds? Just possibly. Jupiter, Saturn, and the other outer planets are generally too cold to be likely supporters of life, Mercury too close to the sun and too hot.

I believe that narrow rationality, pervading government, universities, industries, and other parts of our national and even international life, is provoking a wave of insufficient rationality. Youngsters tired of the tyranny of badly programmed computers, and of people who act like badly programmed computers, are turning to tarot cards and charlatans.

Are we destined to be squeezed to death between bureaucratic automata on the one hand and superstition or raving on the other? I hope not, and I think we can all work together to strengthen the cause of humane rationality, an approach to the world that utilizes reason and an understanding of Nature's laws and an enthusiasm for invention while at the same time celebrating the great importance of human, of natural, of spiritual values difficult to subject to rigorous analysis, an approach that tries to reconcile all of these in planning the future.

Murray Gell-Mann
"How Physicists Can Really Help," *Physics Today*, May 1971, p. 24.

Recent scientific discoveries show us clearly that, at least within our solar system of nine planets, our earth is truly a gem, and its life unique. Perhaps . . . we are indeed alone and unique in our universe.

Mars now seems our only remaining reasonable host of life. Telescopic views of Mars have for some time allowed us glimpses of polar caps on this planet which change with the seasons and are very suggestive of the life-supporting conditions with which we are familiar on earth. However, recent closer views of Mars from spacecraft show that these polar caps are of frozen carbon dioxide rather than friendly ice and water, its atmosphere is exceedingly thin, and its surface pockmarked with craters indicating conditions much more like those on the Moon than on the earth. Further exploration of Mars, or other bodies within our solar system, should give us more perspective on our planet earth, tell us much about its history, and the conditions on earth before life began. Hopefully, we may find on Mars small and primitive forms of life to give us further exciting insight, but we now know not to expect more.

Thus, recent scientific discoveries show us clearly that, at least within our solar system of nine planets, our earth is truly a gem, and its life unique. We know further that it will at least be a long time before man directly encounters any extraterrestial creature remotely like himself; perhaps, contrary to many generations of fiction and to the common expectations of many scientists in recent decades, we are indeed alone and unique in our universe.

How our developing scientific understanding either changes or reinforces religious views is a question each individual will answer for himself. Yet any substantial success in the common search by religious or scientific approaches for the origins and meaning of life must inevitably mold man's view of himself, and recent recognition of the special character of this planet and its life can only heighten man's awe. For the future, human thought and instincts, the innate creators of science, will surely lead us further in exploring our origins and towards understanding man's remarkable situation. If such understanding substantially increases our sensitivity to the wonders we see, and to the sacredness of life, it will serve us well.

Hierarchical Cosmologies: A New Trend?

ROBERT C. NEWMAN

Biblical School of Theology
Hatfield, Pennsylvania 19440

The major recent views on the nature of the physical universe are discussed as a background to consideration of a paper by G. de Vaucouleurs, "The Case for a Hierarchical Cosmology," Biblical data is considered and a tentative "best model" is suggested.

Growth in Knowledge

Cosmology is the study of the physical universe on the large scale. It is concerned, not primarily with individual objects such as stars and planets, but with groupings of stars, such as galaxies and clusters of galaxies, and with the universe as a whole. There have been great changes in this field in the twentieth century. Einstein's General Theory of Relativity introduced the idea that space might be curved. Our expanding knowledge of nuclear physics and of the so-called elementary particles has allowed us to understand the structure of stars, has shed some light on the origin of cosmic rays, and has even suggested the existence of neutron stars.

In the realm of observation, the large reflecting telescopes we have today have been built since 1920. The radio telescope is a product of the radar technology of World War II, and artificial satellites have only been available since 1957. Thus, whereas in 1900 only our own Milky Way Galaxy was known, now billions of galaxies are known to exist. Whereas then the greatest distances were measured in thousands of light-years (1 light-year=6 trillion miles), now we know of objects billions of light-years away. Then almost all information from outer space came to us in the form of visible light; now we use infrared and ultraviolet light, radio waves, X rays, cosmic rays and soon (perhaps) neutrinos and gravity waves.

Isotropic Cosmological Models

It should not be surprising that there has been a great variety of views on the basic structure of the universe during these years. From World War II to very recent times, however, two basic views have been competing: the Steady-State Cosmology of Hermann Bondi, Thomas Gold and Fred Hoyle, and the Evolutionary Cosmology (more popularly known as the "Big Bang" Theory) of George Gamow.[1]

Dr. Newman was formerly Professor of Physics at Shelton College, Cape May, N.J.

Both of these cosmological models include the concept of the expanding universe and both accept the Cosmological Principle. The expansion of the universe is the generally-accepted explanation for the fact that the light from distant galaxies is shifted toward lower frequencies. The simplest cause for such a shift would be motion away from us, just as the sound from an automobile horn or train whistle seems to have a lower pitch when the vehicle is receding. By this explanation, the more distant galaxies are departing at greater velocities, and the most distant known objects are moving away at almost 90% of the speed of light. The Cosmological Principle states that the universe looks the same (when a sufficient volume of space is viewed) from any location in the universe. For the sake of brevity, let us call those models *isotropic* which accept the Cosmological Principle (technically, they are homogeneous, having the same density throughout, and isotropic, having the same physical properties in every direction).

The basic difference between the two models concerns how the universe changes with time. The Steady-State Cosmology includes the so-called Perfect Cosmological Principle, which states that the universe looks the same at *any time*, as well as from any location. Since the galaxies are receding from one another, the distance between galaxies would tend to increase with time unless new galaxies are formed to fill up the spaces. Thus the Steady-State Cosmology postulates the existence of an unknown natural process by which matter is continually created throughout the universe. The universe is considered infinite in extent and age, though any observable (luminous) matter would have a finite age, and the average age of observed matter would be a few billion years. Since creation is viewed as a natural process, no Creator is deemed necessary, nor was there ever a time when the universe did not exist.

The "Big Bang" Cosmology, on the other hand, allows the universe to change with time by assuming that matter is not being created at present. As a result, the distance between galaxies is now increasing (because of expansion of the universe), and the galaxies were closer together in the past. In fact, if the speed of the galaxies has not changed, they all would have been together about 13 billion years ago.[2] The explosion of the universe from this highly compressed state is called the "Big Bang." In this model, the universe may be finite or infinite in extent.

Many Christians have identified the "Big Bang" with Biblical creation, thus taking Gamow's model to be a universe of finite age. Gamow himself, however, felt that the universe (previous to the "Big Bang") had been contracting from eternity past and that the "Big Bang" was really a "Big Bounce." Other proponents have envisioned the universe as periodically expanding and contracting.[3] Thus, even with the "Big Bang" Cosmology, the dominant view has been that of an eternal universe.

It should be apparent by now that cosmology involves metaphysical and theological questions. Hence Christians should not be surprised that non-Christians will present theories which conflict with Scripture.[4] Nor should we be surprised that Christians also will differ in regard to the models they construct in attempting to treat both Biblical and astronomical data.[5]

Developments in cosmology since about 1960 have been most interesting. If the Steady-State Theory in the form described above is correct, then the universe should look the same at all times in its history. Because light travels at the finite rate of 186,000 miles per second (six trillion miles per year), we are actually looking at light that left its source some time in the past when we observe a star. The more distant the star (or other astronomical object), the older is the light we observe. Light from some of the most distant quasars[6] apparently left its sources billions of years ago. Thus the observation that quasars are more thickly distributed at great distances (long ago) than nearby (recently) has been devastating to the Steady-State Cosmology (see Fig. 1).[7]

Cosmology involves metaphysical and theological questions.

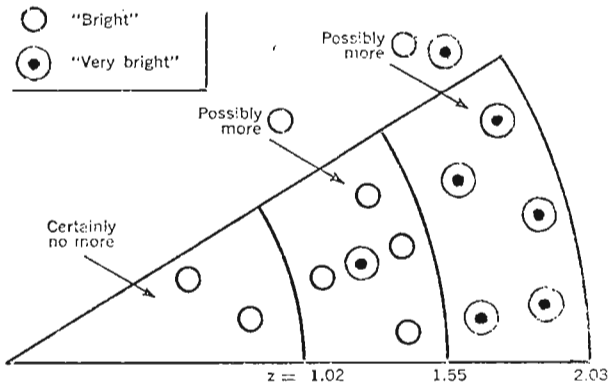

Figure 1: Quasars listed in the revised 3rd Cambridge catalog, plotted to show distance from earth in terms of z, the fractional increase in wavelength due to expansion of the universe. The three regions represent equal volumes of space progressively further away. From "Relativistic Cosmologies" by Wolfgang Rindler, *Physics Today*, Vol. 20 (November 1967). Used by permission.

In addition the "Big Bang" model has given more accurate predictions for the number of galaxies at various distances than has the Steady-State view, and it has been able to explain more easily the observed radio-frequency radiation coming uniformly from all directions.[8] Thus Schatzman in 1968 could say:

> It is probably fair to say that by now the steady-state theory, at least in its original form, has been abandoned by almost all authorities. It was an attractive and plausible idea, but it did not fit the facts, and, like many other attractive theories, it has had to be given up.[9]

In the "Big Bang" camp, it is interesting to note that the "Bounce" (necessary to avoid a specific origin) has been running into difficulty. Schatzman points out that successive oscillations of the universe still may not avoid the entropy problem (that the universe is converting its available energy into unavailable forms like heat and so "running down"),[10] in which case a beginning must still be postulated. More recently Dicke has commented on the difficulty of getting the universe through even a single "Bounce":

> It has long been known that the cosmological equations cannot be integrated through the collapse of

Any cosmological model which makes the universe infinitely old seems to deny the Biblical teaching.

> the universe to show the existence of a "bounce" leading to the start of a new expansion. A mathematical singularity develops in the solution. It had been thought that this singularity was due to the over-idealized nature of the physical assumptions of isotropy and uniformity. It was hoped that the singularity would disappear if sufficient irregularity were introduced into the mathematical model. This has not occurred and the mathematical singularity seems to be necessary under present theory.[11]

If no "Bounce" has occurred, then the universe has a finite age, and again we see the necessity for a beginning.

Hierarchical Cosmological Models

Early in 1970, an article by Gerard de Vaucouleurs appeared in *Science* entitled "The Case for a Hierarchical Cosmology."[12] This is an example of several articles which have appeared recently showing a new direction being taken by certain cosmologists. Briefly, a hierarchical model differs from the isotropic models discussed above in that the Cosmological Principle is denied. Rather than having a uniform density of matter throughout (on a large scale), a hierarchical universe would consist of a hierarchy of objects: galaxies, clusters of galaxies, clusters of clusters of galaxies (called super clusters), etc., without limit for an infinite universe, or up to the size of the universe for a finite one. Each higher-order cluster is bigger, consisting of a group of the next lower-order clusters, but it has a lower density of matter than its constituent clusters. Thus an infinite hierarchical universe has average density zero! The Cosmological Principle is denied because the universe looks different when viewed from inside a galaxy (for example) than it does when seen from outside a super cluster.

Such a cosmology was first suggested in 1908 by Carl V.L. Charlier[13] to explain how the night sky could be dark in an infinite universe with an infinite number of stars, a question raised by Wilhelm Olbers in the early 19th century,[14] now known as Olbers' Paradox. Charlier's cosmology was never widely accepted. Relativity theory and the expansion of the universe have been thought sufficient to avoid Olbers' Paradox in an infinite universe, and Einstein's General Theory of Relativity has revived the idea of a finite universe, which also avoids the problem.

Now G. de Vaucouleurs suggests that some form of a hierarchical cosmology should be considered once again. Though not necessary to avoid Olbers' Paradox, there are three lines of evidence which suggest that a hierarchical cosmology is preferable to isotropic models. First, de Vaucouleurs says that man's estimate of the age of the world has increased over the past few centuries (see Fig. 2). Second, observations show that galaxies form clusters, and these clusters form bigger clusters, etc. There is no evidence that a largest order of clustering is reached in the observable universe. Third, observations show a continuing decrease in density with increase in size for clusters up to the largest clustering known (see Fig. 3).[16] The second and third of these points are discussed by de Vaucouleurs in convincing detail.

Biblical Information Related to Cosmology

Before attempting to discuss de Vaucouleurs' article, let us see what the Bible says in regard to cosmology. Some Christians feel that the Bible teaches that the universe is quite young, on the order of ten thousand years old. Therefore modern cosmologists are thought to be fundamentally wrong.[17] Others feel the Bible does not answer scientific questions ("how?"), but rather questions of purpose ("why?"),[18] so apparently it would provide little in the way of cosmological guidelines. I take a third position, held by Buswell,[19] Hodge,[20] Montgomery[21] and Stoner,[22] among others, in which the Bible is understood to deal inerrantly with scientific questions, but which rejects that particular interpretation of Genesis 1-11 which claims the earth is young and the universe equally so. It is beyond the scope of this article to deal with these matters.

A thorough study of the relevant Biblical passages (e.g., Gen. 1:1, John 1:3, Heb. 11:3, Psalm 33, Psalm 104, Prov. 8) in the original languages is necessary to a proper treatment of Biblical cosmology, but this is not possible for me as yet. However, it seems clear that the Bible teaches that the universe had a beginning, that there was a time when only God existed, and that matter is not eternal. Thus any cosmological model which makes the universe infinitely old seems to deny the Biblical teaching.

Discussion of de Vaucouleurs' Article

The basic premise of de Vaucouleurs, that the physical structure of the universe is hierarchical rather than isotropic, may well be correct. However, he maintains that the density of astronomical objects decreases with distance from us. This seems to be denied by the distribution of quasars (Fig. 1), which apparently gives us information from the most distant parts of the universe.

G. de Vaucouleurs also mentions the new theory of Hoyle and Narlikar, an adaptation of the steady-state theory to a hierarchical cosmology.[23] While this

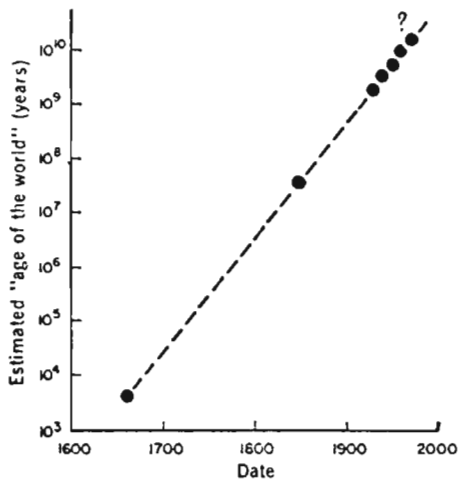

Figure 2: Vaucouleurs' Fig. 1, with caption: "Estimates of the 'age of the world' have grown exponentially during the past three centuries. What is the probability that a limit has finally been reached?" From "The Case for a Hierarchical Cosmology" by G. de Vaucouleurs, *Science*, Vol. 167, 1204 (27 February, 1970). Copyright 1970 by the American Association for the Advancement of Science. Used by permission.

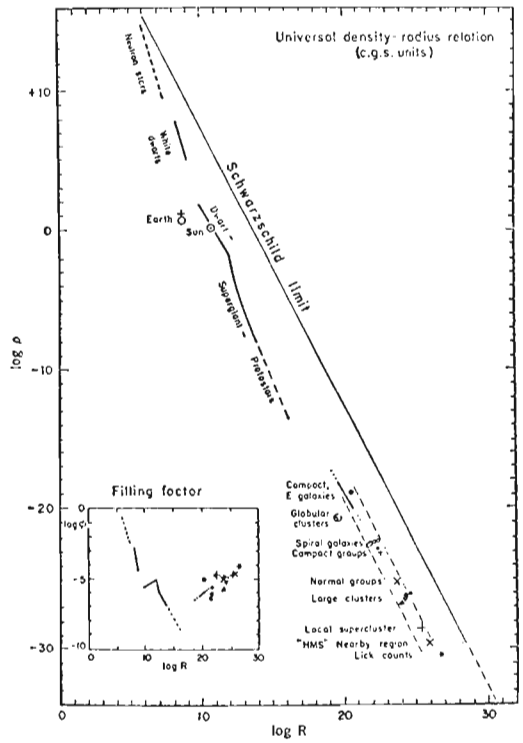

Figure 3: Various astronomical objects, showing the relation of density to radius R. The Schwarzschild limit gives the largest density for a stable, stationary object of radius R. The filling factor is the ratio of observed density to largest density for the same radius R. From "The Case for a Hierarchial Cosmology" by G. de Vaucouleurs, *Science,* Vol. 167, 1209 (27 February, 1970). Copyright 1970 by the American Association for the Advancement of Science. Used by permission.

view avoids some of the problems of the old steady-state theory, it still requires a naturalistic continuous-creation process for which there is no evidence and which violates known conservation laws. Hoyle himself has made it clear that this is assumed to avoid a universe of finite age:

> Speaking personally now I have a strong emotional dislike for special setups in cosmology. I can see that the oscillating cosmology might have been "initially" set up to give the observed asymmetry of time, but any suggestion of "initial" tinkering being necessary to explain the most everyday features of our existence seems intensely distasteful to me . . . The idea I use in cosmological investigations is that all important aspects of the universe are contained within the laws, they are not impressed from outside the laws. This is one of the shortcuts I use. I personally spend no time investigating theories that require special initial conditions.[24]

De Vaucouleurs' chart (Fig. 2) showing man's views on the age of the world seems misleading to me. If by "age of the world," the age of matter is meant, this is infinite in most ancient views, as Buswell points out.[25] John Stuart Mill and others in the 19th century held similar views.[26] If one means the length of time the world has been roughly in its present form, the Hindus thought this was 1,972,949,054 years.[27] As some present-day Christian scholars think the earth and universe quite young, the graph should show a scattering of points, not a straight line, with some points at infinity during every period.

Any view that the matter of the universe is infinitely old must deal with the fact that there is still hydrogen in the universe. But hydrogen, in the presence of gravity, tends to form stars which convert the hydrogen into helium by a nuclear reaction. Thus the hydrogen as such is not infinitely old. This consideration led to the continuous creation assumed in the steady-state theory, by which the world-process, not the matter, is supposed to be infinitely old.

The view that the world-process is infinitely old (that of the steady-state theory, whether isotropic or hierarchical) seems to contradict the Biblical data. But it would also encounter difficulties in cosmological theory and observation. Any matter created in an already-existing galaxy would be trapped there. The galaxy would get more and more massive while still having nuclear fuel to burn to make it visible. So we should be able to see unbelievably enormous galaxies. This view also violates the entropy principle and several conservation laws while assuming the existence of an unknown natural process of creation. The hierarchical "steady-state" view also assumes that the expansion of the universe is local, but we observe that expansion holds for the known universe. Finally, the radio-frequency radiation coming to us from all directions is most easily explained as a remnant of the "Big Bang."

I suggest that a hierarchical model in which the universe is finite in age (and probably in size), expanding from the Biblical creation event, best fits the observations of present-day astronomy. The fact that quasars are more densely grouped at great distances is explained by the fact that we are seeing light that left them early in the history of the universe, when everything was closer together. The existence of a hierarchy is explained by the fact that gravitation is more effective (for a given density of material) for large masses, so that gravitational contraction starts first with the largest quantities of material (forming large clouds of hydrogen gas in the early universe) and then breaks these up into smaller quantities (see Fig. 4), which finally, after many fragmentations, condense to stars.

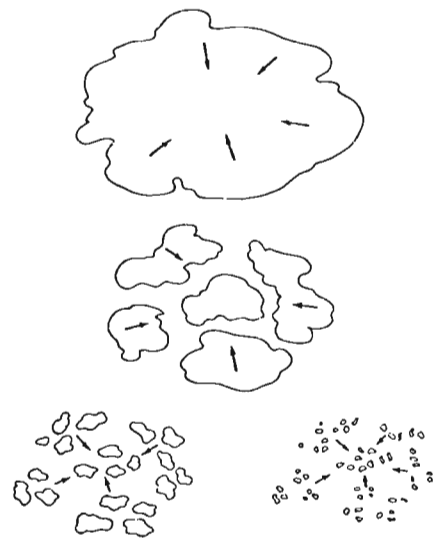

Figure 4: Collapse, fragmentation and subfragmentation of a gas cloud to form various stages of clustering in the early history of the universe. From *Meteorites and the Origin of Planets,* by John A. Wood. Copyright 1968 by McGraw-Hill, Inc. Used with permission of McGraw-Hill Book Co.

I suggest that a hierarchical model in which the universe is finite in age (and probably in size), expanding from the Biblical creation event, best fits the observations of present-day astronomy.

I wish to thank Prof. R.J. Dunsweiler of Biblical School of Theology, and Messrs J. A. Castro, H. J. Eckelmann, and P.G. Phillips of the Center for Radiophysics and Space Research, Cornell University, for reading this paper and contributing valuable suggestions. Thanks also to the indicated authors and periodicals for permission to use their figures.

REFERENCES

[1]e.g., see James A. Coleman, *Modern Theories of the Universe*, New York: Signet, 1963, for a more thorough discussion of these cosmological models.
[2]Robert H. Dicke, *Gravitation and the Universe*, Philadelphia: American Philosophical Society, 1970, p. 60.
[3]George Gamow, "The Evolutionary Universe," *The Universe*, New York: Scientific American, 1956, pp. 68-70.
[4]Some cosmologists have shown an open bias against supernatural creation. See Fred Hoyle, *Galaxies, Nuclei and Quasars*, New York: Harper and Row, 1965, and Stanley L. Jaki, *The Paradox of Olbers' Paradox*, New York: Herder and Herder, 1969.
[5]e.g., Compare John C. Whitcomb, Jr., *The Origin of the Solar System*, Philadelphia: Presbyterian and Reformed Publ. Co., 1964 and Peter W. Stoner, *Science Speaks*, Chicago: Moody Press, 1969, Ch. 1, in regard to the origin of the solar system.
[6]"Quasar" is the short name for a quasistellar object; these objects were discovered by Maarten Schmidt in the early 1960s. Though they look like stars when observed through the largest telescopes, quasars show an enormous shift of their emitted radiation toward long wavelengths. They are thought to be the most distant known astronomical objects.
[7]Wolfgang Rindler, "Relativistic Cosmology," *Physics Today*, vol. 20, no. 11 (Nov., 1967), pp. 23 ff.
[8]*Ibid.*
[9]E.L. Schatzman, *The Structure of the Universe*, New York: McGraw-Hill, 1968, p. 233.
[10]*Ibid.*, p. 245.
[11]Dicke, *op. cit.*, p. 66.
[12]G. de Vaucouleurs, "The Case for a Hierarchical Cosmology," *Science*, vol 167, no. 3922 (Feb. 27, 1970), pp. 1203 ff.
[13]Jaki, *op. cit.*, pp. 203-4.
[14]*Ibid.*, p. 136.
[15]de Vaucouleurs, *op. cit.*, p. 1210.
[16]*Ibid.*, p. 1212.
[17]Whitcomb, *op. cit.*, p. 29.
[18]e.g., Jerry D. Albert, p. 104, and Wilbur L. Bullock, p. 106, *Journal ASA*, vol. 21 No. 4 (Dec. 1969).
[19]J. Oliver Buswell, Jr., *A Systematic Theology of the Christian Religion*, Grand Rapids: Zondervan, 1962.
[20]Charles Hodge, *Systematic Theology*, Grand Rapids: Eerdmans (reprint), 1952.
[21]John Warwick Montgomery, *Journal ASA*, Vol. 21, No. 4 (Dec., 1969), p. 121.
[22]Stoner, *op. cit.*
[23]de Vaucouleurs, *op. cit.*, p. 1212.
[24]Hoyle, *op cit.*, p. 96.
[25]Buswell, *op. cit.*, p. 135.
[26]Augustus H. Strong, *Systematic Theology*, Valley Forge: Judson Press, 1907, p. 378.
[27]Coleman, *op. cit.*, p. 88.

