JOURNAL OF THE
AMERICAN
SCIENTIFIC
AFFILIATION

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

VOLUME 20 NUMBER 3 SEPTEMBER 1968

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

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JOURNAL OF THE AMERICAN SCIENTIFIC AFFILIATION

SEPTEMBER, 1968 PRINTED IN THE UNITED STATES OF AMERICA VOLUME 20, NUMBER 3

VALIDATION OF SCIENTIFIC THEORIES

ROBERT D. JEWELL*

On July 20, 1963 F. Schmeidler and others from the Munich University Observatory were on the shores of Great Slave Lake in Canada seeking to obtain eclipse plates of the star field within six radii of the sun. As often happens in the astronomy business, clouds came up at the last minute and no usable results were obtained. One might wonder why the German astronomers were out fighting mosquitoes in Canada. They were there because recent attempts had failed to verify the earlier observations confirming Einstein's Relativity prediction that a ray of light just grazing the sun would be shifted 1.75 seconds of arc. In fact recent data had yielded results significantly different from that predicted. Also a re-examination of the reduction method used in earlier experiments had raised some questions as to the evidence supplied by them. This example illustrates one characteristic of the scientific method about which there is almost universal agreement. This characteristic is the testing of a theory or hypothesis by means of an experiment or observation.

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If the results of the collected data differ appreciably from that which has been predicted by the theory, then although very interesting scientific activity may result (for example, the Michelson-Morley experiment in 1887 caused quite a chain of scientific activity, as has the more recent discovery of quasi-stellar sources) there is little question as to the proper analysis of the principles of methodology involved. If, on the other hand, the results are in agreement with the predictions of the theory, within the limits of experimental error, there is the problem of how much support the results give to the theory. The problem of the degree of support is not only of interest to the scientist in each particular case, but is also of importance for those interested in giving an adequate analysis and description of scientific methodology itself. Although there is still much uncertainty in this area there have appeared recently lines of inquiry which those concerned with understanding the procedures and concepts of scientific thought should find it useful to consider. It is the purpose of this paper to give a report of these trends of thought and to try to present a preliminary discussion of some of their possible ramifications for the Christian as well as for science itself.

The problem under discussion is not whether data collected which is in accord with the predicted results of theory does in fact tend to confirm the theory, the problem is rather the degree to which such collected data entitles us to conclude that the theory is true. Einstein's relativity theory, for example, when first presented predicted the results of the Michelson-Morley experiment. But one would not be on very safe ground if he concluded that the theory were true on the basis of this evidence alone for it is known that Einstein used this data in constructing the theory. It is for this reason that other conclusions of the theory such as the star shift are important. Even though such a shift had been predicted in 1804 by Johann Soldner it had never been actually investigated. Hence, if the shift were found to actually occur it would then confirm Einstein's theory to a considerable degree. Unfortunately, this is only one of many different *kinds* of examples. In one case a certain type of experiment may bear almost the whole weight of supporting a theory, in another seemingly similar case scientists may regard it as of almost no consequence. Furthermore the value of a particular kind of experiment may vary from one science to another. Sometimes it might appear as if the determination of the degree of confirmation were a cult ritual which no accumulation of facts could allow the outsider to understand without first being initiated into the tribe. It would thus be valuable to all concerned if a general theory of confirmation could be devised so that one could in each case know how much a given experiment or observation would support the theory. With the advent of a highly developed probability calculus and later of game theory it was hoped that such a theory of confirmation was within reach. While the application of these theories has helped in the attack upon problems in the area of confirmation of scientific hypotheses, they have also revealed certain new difficulties.

Some Suggested Analyses of Scientific Confirmation

In order to elicit these difficulties let us suppose that some confirmation function, C, has been agreed upon so that we may say that the evidence, e, confirms a proposition or hypothesis, p, to a certain degree determined by C, i.e., $c(p,e)=x$. (This is merely a supposition, for at the present there is no agreeement among philosophers of science as to the proper function. The problem under discussion may be stated without the specification of a particular function, however.) Suppose further that one is faced with a choice of several actions based upon certain information. An example might be that of a drug company planning to produce a new drug. The company has the choice of several different manufacturing processes and it wants to know which one yields a product safe enough for human consumption to be placed on the market. In this case the company has several possible actions (a_j) before it—one for each manufacturing process—and several possible outcomes (o_m) of each action as well as the scientific evidence, e, which determines the probability of each outcome. So the probability of a certain outcome might be symbolized by $c(o,e \,\&\, a)$. But, as the example of a drug for human consumption is intended to indicate, there is also the problem of the utility or disutility accrued by a particular outcome. If, for example, with the use of one process the probability were high that one sample out of a thousand would be fatal, the utility of that outcome would be negative. As a result this would outweigh the value gained from the healing powers of the drug. The application of the notion of utilities to the theory is not very difficult in principle as can be seen from the illustration at hand. Since killing a person is to be avoided at all costs, considering the mere probabilities would not be enough; the value of each outcome must also be considered and not only the outcome of healing, but also the outcomes of cost of manufacture as well as harm to health. The utility of one particular action, a_j, then is the sum of the utilities of the various possible outcomes of that action. $U(a_j,e)=c(o_1,e \,\&\, a_j) \times u_1 + \ldots + c(o_m, e \,\&\, a_j) \times u_m$, where $u_i=$ the value of outcome o_i.