Is Steady-State Cosmology Really Dead?

OWEN GINGERICH

Smithsonian Astrophysical Observatory and Harvard University
Cambridge, Massachusetts

Independence for Cosmologists

Astronomers from all over the world converged on Brighton, England, in August 1970 for the triennial Congress of the International Astronomical Union (IAU). There they shared the latest data on pulsars and quasars, named the formations on the far side of the moon, and resolved to call 1973 the "Copernican Year." Scarcely noticed among the multiplicity of lectures, symposia and overlapping commission meetings was a battle about whether to create still another commission, one on cosmology.

Traditionally, the cosmologists worked within the commission on galaxies. This happened because when the study of cosmology first became popular in the 1930's, the galaxies provided virtually the only information about the large-scale structure of the universe. The hoped-for answers to questions about the curvature of space, the extent or finiteness of the universe, and the time scale since creation, lay with the distant nebulae and the red shifts of their spectra.

But the last decade has brought an abrupt transformation in the observational base of cosmology. The field, which had been straight-jacketed by ever-ambiguous data, suddenly gained new vigor with the discovery of the quasars and the so-called 3-degree background radiation. For these reasons the cosmologists in the IAU grew restive within the unit on galaxies and sought a commission of their own. Several astronomers fought the new division simply because IAU members can participate officially in only three of the Union's many commissions and yet another group made it more difficult to keep their fingers in a variety of interests. Nevertheless, the ultimate formation of the cosmology commission accurately reflected the new diversification in the data on which cosmological systems rest.

New Data

Dennis Sciama, a one-time steady-state cosmologist, has described his own reaction to the new flow of data:

> I have often wondered what it must have been like to

> be a nuclear physicist in the early 1930's, particularly in 1932—that *annus mirabilis* which saw the discovery of the neutron and the positron and the first splitting of the nucleus by artificially accelerated particles. Now I think I know. As a cosmologist I have seen in the 1960's a similar stream of discoveries following one another at an almost indecent rate.[1]

The first of the unexpected new phenomena were the quasi-stellar radio objects or quasars. Discovered at Palomar in 1960, they posed such an enigma that no formal account appeared in print until 1963. The quasars emitted strong radio radiation, but unlike the majority of radio sources, they appeared star-like on photographic plates. Their spectra exhibited a puzzling pattern of emission lines. These spectral features were at last deciphered as enormously red-shifted lines normally found in the far ultraviolet spectra. In a sense this discovery only deepened the mystery. Interpreted as Doppler shifts, the displaced spectral lines indicated velocities approaching the speed of light; assuming they fit the same red-shift–distance relation of the galaxies, then their distances have to be immense. From this it followed that their luminosities must be incredibly large in order to be seen so well at such great distances.

Standing alone, the quasars seemed too contradictory and unsatisfactorily explained to give any direction in cosmology; yet astronomers quickly recognized that if they really were at immense distances (and hence represented the universe as it appeared in a far-gone epoch), the homogeneity in space and time required by one of the two main rival cosmologies, the steady-state theory, was lacking.

Big Bang vs. Steady State

Readers will recall that, in the absence of decisive data, the 1950's had brought acrimonious disputes between the partisans of the "big bang" theory (which pictured a universe expanding from a super dense state at some definite past epoch) and the "steady-state" theory (which postulated a universe uniform and infinite in time as well as space). Perhaps the best known of the steady-statists was Fred Hoyle of Cambridge University, whose widely-read paperbacks publicized his cosmological view that the universe had existed in the same form forever. Hoyle's openly avowed atheism did not endear him to religious-minded astronomers, who, nourished by the writings of Eddington and Milne, intuitively trusted the "big bang" cosmology with its long-past moment of creation.

During the 1960's the radio astronomer, Sir Martin Ryle, Fred Hoyle's archrival at Cambridge, had already claimed other evidence for an absence of the homogeneity in distant space requisite for the steady-state cosmology. Ryle based his view on a statistical analysis of the faint radio sources he was observing. The strong radio sources appeared comparatively more numerous at great distances and hence in earlier epochs galaxies radiated more actively in radio wavelengths. The ensuing controversy, of the sort that English dons seem to wage with more enthusiasm than American professors, led to bitter claims and fierce rebuttals in the English press and to wry remarks about "pouring Hoyle on Ryled waters."

Undoubtedly the increasing strength of Ryle's observations would have ultimately proved persuasive by themselves, but before they did, a second un-anticipated new phenomenon turned up. At the Bell Telephone Laboratories, and almost simultaneously at Princeton University, weak cosmic radio radiation, corresponding to a black-body temperature of 3°K, was found coming from all directions. The most elementary interpretation of this 3° background radiation explained it as the far red-shifted remnants of the primeval fireball from which the universe began its (roughly) 15 billion-year expansion.

Faced with these new data Fred Hoyle finally renounced his steady-state cosmology in a now-famous capitulation published in *Nature*.[2] As an alternative, he proposed that the universe might go through an unending series of oscillations, expansion followed by contraction like a perfectly elastic bouncing ball.

But more recently, Hoyle has remarked in a televised interview that the steady-state theory has never been more alive or vital.

Can the steady-state cosmology be revived? In order to gain more insight into this possibility I took advantage of a recent visit to England to ask several investigators for an opinion on the current state of cosmology. Unfortunately Hoyle himself was on sabbatical leave from his Institute of Theoretical Astrophysics (IOTA) in Cambridge, but I soon gathered from his colleagues that no very serious effort to save the steady-state theory was underway there. "Of course Fred has a basic commitment to the theory," I was told. "He has been working with fluctuations in a steady-state model, and he can always make it work if the fluctuation is the size of the observable universe! But so far there has been no acceptable alternative explanation to the 3° radiation."

The Background Radiation

Attempts to explain the background radiation in some other fashion have exploited the fact that it has been observed at comparatively few wavelengths. Thus the detailed shape of the microwave radiation curve is not yet known, and it can only be hypothesized that the radiation follows a smooth black-body relation. Given the proper chemical composition of interstellar grains, they could emit selectively at just the observed wavelengths, producing an apparent but spurious black-body curve. The trouble with this scheme is that whenever observations become available at another wavelength, the proposed composition of the grains must be revised to a still more esoteric form. Not only are the observations available at comparatively few wavelengths, but it is only conjecture that the curve turns downward at the proper longer wavelengths. In fact, some recent measurements made by a group at M.I.T. indicates that the curve does *not* turn back down as anticipated for 3°K black-body radiation, but these experiments are disputed by other investigators. Although most astronomers specializing in this area discredit the M.I.T. results, those measurements sustain lingering doubts that all may not be well with the present explanation of the background radiation.

This paper was originally written in the spring of 1971. In the year since it was prepared, the picture in cosmology remains much the same: conflictingly interpreted observations, but a lack of enthusiasm for renewing the steady-state theory.—*Author.*

Quasars

The interpretation of the quasars is even more controversial. Some astronomers maintain that the quasars are relatively nearby high-velocity ejecta from the nucleus of our own Milky Way galaxy. This view avoids the difficulty of the fantastic intrinsic luminosity that quasars must have if they are at great distances, but it fails to explain how an explosion in the center of our galaxy could yield so much kinetic energy. Most astronomers consider this a fatal objection to the "local" interpretation of quasars.

The fact that some quasars exhibit simultaneously several patterns of spectral absorption lines, with multiple red shifts, provides a serious challenge to the simple red-shift–distance interpretation. At the very least, some additional physical mechanism must be involved. Equally puzzling is the result of Geoffrey and Margaret Burbidge, still debated, that the quasars exhibit a marked propensity to have a set of absorption lines at a specific red shift of 195%, a phenomenon that would not be expected if the red-shifts indicate distance and if the quasars were somewhat randomly distributed in distance. G. Burbidge and Hoyle have also shown that when the red shift is plotted versus apparent magnitude, there is a great deal of scatter, in contrast to a similar diagram for faint galaxies. In their opinion, this scatter argues against any simple red-shift–distance relation[3].

In spite of the fact that the puzzling pieces of data about quasars don't all fit into place, most astronomers agree that they are at immense or "cosmological" distances simply because the resulting picture is comparatively tidy. As Palomar's Alan Sandage has pointed out, the quasars seem to fit at the end of a smooth sequence that goes from distant ordinary galaxies through galaxies with peculiarly bright and active nuclei (including the so-called Seyfert galaxies) and through a class of radio sources linked with faint galaxies. The fact that Hoyle and Burbidge have found a scatter diagram in the graph of red shifts versus magnitudes for quasars can merely mean that quasars, like stars, have different intrinsic luminosity classes, and the multiple absorption-line red shifts could result from the absorption by material between us and the more distant quasars.

As the astrophysicist Philip Morrison reminds us, it is the duty of scientists to make sense out of the universe and this must be done by searching for unity rather than disparity in the interpretation of phenomena. Certainly at present the most unified view of the cosmos places the quasars at immense distances from our own galaxy, and on a sequence with other galaxies and radio sources. But such an interpretation is automatically an evolutionary picture that rules out a steady-state cosmology, for it concentrates the quasars at a remote bygone epoch when the universe was far different than it is now.

Oort's Explanation

An ingenious and coherent explanation for the distant concentration of quasars and radio sources has recently been outlined by the Dutch astronomer Jan Oort.[4] His argument exploits the fact that within a Big-Bang cosmology, increasing distances reveal the universe at increasingly younger stages in its development. Oort notes that whereas the population density of radio sources was hundreds of times greater when the universe was only 20% of its present age, the numbers then drop off very rapidly for still greater distances and younger times. In fact, not a single radio source has been found at a distance greater than that corresponding to 13% of the present age of the universe. Only at an age of about 20% had the universe expanded sufficiently for the density to allow the formation of the rotating spiral galaxies, Oort believes, and hence in this period an immense concentration of galaxy births occurred. Associated with the birth trauma of the spirals, he hypothesizes, was an intense, explosive activity in the galactic nuclei that reveals itself as quasars and other radio sources.

It is the duty of scientists to make sense out of the universe and this must be done by searching for unity rather than disparity in the interpretation of phenomena.

Oort also remarks on the most interesting fact that the universe apparently has just enough energy to keep expanding forever, but not much excess. He goes on to say that if it had much less energy than this, it would have quickly collapsed again, thus not giving time for the evolution of intelligent life, whereas if it had had much more energy, the density would have dropped so rapidly that galaxy formation might not have occurred. The single argument of this kind is not by itself so impressive, but I recall another passage of the same genre in the last chapter of Hoyle's book *Nuclei, Galaxies and Quasars*. There he remarks that if the nuclear energy levels of oxygen were only slightly different with respect to carbon, the formation of oxygen would have been greatly enhanced at the expense of carbon, so that carbon would have been so rare that life could not have formed. Another considerably more famous phenomenon of the same sort concerns the uniqueness of water, carefully explained in Henderson's book on *The Fitness of the Environment*.

Personalities at Cambridge

Soon after I arrived in Cambridge, England, I encountered Martin Rees, one of the IOTA staff members. In a recent *Scientific American* article he and Joseph Silk had addressed themselves to the formation of galaxies[5]; although their main arguments were embedded within the framework of an evolutionary universe, they included a rather weak claim that the ideas might also work in a steady-state situation. I chided Rees for trying to have it both ways, and he conceded that the steady-state theory looked moribund. He added however, "I try not to have any beliefs on cosmological theories. I want to be open-minded and prepared to accept evidence for any of them."

Dennis Sciama, who had joined our discussion, countered Rees' position: "You can try to be neutral, but you have to make a commitment for what you are willing to do. I won't spend any more time working on the steady-state cosmology, and so for me personally steady-state is dead." Others with whom I spoke agreed that few cosmologists were spending time on the steady-state theory these days.

One of the most penetrating thinkers I met was

W. H. McCrea, Research Professor at Sussex University, who has not only accepted the big-bang cosmology, but has worked out a philosophy about why it is the sort of universe we view. His "A Philosophy for Big-Bang Cosmology" printed in 1970 in *Nature*[6] presents a stimulating analysis. McCrea points out that in spite of the simpifying assumptions underlying the cosmology of the expanding universe, it is, "self-consistent in so many unexpected ways that it can scarcely be illusory." As McCrea sees it, increasingly sophisticated theorems show that many of the observed properties of the universe (e.g., its particular chemical composition, its expansion, its isotropy) will arrive almost independently of the particular conditions of its origin; conversely, observations on these features will reveal comparatively little about the initial circumstances.

McCrea's philosophy is in part an answer to the unsparing anti-cosmological criticism unleashed by Gerard de Vaucouleurs in 1970 in *Science*.[7] The Texas astronomer argued convincingly for a hierarchy of inhomogeneities, which, in his opinion, vitiated the simplified relativistic models of the expanding universe that have now won wide acceptance. McCrea's response is that ultimately the simplifications don't matter; where somehow we can't get enough observations of homogeneous properties, this lack does not destroy our ability to describe the large-scale universe.

> Physical theory is not in general designed to make predictions about the universe in the large. If it does, they will be about the smoothed-out universe; for this and other reasons they will not be subject to precise tests. But the fact that the theory does apparently make generally valid predictions of this uncovenanted sort gives a new kind of confidence in physical theory.

McCrea's arguments give little encouragement to those who would seek an ever-closer parallel between Genesis 1 and contemporary cosmology. To be sure, the difficult problem of reconciling a steady-state universe that had existed forever with the concept of creation has apparently vanished with the demise of the steady-state cosmology. But the picture of a universe that is less and less "knowable" as we work back toward the initial singularity gives only the fuzziest view of creation.

That our physical laws are created constructions of the human mind . . . should serve as a warning to anyone who would "prove" or "disprove" Genesis 1 by modern astronomy.

Contrast this with "the first half hour of creation" popularized by George Gamow a decade or two ago. In Gamow's version the highly condensed primeval energy converted itself into matter within a calculable number of minutes, producing the present distribution of chemical elements in that initial nuclear cook-out. A fundamental contribution of Hoyle and his associates, stimulated by the requirements of the steady-state cosmology, is the recognition that the heavy elements (beyond hydrogen and helium) could be synthesized by nuclear reactions in stars. As McCrea reminds us, we know now that the chemical composition of the universe is only very roughly dependent on initial conditions, contrary to Gamow's hypothesis.

McCrea raises the issue of the evolution of physical laws themselves. Admittedly the notion of changing laws is not very useful, but, he continues (and I think rightly), "in this fashion we get away from the concept that physical laws are something that the universe must obey. They are something our thinking about the universe must obey." That our physical laws are created constructions of the human mind has been maintained for years by many philosophers of science; McCrea's perceptive remarks emphasize the situation with respect to the origins of the universe. They should serve as a warning to anyone who would "prove" or "disprove" Genesis 1 by modern astronomy.

More on Harold Hill and Joshua's Long Day

Twice before the *Journal ASA* has reported on the claims of Harold Hill that a computer has recently corroborated the missing day of Joshua and the reversed sun dial of Hezekiah (22, 120 (1970) and 23, 32 (1971)). There seemed to be universal agreement that no supportive evidence could be found. Now we hear from Joel Darby of the Book Fellowship of North Syracuse, New York, answering letters previously sent to Harold Hill requesting information about his sources. Mr. Darby indicates that he knows Mr. Hill to be a dedicated Christian man concerned about the saving of souls, and that therefore he is willing to take his word for the fact that a true event was described in Mr. Hill's earlier disclosure. He does indicate that "it is regrettable that Brother Hill has not yet found the mis-filed notes he had taken on this story when it was first being discussed in the scientific circles in which he travels." Mr. Darby explains that efforts to locate Mr. Hill through NASA failed, not because Mr. Hill and the Curtis Engine and Equipment Co. do not in fact work for NASA, but because they work through the Bendix Field Engineering Corporation, rather than directly. Mr. Darby also points out that Professor C. A. Totten of Yale University published a similar story about the scientific corroboration of the missing time in a book, *Joshua's Long Day* (1890), which is available on loan from Book Fellowship. The *Journal* would be happy to receive any other specific information on this question.

REFERENCES

Note: References 1, 3 and 5 have been reprinted in *Frontiers in Astronomy*, a *Scientific American* reader edited by Owen Gingerich (W. H. Freeman & Company, 1970).

[1]Dennis Sciama, "Cosmology before and after Quasars" (book review), *Scientific American*, September, 1967.

[2]Fred Hoyle, "Recent Developments in Cosmology," *Nature*, October 9, 1965, vol. 208, pp. 111-114.

[3]Geoffrey Burbidge and Fred Hoyle, "The Problem of Quasi-stellar Objects," *Scientific American*, December, 1966.

[4]J.H. Oort, "Galaxies and the Universe," *Science*, 25 December 1970, vol. 170, pp. 1363-1370.

[5]Martin Rees and Joseph Silk. "The Origin of Galaxies," *Scientific American*, June 1970.

[6]William H. McCrea, "A Philosophy for Big-Bang Cosmology," *Nature*, October 3, 1970, vol. 228, pp. 21-24.

[7]Gerard de Vaucouleurs, "The Case for a Hierarchical Cosmology," *Science*, 27 February 1970, vol. 167, pp. 1203-1213.

Brain, Mind and Computers

STANLEY L. JAKI

Department of Physics
Seton Hall University
South Orange, New Jersey 07079

A Search for a Proof

Originally, my book *Brain, Mind and Computers* was supposed to be a chapter with the title, "Physics and Psychology," in another book of mine, *The Relevance of Physics*. I must therefore say something about *The Relevance* to help you understand the real aim of the *Brain, Mind and Computers*. *The Relevance* grew out of an experience which I had in 1952 as a young professor of systematic theology. In that year the lectures had to be on the essence, existence and attributes of God. It was then that the idea seized me that I should work out a watertight and overpowering proof of the existence of God based on modern physics and astronomy.

In retrospect this was brashness itself, but perhaps natural for a scholar still in his twenties. I must say, however, that I went about the business rather methodically. Providence too helped. Through a surgical mishap I lost my voice and had to give up teaching. It did not take too long to decide what to do with all the time on my hands. Since I already had a B.S., I entered graduate school in the fall of 1954. My hopes were that by the time I had my Ph.D. in physics I would have the proof in my hands.

I received my Ph.D. four years later, but not the scientific proof of the existence of God. Luckily enough, I was still without my voice. This meant ample time for further studies. During my graduate-student years it became evident to me that the question of a scientific proof of the existence of God had a very important history to it. As a result, I spent the years 1958-60 reading history and philosophy of physics at Stanford and Berkeley. It was there and then that I received the answer to my problem. For reasons inherent in the method of physical science, no watertight proof of the existence of God can be built on its data and conclusions. But this also meant that no refutation of the existence of God could be built on physics either.

This was my first glance in depth on the limitations of exact science and of its method. I also soon began to realize that I learned something which had tremendous bearing on the whole context of modern scientific culture. It was not difficult to see that the major ills and woes of our modern society come from an undue emphasis on the scientific or quantitative method. In all this there was no basically new insight. Others said it long before me, but one aspect of the problem was still to be spelled out in detail. This special aspect consisted in giving a detailed documentation of the limitations of physics through the very words of its best practitioners. To present the limitations of physics convincingly, it had to be done by physicists themselves and by physicists of all ages.

This is what *The Relevance of Physics* is about. It is a multidimensional analysis of the history of physics through the reflection of physicists on their own aims, hopes, accomplishments and failures. By multidimensional analysis I mean that the book retraces the history of physics through eight different angles. Four of these relate to the frustrated hopes of reducing other areas of studies to a branch of physics. In *The Relevance* I tried to illustrate this failure with respect to biology, philosophy, ethics and theology. Originally I also planned in that section of the book one more chapter that has grown into a separate book with the title *Brain, Mind and Computers*. In it I did not aim at producing a resounding proof of brain-mind dualism. I merely tried to show that when it comes to the problem of brain-mind interaction the positions known as physicalism, reductionism and behaviorism, fall very short of their high-flying claims.

Defense of Dualism

In other words, if I have made any contribution to the question of the brain-mind relationship, and to the defense of dualism, it was a negative one. What I tried to do was to clean the air, to dissipate some heavy fog, to unmask a very systematic and very successful publicity campaign which tries to create the illusion that every notable investigator of the topic has turned his back on dualism.

Whether I succeeded is really unimportant. But we must recognize that in every major field of human endeavor, proofs and demonstrations have a restricted role. Much depends also on creating or dissipating a mental or cultural atmosphere. To take an example, nobody has ever proved that the universe was a clockwork mechanism, but for two centuries everybody came to believe it. How did this happen? Any student of cultural history knows it or should know it. It came about by a combination of wishful thinking and of a systematic publicity campaign. Those of wishful thinking wanted a disarmingly simple solution; those of the publicity campaign had an ax to grind. Voltaire and the encyclopedists made no secret about that.

Future history will tell how much planning has been behind the attack on the world of values and on dualism in particular by 20th-century physicalism and behaviorism. Preliminary conclusions can, however, be safely drawn by those who have some insight or first hand experience into the hiring policies of many departments of psychology, sociology and philosophy. The presence of wishful thinking should be all too evident for those who can read between the lines, or who have read, for instance, Skinner's *Walden Two*.

Paper presented at ASA Convention in August 1970.

Of course, as long as theological and philosophical values were the target of this campaign and wishful thinking, the academe, society and publicity-media kept applauding. There was no particular concern shown either when man's mind became equated with a feedback mechanism. Things, however, suddenly went sour when a new generation began to implement a basic tenet of their elementary, high-school and college education. The tenet is that ethical values are merely patterns that can and must keep changing. Consequently, all that is needed for the justification of a new morality or new social philosophy is that a sufficient number of individuals should act it out. The reasoning is that if you have a certain number of people behaving in a specific manner, you have a pattern which however distasteful or destructive, should be acceptable, because it is a pattern.

There is an inner logic in everything, or in a more colloquial form, one has to pay the piper one day. Nowadays, modern society is doing just that, but I wonder if its own havoc would bring it to its senses. At least, I do not see any sign that a serious reconsideration of false and destructive premises would already be under way. Twenty-five years ago history had witnessed the conclusion of a great crusade fought for human rights, for the inalienable rights of any individual whatever his color and social status. Today, expressions like inalienable rights of the individual, are frowned upon in the sophisticated academe as conceptual dinosaurs.

Modern secular and technological society still has to come to terms with an unavoidable reconsideration. It still must admit that there is no escaping from the labyrinth of pattern-philosophy except by recognizing that there is something eternal and spiritual in man which should be given unconditional respect. Herein lies the existential background of the ultimate explanation of the presence of consciousness and thoughts in man. As I said before, the fashionable and prevailing presumption is that mind and soul are only names and are of concern only for theologians and clergymen.

This was rather bluntly put two years ago by Mortimer Adler in his book, *The Difference of Man and the Difference it Makes*. There he stated that the defense of an immaterial principle in man, call it soul or mind, is today a matter of concern only for Roman Catholics and Orthodox Jews. His failure to mention Protestants should be rather revealing. At any rate I am most pleased to be among scientists who are uncompromising Christians as well, who refuse to sell out to pattern-philosophy and to a sophisticated godlessness prevailing even among Christians.

I also have to tell you that few things can shock me more than when I am told by fellow Roman Catholic theologians, mostly younger ones, that we should not be concerned with the defense of dualism. It is outmoded, they say, and we can very well do without it. Well, I asked one of these whether he would still exist after his body had been duly cremated and his ashes scattered into the nearby river? Then and only then did he realize the obvious, namely that Christian existence is inconceivable without the acceptance of dualism.

Vindication of Dualism

A reacceptance of dualism by secular society is the only road toward social health. Vindication of dualism means, of course, far more for us believing Christians. It means for us the securing of rational grounds without which faith cannot survive in any thinking man. Vindication of dualism also means for us a basically favorable climate in which one could speak more confidently about the Magna Carta of Christianity, the resurrection of Christ and our eventual resurrection on the last day.

For reasons inherent in the method of physical science, no watertight proof of the existence of God can be built on its data and conclusions. But this also means that no refutation of the existence of God can be built on physics either.

The problem has a very deep relevance for each of us personally. Moreover, a thorough acquaintance with the problem can help a great deal in strengthening Christians, especially the younger ones, and increasing their number. I said "great deal" and frankly I am somewhat uneasy about it. I should have rather said "great deal, yes and no".

A "great deal" is a quantitative expression. It refers to measurement and measurement is always a comparison, along a scale. A good grasp of the "Brain, Mind and Computer" problem should mean a great deal in a sense. But I doubt that good philosophy and good scientific philosophy alone can produce many convinced adepts for dualism. If dualism is still around and strong, it is largely because there are still Christians around, and Christians are generated not so much by lengthy arguments as by the immediate, instinctive grasp of the incomparable greatness of Christ.

That Beethoven's *Ninth Symphony* or Rembrandt's *Nightwatch* are incomparable masterpieces, such a proposition must be grasped largely instinctively. By instinctive I do not mean mystical or mysterious. What I have in mind was once very forcefully expressed by the Nobel-laureate physicist, and a great Christian, A. H. Compton. As he discussed in a lecture at Yale the claim that the laws of physics left no room for the freedom of will he raised his little finger, bent it and said: if the laws of physics ever should come to contradict my conviction that I can move my little finger at will then all the laws of physics should be revised and reformulated.

Of course, most people would say that they know that they can move their little finger at will, and that they are conscious of that. But very few are those who are able to see the immensity of such obvious experiences. Technical discussions about "Brain, Mind and Computers" can help a great deal to deflate modern biases against dualism. Such discussions can clear the atmosphere but would not necessarily prompt one to an enthusiastic appreciation of the clean air, much as he may suffer from its pollution.

Arguments for Dualism

So much about some background factors that determine the value and effectiveness of those air-clearing arguments. The rest of this paper should deal with the arguments themselves. The arguments are in a sense negative. They probe on four fronts the

physicalist claim that with the advent of electronic computers one has on hand a physical model on which the physicalist explanation of mind can safely be based. But a physicalist explanation of mind also presupposes that the human brain is really analogous to some specifically known mechanism, and preferably to the electronic computer. Again, a physicalist explanation of mind presupposes the successful analysis and classification of all psychological processes along a quantitative framework. Finally, it is the burden of the physicalist explanation to show that human reasoning corresponds to the combination of atomistic concepts, which in turn are faith images of sense perceptions.

Do Computers Think?

It is these four major claims that are placed under close scrutiny in the four chapters of the *Brain, Mind and Computers*. Of the contents of the first chapter, entitled, "Computers and Physics", I would here recall only one point. It is about the endlessly repeated claim of many present-day computer engineers and writers on computers that computers do really think. They indeed succeeded in building up a consensus, an atmosphere in which it has become an infallible sign of progressive thinking to attribute at least some rudimentary thinking ability to computers. To unmask the fallacy of this consensus the historical approach seemed to be rather appropriate.

Computers, it is generally believed, are the products of our own age. Actually, they have a very long history. They have been in the making for the past 300 years ever since Pascal constructed the first adding machine. The next genius to work on computers was Leibniz. Another mathematical genius, Charles Babbage, built in the 1820's the first modern digital computers, and the first analog computer was designed in the 1870's by Lord Kelvin and by his brother, Professor James Kelvin. The twentieth century merely witnessed the electrification and electronization of those machines in the hands of Vannevar Bush at MIT and Aiken at Harvard. If there was in our century a truly creative addition to computer theory it was the work of John von Neumann. It concerned mainly the generalization of memory storage and of combinatory procedures.

All of these men, so distant from one another in time, temperament and background had at least one thing in common. They all took pains to emphasize that computers do not think in any sense of the word. You can find the detailed documentation of this in the first chapter of my book. To bring together that documentation was a rather straightforward task. All I had to do was to dig up the material which was at most hinted at, but usually passed over in silence in all books on "thinking machines". Well, frankly, why that silence? The art of burning books, of annihilating records, or of removing them from easy circulation, or of keeping a methodic silence about them is more with us than ever. It certainly does not indicate scholarship or objectivity or unconditional love of truth. But how would you expect the recognition from physicalists, allegedly respectful only of facts, that all the great creative contributors to computers had a view diametrically opposite to the physicalist claim about computers.

Physicalists, I am sorry to say, are more concerned about creating an atmosphere favorable to them, than about the careful, balanced presentation of facts. A very good illustration of this is the way in which Babbage is handled in modern computer literature. Take, for instance, the best modern monograph on Babbage, *Charles Babbage and his Calculating Engines*, written by Philip and Emily Morrison. There, in a short footnote, you find mentioned that Babbage based a proof of the possibility of miracles on the theory of digital computers. Well, actually he wrote a whole book on this which was published as *The Ninth Bridgewater Treatise*, a famous series of apologetical works discussing problems of natural theology. Babbage was a most devout Episcopalian, of which no mention is made in the Morrisons' monograph. To crown the comedy, if not conspiracy, there is an excerpt from *The Ninth Bridgewater Treatise* in the work by the Morrisons, but the excerpt is an Appendix in the *Treatise*. It has little if anything to do with the train of thought which represented a most integral and important part in Babbage's intellectual convictions, namely his religious and dualistic belief.

When it comes to the problem of brain-mind interaction, the positions known as physicalism, reductionism and behaviorism, fall very short of their high-flying claims.

One may, of course, argue that Babbage was mistaken in basing a scientific proof of the possibility of miracles on computer theory. But this is purely a secondary matter. The important point is that no one

OTHER OPTIONS?

Models of the relationship between body and soul can be classed as belonging to one of four groups.

Strict Dualism. A strictly independent soul is viewed as living in a strictly independent body. The soul is the true person, and it manipulates the body during life. At death, the body passes away as the vehicle of the soul, and the soul continues its existence in a disembodied state.

Piano-Player Analogy. The whole human personality is compared to the music produced by the cooperative interaction of the piano (body) and the piano player (soul). The soul is independent of the body, but the functioning of the *person* requires interaction between body and soul. The person can be affected either by interacting with the piano alone (the body) or by interacting with the piano player alone (the soul). Although the soul remains upon death of the body, the person *per se* does not function wholly until the resurrection.

Emergent Systems Property. The soul is still presented as a reality, but a reality which is produced as an emergent property of the living system of a human being. As life is produced as an emergent property of a non-living system by the appropriate patterned in-

can gain an objective picture about Babbage's theory and philosophy of computers without a careful study of *The Ninth Bridgewater Treatise,* a very fine theological work. But giving an adequate account of that work would also reveal in one stroke that the most creative contributor to calculating machines was also a most literate advocate of brain-mind dualism. It is of these and similar facts that the physicalists do not like to remind their readers or their audiences.

Brain Research

Physicalists do not like to dwell either on the long series of rebuffs administered to them by brain research. Special emphasis should here be put on the expression "long series," as intellectual debates often bog down in the gossip of the moment. How often do we hear stated that such and such a discovery led us to the threshold of a major breakthrough and yet somehow that magic threshold is never crossed. A sobering monograph could, for instance, be written on the role of wishful thinking in the evaluation of recent biomolecular research into the secret of life. But even more sobering should be a detailed illustration of the fact that recent failures to produce life *in vitro* are merely the last phase of at least a century-long process. This is not to suggest that a dualist should be alarmed if self-reproducing units would be formed in test tubes. The step from the non-living to the living is enormous. But it should dwarf in comparison with the gap that separates the living from what is living and self-conscious. So far there is no physicalist explanation for the former, and of this physicalists should constantly be reminded. The burden of producing quantitative, experimental proofs is on him and not on the dualist. Physicalists like to appear ten-feet high. Actually they are stooped under the gigantic burden of producing two proofs, of which not even the far easier is in sight yet.

Christian existence is inconceivable without the acceptance of dualism.

The incomparably more difficult of the two is the still awaited physicalist account of memory and consciousness. Here again, the disparity could hardly be greater between the physicalist claims and the profound mysteriousness that envelopes the two areas. In the second chapter of my book, entitled "Computers and the Brain" I dwelt at length on the enormous complexity of human memory, and of its dogged resistance to any classification neat enough for the purposes of physicalists. But in addition, there remains the problem of identifying memory units, memory storing and memory retrieval processes in the brain. Headlines in the *New York Times* and in *Scientific American* notwithstanding, ignorance on these points is complete. The same holds true about consciousness. There is no indication whatever that a physiological explanation of thinking and consciousness is anywhere near.

Sir Charles Sherrington, the foremost student of brain in this century, took indeed the view that four hundred years of research would still be needed to have that physiological explanation. Well, four hundred years is an awful lot of time and prophecies of this type demand a great deal of faith. Sir Charles himself wrote and spoke during much of his career in a style that could give no real comfort to a dualist. Being a great scientist, he did not sweep under the rug the enormous difficulties which a physiological explanation of human thinking had to face. But he looked askance at the notion of an immortal, immaterial principle of human cogitation as a violation of causal reasoning. While recognizing that "mind, for anything perception can compass, goes in our spatial world more ghostly as a ghost," he also insisted in the same breath that

> With the insertion into the human individual of an immortal soul, . . . a trespass is committed. The very concomitance of the two concepts, which seems a basal condition of our knowledge of them, is thrown aside as if forgotten. Such amplification of the one concept may be legitimate for a revealed religion. Its evidence then rests on the ground we do not enter upon here. But as an assertion on the plane of natural knowledge it is an irrational blow at the solidarity of the individual; it seems aimed against that very harmony which unites the concepts as sister-concepts. It severs them and drives off one of them, lonely enough, on a flight into the rainbow's end.

This statement, made in 1940, was probably his most publicized utterance on the matter, but not his last one. Twelve years later, he asked to his home Sir John Eccles whom he considered his intellectual heir. I have the privilege to know some details of that conversation from Professor Eccles himself, a good friend of mine. Sherrington spoke a great deal about the mystery of brain-mind interaction and concluded: "For me now the only reality is the human soul." What follows are the words of Professor Eccles who is, as you know, a leader in brain research and a Nobel-laureate. "I did not break in to ask if this statement was an act of faith expressing a religious conviction, though I thought he so implied. Five days later he was dead."

teraction of the non-living subsystems, so soul is produced as an emergent property of non-soul subsystems when they interact according to the appropriate pattern. At death the identity of the person is retained in the mind of God, and he himself passes from death to new life in the resurrection.

Materialistic Exclusionism. In this model man is describable simply in terms of the physics and chemistry of the matter of which he is composed. There is no such a reality as soul, and all apparent experiential evidence to the contrary is only an illusion. When the body dies, the man dies totally and permanently.

In his paper, Dr. Jaki speaks as if only the first and last of these options were available. Since the model of materialistic exclusionism is strongly non-Christian, he is forced to the defense of strict dualism. It is quite possible, however, that the realities he seeks so devoutly to maintain may be advanced with even greater fidelity by investigating the possibility and the significance of the second or third options. It is my own opinion that the third option is by far the most helpful in tackling problems in which a coherent picture of the relationship between body and soul is mandatory.

Richard H. Bube
Department of Materials Science
Stanford University
Stanford, California 94305

Psychology

The soul to which Sherrington gave his vote refers today to a clearly metaphysical or theological reality. The original Greek name for soul, *psyche,* has of course no metaphysical connotation when used to describe a major preoccupation of our time, the study of psyche, or psychology. This change in semantics can easily be understood if one takes a quick look at the origin of modern psychology. Modern psychology was born in the wake of the first triumphs of Newtonian or mechanistic physics. Beginnings in intellectual history are difficult to define but Locke is as good a choice as any to represent the start of modern psychology. It was made in the hope that a physics of the soul could be written. Such was at least the perspective in which Voltaire and Hume saw Locke's chief merit. A hundred years later, during the early nineteenth century, textbooks of psychology often carried titles, "Intellectual Physics", "Mind Physics", and the like. That the 18th and 19th century-associationist phychologists looked at physics as their idol, should be well known. The start of psychophysics with Fechner was also motivated by the hope that the data of psychology lend themselves to a systematization exactly similar to the laws of physics.

Fechner, most of the early associationists, and Locke, were still dualists. For them the existence of a soul in a metaphysical sense was a tenet which they refused to doubt. The first major modern psychologist who combined physicalism in psychology with materialistic monism was Sigmund Freud. As he knew very little physics, he boldly drew up in 1895 the plan of a "Project for Scientific Psychology." By this he meant the total and rigorous reduction of psychology to physics. Within a year he gave up working on the plan but not the hope. His system based on the libido was still a physicalist account of psychology but without physics and its terminology. Freudian terminology was in fact so "unscientific" (opposite to quantitative and physical) that it served as a chief target of the behaviorists. Watson, for one, derided the "demonological terminology of the Freudians" while Freud described behaviorism as a theory "naive enough to boast that it has put the whole problem of psychology out of court."

In this patently bitter conflict you have in a nutshell the rest of the frustration of 20th-century physicalist psychology. On the one hand, there is the deep seated antagonism between psychoanalysts and behaviorists. The former claim that introspection and empathy are basic tools of research, but for behaviorists introspection is an anathema. In the camp of psychoanalysis the clashes are very sharp between the followers of Jung and Freud. Equally uncompromising is the opposition in the behaviorist camp between the Watson-Skinner school and the Gestaltists. And please remember, the bone of contention is always physics, or rather the measure of carrying physics into psychology. Jung parted with Freud because he saw in Freud's physicalism an abdication of human personality, of its strivings and its goal-directed attitude. The Gestaltists in turn accused Watson and his school of their failure to make use in psychology of the conceptual wealth developed by modern physics.

However that may be, one thing should be certain for any unbiased student of 20th-century psychology: it is not a science in the sense physics is a science. The data and the subject matter of psychology are as complex as ever, and have such strange features that their handling by the methods and concepts of physics is simply impossible. This is a lesson which a dualist cannot afford to forget. It is also a lesson of which a physicalist should be constantly reminded. For if man is truly a servo-mechanism and nothing else, then why is it that the great realm of man's psyche just cannot be pigeonholed into the narrow and simplistic categories of mathematical and physicalist psychology?

There is no indication whatever that a physiological explanation of thinking and consciousness is anywhere near.

Such questions do not cut much ice, I know, with most cultivators and interpreters of psychology. The reason for this is their tragic philosophical shallowness. Gone are the days when a giant of psychology, like William James, no friend of dualism, could still have a clear perception about the anguish of monists, and about their true predicament: "The monists," he wrote, . . ."writhe like worms on the hook to escape pluralistic or at least a dualistic language, but they cannot escape it." Gone are the days of plain logic and straightforward recognition of such basic truths that no one can make a silk purse out of a sow's ear. The most relevant truth about physicalist psychology is still the statement made by Priestley, one of the founders of associationist psychology: "I see clearly and acknowledge readily, that matter and motion however subtly divided, or reasoned upon, yield nothing more than matter and motion still." Much of the confusion in today's psychology comes from the fact that physicalists can be so forgetful of such an elementary truth.

Whether they are forgetful can only be known by inference. All one knows is that they do not talk or write about these things. And you know, physicalists are fond of pointing out that all that man can observe are material, physical signs. However that may be, physicalists talk and write profusely and by this very fact they unwittingly trap themselves. Language and its written symbolism are the very rebuttal of physicalism. True, we know about thoughts and concepts only through spoken or written words, but it is also well known that concepts are not strictly codified in words. There is always some overlap, some undefinable margin of uncertainty, the like of which does not and cannot occur with machine components. Wittgenstein learned that through his frustrating failure to find atomistic concepts, from which the rest of thought could be mechanically built up. His failure was rather inexpensive as compared with the failure of those who tried to do something similar with languages. What I have in mind is the highly subsidized program of machine translation. After two decades and after millions of dollars, it has now been largely shelved. Yet, machine translation is only the most elementary part of the so-called quantitative systematization of language.

Science of the Quantitative

This reference to "quantitative" should serve as an opportunity to clear up one possible misunderstanding. Perhaps I gave the impression that I conceded to the physicalist whatever was quantitative in human thought and experience. Far from it. I merely tried

to emphasize that physicalists have not even reached first base unless they have succeeded with the quantitative systematization of brain research, of psychology and of conceptual analysis. As far as the record shows they do not seem to have any chance in this respect. But suppose they do. Should then a dualist throw up his hands? Not at all. He has not yet used his most effective weapon, which really strikes the physicalist in his presumed stronghold, the realm of the quantitative, and especially the realm of quantitative proofs. These latter rest on our ability to count and to do arithmetic in a consistent way. As consistency presupposes laws, counting too makes sense only if it is done according to some laws of arithmetic. Depending on the extensiveness of the arithmetic one uses, its laws too form a more or less extensive set. This set also must have its proof of consistency or else 2 and 2 will not always and necessarily make 4 and the whole enterprise will collapse.

In 1931 Gödel proved that no sufficiently broad set of laws of arithmetic can have its proof of consistency within itself. To have the proof, one must reach after assumptions lying outside the set and to prove these assumptions the same step should be repeated again and again. This means that to prove the consistency of the science of the quantitative one must rely on considerations which the prevailing jargon calls metaquantitative or metamathematical. In older times when there was still more courage to call a spade a spade, one would have said not metamathematical but metaphysical. Well, I do not wish to argue about words. The explanation of man by machines completely breaks down if one admits at least the realm of metamathematical. Steps that are metamathematical or metaquantitative, cannot have by definition quantitative symbolization which as machine parts could be built into a computer.

Machines Cannot Even Add

My last remark, in this connection, should be a warning about an often heard interpretation of Gödel's theorem with reference to the mind-computer problem. The mind, so goes the typical saying, can therefore do something that the machine cannot do, namely to formulate Gödel's theorem and therefore the mind is still superior to machines. Implicit here is the admission that machines can do some or a great many things that the mind can do, such as addition, multiplication, extracting square roots, performing numerical integration and even proving some theorems of geometry. Herein lies the worst fallacy of the whole modern discussion about computers and minds. Machines do not add, they do not calculate, they do not integrate any more than a gutter does not *add* or integrate by collecting millions of raindrops. In an electronic computer not raindrops but electronic impulses are collected and channelled along strictly predetermined routes. In the process no addition is performed. It takes a mind, always a mind, to abstract meaning from each step through which the machine is directed by its specific man-built mechanism.

One thing should be certain for any unbiased student of 20th-century psychology: it is not a science in the sense physics is a science.

The ultimate proof of this has little or nothing to do with expertise in computer science. The ultimate proof rests on having a mind sensitive enough for the enormous magnitude of such basic human experiences as one's ability to move one's little finger at will. Among these basic experiences is the uncanny sense of having proved something. It need not be an esoteric theorem in integral equations. It may be as simple as Pythagoras' theorem which in my schoolboy days was called *pons asinorum*, or the bridge for donkeys or rather dunces. Well, it certainly saved some poor students as a last resort question, but it also doomed, legend has it, the Pythagorean, who discovered it. The Pythagoreans, as you know, were in a sense the first physicalists. They claimed that everything was composed of unit lengths. But the hypotenuse of a right-angled triangle with unit sides is neither two nor one, but the square-root of two, an irrational number.

Human Mind

It is the privilege and marvel of mind to find rhyme and reason even in what may appear irrational. It is the privilege of human mind to take for real what are so aptly called imaginary numbers. Only the human mind can imagine, that is perceive, meaning under the layer of disconnected sense data. Only the human mind can grasp facts and also respect them. In this attitude of respect, which is definitely not machine like, is comprised the whole dignity of man. Perception of truth is only part of the story: man also must respect facts and truths to survive and to make progress. No one put this more impressively than T. H. Huxley, Darwin's champion and a sharp antagonist of dualists: "Sit down before fact as a little child, follow humbly wherever and whatever abysses nature leads, or you shall learn nothing." Since this is my favorite quotation which I have been carrying in my breastpocket for years, I should tell you something about it. It is from a letter of Huxley to an Episcopalian minister, Kingsley, who in a long letter tried to comfort Huxley and to raise his eyes to things eternal following the death of Huxley's seven year old son. Huxley's reply was polite but defiant. He urged Kingsley to have full respect for the facts of nature, which in Huxley's view excluded soul, God and eternity.

Well, if facts are only the facts of nature then perhaps Huxley was right. But there are also the facts of human experience and the facts of history. Nothing shows better their paramount importance than the fact that the facts of human experience and history cannot be repeated. Unlike the facts of nature, they are unique. Without respect for these facts, there can be no true respect for facts of any kind, including the facts of nature.

I wonder if Huxley ever sat down before one fact in particular, the fact of the child from Bethlehem and with the open receptive eyes of a child, with the same unconditional respect which he advocated for the lifeless facts of nature. Clearly, somewhere, there was some bias, some oversight. This is all the more regrettable as Kingsley's letter to Huxley made it sufficiently clear, that dualism rests ultimately on respect for facts, for all facts without any restriction *and* on one's willingness to be led by them even if the journey is bound to eternity.

Literary Statistics and Pauline Authorship
II. Exposition and Critique

MAYNARD C. NIEBOER

1143 Eastwood Drive, Mt. Pleasant, Michigan 48858

Part I surveyed the development of literary statistics and demonstrated some of the basic concepts inherent in literary statistics. Part II concentrates on an exposition of A.Q. Morton (1960ff) and then seeks to give a critique of the rationale and approach of literary statistics to biblical studies in terms of both Harrison and Morton. Morton contends that no more than five of the 14 *epistles traditionally attributed to Paul can safely be regarded as Pauline. He tests their authenticity in terms of sentence length distribution, frequency of* kai (*and*) *and* de (*particle*) *as primary measurements. The frequency of* en, autos, *and* einai *are confirmatory tests. These tests are assumed to reflect an unconscious habit pattern of an author which is independent of time, circumstance or subject. The only limitation is that the piece must be prose.*

It is the conclusion of this paper that literary statistics can be legitimately used by evangelical scholars within the framework of their view of Scripture. More specifically, it can provide a refined tool to study facets of style and language in the Scripture. Neither Harrison nor Morton have conclusively shown that differences in style among the socalled Pauline Epistles are due to another author. However, their work has clearly pointed out specific differences in writing style and word usage which must be considered by anyone seeking to understand the literary dimension of the Pauline corpus. More basic work needs to be done to refine authenticity tests (parameters) and to specify minimum sample size for this type of work.

Introduction

In Part I (*Journal ASA* 23, 96 (1971)), I surveyed the development of literary statistics, and analyzed in some detail the application of "statistical" procedures to the Pastoral Epistles by Harrison. We turn now to an analysis of A.Q. Morton, who has published a great deal of work studying the Pauline Epistles.

The thesis of Morton's publications is that by statistical analysis it can be shown that no more than five of the 14 Epistles traditionally attributed to Paul can safely be regarded as Pauline (*Hauptbriefe* and most likely Philemon).[1] Morton feels that at first the Church had no reason to question the authenticity of the Pauline Epistles. But for the past 150 years, scholars have sought to obtain more accurate knowledge of Paul and of Christianity itself. They have done the best they can with the tools available, but there has been little or no agreement concerning which letters are Paul's, and which are spurious. The authors examine literary criticism as a tool for studying Pauline writings, and conclude that it is nonuniform and too inconclusive to be of real value: "Literary criticism, however, widely interpreted is a blunt and awkward instrument for this kind of job; too imprecise and subjective to be decisive".[2] They base this conclusion upon the contradictory findings and the widespread disagreement of the proper criteria for evalution.[3]

The authors also dismiss theological analysis as a valid way to determine the authenticity of the Pauline Corpus. The reason is essentially the same as that for literary, namely too much disagreement. The authors reach the following conclusion:

> The best that can be done through theological acumen is very far from yielding a firm basis for Pauline authorship . . . It is due to the fact that literary and theological criticism are incapable of reaching firm conclusions . . . It is safe to say that hope of going further by these means is dead . . . This of course does not prevent theologians from proceeding as if tentative assumptions were as proven fact.[4]

Morton's Procedure

The authors indicate several reasons why they cannot accept the traditional authorship attached to the Pauline Corpus. Since prior attempts at this problem have been so subjective and have resulted in rather indecisive conclusions, Morton feels that it is manda-

tory that a more objective, scientific analysis be made. He tells us that external evidence is no solid basis for this study, and therefore work must begin with internal evidence. When we speak of internal evidence we become involved in the question of style. The word "style" when referring to an author is a rather nebulous term raising all kinds of difficulties. Thus, the authors tell us that for this work, style will be used to mean a very specific thing, namely the choice of words by an author:

> For the purposes of this enquiry, composition is understood to be the selection of one word from a number of alternatives and placing that word in a phrase, a clause, or a statement. And style is used here to denote the personal element in that choice.[5]

Morton then lists the factors which influence an author's choice of words, namely subject matter, cultural background, and simply personal preference. They go on to make the assertion (or supposition) that quality and content of prose depend upon rare or less frequently used words, whereas essential organizational structure depends upon some very common words. The point here is that these common words or filler words become habitual with authors, and thus are a good subject for stylistic studies. Morton feels that the best way to express and assess an author's habitual use of these common words is to apply statistical analysis because we are working with variable quantities. Thus, Morton begins his development of a statistical test for author's style by setting forth the principles involved. The first one is the concept of probability; another important principle to grasp is that of the sample-population relationship. The point is that we can never be absolutely certain about authorship, we can only decide in terms of probability for and against certain authorship:

> This relationship of the population and sample fixes the pattern of argument for a test of authorship. The basis of the test is that, in respect of the habit under examination, all the works of the author form a single population and any of his works can be regarded as samples drawn from this population.[6]

The first step is to show that the work of a given author is statistically homogeneous, that it has a homogeneous variation among various parts of that work. Then, all the author's works are compared statistically to show that differences between the works are no greater than sampling differences, so that all the works of an author can be treated as a single population. The third step is to show that what is true of the first author is true of all the writers in a class, i.e., to show that you are dealing with general habits, and not simply the personal habits of an individual. The last step in this approach is to show that the tests are sensitive enough to be of practical value, i.e., exclude from the population of an author's work any of those which he didn't write. It is necessary here to employ a battery of tests to be sufficiently discriminating.

For students of the Pauline Corpus, the class of writer to be examined is that of writers of homogeneous, continuous Greek prose. Morton feels that Greek and prose are self explanatory, but that two of these words need explanation. "Continuous" is to ensure that samples are not made up from short prose insertions taken from between dialogue or verse, but blocks of prose taken as one piece. "Homogeneous" is used in the statistical sense to insure that data are of all one kind, i.e., all drawn from the same population. Morton describes the approach as follows:

The thesis of Morton's publications is that by statistical analysis it can be shown that no more than 5 of the 14 Epistles traditionally attributed to Paul can safely be regarded as Pauline.

> In summary, we are to look at a representative selection of writers of Greek prose. In each of them we will look at some habits which can be numerically expressed and statistically treated. The aim is to show that, in respect of these habits, all the works of the writer can be shown to be samples drawn from a single and stable population. The examination of half a dozen habits should exclude from the population of genuine works any which are spurious just as half a dozen physical characteristics will enable a jury to decide if the accused was present at the scene of the crime or if some other man was involved.[7]

Morton carefully examines sentence length as one reliable test of authorship. Morton gives his definition of a sentence for this work:

> . . . sentence is the group of words which end with a full stop (.), a colon (:), or an interrogation mark (?)[8]

Morton concludes that sentence length is a useful test for comparing authors' style and determining authenticity. But it does have some qualifications; no exceptions were found when it was applied within its limits of about a 50 year time interval and to homogeneous continuous prose. Furthermore, an argument based upon sentence length must be exclusive, that is you can never prove that two works were written by one author, only that two works cannot have been written by one author. There are six Greek words which make up nearly thirty-one percent of the whole New Testament text, and generally speaking these six are most frequently used by all Greek prose writers. Among these, five are considered adequate to be tested for sensitivity in determining style differences (see Table 12 in Morton's appendix). Thus, Morton seeks to test these five common words plus sentence length as means to express or compare style differences. These three methods of statistical tests are: standard error, Poisson distribution and word intervals. The Chi-square test is the way each of these is compared for deviation from the expected distribution. Morton then tests these words in a comprehensive sampling of classical Greek prose writers. Based on this examination of Greek prose writers, Morton makes the following summary:

1. Greek prose writers have habits which persist over long periods of time and wide ranges of subject matter. Comparisons within the same literary genre can be made with confidence and precision.
2. The habits of writers are affected by change of genre, and the comparison of works of widely differing genre should be made with care and reservations.
3. In all works of this kind, the text should be examined to see that the habit is representative of the work and not affected by some sections of the work which may be quite unlike the work as a whole.

He concludes that sentence length, occurrence of *kai* and *de* at the start of sentences are primary tests.

The frequency of *en, autos* and *einai* are confirmatory. Morton reports that new tests are under study, so this is not the final word. However, Morton does feel that the basic findings have been made and we need only to refine the tests and data.[9]

Morton tells us that he is not interested in making a precise classification of literary form of the Pauline writings, but merely to find out if the Pauline Corpus contains the difference in literary form found in Isocrates to create significant statistical differences. Perhaps the biggest problem with the Pauline writings is that many of the samples are so short that one could only hope to detect "gross stylistic differences". AQM then reports the findings for sentence length, and the frequency of the common words observed in Paul (*kai, de, en, autos,* and *einai*). Morton reaches the following conclusions concerning the analysis of the Pauline Corpus: The *Hauptbriefe* form a statistically homogeneous group. Between this group and the other Epistles (except Philemon) a large number of significant differences exist. These differences are larger than any differences known to exist in the writings of Greek prose regardless of literary form or any other factor. "It is impossible to explain these differences without assuming a difference of authorship".[10] Morton goes on to elucidate this conclusion as follows:

> Once it is accepted that the first four major Epistles are by a single author the question arises of deciding who he was. In all this book it is assumed, by definition that Paul is the man who wrote Galatians, and so Paul is the author of all of Galatians, and I Corinthians and of most of Romans and II Corinthians. He may well have written Philemon; there is no evidence which would deny him the authorship of this Epistle. As soon as you turn to the other Epistles, the argument descends to a lower level of certainty. The precision of the argument in the first four Epistles derives from our having the four Epistles to examine and having three of them large enough to divide into samples and test for homogeneity. It appears that the remainder of the Epistles come from several hands. Hebrews is unique, as are Ephesians, Philippians and Colossians. I and II Thessalonians make a pair, as do I and II Timothy. But in each case the decision is made on much less evidence than one would wish to have. It is all the evidence we have and so must logically be accepted, but it should be understood that the two statements, that Paul wrote the four major Epistles and the others come from six hands rests upon two different degrees of certainty corresponding to the evidence which is available.[11]

Critique of the Statistical Approach

The primary purpose of this critique will concern the statistical approach in general, rather than a detailed critique of either Morton or Harrison. I would like to structure this evaluation in terms of the following questions. Can statistics be applied to prose literature? Then, more specifically, is it legitimate to analyze the Word of God with a statistical approach? Third, what specific function and/or value does statistics have in analyzing Biblical writings?

1. *Can statistics be used in literary criticism?*

It should be quite clear that whenever numerical data can be accumulated, statistics can be applied to help interpret. As the historical survey showed earlier, considerable work has been done already in applying statistics to literary analysis. The analysis of Grayston and Herdan, quoted earlier, along with the Biblical data accumulated by Morgenthaler shows conclusively that vocabulary and word usage data can be tabulated and analyzed; Van Elderen has demonstrated that Greek participles also can be tabulated and analyzed; Morton is now in the process of tabulating grammatical differences. Furthermore, Morton's rationale and approach summarized in this paper clearly demonstrate the utility in analyzing variable quantities (words). As Morton further points out, words are not produced by a random generator, but come in context. However, all the work that has been done clearly demonstrates that words do occur in patterns which closely approximate a random distribution; and thus statistical techniques apply to prose in general, and Biblical prose in particular.

Linguistic studies, word usage and frequency help us to characterize the form of an author's style and define the literary dimension of Scripture.

2. *Is a statistical approach legitimate for the Bible?*

The question really reduces to this: What about using statistics to analyze Scripture within the context of our belief that it is the inspired word of God? To answer this question, we must begin with our own view as to how we received the Bible, and the nature of inspiration. "The Bible didn't fall from Heaven, but originated and grew in the Church of God". The books of the Bible were written by human authors in terms of their own personalities, styles and perspective upon the situation. The writing of Scripture was not by mechanical dictation by the Spirit, but the Spirit used each personality with his own talents, training and experiences to convey God's word in a given historical situation; the authors used sources, reflection, and selection of material but were superintended by the Spirit. Thus, the principles of Scripture normative for us are imbedded in the context of another time in history, and in a radically different culture. In order to discern their meaning we first must understand the meaning for that day (exegesis) before we can apply the meaning for our time (exposition). In this, we recognize that we are working with translated copies and so we apply textual criticism to arrive at the best textual source. Simultaneously with this, we need to understand Scriptural language and cultural context as well as study grammar, word meanings and total context in order to arrive at the proper understanding; this is an ongoing process to determine the most accurate interpretation. Therefore, we apply the historico-grammatical approach to interpretation of Scripture. The testimony of Scripture doesn't lay behind the writing, but within the matrix of words, grammar and syntax. Thus we must understand the mind of the writer as much as possible, as well as his vocabulary and style. Linguistic studies, word usage and frequency helps us to characterize the form of an author's style and define the literary dimension of Scripture. The following quotes from G.E. Ladd [12] convey the meaning very nicely:

> Literary criticism is the study of such questions as the authorship, date, place of writing, recipients, style, sources, integrity, and purpose of any piece of literature. If the Bible had fallen directly from heaven, or had been verbally dictated by the Holy Spirit, literary criticism of the Bible would be irrelevant. If, however, the Holy Spirit used men in given historical

> situations to be vehicles of the Word of God, then we must try to recover that historical situation by asking critical questions. This is especially true if the Word of God for the entire church was given through the medium of a particular church facing specific problems. We cannot adequately understand the abiding message of God's Word until we have interpreted its particular immediate message in terms of the historical situation. When we study the letters of Paul addressed to individual churches, we must try to interpret what Paul wrote in terms of all we can recover about the situation in the church to which the letter is written.[13]
>
> Thus the Bible is indeed the inspired Word of God, the Christian's only infallible rule for faith and practice. But the present study has attempted to demonstrate that the truth of infallibility does not extend to the preservation of an infallible text, nor to an infallible lexicography, nor to infallible answers to all questions about authorship, date, sources, etc., nor to an infallible reconstruction of the historical situation in which revelatory events occurred and the books of the Bible were written. Such questions God in His providence has committed to human scholarship to answer; and often the answers must be imperfect and tentative. A proper evangelical, biblical faith suffers a serious disservice when the spheres of Biblical authority and critical judgment are confused.
>
> Although the truth of the Bible is not dependent upon our ability to answer critical questions, it is quite clear that our understanding of the truth of the Bible is enlarged and rendered more precise by such study. A proper biblical criticism therefore does not mean criticizing the Word of God but trying to understand the Word of God and how it has been given to man.[14]

We turn now to the final series of questions.

3. *What specific function or role does statistics have in analyzing Biblical literature?*

I would like to answer first in terms of its potential value, and then discuss what the two studies (Harrison and Morton) have accomplished. We have just discussed the historical (culture and time, textual transmission, textual criticism, occasional nature) and human dimension (thought patterns and idiom, personal style) of Scripture. We have also indicated that there is a literary dimension (vocabulary, syntax, thought pattern); all are subject to critical and exegetical studies in order to learn Scriptural meaning for us. The use of probability and confidence limits applies to our hypotheses and theories concerning authorship, style, word usage, textual criticism, etc.

Statistics is not normative nor does it objectively decide authorship. . . . It is a tool which can be misused or applied to good advantage within the limits of its capabilities.

Again Ladd has described this very well:

> But evangelical laymen as well as ministers and teachers need to understand that God, in His providence, has given the Word of God to the church through historical events and processes which cannot always be recovered. It is the task of criticism to reconstruct the historical situation so far as it is possible. Since our knowledge at many points is scanty, we often cannot accurately speak of facts, but only of probabilities, possibilities, hypotheses. This is precisely what the rationalistic critic must do. Indeed, the history of criticism is the story of the ebb and flow of critical theories, out of which have emerged many positions so well established that they may be recognized as facts. The evangelical critic must also construct his theories and hypotheses; he must constantly differentiate between facts and theories; but he will establish hypotheses which are consistent with the total biblical data including its doctrine of revelation and inspiration.[15]

However, as Ladd concludes, all these critical studies must be from the following stance:

> Here is perhaps the greatest miracle of the Bible; that in the contingencies and relativities of history God has given to men His saving self-revelation in Jesus of Nazareth, recorded and interpreted in the New Testament; and that in the New Testament itself, which is the words of men written within specific historical situations, and therefore subject to the theories and hypotheses of historical and critical investigation, we have the saving, edifying, sure Word of God. In hearing and obeying the Word of God, the scholar must take the same stance as the layman: a humble response which falls to its knees with the prayer, Speak, Lord for thy servant heareth.[16]

The crucial point which needs to be made is that statistics is not normative nor does it objectively decide authorship. It only shows (formal) differences in terms of the chosen parameters. The differences detected are only as valid and descriptive as the parameters we choose. Secondly, and perhaps most important, it shows (formal) differences with a certain probability, but it gives no content to those differences. This is an interpretation which must be made by people. Their interpretations will be governed first by their presuppositions concerning Scripture and second, by the meaning of inspiration. That is, even if one accepts Scripture as the Word of God, he may have a slightly different meaning for inspiration and this will influence his interpretation of the differences. Factors such as how he views the use of an amanuensis, occasional nature, organic inspiration, mechanical dictation, etc., will affect his interpretation of those differences. As discussed previously in this section, linguistic studies of word and grammar usage (and frequency) can help us to gain insight into the meaning of organic inspiration. It shows the variety of formal style of an author, his diversity in vocabulary, in grammar, or it can *suggest* that perhaps two works are radically different in vocabulary and word frequency. This is only repeating that statistics is a tool which can be misused or applied to good advantage within the limits of its capabilities.

The following are a summary of the specific ways in which statistics can be helpful in studying style, and biblical linguistics in general:

a. The distribution functions (normal, Poisson, binomial) give us "handles" to describe vocabulary and grammar patterns in a comprehensive way. Chi-square allows us to compare distributions.
b. Greatest value of statistics here perhaps is in terms of data reduction. Literally hundreds of measurements (word counts etc.) can be reduced to two numbers, average and standard deviation (data range); thus facilitating comparisons, data presentation and allowing general trends to become apparent.
c. It gives a systematic and quantitative way to use smaller samples to measure the probability of differences among large populations i.e., how much of a book to measure, how many words to count, etc.

Even if significant stylistic differences are shown to be present, how do we know that style as defined is singly decisive for authenticity?

d. It puts a quantitative confidence limit upon measuring differences (from the human point of view, it lets us put a number upon the risk involved in determining differences). In short, it gives us a tool to help measure and deal with the inherent variation we find in all things, whether it be the number of times a person uses the word "and", and the heights and weights of people, or the tensile strength of metal.

Harrison concluded on the basis of his work that the Pastoral Epistles were written in the second century by a "Paulist", but they contained some authentic Pauline fragments. Morton concludes that he has objectively and decisively shown that Paul is the author of only Galatians, Romans, I and II Corinthians; the Pastorals along with the other letters (except perhaps Philemon) were written by several other authors.

Harrison's work was more in the popular mode of statistics, whereas Morton's approach is more the science of statistics. However, tabular data, counts and averages are the starting point for the science of statistics, so these approaches differ only in quantity rather than in quality. Hence they can be evaluated basically as the same approach. I should point out that the big difference between Harrison's approach and that of Morton is that the more advanced approach gives one a quantitative estimate of results. In other words, the probability or confidence limits, proper distribution parameters and reduction of the data to workable parameters cannot be adequately accomplished merely in terms of totals and averages. Therefore, whenever possible it is preferable and in many cases necessary to calculate distributions, standard deviations and make chi-square comparisons. In that sense, Harrison's work was incomplete and not quantitative.

One more general comment needs to be made concerning objectivity. Harrison implicitly indicated he was being objective in his work and Morton expressly asserted pure objectivity. A semblance of "objectivity" can be attained in distinguishing differences such as sentence length or number of *kais* (as compared with intuitive, qualitative judgments of one individual). However, even with the statistical results indicating a high probability of difference in certain characteristics, the significance or meaning of that dfference still must be interpreted by the tester, and here is where the presuppositions of Morton and Harrison have dictated the conclusions. We can state categorically that neither has a claim to pure objectivity.

More specifically, the crucial worth of statistics depends upon the correct parameters. The results of statistical analysis are only as good as the observations and especially the parameters used. Do sentence length, *kai,* Hapax, frequency of word usage, etc., adequately define a certain author's works? What characterizes an author comprehensively enough to function as a test to define his work? Is the concept of literary style sufficient and comprehensive enough (style is only a formal characteristic as it is usually defined)? The Pastorals have been questioned in essentially four areas, as indicated on the first page of this paper. Linguistic style, or word usage is only one of the four listed, and yet there seem to be other major differences. Both Harrison and Morton make authenticity judgments on linguistic style (word usage) alone, without regard to other criteria. The obvious question arises then, even if significant stylistic differences are shown to be present, how do we know that style as defined is singly decisive for authenticity? This can only be an assumption, or at best in the case of Morton, a first approximation. Morton at least tested his parameters extensively on Greek authors before applying them to Pauline literature. However, he then assumed they would apply to the Epistles (although AQM feels he has proved the universal validity of his parameters). Morton didn't take into consideration the differences between classical and Koine Greek, nor Paul's use of an amanuensis or the occasional nature of the Epistles; he felt these were insignificant aspects. Morton especially must show that his parameters apply equally as decisively to Koine Greek.

Both Harrison's and Morton's data indicate clear differences in the Pastorals compared with the other letters. All of us must deal with these differences. But we clearly must challenge conclusions which state that on the basis of statistical data alone there is no question that some other author wrote the Pastoral Epistles. Due consideration must be given to other possible explanations such as amanuensis, occasional nature, style differences within Paul, interaction between the amanuensis and Paul's dictation method, etc.

Summary and Conclusions

The following are a summary of the aspects of a statistical approach to literary analysis which should be particularly noticed:

1. Statistics is not objective; the results require interpretations, and thus are influenced by presuppositions. There can be no claims to pure objectivity or ultimate authority.
2. Does linguistic style alone decisively characterize authenticity? Statistical analysis is a purely formal test.
3. What parameters adequately define style?
4. There is a major problem concerning the minimum sample size which allows a valid test.

The following conclusions can be drawn from this analysis:

1. Statistics can legitimately be applied to prose analysis; however, more work needs to be done to refine (perhaps "develop" would be more appropriate) parameters.
2. The statistical approach decisively shows that there are differences in the Pastorals compared with the rest of the Pauline letters (in terms of the given parameters). It has highlighted certain stylistic and linguistic features in the Scripture.
3. The question is still open concerning specific content or the cause for these differences; it has not been conclusively shown by statistics that the differences are due to a different author.
4. Neither Harrison nor Morton have answered the above problem areas in literary statistics.
5. Literary statistics is a tool which can be used legitimately by evangelical scholars within the framework of their view of the Bible. Specifically, it gives

us a refined tool to study facets of style and language.

REFERENCES

[1]Brought up to date in *Paul, the Man and the Myth,* (New York: Harper and Row,1966). AQM books are co-authored, but the approach and concepts are basically Morton's ideas.
[2]*Ibid.*, p. 23.
[3]*Ibid.*, p. 25ff.
[4]*Ibid.*, p. 37.
[5]*Ibid.*, p. 43.
[6]*Ibid.*, p. 49.
[7]*Ibid.*, p. 51.
[8]*Ibid.*, p. 54.
[9]*Ibid.*, p. 88.
[10]*Ibid.*, p. 94.
[11]*Ibid.*, p. 94.
[12]Ladd, G.E. *The New Testament and Criticism.* Grand Rapids: Eerdmans, 1967.
[13]*Ibid.*, pp. 112-113.
[14]*Ibid.*, pp. 216-217.
[15]*Ibid.*, p. 16.
[16]*Ibid.*, p. 218.

H^3 Reminisces

THE AMERICAN SCIENTIFIC AFFILIATION: 30 YEARS

H. HAROLD HARTZLER

Mankato State College
Mankato, Minnesota 56001

Origin

A group of Christian men and women, each trained and active in some area of science, met for the first time in Chicago at the Moody Bible Institute during the week of September 2-5, 1941. At the invitation of Dr. Will H. Houghton, who was then President of the Moody Bible Institute, five men met for a week of discussion. The inspiration for this meeting came from the work of Irwin A. Moon who had been giving his Sermons from Science demonstrations throughout the country. Many young people came to Mr. Moon after one of his demonstrations, asking whether modern scientific knowledge rules out Christian faith.

Those who attended the Chicago meeting were Irving A. Cowperthwaite, Russell D. Sturgis, Peter W. Stoner, John P. Van Haitsman and F. Alton Everest. After several days of deliberation, it was decided that an organization was desirable so that many Christians might work together in order to help correlate the facts of science with the tenets of the Christian faith. Officers elected were F. Alton Everest, President and Irving A. Cowperthwaite, Secretary-Treasurer.

Soon after this meeting, war broke out between the U.S. and Japan. Because of severe travel restrictions, the first national meeting of the newly organized group was not held until 1946. In the meantime Dr. Everest was able to contact many potential new members of the American Scientific Affiliation through his war-time activities. Growth was slow but certain with the principal activity during the early years being the gathering of material for a symposium volume to be entitled *Modern Science and Christian Faith.* This book, the purpose of which was to help students struggling with problems relating science and Christian faith, was published in 1948; it consisted of ten chapters, each written by a different author in nine areas of science. The first annual convention of the Affiliation was held at Wheaton College, Wheaton, Illinois in August 1946. It was a great inspiration for me to be able to attend this meeting and to meet Christian men from various backgrounds, all of whom were interested in correlating various areas of science with their Christian faith. It was there that I first gained some insight into the real potential of the ASA.

It has been my privilege to have been able to attend every annual convention of the ASA.

Annual Meetings

Since 1946 annual meetings have taken place throughout the country from as far east as Boston to as far west as Los Angeles. These meetings are attended by members and others who are interested in the work of the Affiliation. They are usually held on the campuses of Christian colleges, although they have also been held on University campuses. One of the outstanding conventions of the early years was the one held at BIOLA (Bible Institute of Los Angeles) in August of 1949. Five full days were packed full of inspirational speeches and activities. One whole day was taken for a trip to Mount Palomar to see the 200-inch telescope. At this convention George McReady Price was present to defend his ideas of "Deluge Geology," and so was J. Lawrence Kulp of Columbia University, who presented a paper to show the many shortcomings in the theory of "Deluge Geology." Los Angeles seems to be filled with many kinds of "isms" and a number of spokesmen were heard at this meeting. In addition to thoroughly enjoying the meeting, I had the interesting experience of traveling from Los Angeles

Dr. H. Harold Hartzler has been Executive Secretary of the American Scientific Affiliation for the past 10 years. Paper presented at ASA Convention in August 1971.

to Chicago with Hendrik Oorthuys and Roger Voskuyl, both of whom have been active in the ASA.

Another outstanding convention was held at King's College, Briarcliff Manor, New York, in 1965. This meeting was jointly sponsored by Inter-Varsity Christian Fellowship and the American Scientific Affiliation. Prior to the meeting a number of members and friends attended the New York World's Fair. John Alexander, then the newly elected Director of IVCF took an active part in this meeting.

A review of the annual conventions of the ASA may be in order. The first meeting held at Wheaton College August 28-30, 1946 was under the chairmanship of Russell L. Mixter, who later served as President and then as Editor of the *Journal ASA*. The second meeting held at Taylor University August 27-29, 1947 was directed by Irving A. Cowperthwaite and ended with a discussion on the topic, "Looking into the Future with the American Scientific Affiliation" led by our president F. Alton Everest.

The third annual convention was held at Calvin College September 1-3, 1948. I will always remember the wonderful hospitality shown to all guests by Mr. and Mrs. Edwin Y. Monsma and by Mr. and Mrs. Martin Karsten. It is interesting to note that a discussion was held on the topic "What Shall be the Role of ASA in the Study of Evolution?" It was at this convention that copies of our symposium volume, *Modern Science and Christian Faith* first appeared.

The fourth annual convention held at the Bible Institute of Los Angeles August 22-26, 1949 was the first one where extensive field trips were held. These included trips to Mount Wilson Observatory, Rancho La Brea tar pits, Palomar Observatory and Moody Institute of Science. The fifth annual meeting was held at Goshen College August 29-Sept. 1, 1950. It is interesting to note that the ASA was already interested in a topic of curent interest. "Conservation, A Christian Responsibility" was discussed in a paper by Alta Schrock, then a Professor at Goshen College.

From a small city in Goshen, Indiana, the ASA moved to a large city for its next annual meeting. This was held at Shelton College in New York City, August 28-31, 1951. Among many interesting papers the author well recalls the one entitled, "The Philosophy of Science" by Gordon H. Clark of Butler University. The Wheaton College Science Station located near Rapid City, South Dakota was the site of the seventh annual convention. This was held August 26-29, 1952 and afforded many opportunities for field trips.

The eighth annual meeting was held at Grace Theological Seminary, September 1-3, 1953. William J. Tinkle served as General Chairman of the convention. Among controversial papers was one presented by Henry Morris entitled, "Biblical Evidence for a Recent Creation and Universal Deluge." One of the few conventions held south of the Mason and Dixon line was held at Eastern Mennonite College, Harrisonburg, Virginia, August 24-27, 1954. This ninth annual meeting was chaired by Maurice T. Brackbill, who served as a very gracious host. I recall with a great deal of pleasure the farewell devotions conducted by Walter R. Hearn.

As a new experience for the ASA the tenth annual convention was held at a ranch in Colorado. This took place August 23-26, 1955 at Young Life Camp, near Colorado Springs. It was at this meeting that definite plans were made to publish a book on evolution to appear in 1959, the centennial year of Darwin's book, *The Origin of Species*. This symposium volume, under the editorship of Russell L. Mixter, was published in 1959 with the title, *Evolution and Christian Thought Today*.

For the 1956 meeting the ASA returned to Wheaton College. This was held August 21-24 under the chairmanship of Paul M. Wright. At this meeting an interesting symposium was held on the subject of Extra-Sensory Perception. Gordon College and Divinity School was the site of the twelfth annual convention. This was the first meeting of the ASA in which several members of the group openly advocated theistic evolution as a live option.

After some discussion the ASA Executive Council decided to hold an annual meeting on the campus of a University. The thirteenth annual meeting was held at Iowa State College August 26-28, 1958. At this meeting an added attraction was the presentation by George E. Speake entitled "Sermons From Science". Interesting discussions followed each evening lecture. An innovation was a special program for wives arranged by Walter R. Hearn who served as General Chairman of the convention.

The fourteenth annual convention was held June 9-12, 1959 as a joint meeting with the Evangelical Theological Society. The ETS is an association of Evangelical Christian scholars who, have been meeting annually or oftener since 1949, for mutual stimulus and fellowship. This group of theologically trained persons encourages Biblical and theological scholarship. This joint meeting, held at Trinity Seminary and Bible College in Chicago, was the third joint meeting of the ASA and the ETS. Earlier meetings had been held at Grace Theological Seminary at Wheaton College. The theme of the 1959 meeting was, "Toward an Evangelical Philosophy of Science."

Seattle Pacific College acted as host for the fifteenth annual meeting held August 22-25, 1960. At this meeting plans were made for the establishing of Commissions. These Commissions were useful for a number of years in the development of programs for annual conventions, but after a period of ten years seemed to have outlived their purpose. The Executive Council, at their meeting on April 17, 1971, decided to eliminate all Commissions by August 31, 1971.

The sixteenth annual convention held August 22-25, 1961 at Houghton College was arranged by Henry D. Weaver, Vice-President of the ASA. The entire conference was on the theme, "The Christian's Responsibility Toward the Increasing Population." Again, it seems that the ASA was in the forefront of a current world problem. Bethel College in St. Paul, Minnesota was the host institution for the seventeenth annual convention held August 20-24, 1962. This was the first meeting under the supervision of one of the Commissions. The theme chosen by the Psychology Commission was, "Modern Psychology and the Christian." Paul C. Davis, Dean and Professor of Psychology at Los Angeles Pacific College, served as Program Chairman.

The eighteenth annual convention was held August 19-23, 1963 at Westmont College, Santa Barbara, California. "Expanding Horizons in a Shrinking World" was the convention theme. This annual program was arranged by the Social Science Commission under the chairmanship of Paul Peachey. The ASA was happy

to have Wil Rose, President of Data International Assistance Corps present to present an address on the subject, "The Role of the Individual in International Technical Assistance." Again the ASA went south for the nineteenth annual convention which was held at John Brown University in Arkansas. The dates were August 24-27, 1964. The theme of the convention was, "Panorama of the Past." Irvin A. Wills served as a most gracious host at this convention.

The twentieth annual meeting was held August 23-27, 1965 at The King's College, Briarcliff, New York. This meeting was sponsored jointly by the American Scientific Affiliation and by the Inter-Varsity Christian Fellowship. The theme of the meeting was, "Christian Commitment and the Scientific Attitude."

North Park College of Chicago was the host institution for the twenty-first annual convention. Again this meeting was under joint sponsorship by the ASA and the ETS. A highlight of this meeting was the Twenty-fifth Anniversary address by the first president of the ASA, F. Alton Everest, from the Moody Institute of Science.

For the second time in the history of the organization the ASA met on a secular campus August 28-31, 1967. Stanford University served as a very fine host with Richard Bube serving as local arrangements chairman. On this occasion the program was arranged jointly by the Psychology Commission and the Biological Science Commission. The theme chosen and carried out was, "A Christian Approach to Human Personality: A Psychological and Biological discussion."

It is my conviction that God does have a great work ahead for the ASA.

The ASA returned again to Calvin College (this time on a new campus) for its twenty-third annual convention. This was held August 20-23, 1968 and each of the Commissions, (Social Science, Psychology, Physical Sciences, Biological Sciences, and History and Philosophy of Science) had a part in arranging and carrying out the program. A special meeting was held on Monday, August 19 to discuss purposes of the ASA and possible cooperation with other groups. The ASA was very happy to have William G. Pollard, of the Oak Ridge Associated Universities, present to take part in a discussion and to present a public address with the title, "Man on a Space Ship."

The second meeting of the ASA at Gordon College took place August 18-21, 1969. This was the twenty-fourth annual meeting and the program was arranged by all Commissions. A workshop in Science and Religion in the High School Classroom was arranged for high school teachers by V. Elving Anderson of the University of Minnesota. A highlight of this meeting was the banquet address given by William E. Pannell of Detroit, who spoke on the subject, "Science, Scripture, and Race." Most of the papers presented at this meeting have appeared in an ASA publication edited by Gary Collins entitled, *Our Society in Turmoil.*

The ASA met again at Bethel College for its twenty-fifth annual convention. This was held on the new campus of Bethel College, August 17-20, 1970. Dewey K. Carpenter served as Program Chairman. Two major addresses were given by Charles Hatfield who spoke on "Man, Models, and Mathematics" and Richard H. Bube speaking on "Whatever Happened to Scientific Prestige?"

Personal Friendships

It has been my privilege to have been able to attend every annual convention of the ASA. Many very wonderful friendships have resulted. The fellowship with many fine Christians who are engaged in the scientific enterprise has been a source of real joy and comfort. Perhaps the mention of a few names would be in order. At that first convention at Wheaton College two persons stand out. Dr. Walter L. Wilson from Kansas City, a fine Christian physician and lay minister, presented a paper which has been remembered to this day. Paul DeKoning, from Michigan State University, was there and shared a room in the Wheaton dormitory with the author. What a wonderful man of prayer!

It was at the second annual convention that the author first met F. Alton Everest. Dr. Everest has been a tower of strength from the beginning of the ASA. After serving as president for a period of ten years, during which time he also edited the first symposium volume of the ASA, he became the first editor of the *ASA Newsletter.* This association continued for another period of ten years.

Another name must be mentioned. Irving A. Cowperthwaite served as the first secretary of the ASA and for many years had a perfect attendance record at national meetings. Besides being a fine Christian, he is a man of excellent judgment and has served the ASA well through the years. I am deeply indebted to both F. Alton Everest and Irving A. Cowperthwaite for the splendid historical papers which have appeared in the *Journal ASA.* Dr. Everest's article on the first decade of the ASA appeared in 1951, and Dr. Cowperthwaite's article on the twenty-year history appeared in 1961.

Local Sections

Very early in the history of the ASA it was felt by some members that local sections should be established. The first one started in the Los Angeles area. Later local groups were organized in Indiana, Delaware and Washington, D.C. At present there are twelve local sections which meet two or more times a year. The names of the local sections are as follows: Central Pennsylvania, Chicago, Indiana, New England, New York City Area, North Central, Oregon, San Francisco Bay, Southern California, Washington-Baltimore, Western Michigan and Western New York. Scattered as they are throughout the United States, most of the members can attend at least one of the local meetings. Many members consider the local meetings to be one of the most important activities of the ASA.

Publications

Publications of books, Monographs, and the *Journal ASA* have been the principal means of letting the public know of the work of the ASA. The first issue of the *Journal ASA* appeared in 1949 under the editorship of Marion Barnes. After two years this position was taken over by Delbert Eggenberger. More recently David Moberg and Russell Mixter have served as editors. At the present time Richard H. Bube, of Stanford University, is doing a superb job as editor of the *Journal ASA.* With the exception of the first year the *Journal ASA* has been published as a quarterly. Beginning in 1959

the *ASA Newsletter* has appeared five or six times a year. For eleven years F. Alton Everest served capably as editor. Since 1969 Walter R. Hearn, of Iowa State University, has been the editor of this important publication. The *ASA Newsletter* has served an important purpose in keeping members informed concerning the work of the organization and in many cases it has helped members to keep informed concerning the activities of other members. A publication for which the ASA has received very little recognition is a tract entitled *Ten Scientists Look at Life.* This was edited by Alfred Eckert and contains the personal testimonies of ten men of science, most of whom are ASA members.

The ASA has published three monographs: *Christian Theism and the Empirical Sciences* by Cornelius Jaarsma; *Creation and Evolution* by Russell L. Mixter; *The Eye as an Optical Instrument* by Frank Allen.

In order to publicize the ASA the Executive Council has authorized two brochures. The first entitled *The Story of the American Scientific Affiliation* briefly describes the organization and contains the Constitution. The following is taken from the introduction: "Nineteenth and twentieth century science has brought forth some remarkable evidence substantiating the reliability of the Holy Scriptures. This same science has also brought in a materialistic philosophy which is leaving a scar upon our civilization. An excellent method of combating the latter is to make known the former, and to this task this organization of Christian men of science brings its rigorous, specialized training, and humble faith." The second publicity brochure is entitled *American Scientific Affiliation* and briefly tells of the following: Publications, Organizations, Past, Present, Future, Objectives, Doctrinal Statement and Activities. It also states how one may become a member of the ASA.

On the front of each annual program from 1946-1968 the following statement appears: "A group of Christian scientific men, devoting themselves to the task of reviewing, preparing and distributing information on the authenticity, historicity, and scientific aspects of the Holy Scriptures in order that the faith of

Members of the Executive Council 1941-1972

Name	*Years on Council*	*Office Held*	*Field*
John P. Van Haitsma	1941-42		Biology
Irving A. Cowperthwaite	1941-43	Sec-Treas	Chemistry
Russell D. Sturgis	1941-44		Chemistry
Peter W. Stoner	1941-45	Vice President	Astronomy
F. Alton Everest	1941-50	President	Electrical Engineering
Marion D. Barnes	1942-46	Sec-Treas	Chemistry
Edwin Y. Monsma	1943-47	Vice President	Biology
Russell L. Mixter	1944-53	Sec-Treas, Pres	Biology
Allan A. MacRae	1945-49	Vice President	Archaeology
Roger J. Voskuyl	1947-51	Vice President	Chemistry
J. Lawrence Kulp	1948-52	Vice President	Geology
H. Harold Hartzler	1950-59	Sec-Treas, Pres, Ex-Sec	Mathematics
Brian P. Sutherland	1951-55	Vice President	Chemistry
Delbert N. Eggenberger	1952-56		Physics
Hendrik J. Oorthuys	1953-57	Sec-Treas	Electrical Engineering
John R. Howitt	1954-58		Psychiatry
Wilbur L. Bullock	1956-60	Vice President	Biology
Walter R. Hearn	1957-61	Sec-Treas, Vice Pres	Biochemistry
Henry D. Weaver, Jr.	1958-62	Vice Pres, Pres	Chemistry
J. Frank Cassell	1959-63	President	Biology
V. Elving Anderson	1960-64	Sec-Treas, Pres	Genetics
Robert D. Knudsen	1961-65	Sec-Treas	Philosophy
Robert B. Fischer	1962-66	President	Chemistry
Richard H. Bube	1964-68	Vice Pres, Pres	Physics
Wayne U. Ault	1965-69	Vice President	Geology
Virgil H. Freed	1966-69	Sec-Treas	Chemistry
Charles Hatfield, Jr.	1967-71	President	Mathematics
Donald C. Boardman	1968-72	Sec-Treas, Pres	Geology
John A. McIntyre	1969-73	Sec-Treas, Vice Pres	Physics
Marlin Kreider	1970-71	Sec-Treas	Physiology
Gary R. Collins	1970-74		Psychology
David L. Willis	1971-75	Sec-Treas	Biology
Claude E. Stipe	1972-76		Anthropology

many in Jesus Christ may be firmly established." Beginning with the 1969 annual program a statement on the front of the program appears as follows: "The American Scientific Affiliation is an association of men and women who have made a personal commitment of themselves and their lives to Jesus Christ as Lord and Savior, and who have made a personal commitment of themselves and their lives to a scientific understanding of the world."

Membership

The ASA has had a steady growth in membership through its thirty year history. In 1941 the membership was 5, by 1946 it had grown to 73, by 1951 to 220, by 1961 to 860 while today, the number is 1750. Non-members who subscribe to the *Journal ASA* have increased steadily through the years. Today the number of such non-member subscribers is 850.

Executive Secretary

In 1961 a major forward step was taken by the Executive Council with the appointment of a part-time Executive Secretary. The duties involve the supervising of all activities having to do with the national office. The Executive Secretary is also charged with promotional activities of the organization and with the general supervision of the annual program. The Executive Secretary attends all meetings of the Executive Council and helps the officers carry out their work.

As of this date, 1971, the Executive Council is planning to hire a full-time Executive Secretary so that the work of the ASA can continue to grow and be of greater service to the cause of Jesus Christ.

The Future

God has been faithful through the years. May each member of the ASA be faithful in carrying out the objectives: (1) To investigate the philosophy and finding of science as they are related to Christianity and the Holy Scriptures. (2) To disseminate the results of such studies to both Christian and secular worlds.

It is my conviction that God does have a great work ahead for the ASA. May we join together in this great enterprise of showing that God's Word and God's World show a marvelous harmony which deserves our continued study. May we never depart from the faith as expressed in our doctrinal statement. (1) The Holy Scriptures are the inspired Word of God, the only unerring guide of faith and conduct (2) Jesus Christ is the Son of God and through His atonement is the one and only Mediator between God and man.

Conference Report

THE RELEVANCE OF SCIENCE TO PRACTICAL THEOLOGY

For three days from September 10-12, 1971, *a group of* 13 *scientists* (4 *physicists,* 3 *materials scientists,* 4 *biologists and* 2 *chemists*), 10 *theologians* (8 *seminary professors and* 2 *campus ministers*), *and* 10 *others* (2 *university administrators,* 1 *church administrator,* 1 *co-director of Center for Science in the Public Interest,* 1 *businessman,* 1 *editor for C & E News,* 3 *graduate students and* 1 *consultant*) *met together at the Kirkridge Lodge in the Pocono Mountains to discuss the impact of science on Christian action in the world today. The occasion for the meeting was the presence in the United States of Dr. Carl Friedrich von Weizsacker, who made three addresses to the group on the Christian's interaction with society: "Philosophical Problems," "The Background for Decision," and "Practical Problems." Six other participants also gave addresses on related topics.*

Dr. von Weizsacker is presently Professor of Philosophy at the University of Hamburg. His early training and professional career, however, were in the field of nuclear and astrophysics. In addition, as a Christian, he has been a major figure in church and theological circles, having been Gifford Lecturer (1959-60) and initiator of the Gottingen Dialogues between theologians and physicists (F. Gogarten, R. Bultmann, W. Heisenberg). In addition to these significantly Christian activities, he has been involved in social and political affairs as the initiator and co-signer of the Gottingen Manifesto opposing government plans for nuclear rearmament of the West German Federal Army, initiator and co-founder of the Society of German Scientists, regular participant in the Pugwash Conferences, vice president of the Institute for Strategic Studies, and co-founder of the German Society for Peace and Conflict Research. Furthermore, he is the author of *The History of Nature, The Relevance of Science,* and *The World View of Modern Physics.* He is a member of the Max-Planck Gesellschaft, Deutsche Akademie der Wissenschaften, Deutsche Akademie fur Sprache und Dichtung, Deutsches P.E.N. Zentrum der Bundesrepublik, Gottingen Akademie der Wissenschaften, and Vereiningung Deutscher Wissenschaftler. Awards include the Max-Planck Medal, Goethe-Prize, Peace Class of Order Pour-le merite, Frankfurt Peace Prize, and Erasmus Prize.

Reported by John A. McIntyre, Texas A&M University, College Station, Texas, and Richard H. Bube, Stanford University, Stanford, California, who were participants.

Highlights of Preliminary Talks

Professor Gerhard Barsch, physicist from Penn State, pointed out the growing scientific studies that fall into the realm of Future Planning, with efforts being made to develop various scenarios of the future. All such planning must assume some kind of value system. How should this value system be chosen? One suggestion that has been made is that an international poll be held! Professor Barsch emphasized the importance of involvement of Christians in this kind of activity. Professor Barsch also offered the following model for Christians in the world today, which will appeal to solid-state scientists: Christians as "activating" imperfections in the world "crystal."

Dr. Kenneth Vaux, whose principal concern is the correlation of medicine and Christian ethics at Baylor College of Medicine, discussed two interface issues: the destiny of the universe and the nature of the human being. He proposed that Christians must say "No" to Bultmann on existentializing theology out of reality, and also "No" to Moltmann since theology should deal not only with what *could* be, but with what *should* be. Dr. Vaux argued that if cosmic forces are "entropic," then human resignation to the inevitable is the only response; on the other hand if cosmic forces are "purposive," then human responsibility is demanded. Unless *this* life, *this* history, *this* cosmos are at least a correlate of ultimate meaning (i.e., of God's fulfilling His purpose), then Dr. Vaux felt that nothing is justified except pessimisim. *Quote*: "The meaning of Divine Providence is human responsibility."

Professor Robert Francoeur, biologist from Fairleigh Dickinson, argued for recognition of man as co-creator, particularly in terms of the growing technology of reproduction, which is already raising basic questions about sexuality.

Dr. Ian Barbour, Professor of Physics and Chairman of the Department of Religion at Carleton College, considered attitudes with respect to nature and technology. He summarized replies to Lynn White's claim that environmental degradation has Judaeo-Christian roots as follows: (a) non-Christian cultures also harm their environment; (b) there are diverse strands in the Bible, and emphasis on stewardship and the intrinsic value of nature should not be forgotten; (c) the importance of later developments in the world, such as capitalism and industrialization cannot be overlooked; and (d) in America there are special effects due to a "frontier" mentality and practices carried over into "non-frontier" situations. Dr. Barbour also saw two revolutions currently being waged against modern technology: (1) the pre-affluence revolution by the poor and black, and (2) the post-affluence revolution by the youth and conservationists. Historically a tension has always existed between conservation and social justice for the following reasons: (a) the dispossessed benefit least from technology, (b) technology tends to reinforce the existing power structure, (c) the free enterprise system is insufficient to direct technology, (d) the social costs of technology must be paid by the users, (e) there are limits on economic growth possible, and (f) there is a growing concern for distributive justice.

Professor Rustum Roy, Professor of Solid State at Penn State, discussed his model of how a Christian can participate practically in the decision-making structures of a democratic society. The following speaker, A.J. Fritsch, S.J., co-director of the Center for Science in the Public Interest, disagreed with Professor Roy about working within the system and emphasized instead the need to work outside the system as a modern prophet. He felt that an environmentally balanced system is impossible within the profit motive. Further discussion emphasized the need for both kinds of approach, with openness rather than condemnation of one by the other.

Talks by von Weizsäcker

In his first talk on "The Philosophical Background," Professor von Weizsäcker discussed some basic features of scientific theories. He pointed out that science is usually successful by limiting itself to a given field. Physics does not ask, "What is matter?" Biology does not ask, "What is Life?" Psychology does not ask, "What is mind?" *But* major breakthroughs do occur when such field-transcending questions are asked.

Von Weizsäcker argued that the evolution of science is identical with the science of evolution. Not only does nature change (or evolve) with time, but man's theories of nature evolve with time. One can think of a scientific theory as occupying a certain niche (explaining certain phenomena of nature). The occupation of the niche may not be very successful (such as the caloric theory of heat); one or two facts in disagreement, however, are not sufficient to lead scientists to abandon the theory. Rather, a new and more successful theory must be introduced which drives the old theory out of its niche.

Dr. von Weizsäcker's thoughtful and carefully qualified remarks, coupled with his humility and Christian understanding, led to an unforgettable experience of how Christians should join together and share the burdens of their world.

Two fields of science involve irreversible phenomena: organic evolution and thermodynamics. If, as is done in statistical mechanics, the Second Law is defined as stating that systems change toward conditions of highest probability (entropy always increases), then the initial conditions at the beginning of evolution as a system of individual atoms do not represent a very probable state. Complexity is a better index of entropy than disorder. These atoms will combine into molecules and these molecules into more complicated ones and so on, through the stages of evolution. An interesting confirmation of this progression is that the evolutionary history in the rocks always points from the amoeba towards man and never from man toward the amoeba. Of course, this confirmation is valid only if one assumes that evolutionary history has always been subject to the Second Law of Thermodynamics. Von Weizsäcker emphasized that, whether his novel suggestion that entropy increases in the evolutionary process proves to be true or not, there is never any problem for evolution from the Second Law. This follows from the fact that outside energy sources always supply the necessary entropy to drive evolution even if the process itself produces a decrease in entropy (leads to less probable structures).

From these rather abstract remarks about the foundations of science, Professor von Weizsäcker proceeded in his second lecture on "The Background for De-

cision", to introduce the concept of *ambivalence* as a factor which enters into all courses of action in society. By ambivalence, he was referring to the fact that when a social action is taken to carry out a purpose, even though the action is successful, there will be associated results which are undesirable. Examples are the development of technology with its deleterious effect on the environment or the advances in health care with the resulting population explosion. Some people feel that such ambivalence can be escaped by changing the social system or by replacing the politicians. However, von Weizsäcker is convinced that ambivalence is unavoidable in the human situation. He noted that the liberal, capitalistic political system of the West with its desirable freedoms has led to social injustice. However, the replacement of the capitalistic system by socialism with its goal of social justice led to a restriction of freedom. Such ambivalence is not surprising to the Christian whose faith is based on the reality of the fall of man. Sometimes however, the church has forgotten this fact in its passion for a better world social order.

The second lecture closed with an analysis of the problem of war. For the next ten years one might count on an extension of the present stability of the nuclear weapons systems. However, with new systems being introduced about every seven years, the present balance cannot be expected to prevail indefinitely. Thus, unless something drastically new is done, a nuclear war would appear to be inevitable. The only suggestion that might be made is that of a world government with control over the nuclear armaments. However, the possibility of civil war would still remain. Also, the possibility of emigrating from an oppressive government would vanish. But humanly speaking, what else is there to try? World government appears to be a necessary but not a sufficient condition for the avoidance of war.

Von Weizsäcker's third talk took a more personal note. He spoke of his soul-searching after having participated in the atomic bomb project in Nazi Germany. He almost gave up science; the encouragement from a conversation with Karl Barth was instrumental in his continuing as a scientist. Barth told him, "Continue in science if you have Christian faith that Christ will return again; otherwise don't." For a Christian, the outlook for a radical change in history is justifiable.

While the individual Christian must decide how to act in this world, the Church must likewise make such decisions. Von Weizsäcker again spoke to this point from his own experience. After the war, he found his scientific colleagues abroad often took a moralistic, judgmental attitude toward him as a German nuclear scientist. On the other hand, the Christian church came into Germany after the war to help those in need. The attitude of the Christians was: "We are all sinners together". Because of this experience, von Weizsäcker turned in a serious way to the Christian Church of his childhood.

Another feature of the church in postwar Germany also attracted him. The church was the only organization that was courageous enough and altruistic enough to take a stand on some politically unpopular issues such as refugees.

I believe that any Christian who is qualified to write a good popular book on any science may do much more by that than by any directly apologetic work. The difficulty we are up against is this. We can make people (often) attend to the Christian point of view for half an hour or so; but the moment they have gone away from our lecture or laid down our article, they are plunged back into a world where the opposite position is taken for granted. As long as that situation exists, widespread success is simply impossible. We must attack the enemy's line of communication. What we want is not more little books about Christianity, but more little books by Christians on other subjects—with their Christianity *latent*. You can see this most easily if you look at it the other way round. Our Faith is not very likely to be shaken by any book on Hinduism. But if whenever we read an elementary book on Geology, Botany, Politics, or Astronomy, we found that its implications were Hindu, that would shake us. It is not the books written in direct defense of Materialism that make the modern man a materialist; it is the materialistic assumptions in all the other books. In the same way, it is not books on Christianity that will really trouble him. But he would be troubled if, whenever he wanted a cheap popular introduction to some science, the best work on the market was always by a Christian. . . . Its Christianity would have to be latent, not explicit: and *of course* its science perfectly honest. Science *twisted* in the interests of apologetics would be sin and folly.

C. S. Lewis
"God in the Dock: Essays on Theology and Ethics"
Walter Hooper, Ed., Eerdmans (1970)

Thus von Weizsäcker emphasized that, when taking action in the world, the proper attitude of the church is at least as important as what it says and does. It should speak the truth as it sees it (and be sure that it does its homework), but also it should speak with humility.

In summary, the colloquy with Professor von Weizsäcker was most fruitful and impressive. Here was a distinguished scholar in several fields willing to devote his keen mind to the intractable practical problems that do not fit neatly into a scholarly discipline. His thoughtful and carefully qualified remarks coupled with his humility and Christian understanding led to an unforgettable experience of how Christians should join together and share the burdens of their world.

BOOK REVIEWS

OUR SOCIETY IN TURMOIL by Gary R. Collins, Ed. Carol Stream, Illinois: Creation House, 1970.

Evangelicals have been characterized as religiously-minded people who are "rushing pell-mell into the twentieth-century." *Society in Turmoil* may accelerate the pace, perhaps even to reach the seventies during that decade.

Most of the book's chapters use a format of facts, conjecture and Christian application. However, before specific issues are discussed, an initial tone-setting chapter by John Montgomery demonstrates a Scriptural basis for social involvement by the believer. In addition, Montgomery very lucidly challenges Christians to be as aware and outspoken in such areas as open housing and ecological responsibility as in the area of sexual freedom, the traditional fundamentalist's major moral concern.

Fourteen social issues follow Montgomery's chapter, most of them relevant in contemporary thinking.

A chapter on racism by William Pannell is an incisive plea for the church to stop being racist: "The sin of Evangelicism is not that we are un-American. It is rather that we are more American than Christian."

In a discussion of crime and civil disobedience, Russell Heddendorf takes the sociological position that civil disobedience indexes a basic questioning of the "presuppositions which are fundamental to society." The distinction made between crime and civil disobedience is one of many extremely provocative notions set forth in this well-written and scholarly essay.

A chapter on birth control by Merville Vincent furnishes a good exposition of the problem: he presents the issue and the most viable alternatives before giving his bias.

Other lively and well-reasoned chapters focus on issues of war, space exploration and man's future with computers.

Some chapters, however, are not so strong.

The author of the chapter on drug use in America has seemingly not spent much time among those who make up the subculture he discusses. In addition, the writing often falls into sentimentality (Christianity is a "state with an unending euphoria untouched by illegality or a black market"), and implicitly the reader is led falsely to believe that drug research shows dangerous effects only with continued drug use. Most disturbing, though, is the lack of any suggestion for ameliorating this social problem other than bringing the drug user to salvation.

Another chapter with major weaknesses is the one which addresses itself to behavioral control through biological and psychological manipulation. No attention is given to recent research on biochemical memory transference between organisms, nor is the current research on behavior modification and behavior therapy techniques reported. Even on the basic issue of free will the author's argument is distressingly weak.

Explicit goals are stated in the preface of this book: the chapters will hopefully "stimulate discussion, reaction, action and a renewed dedication to Jesus Christ." It cannot be denied that this collection of essays achieves its first two goals. It is very lamentable, however, that the third is less well met. Most of the chapters are really empty of specific ideas on how to meet the social issue in question. Since many of the social issues discussed are acute problems, abstract ideas and principles must be supplemented by suggestions for specific action, something to stimulate activity and perhaps to develop momentum.

Despite some shortcomings, *Society in Turmoil* deserves reading by the great majority (silent) of Christians because of its unique willingness to grapple with contemporary issues. The final goal of the book is stated as challenging renewed dedication to our Lord. Potentially, the essays can serve as a basis for evangelical churches to "stir up that gift which is within them," so as to be aware of and involved in meeting our current social dilemmas in a Christ-like *and* informed manner.

Reviewed by Wayne V. Adams, Department of Psychology, Colgate University, Hamilton N.Y. 13346

GOD IN AN AGE OF ATHEISM by Paul S. Shilling, Abingdon Press, Nashville, Tenn. 239 pp. $5.50.

Dr. Shilling's thesis is shared by any thoughtful Christian. We are living in an age of doubt; we must examine anew the meaning of the reality of God. His sub-thesis, that the serious atheist is more likely to contribute more to intelligent understanding of both God and man than the pious believer, is subject to debate.

Dr. Shilling's analysis of contemporary doubt forms the great value of this work. He sees the sources of modern unbelief in the nineteenth century attack upon religion by Feuerbach, the Marxists and Nietzsche.

He then proceeds to examine the six major types of atheism present in our time with an objectivity that marks the serious scholar. Freudian psychoanalysis identifies God with the father image; religion is an illusion. Ernst Bloch, the Marxist, has no place for a static God in his not-yet program of evolutionary futurism. Existentialism rejects God in favor of self-authenticating humanism. Scientific humanism sees the issue as dogma vs. science and opts for man's technological progress. Linguistic philosophy analyses language to find the God-concept meaningless rather than absurd. Finally, Christian atheism or the "God is Dead" theology represents Christian disillusionment in a secular society. These various attacks upon the doctrine of of God must be faced by the believer.

Of less value for evangelicals is the supposedly constructive part of this work which explores afresh the

meaning of God. Dr. Schilling attempts this by an eclectic appraisal of the positive points of the atheist critique rather than by the approach of scientific theology, i.e., letting the object, God, speak for Himself. Nowhere does he build theology upon the divine self-revelation. Rather theology must be relevant, this-worldly, cosmic, transcendent, eschatological, temporal, cooperative and participatory. The new eclectic deity is Being, Creative Process, Love, and Personal Life, a God scarcely recognizable by one who has come into personal relation with the Biblical Creator, Redeemer, Father-Son-and-Holy Spirit.

While modern man does need a new sense of the meaning of God, the testimony of Christian theology and experience is that the God who has made Himself known in Christ and the Scriptures is the true God who can satisfy even needy modern man. While the atheistic critique may show up major short-comings of Christians—their traditionalism, their irrationalism, their failure to clearly communicate and their failure to support profession with practice—there is indeed little that atheism can add to Christian understanding of God's nature and will given in His special revelation.

Reviewed by Bert H. Hall, Division of Religion and Philosophy, Houghton College, Houghton, New York

---

PSYCHOLOGY AND RELIGION: A CONTEMPORARY DIALOGUE by Joseph Havens, Ed. Van Nostrand, New York 1968.

This book is a summary of discussions which emanated from the 1959 meeting of the American Psychological Association. Under the auspices of Faculty Christian Fellowship of the National Council of Churches, a group of psychologists met twice yearly to discuss and present papers during the succeeding years. The book presents their ideas on the relationship between psychology and religion via a conversational format. In quasi dramatic fashion the reader is brought into much of the actual dialogue that ensued. In addition, Havens summarizes and theorizes on the issues.

The participants range from the Thomistic Catholic psychologist, Charles A. Cuman, to the existentialist Jewish analyst, Richard A. Rubenstein. Others include many of the noteworthy scholars in the area. They are: James E. Dittes, Robert B. MacLeod, Paul W. Pruyser, Joseph R. Royce, Walter Houston Clark, and David Bakan.

The book recognizes in the beginning that most psychologists either keep what religious faith they might have separate from their professional work or they do not consider religious phenomena to be relevant at all. With this in mind, the several presuppositions of the participants are investigated. The question of whether a researcher has to believe in God to study religious phenomena is considered. The methods of theology and psychology are compared.

The more recent developments in humanistic psychology are reviewed. The sense in which all science and theology begins with man's experience is considered. It is suggested that intuition and the phenomenological method are the essence of all science and theology. The growing emphasis on human experience in psychology indicates a shift away from objectivism. This provides the basis for a continuing dialogue with religionists.

The report continues with a consideration of the nature of religious symbols as they relate to many of the constructs presently used to describe man in humanistic psychology. The nature of man's experience as seen in much existential psychology is very similar to religious descriptions.

Finally, the nature of religious experience is discussed and the demand of modern man for experimental events is noted Not only the young but psychologists in particular, are experientially oriented. The concern for experience to precede dogma is asserted.

At times the "alternative conversation essay format" makes for confusion. Yet in this rather relaxed manner one is introduced to the main themes of the contemporary scene in a short volume. A complete bibliography is included for further reading. Havens has done a commendable job. No other recent volume quite provides this survey. It is recommended for all readers who desire an introduction to the field.

Reviewed by H. Newton Malony, Assoc. Prof. Psychology, Fuller Theological Seminary, Pasadena, California

---

INTELLECTUAL HONESTY AND RELIGIOUS COMMITMENT by A. T. Bellinzoni, Jr., and T. V. Litzenburg, Jr., editors. Philadelphia: Fortress Press, 1969, 84 pp.

Mr. Bellinzoni and Mr. Litzenburg have edited for publication three papers given at a symposium at Wells College on the topic which became the title of their book. Professors H. Aiken, R. R. Niebuhr and W. Alston were the original members of the symposium. Alston and Aiken are philosophers; Niebuhr is a Protestant theologian. Professor M. Novak, a Roman Catholic theologian (lay), was included in the publication "to widen the scope."

The editors in their "Introduction" state the question with which these men wrestle—"the question of religion: Is it reasonable or is it not, is it a matter of the mind or of the heart, or is it both?" They then give brief, but helpful, summaries of each man's presentation and then raise some questions for the reader to consider.

Dr. Aiken is first with his essay, "Honesty and Commitment: A Philosopher's View." Aiken defines religion "adjectively" rather than metaphysically. He describes it as it is, rather than as it might have been intended to be. He defines intellect as "the cognitive faculty par excellence" and then hastens to place "common sense" limitations upon it. Would it not be better to take the opposite path, *i.e.*, to look upon the formal intellectual processes as the demonstration of what "common sense" people do and believe intuitively? Aiken limits severely the role of reason in religion —"A religious discourse . . . is primarily devotional in its intent, regardless of the terms in which it is being formulated." "Speculative theism" is no essential part of religion. By this I take him to mean "rational theism." If this is so, Aiken needs to define more specifically the relationship between religions of immanence and transcendence. To include classical Christanity under the general term "religion" is simply to beg the question. At the end of his essay, Aiken states that religious commitment is not necessarily a good in itself since Hitler was religious. How he can distinguish between Hitler's "bad religion" and somebody's "good religion" without a more intensive use of reason needs

explanation. And to ask that we transcend monotheism to "the God above God" sounds strangely as if we are being asked to worship no God or an idol. Aiken's perspective rests upon the modern disparagement of the role of the intellect in the religious sphere. It is illustrated in his question "was it not Jesus who said that the letter killeth but the spirit alone giveth life?" Jesus, of course, did not say that; St. Paul did. And he did not mean by it what Aiken forces him to say, *i.e.*, that "religious thought and emotion [do not] require expression through any particular set of terms." Paul is arguing in the Corinthian letter that the letter [the Mosaic law] drives a man to despair; the Spirit of God brings life. Elsewhere Paul announces his belief in the importance of sound and correct doctrine. (cp. Galatians). In the final analysis, Aiken does not permit us to choose rationally among any religions or for religion at all, nor can he approach religion morally unless he can in some rational way tell us what this means. Granted that a man need not be required to give a systematic definition of God whenever he uses the term, yet when chosen to proclaim a religion's message and beset by inquiring souls, he should be able to speak honestly and clearly.

If Aiken attempts to speak to the problem of intellectual honesty in religion by limiting the role of the intellect in the religious sphere and including Christianity wholly within the spectrum of religion, Professor Alston does so by differentiating between conscious intellectual dishonesty which involves deliberate misrepresentation for self-seeking purposes and unconscious intellectual dishonesty which involves the charge of self-deception. Alston concludes that the latter almost never can be charged to a person on the level of religious belief because one never knows completely the personality factors involved and because the religious sphere is such a complex entity. He states that a "style explanation", i.e., the cognitive, intellectual environment of the thinker, conditions a man so that blind spots occur and that a "motivational explanation," wherein the thinker refuses to let himself see the weaknesses of his "system," is probably the less reasonable explanation of his deficiencies.

Alston rightly calls for sympathy, morality, and understanding so that one does not hastily attribute conscious or unconscious intellectual dishonesty to a man, yet his recognition that such a theologian as Tillich "grew up in an intellectual environment which placed little or no premium on careful distinctions" contains the seed of the proper Christian response. Until the role of the intellect is reasserted in the sphere of religion and revelation, the problem of honesty or dishonesty will suffer even more from ambiguity. Reason alone will not take a man to the love of God, but it will take a man to and through the speech of God.

With R. Niebuhr, we come to a more directly theological approach to the question of intellectual dishonesty in the sphere of religion. He intentionally bypasses the question of the existence of God in terms of religious statements and focuses upon the problem of evil and its relationship to honesty. Can a man be religious and rational in the light of the existence of evil? Niebuhr's answer is in the cross as an event, which keeps one from adopting too simplistic an answer, since the cross involves God and man in the agony and pain of existence. The cross frees one to be ever open to intellectual honesty. "It is not the guarantor of honesty but the means to honesty and openness and a symbol of the hopeful search for fresh attitudes . . ." With Niebuhr, we have refreshing emphasis upon the intellect as a faculty and process which seeks to remove inconsistencies and contradictions, but which still does not prohibit "a man from recognizing and entertaining two conflicting convictions." Hence, he finally rests in paradox and tension in the rational-religious sphere. He refers to theories of the atonement rather than to facets of the whole biblical view of the meaning of the cross. His welcome emphasis upon the intellect is weakened by his unwillingness to grant revelational-rational status to propositional revelation. One does not serve the intellect or religion by refusing to recognize God's revealed, rational word as the explanation of His deeds.

Novak approaches the problem through four perspectives: the genetic, which shows that honesty is not an unhistorical concept but springs from one's environmental development; the dialectic, which reveals honesty as necessarily operating in relationships with freedom; the universal, which describes the maximization of honesty and freedom as demonstrating the power of God; and the concrete, which describes man as living more by ritual and dramatic symbol than by creed or proposition. Novak's approach is basically anthropological; he does not mention the term or concept of revelation. He sets up a false dichotomy between life and creed—"The Catholic faith is not a set of propositions to which one must subscribe; it is a way of life." Hence intellectual honesty becomes almost entirely a quest for enactment of temporary symbols rather than faith in, acceptance of, or obedience to the rational as a revelation of the true.

This brings us to the main weakness of the essays. Despite many penetrating insights into the dilemmas that face religious and rational men, the emphasis falls upon religion. The law of contradiction is not even mentioned let alone discussed. Until men come to grips with the basic law by which the intellect operates, the law of contradiction, and the presupposition which alone can validate it, revelatory Christian theism, religious commitment will be with us, but intellectual honesty with and before the truth will recede into the background.

Reviewed by Irwin Reist, Associate Professor of Theology, Houghton College, Houghton, New York

---

THE CHRISTIAN ENCOUNTERS THE AGE OF TECHNOLOGY by Hubert F. Beck, Concordia Publishing House, St. Louis, Missouri, 1970, 133 pp. Paperback. $1.50.

This book by the campus pastor for Lutheran students at Texas A & M is part of a series of "Christian Encounter" books by Concordia. It is more the purpose of the author to raise critical questions than it is to supply final answers. Such questions, for example, as "Can the church continue to recognize possibilities for a just war?" "What is the ideal life?" "What should a man set as his life goal when vast blocks of leisure replace the old activities by which he made his contribution to society through labor?" "Are there dimensions of life that a man tampers with only at the risk of his own welfare?" "How can the church become known as the great reconciling agency, bringing love

and light into the dark cells of solitary confinement that mark the technological age?"

The author argues that the growth of power and man's passion for power in the technological age are determining characteristics of this age. Both physical power and intellectual power have been vastly increased over any time in the past; political structures have arisen to handle these sources of power in their social context. How is the church, as a structure among structures, to relate in carrying out its mission?

The will to use power also characterizes our age. Consider changes in agricultural practices, the conquest of space, medical advances, and development of atomic energy and bombs. In this context, conventional conceptions of sin as weakness and limitations of man must be augmented by conceptions emphasizing sin as the misuse of power. Christ is the One who gives new direction to misdirected power. "How can the truth of the eternal God be impressed upon man of today as the truth not only of a very ancient God but also of a very young and contemporary God?"

In a day when the individual is becoming more and more victim to the loneliness of solitary confinement in this technological age, there is a need to recover a sense of community in addition to a sense of individualism. To this phenomenon the author applies McLuhan's phrase of "retribalization." Modern communication with its instantaneous bringing of significant events to all places in the world, and modern transportation with its shrinking of travel distances from weeks or months to hours, both act to effect this type of global retribalization. How does the church stand firm in fulfilling the fulness of the Gospel in such a retribalized world?

The first industrial revolution dealt with man's physical system and brought economic problems of some magnitude; the second industrial revolution deals with man's nervous system and likewise brings economic problems and tensions. New definitions of work are needed; the assumption of productivity as the basis for economics must be questioned.

In an epilog the author sets forth Christian hope as the one great contribution Christians can make to these problems. A new Gospel is not needed or called for; but the changeless Gospel must be freed from constraints characteristic of particular and transient societal patterns, economic systems and styles of government. As seems to be so popular in books dealing with Christian hope in a technologically dominated future, the author espouses a kind of neo-post-millennialism in which with the "new heavens and the new earth" as our goal, we "bring closer to fulfillment the society that we should like to have ready for presentation to our Lord when He comes again."

THE LATE GREAT PLANET EARTH by Hal Lindsey with C. C. Carlson, Zondervan, Grand Rapids, Michigan, 1970. 192 pp. $3.95.

In 1963 John A.T. Robinson, Bishop of Woolwich, put together a non-scholarly but lively popular agglomeration of Tillich, Bonhoeffer and Bultmann, and made publication history with *Honest to God*. Although he added very little not well known to theologians, his approach hit the popular press as they had never done. In 1970 Hal Lindsey, a graduate of the School of Theology at Dallas Theological Seminary and currently teaching with Christian Associates, with the help of C.C. Carlson, a columnist and free-lance writer, put together a lively and popularly written summary of the traditional pre-tribulation rapture pre-millennial eschatological position. The result, *The Late Great Planet Earth*, may have a large impact on the current Christian revival, especially among young people.

Lindsey offers nothing that is not part of the standard literature on the "pre-trib pre-mil" position, which was popularized in the early part of the current century through the Scofield Bible. But, whereas in earlier days scholarly authors had less popular appeal [C.C. Ryrie, *The Basis of the Premillennial Faith* (1953); R.D. Culver, *Daniel and the Latter Days* (1954); E.S. English, *Rethinking the Rapture* (1954); or basic Bible studies such as W.L. Pettingill, *Simple Studies in The Revelation* (1933), *Simple Studies in Daniel* (1933); to name just a few], Lindsey and Carlson have added color and pizzazz with phrases such as "The Future Fuehrer," "The Ultimate Trip," "Scarlet O'Harlot," "The Russian Waterloo," "What's Your Game, Gog?" They even refer to the people of China and Japan as "The Yellow Peril."

In the light of common deliberations today on such problems as the population explosion, environmental pollution, conservation of natural resources, etc., one might have expected the book to consider these questions in the light of the Biblical revelation. Such considerations, however, are almost completely absent. The authors favor instead a straight-forward development of the "pre-trib pre-mil" position, updating it only insofar as to take account of the existence of the state of Israel, and the repossession of the old Jerusalem by Israel in the 1967 war with Egypt.

It's all there. The rebuilding of the Third Temple on Mount Moriah ("P.S. The Arabs are not going to like this idea of rebuilding the Temple one bit." p. 152) with sacrifices and oblations. The arming and organizing of a vast confederacy headed by Russia, which will attack Israel. Three other great powers: the Arab-African alliance, the restored Roman empire in which Western Europe will dominate and not the United States, and the oriental forces of China. As the European Common Market heralds the beginning of the restored Roman Empire centered in Western Europe, so the Ecumenical movement heralds the beginning of the great anti-Christian superchurch. Before the showdown, the Rapture of all Christians out of the earth ("We should be living like persons who don't expect to be around much longer." p. 145). Then the final hostilities of World War III with Russia attacking Israel, sweeping through and double-crossing the Arab-African alliance, only to be utterly wiped out by the Roman dictator with supernatural overtones such that the remaining people of Israel are converted to Christ. After the nuclear holocaust accompanying these events, the remaining two great powers—the Roman Empire and China—will face each other as an Oriental army of 200 million soldiers marches to the eastern bank of the Euphrates. As this battle of Armageddon reaches its climax, Jesus Christ returns to "save man from self-extinction." Then He institutes his 1000 year reign on earth, the final achievement of "The Great Society." At the end of the 1000 years, the era of eternity is entered.

Maybe. There are grave problems in the working out of these perspectives in practical Christian living. It seems to me that it is possible to retain the assurance

of God's rule over the future, and to be able to joyfully proclaim, "*Maranatha*," without accepting a particular system of interpretation on the often ambiguous details of Biblical eschatology.

In a final chapter Lindsey and Carlson test their prophetic wings by offering a series of predictions based on their understanding of Biblical prophecy. Most of them seem quite independent of their particular eschatological position. Growing apostasy in the institutional church and an acceleration of denominational mergers. Increasing use by apostate ministers of non-Biblical positions and techniques. Increasing exodus of young Christians from the church with the development of true Christian faith among the youth. Persecution of believing Christians by nominal Christians. Development of a true underground church of believers. A growing world religious organization with political interests. Efforts to make Jerusalem the religious center of the world and to rebuild the ancient Temple. The Middle East as the focus of world concern. Development of riches for Israel from the Dead Sea. Loss of world leadership by the United States. Emergence of a United States of Europe. Growing involvement of the papacy in world politics. Growing desire for one man to rule the whole world. Limited use of nuclear weapons somewhere in the world to set the stage for acceptance of the Antichrist. Increase in sociological problems, famines, drug addiction, merging of drugs and religion. Growing predominance of astrology, witchcraft and oriental religions in the western world.

What should be the Christian response to these possibilities? Lindsey and Carlson suggest deepening of personal relationship with Christ and an added impetus to share the gospel with others.

> We shouldn't drop out of school or worthwhile community activities, or stop working, or rush marriage, or any such thing unless Christ clearly leads us to do so.

Reviewed by Richard H. Bube, Department of Materials Science, Stanford University, Stanford, California 94305

Are Christian Colleges Worth the Trouble? by C. George Fry, *Christianity Today*, Vol. XV, No. 10, pp. 6-10 (1970). Dr. Fry, Assistant Professor of history at Capital University argues masterfully that the unique contribution a Christian college can make to society is to share the great insight that all dimensions of man's life rest under the sovereignty of God. The primary task of a Christian college is therefore to promote Biblical religion which is both a call to wholeness of life and society and a call for help. Is not religion as suggested by its Latin root *religare* a binding together, an integrating of all of life's experiences? From this perspective one further sees that Biblical religion makes three fundamental affirmations that undergird all true learning and scholarship. They are the unity and universality of truth, the reliability of sanctified reason, and the priority of experience, of experimental method. It is an encouraging example of true ecumenism to see the many parallels of thought that exist between Dr. Fry, a Lutheran, and the Calvinist theologian and educator, Abraham Kuyper. This ecumenism is deeply rooted in the great respect for and understanding of the Bible by these two Christians. Reported by *W. Jim Neidhardt* (Newark College of Engineering).

The Cultural Basis for Our Environmental Crisis by Lewis W. Moncrief, *Science* 170, 508 (1970). There is little historical or scientific support for the contention that the Judeo-Christian tradition is the "historical root of our ecological crisis." At best this tradition has had only an indirect effect on the treatment of our environment. Capitalism (with the attendant devolopment of science and technology) and democratization are more directly responsible for urbanization, individual resource ownership, increased wealth and population, which in turn have provided conditions for environmental degradation. In our present situation in America three features block solution to this impending crisis: absence of personal and moral direction concerning our treatment of our natural resources, inability of our social institutions to make adjustments to this stress, and abiding faith in technology. Reported by *Jerry Albert* (University Hospital of San Diego County).

Ecological Commitment as Theological Responsibility by Joseph Sittler, Professor of theology at the University of Chicago. *Zygon* 5, No. 2, 172-181, June 1970. Dr. Sittler presents the case for developing a theology *of* ecology before starting on a theology *for* ecology. It should be clearly understood that greater precision in understanding of the physical sciences, rather than being disintegrative of the Biblical understanding of God, should be illustrative of God's greatness in holding all things together. He first suggests that the question of reality is itself an ecological question, for reality is known only in relations. It is possible that there is no ontology of isolated entities, instances, forms, and processes in God's Creation. An adequate ontological structure for Christian thinking is in terms of community, communion, ecology. "Being itself" may be a relation, not an isolated event or thing. Biblically things are what they are declared to be only in relation to other things. The Bible does not define God; this is reflected in Calvin's thought: "He is the fountain of all livingness." God is the name from whom all things flow and man is what he is because of relation to Him. *Imago Dei* does not point to a substance or an attribute but specifies a relation. The fundamental terms of Scripture are all relational: God, man, love, sin, hate, grace, covenant. Man lives with his fellow humans and the rest of Creation in relationship. Again when Scripture talks about man and God, life and history, terms such as restoration, redemption, salvation, faith, and hope are used which deal with the establishment and breaking off of relationships, of blessing in the re-establishment of a relationship.

Secondly, reality as relation requires that we behold all of reality with a reverence that sees ourself and all external to us as created by God who is both our Father and the One who maintains us and the whole cosmos in relationship to Him. Any act to change the relational order of God's Creation must be done only in ways that further His Glory.

Thirdly, we as Christians have made a wrong distinction between man as part of nature and man as part of history. Redemption is therefore falsely seen as only a historical drama that has no meaning for and cannot be praised in terms of care of God's Creation. Scripturally, God loves the human community, not isolated from, but in relation to the rest of Creation. Genesis portrays God as creating man to relate in joy and in work both to his neighbors and the whole earth. Psalm 104 declares that all life in Creation depends upon, receives existence and life from God's Spirit. In Roman's 8 we read: "The whole creation waits with eager longing for the revealing of the sons of God." Does this not suggest that the Creation, in openness. waits for men of faith to use it with dignity and respect, not as simply operators within the resources of the world? Biblically, the world is not God, but it is God's and His Grace is present in nature as well as in historical activity. For God's Grace is present not only in His acting in history to provide redemption and forgiveness for man but in His holding together as a cosmos the rich variety of all forms, nuances, and modes of existence. He clearly points out that both Luther and Calvin quoted with approval St. Thomas's insight: "Grace does not destroy nature but perfects it." A thoughtful article that leaves us with both questions and enriched understanding. Reported by W. *Jim Neidhardt* (Newark College of Engineering).

The Fundamental Physical Constants by Barry N. Taylor, Donald N. Langenberg and William H. Parker, *Scientific American*, Vol. 223, No. 4, pp. 62-78 (1970). The authors began their collaboration at the University of Pennsylvania where they made further measurements of the ratio of Planck's constant to electronic charge by means of the superconducting Josephson Effect. In their article they clearly pinpoint the significance of obtaining as precisely as possible the values of the fundamental physical constants. If one looks at physics one sees what appears to be a vast array of widely divergent fields, but, upon closer inspection there is a unifying theory of physics that binds all these fields into a coherent whole. "And the fundamental constants are quantitative links in the web of theory that binds physics together." Measurements of such constants to another decimal point is not just for the sake of the point itself but because the additional decimal point may lead to the discovery of a previously unknown inconsistency, or the removal of a known inconsistency, in our physical description of nature. The difficulty of increasing the precision of such measurements is stressed by the authors. Even least-squares analysis will not eliminate the problem of what weight to give to the various uncertainties of an experiment. Some workers cautiously overstate all systematic uncertainties so that later work will not prove them incorrect. Others underestimate systematic uncertainties, perhaps having an unconscious (or conscious) desire to be known for doing the best experiment. The authors also point out that new experimental methods of measuring constants have their own subtle hazards. As the "bugs" are removed in experimental procedures and one begins to get values close to the previous "accepted" value the experimenter tends to relax, to stop looking for further uncertainities and refinements in procedure. Possibly significant deviations are thereby overlooked. The article clearly lends credence to the thesis that complete objectivity is an ideal, or ultimate goal, of science difficult indeed to obtain by mere humans. Science thus shares such limitations with other human activities. Reported by W. *Jim Neidhardt* (Newark College of Engineering).

The Idea of a Christian College by Arthur F. Holmes, *Christianity Today*, Vol. XIV, No. 22, pp. 6-8 (1970). In this article, Dr. Holmes, chairman of the philosophy department at Wheaton College (Ill.), argues that Christian colleges can make a unique contribution by providing students with a whole outlook on life replete with values and attitudes as well as beliefs. Dr. Holmes sees Christian scholarship as being *perspectival*, as being *pluralistic* (in recognizing that even within Christianity differing traditions can respect each other and have complementary insights), and as being *exploratory* in approaching learning. It is a very thoughtful article. Reported by W. *Jim Neidhardt* (Newark College of Engineering).

Sensuous-Intellectual Complementarity in Science by Thomas R. Blackburn, *Science*, Vol. 172, No. 3987 June 4, 1971. The author is Associate Professor of chemistry at Hobart and Williams Colleges, Geneva, New York. He argues that science is losing many gifted young people because of their rejection of a scientific world-view that sees detachment and abstract-quantitative analysis as the only valid way of describing nature. Indeed, this world-view mistakes domains and functions in quantification space for nature and their manipulation as the only scientific method. A complete natural science should incorporate both direct sensuous information and abstract-quantitative information in a complementary framework. By sensuous he means the response of the whole person, including the senses, to phenomena; this approach is characterized by an openness to nature and other people in which man's subjective moods and intuition play a real role. Sensuous and quantitative information are seen as complementary to one another in that they meet the following criteria for complementary realities: 1. The two approaches present us with conflicting pictures of nature, yet the phenomena are consistent and repeatable in each mode. 2. Which description one uses depends entirely on one's method of knowing. 3. Both approaches are "rational." 4. Neither approach can be subsumed into the other. 5. Sensuous information is not independent of quantitative knowledge for they both are grounded in the same system of nature. 6. Both sensuous and quantitative descriptions of nature are true but are by themselves not complete knowledge. Taken together, these apparently mutually-exclusive approaches to describing nature yield exhaustive understanding.

That natural science should be extended to include sensuous experience, that such experience and quantitative knowledge are truly complementary to one another, that this more "open" science will be truly helpful in dealing with complex ecological systems, that such a perspective may be more receptive to religious understanding, and finally that young people will be drawn back to science by this approach; these are all points that will be hotly debated in the scientific community as well as the more general intellectual community. Reported by W. *Jim Neidhardt* (Newark College of Engineering).

I think it can be stated bluntly that scientism, if it rests its trust on the expectation that science by its own nature is enabled to give us sufficient guidance in human affairs, is a false religion. Its faith, if going so far, is superstition; the role of the priest does not become the scientist, and good scientists know that; the scientific code of behavior needs a background of an ethics which science has not been able to provide.

C. F. von Weizsäcker
The Relevance of Science, Collins, London (1964), p. 23

More on *Archaeopteryx*

Unfortunately, Professor Moore's criticism (*Journal ASA* 23, 159(1971)) of my remarks concerning how extensively the fossil record supports the scientific concept of organic evolution continues a long-established tradition for anti-evolution writings. He dismisses the overwhelming evidence from the many transitional fossils known to paleontologists by terming it "circumstantial", ignores its obvious genetic (ancestor-descendant) implications, and insists that "after its kind" limits variability forever (rather than just applying to the parent-child situation). The result of this aproach is well-illustrated by his mention of *Archaeopteryx* (or the synapsid reptiles) followed by his assertion that no intermediate or transitional fossils exist.

However, *Archaeopteryx* is in fact a good example of such a form, intermediate between the major groups of reptiles and birds (as is another, even more reptilian, Triassic form recently discovered and currently being studied by vertebrate paleontologists). I urge readers to examine museum specimens or detailed photographs of these fossils, and see for themselves how thoroughly intermediate *Archaeopteryx* really is. Some of its morphologic features—such as its large eyes, forelimb modified into a wing, and feathers—are bird-like. Other characters—like its elongated bony tail, functional fingers on its forelimb, and conical teeth—are reptile-like. Still others—such as its breastbone, somewhat expanded braincase, and incompletely fused forelimb bones—are intermediate. If major different types of organisms had been independently created, we should find no transitional fossils bridging the morphological (and temporal) gaps between them. Consequently the existence of *Archaeopteryx* (and the many other transitional fossils) is fatal to that idea, in most paleontologists' opinion.

Misunderstanding sometimes arises from the practical necessity for taxonomists to assign all organisms to higher taxa (the so-called "major types") defined originally from studies of living animals before the fossil record was investigated. Consequently, most taxonomists place *Archaeopteryx* into the Class Aves because it has feathers, although placing it into the Class Reptilia because it has teeth or a bony tail could be justified as well. Such practice perhaps tends to obscure to the non-specialist how truly intermediate between Aves and Reptilia this fossil is in its total morphological pattern. (In fact, a number of scientists have pointed out this and other problems connected with the difficulty of using a hierarchical classification system to portray adequately the morphologic and chronologic continuum so often seen in the fossil record.)

In conclusion, with the fossil record yielding many examples of transitional fossils anatomically and temporally intermediate between recognized forms at both higher and lower taxonomic levels, is it any wonder that paleontologists have concluded that organic evolution was indeed the method of creation, and that those ignoring such overwhelming scientific evidence must have nothing worthwhile to say concerning religious matters as well?

Roger J. Cuffey
Dept. of Geosciences
Pennsylvania State University
University Park, Pa. 16802

(A detailed discussion of these points will be presented in the Journal *Dialogue on "Scientific Evidence and Evolution." Watch for it in a later issue.)*

The Dichotomist Should Become More Wholistic

Mayers (*Journal ASA* 23, 89 (1971)) suggests that dichotomistic people are unlikely to ever be led by the Spirit of God to praise God in tongues. Speaking in tongues is too non-linear, too irrational for them. Mayers' analysis may be quite right (I'd like to see his thesis developed more fully and concretely); but, I can't see that the answer for the dichotomist is to find *other* ways to open up to God and to praise Him.

Opening up to God and praising Him in the fullest sense are in-spirit things—of the very warp and woof of speaking in tongues. And, the dichotomist not only cannot speak in tongues, he normally cannot pray in groanings, be guided by the Spirit or an angel, exercise the charismatic word of knowledge or wisdom, prophesy, heal the sick, or raise the dead. The dichotomist because of his inability to operate in the non-rational, non-linear, in-spirit realm has little or no experience of any of these matters.

The answer then, if the Biblical revelation is the true religion, is for the dichotomist to become at least partly wholist: so that he can accept all of the Bible. The dichotomist is isolated in the realm of intellectualism and unable to move into Biblical mysticism. He can pray and praise with his mind, but not with his spirit. (I Cor. 14:15) When it comes to the in-spirit realm the dichotomist is uninitiated and hence sees in-spirit activities as irrational. (I Cor. 14:23).

When William James analyzed religious conversion, he decided that some people—the "healthy-minded", which he found in primarily modernist churches and Unitarianism—were not particularly susceptible to conversion and really did not need to be "twice-born." No doubt, the "healthy-minded" are not particularly susceptible to conversion; but, they need to be born again anyway. So, with the dichotomist who is not particularly susceptible to speaking in tongues (or to any other in-spirit activity), he needs it anyway. Or, as Paul said, "I wish that ye all spake in tongues."

It is not enthnocentrism nor selfish rejection that leads Paul, a wholist, to wish that all Christians would speak in tongues (and even more to prophesy, an equally mystical exercise), but rather the love of God,

who wants all men to be whole.

Paul H. Seely
2807 *Balfour*
Milwaukie, Oregon 97222

Disagreements with McCone

Mr. McCone who wrote "The Phenomena of Pentecost" (*Journal ASA* 23, 83 (1971)) needs to read "They Speak with Other Tongues" by John Sherrill,—one of many writings about the facts—not theories—of "Tongues". Sherrill, a sceptic on the subject, spent about four years gathering data on this phenomenon and amassed a great number of case histories on the subject; some dated back through the centuries, many are of recent date. He made tape recordings of people speaking in tongues and also of imitations and had these examined by linguists. The experts easily distinguished the true speech from the gibberish.

Mr. McCone's assumption of four languages only is far fetched. To use a modern analogy, call the hearers Canadians, Filipinos, and residents of Alaska. All of these might understand English but would not necessarily call that "our language". The Canadian from Quebec would be delighted to hear French, from Norway House a Cree tongue, from Tuktoyaktuk an Eskimo dialect. For the Filipino it might be Tagalog, Spanish, Cebuanese, or other. For the Alaskan it might be Tlingit, or any of the Athapascan or western Eskimo tongues.

Acts 2 tells that the one hundred and twenty speaking in "our own tongues" were telling "the mighty works of God". There is no reason to assume that they were giving the news of Christ since Peter was impelled to quell the sound and to give this message in, presumably, the Hebrew language. His message brought conviction following as it did upon the miracle that these people recognized.

If Mr. McCone is a scientist he will (1) examine all the data available, not just some of it; (2) hear a few hundred voices and interview the speakers; (3) "taste and see"; i.e., perform a valid experiment—but only if he is a born-again Christian lest he get himself into real trouble.

To use a quote that Mr. Sherrill used, "Your faith is on ice; ours is on fire".

Margaret H. Blom
Box 113
Palmer, Alaska

I read with interest the article by Dr. R. Clyde McCone. The recent events of our day have produced a real interest in the Holy Spirit which I believe is good and can only benefit and help Christians living in our complex world.

However, I disagreed with some of the contents of the article and I felt it necessary to reply. I criticize only in the spirit that I would like to clarify a subject which is of particular interest to myself. In the section of the article where Dr. McCone speaks of "Other Tongues" He mentions that "Luke does not say that the Spirit gave them the ability to speak a language hitherto not known to them." It seems to me that this is not entirely correct because in Acts 2:8, Luke specifically identifies the ability they had to speak in "languages" (*dialektos*) not "tongues" (*glossa*). In other words, later Luke does identify exactly what he meant. I do not disagree that they were also given the ability to speak a message (*apophtheggomai*). It seems to me they were given both aspects: message and language (not just tongue as message). I am one of those who has some difficulty accepting the current interpretation of "tongues" as we see it expressed in the Pentecostal movement even though I am sympathetic to their desire to have more of the strength of the Holy Spirit.

In spite of my disagreement of your interpretation in Acts on this point, I appreciated your article.

Rev. Robert S. Burns
St. Paul's Presbyterian Church
Banff, Alberta, Canada

Professor R. Clyde McCone makes the point that the "other tongues" with which the 120 disciples began to speak on the Day of Pentecost were the "Gentile tongues most familiar to their hearers" rather than the Hebrew language in which they were accustomed to hearing the law expounded. He contends that these "other tongues" were not miraculously induced languages, but simply languages commonly spoken in that day, in which the 120 were already proficient.

By way of reply, I would first of all be inclined to question the assertion that only Hebrew was used at that time in expounding the law. Was not the law expounded in Aramaic in the synagogues already in the first century A.D.? Further, the statement, "This fact, plus the sacredness of the temple, demanded that Hebrew be used exclusively on this occasion," assumes that the outpouring of the Spirit took place at the temple. This may have been so, but can we be sure of it? All we read is that the 120 "were all together in one place" (Acts 2:1).

My greater difficulties with McCone's thesis, however, arise from the other two references to tongue-speaking in the Book of Acts. In Acts 10:46 we read that the Jews who had come with Peter to Caesarea were amazed because they heard Cornelius and his household speak with tongues (the same expression is used as in Acts 2:4 except that the word for "other" is missing). On the basis of McCone's interpretation of tongue-speaking, what was there to be amazed about? In the fact that Cornelius, the Roman centurion, did not speak in Hebrew but in his native Latin? What would be so unusual about that? I have the same difficulty with the tongue-speaking reported in Acts 19:6, where the disciples whom Paul had found at Ephesus are said to have spoken with tongues (the same Greek words are used here as in 10:46). Would there be anything unusual about the fact that these Ephesian disciples did not speak Hebrew?

I also have difficulties with the author's understanding of tongue-speaking as described in I Corinthians 12-14. He understands the phenomenon there described as follows: "Later in the cosmopolitan city of Corinth, those who had received the Spirit felt free to pray and witness in the particular language which was most familiar to them" (p. 88). But this view of the tongues in Corinth does not comport with the description found in 14:2, "For one who speaks in a tongue speaks not to men but to God; for no one understands him, but he utters mysteries in the Spirit" (RSV). If the people at Corinth, when they spoke with tongues, spoke "in the language which was most familiar to them," surely there would have been some

who could understand! Surely no one would care to contend that each member of the Corinthian church spoke a separate language! An even greater difficulty with this view is based on what Paul says in 14:14, "For if I pray in a tongue, my spirit prays but my mind is unfruitful" (RSV). This suggests that when a person speaks or prays in a tongue, his mind is in a state of quiescence. Surely this does not describe a person who was praying or speaking "in the particular language which was most familiar" to him, does it?

Anthony A. Hoekema
Professor of Systematic Theology
Calvin Theological Seminary
Grand Rapids, Mich.

Replies by McCone

To Margaret Blom:

My article "The Phenomena of Pentecost" was not an examination of 20th century phenomena. Its focus was on first century events. I did not *assume* that there were four languages (or less) used on the day of Pentecost. Rather, the article briefly summarized the data that support this conclusion. Sherrill, whose book I have been familiar with for some time, does not ask the question, "What did happen on the day of Pentecost in terms of languages?" He *assumes*, as do many others, that the Galileans upon receiving the Holy Spirit began to speak in many other languages that they did not know. In my article I have made this assumption the object of investigation and have found it to be scripturally and historically without support. What happened on the day of Pentecost is established by the inspired record given to us in the Bible, not by some experience that I may or may not have, or that Mr. Sherrill or anyone else may or may not have. Documented historical data supply the language context in which this event occurred.

Margaret Blom's "modern analogy" indicates that she did not understand the point or the purpose of my analogy. It may also not have been clear to others. Therefore, permit me to briefly restate it. All those who "heard them speak in his own language" were Jews. They were devout Jews who were in Jerusalem for the feasts of Passover and Pentecost. The native languages of these Jews were the national languages of the homes of their dispersion, just as the native language of those Jews living for a number of generations in America is English. In some places in Canada the Jew is bilingual, speaking both English and French, just as on the day of Pentecost many of the Jews were bilingual, speaking both Aramaic and Greek. Under certain circumstances a Jew in the United States or Canada might learn to speak Cree or Tlingit, or any other American Indian language; however, the ethnic and socio-economic situation is such that these languages would never become "his language" nor that of his family. If Tagalog in time should become the only nationally used language of the Philippines and some Jews made this the location of their homes and business, then in a generation or two there would no doubt be Jews who would be native speakers of Tagalog.

My analogy was not given to prove a point, but to illustrate and clarify by giving a modern parallel situation. The fact that there were not more than four languages used rests upon the documented data which I presented, to which Margaret Blom makes no reference.

The extent of my investigation reaches much farther and deeper than this brief article may indicate. I have continued to examine all of the data available to me that time would permit. As a result, I have recently written a much longer article with more extensive documentation.

Finally, regarding the temperature of *my* faith (I have no judgment to make about the faith of others), it is not on ice, it is not on fire, but it is in the fire, where it is being tried and proven. See I Peter 1:7.

To Rev. Burns:

My statement regarding what the Holy Spirit gave is solely a matter of the text. Acts 2:4 reads, ". . . as the Spirit gave them utterance (*apophtheggomai*)." It does not say, "as the Spirit gave them a tongue or a language (neither *glossa* nor *dialektos*)." The Galileans did indeed speak in languages with which both they and their readers were familiar but which were "other" than the sacred Hebrew. The purpose Rev. Burns has in the distinction between *glossa* and *dialektos* is not really clear to me. It appears to me that he is saying that he would translate *dialektos* as language which a person has the ability to speak, and *glossa* as tongue which a person does not have the ability to speak. If this is the point he is intending to make, I would point out that the Greek word *glossa* is used in three ways which are parallel to the English "tongue." It is a physical instrument in the mouth as in Mark 7:33. It is used as an instrument of expression as in James 1:26. It is also used as a language as in Rev. 5:9 and in six other places in Revelation. Acts 2:8, which is referred to by Rev. Burns reads, "and how hear we every man in our own *tongue* which we were born?" Here the Greek word translated tongue is *dialektos*. This expression is repeated at the end of the list of areas in Acts 2:11, where it reads ". . . we do hear them speak in our tongues the wonderful works of God." Here the word translated *tongues* is from the Greek *glossa*. Thus *dialektos* and *glossa* are used interchangeably and both mean language.

To Professor Hoekema:

Professor Hoekema is quite right in observing that Aramaic may have been used in some of the synagogues as early as the first century A.D. In fact, Greek may have been used to some extent in a few. To what extent and in how many synagogues Greek or Aramaic was used would probably be difficult to establish. However, in some well-defined manner the status of Hebrew as a sacred language was still maintained even in the synagogues of the Diaspora. Professor Hoekema is also right in saying that the exact location of the Galileans when the Holy Spirit was poured out upon them, is not known. However, they were certainly among the pilgrims gathered at Jerusalem for the Feast of Pentecost. The center of the feast and of the activities was the temple. The outpouring of the Holy Spirit was certainly in some way identified with the feast that prefigured it. Regardless of the exact location, the witnessing of the Galileans was associated with the activities of the day. If the *devout* Jews reserved any activities for the exclusive use of Hebrew, it was the temple-centered feasts of Passover and Pentecost.

Professor Hoekema asks what there was to be

astonished at, if Cornelius spoke in his native Latin (or Greek). He is still assuming that the only thing that could bring astonishment is speaking in a language one had never used before. Four things must be observed in connection with the event at Cornelius' house: 1) Cornelius was a Gentile; 2) he was devout and was seeking to know the God of Israel, 3) there was considerable proselytizing by the Jews of the First Century (Matt. 23:15); and 4) those who were astonished were "of the circumcision which believed" (Acts 10:45). For a Gentile to come to the God of Israel required a certain amount of instruction and some minimal use of the Hebrew language. He, of course, also must be circumcised. These ideas died hard in the church as is indicated in Acts 15. In fact, it took a special vision to bring Peter to Cornelius' house and to prepare him for what happened. The Holy Spirit was poured out upon these Gentiles without any of the ritual requirements of circumcision or use of the sacred Hebrew language. It is true *we* would not be astonished, but we can only understand *their* astonishment if we can transport ourselves into the cultural religious context of "the circumcision which believed."

The situation at Ephesus was associated with the synagogue and also is an example of abandoning a ritual use of Hebrew in favor of a spontaneous heartfelt expression in languages most familiar to them.

The language situation among the Gentile believers in the cosmopolitan city of Corinth was much different than that among the devout Jews at Jerusalem. A.H.M. Jones in *The Later Roman Empire, Vol. II* points out that particularly among the lower classes through Asia Minor and the other places in the empire, small areas of native languages continued along with the Greek and the Latin. In this case a Gentile from one of these areas moved by the Holy Spirit would speak freely in the language native or most familiar to him. However, if he did, for a majority of the Corinthian congregation, if not all, he would be speaking to God, "for no one understands him." If there were any there who did understand, they were to interpret or translate it so that the group as a whole could understand.

That the mind being unfruitful means that it is in a state of quiescence, does not follow. The mind is involved as the faculty in the meaningful distinctions made by language. This becomes unfruitful in the church when the medium of communication or language is not shared. In fact Paul explicitly states as much in I Cor. 14:19, "Yet in the church I had rather speak five words with my *understanding*, that by my voice I might teach others also, then ten thousand words in a tongue" (Tongue here is by implication a Gentile language not understood by the hearer). See also I Cor. 14:10 and 11.

R. Clyde McCone
Professor of Anthropology
California State College
Long Beach, California 90801

Request for Technical Books and Journals

May I congratulate you on the quality of the *Journal ASA*. I feel it is really getting to grips with the problems and providing a real forum for discussion. Could I ask for an article sometime discussing the evidence for an object on the top of Mount Ararat? It is a subject of interest to all Christians and I myself would like an objective appraisal of the evidence.

My main reason for writing is to ask you whether you could put an appeal in the *Journal ASA* for technical books and journals for our Department here. I am teaching Chemistry at Makerere and one of my main reasons for coming was that I felt God wanted me to teach in Africa. Since I have been here I have been trying to improve our Departmental Library and bring it up to date. Our own funds for this are limited and I have been trying to get donations of materials from various sources.

I wonder if you could circulate this appeal to your members and readers, since this is a practical way of helping a developing country. I am mainly interested in recent chemistry textbooks (or related disciplines such as Materials Science or Chemical Physics or Solid State) or monographs—these should be sent direct to me at the above address. We would also like back copies of journals which we do not have, if anyone would like to get rid of any: in particular *J. American Ceramic Society, J. Electrochemical Society, Inorganic Chemistry, J. Physics and Chemistry of Solids* etc. Anyone wishing to donate journals should contact me first to see whether we need what is offered—this is because postage on journals is so expensive that it is not worth sending them unless we need them. I'm afraid that we cannot pay postage costs, but if books or journals are sent by surface book post this shouldn't be too much. Books in physics or biological sciences would also be acceptable, and I would donate them to other Departments concerned.

P. E. Childs
Department of Chemistry
Makerere University
P.O. Box 16020
Kampala, Uganda

Advertise *Journal* to Every Clergyman

I am impressed with this *Journal*, and I am giving this subscription to my father. I am sure he will receive a blessing, and a stimulation of the mind.

This will be an early Christmas.

I suggest that advertisement and sample copies be sent to every clergyman in America. It is time we faced the issues head on with some intelligent and rational thought.

Elwood B. Stetson
Owosso College
Owosso, Michigan 48867

The gods of nature have been vanquished by the God whom Christians call Our Father; therefore man, as God's son, has received power over nature. As he is son and not servant, he is free, and his freedom includes the freedom to act against the will of his Father, the God of love. He can now subject the world to himself, and secularism does precisely this.

C. F. von Weizsäcker
The Relevance of Science, Collins, London (1964), p. 178

What Do You Think of THAT?!

Cause of Death: Overpopulation?

The cause of death in many great catastrophes can be directly attributed to overpopulation according to Garrett Hardin of UCSB. Yet overpopulation is never cited as the cause – as "econuts" would like to emphasize – because such an assignment would be unthinkable. Better instead to attribute death to cyclones, tuberculosis, leprosy, enteric disease or animal parasites than to recognize the role played by malnutrition caused by overpopulation. Better to blame "fate" or "weather" than to recognize our own responsibility. (*Science 171*, 527 (1971))

Molecules in Space

Five amino acids were found in a meteorite that fell near Murchison, Victoria, Australia on September 28, 1969. For some time simple molecules such as OH, CH, and CN have been known in space, but to this list have recently been added H_2CO, NH_3, H_2O, CO, HCN, HC_3N, CH_3OH and HCOOH. The more complex amino acids found in the Murchison meteorite were protected inside solids and thus were not dissociated by the solar wind. (*Physics Today*, February 1971, p. 17)

You Can't Go Home Again

One branch of the conservationist movement sometimes speaks as if the solution to today's problems would be obtained simply by returning our culture to that of an earlier, less complicated, less technological day. John Boardman of Brooklyn College argues against this kind of simplistic approach on the grounds that successful implementation would sentence over three-fourths of the human race to death by starvation or disease. (*Physics Today*, February 1971, p. 9)

Big Body, Big Brain

Harry J. Jerison of the School of Medicine of UCLA reports that the relationship between brain size (endocast volume in ml), V, and body size (weight in kg), W, can be described quantitatively for 69 species of fossil ungulates and carnivores by the simple relationship, $V=AW^{2/3}$, where A is a constant for a given species or assemblage of species, and varies for different assemblages between the limits of about 0.015 and 0.12. (*Science* 170, 1224 (1970))

Calling All Fundamentalist Authors

Science and Scripture is a magazine published by Michael L. Trapasso of Beaumont, Texas. He is interested in getting authors of papers and offers to pay 1¢ to 2¢ per word, with raises for authors who become regular contributors. Authors are informed that their writing should be intellectually overtoned, objective in presentation, in harmony with the facts, and tailored for the layman. Oh yes—one other detail: if you're not a Fundamentalist, or if you should happen to be soft on theistic evolution, forget it!

Baptists Bury Others in Sunday School Size

A survey of the 107 largest Sunday Schools in the country (all with weekly attendance of over 1000) reveals that 78 of the 107 belong to one of the Baptist denominations. Churches listed as interdenominational, non-denominational or independent account for 10 of the leaders. There are 3 United Methodist churches, 3 Christian churches, 2 Nazarene and 2 Lutheran churches. (*Christian Life* 33, No. 5, 28 (1971))

Fooling Around with the Fine-Structure Constant

Some interest was aroused by a paper by Armand Wyler in *Comptes Rendus* in which he theoretically derived a value for the fine-structure constant in terms only of simple rational powers of integers and pi, which agreed with the experimental value to within one-half part per million. Using a computer, Ralph Roskies of Yale and Stanford Linear Accelerator showed in 30 seconds that there were five other polynomials different from Wyler's (but of the same form) that would match the value of the fine-structure constant as well. (*Physics Today*, August (1971), p. 17, and November (1971), p. 9)

In September, 1941, five scientists of deep Christian conviction met together in Chicago. They found that they shared mutual concerns in the relationship of science and Christian faith. The **American Scientific Affiliation** is an outgrowth of that meeting.

ASSOCIATE MEMBERSHIP is open to anyone with an active interest in the purposes of the Affiliation.

MEMBERS hold a degree from a university or college in one of the natural or social sciences, and are currently engaged in scientific work.

FELLOWS have a doctoral degree in one of the natural or social sciences, are currently engaged in scientific work, and are elected by the membership.

Members of the Affiliation endorse the following statement of faith: The Holy Scriptures are the inspired Word of God, the only unerring guide of faith and conduct. Jesus Christ is the Son of God and through His Atonement is the one and only Mediator between God and man.

DUES for these three types of membership are: Associciate $8.00, Member $12.00, and Fellow $15.00, per year. A member in any of these three categories can take the *special student rate* of $3.00 per year as long as he is a full time Student.

PUBLICATIONS include the *ASA News* (sent to all members four to six times each year); three symposia: *Modern Science and Christian Faith,* F. Alton Everest, Editor, Van Kampen, Wheaton, Illinois (1950) (out of print), *Evolution and Christian Thought Today,* Russell L. Mixter, Editor, Eerdmans, Grand Rapids, Michigan (1960), and *Our Society in Turmoil,* G. Collins, Editor, Creation House, Carol Stream, Illinois (1970). Individual authors are also encouraged to publish independently.

LOCAL SECTIONS of the American Scientific Affiliation have been organized to hold meetings and provide an interchange of ideas at the regional level. Information may be obtained from the persons listed below or from the national office.

CENTRAL PENNSYLVANIA	Dr. T. V. Hershberger 304 Animal Sci. Bldg. Pa. State University Univ. Park, Pa. 16802
CHICAGO	Dr. Russell L. Mixter 1006 N. President St. Wheaton, Ill. 60187
INDIANA	J. Philip McLaren Bethel College Mishawaka, Ind. 46544
NEW ENGLAND	J. W. Haas, Jr. Gordon College Wenham, Mass. 01984
NEW YORK CITY AREA	W. James Neidhardt 37 Squirehill Drive Cedar Grove, N.J.07009
NORTH CENTRAL	Dr. James E. Rodgers Bethel College 1480 N. Snelling Ave. St. Paul, Minn. 55101
OREGON	Paul G. Simpson Dept. of Chemistry Oregon St. University Corvallis, Ore. 97331
SAN FRANCISCO BAY	Robert Anderson 141 Garnet Avenue San Carlos, Calif. 94070
SOUTHERN CALIFORNIA	David Sheriff 2072 Midwick Altadena, Calif.
WASHINGTON-BALTIMORE	Glenn I. Kirkland 7901 Maryknoll Ave. Bethesda, Md. 20034
WESTERN MICHIGAN	Clarence Menninga Calvin College Grand Rapids, Mich. 49506
WESTERN NEW YORK	Anne Whiting Prof. of Biology Houghton College Houghton, N.Y. 14744

Membership application forms, ASA publications and other information may be obtained by writing to: AMERICAN SCIENTIFIC AFFILIATION, 324½ So. Second St., Mankato, Minnesota 56001.