Those who are proponents of the pragmatist or instrumentalist school of thought feel that the correct analysis of confirmation in science is the one which involves the computation of certain utilities. Their conclusion rests on the grounds that the final test of any theory is its usefulness. The pragmatist view in general is probably familiar to all educated Americans, especially those who are close to Christian circles since there has been considerable criticism of it from some of these circles. In the case of confirmation, however, there is something to be said for it *prima facie*. A decision to accept a theory is an action of a certain sort and it is an action with important consequences to the person involved, qua scientist, as well as, qua person.

Although it is hazardous to make such statements, it would appear that for present-day philosophers of science an analysis along these general lines is the leading candidate. One might hope then that the utilities could be specified and defended in some non-subjective fashion so that the description of science as a purely rational endeavor could be retained. Today, however, there seems to be a growing pessimism as to whether this latter objective can be fulfilled. For when it comes to determining the values of the utilities of the various actions it looks as though one is involved in value theory or ethics and thus has left philosophy of science pure and simple. The pessimism has gone so far that in an address on this subject at the University of Pittsburgh not too long ago a noted philosopher of science, Carl Hempel, was heard to say—humorously, to be sure, but still intending a serious point—that perhaps the preachers were correct after all when they claimed that the conclusions of science involve a value judgment, a judgment which could not be made purely within the rationally defined procedures of science.

Another widely accepted solution in this same tradition has come from game theory. It is the "minimax" procedure which says that one should act

according to the rule that will minimize the maximum risk. It seemed for a while that the difficulties of making assumptions outside the scope of science proper did not arise when such a procedure was applied. Nevertheless the minimax principle does involve a metaphysical assumption. The minimax principle can be understood as recommending that one select the rule "for which the largest of the (statistically defined) probability estimates of the losses that might be incurred in a given context as a result of following this rule is no greater than the largest of the corresponding risks." This is a typical statement from the literature. R. C. Jeffrey in "Valuation and Acceptance of Scientific Hypotheses" (*Philosophy of Science* 23: 230-246 (1965)) has pointed out that when a player uses this seemingly cold and objective mathematical recommendation he is really making a rather massive metaphysical assumption for he is assuming that this is, for him, the worst of all possible worlds, one which is, so to speak, out to get him. Similarly the most obvious alternative, the "maximin" procedure would assume that this is the best of all possible worlds for the player using it.[1]

Because of such difficulties in the pragmatist theories some have turned to the hope mentioned earlier that certain utilities could be specified for the sciences which would be completely impersonal and free from the onus of falling under ethics. The general debate between this approach and the pragmatic one is not new. For instance, a similar debate occured between W. K. Clifford and William James with Clifford arguing that any hypothesis ought to be rejected until there is adequate evidence for concluding that it is true and James arguing that there are important decisions that we have to make before adequate evidence is available. A problem that arises here is that in the human predicament it is not always easy to decide when the evidence is adequate to determine truth. The *meaning* of "truth" in science is not difficult: an hypothesis is true if it correctly describes what is the case, if it corresponds with the facts. The difficulty is that the truth of a theory cannot be determined directly in spite of the fact that the definition of truth is clear and simple; for it is the nature of a scientific theory to go beyond the known facts. If theories did not provide for the prediction of things which were not presently known, they would be of little interest, especially the very abstruse theories of mathematical physics. Hence it would appear that the human being must search for marks such that if an hypothesis has them, they will count as adequate evidence that the hypothesis is true.

Perhaps then utilities could be found which would count as marks that an hypothesis were true and would thus relieve some of the disapprobation which often falls upon the use of utilities in the context of confirmation. Some so-called purely scientific utilities have already been suggested. They are familiar to the scientist although often they are used quite vaguely. In the forefront of present thought are the utilities of increased simplicity, addition of new informational content, increased inner connection of the parts of the general theory, and the explaining of observational reports and empirical laws. And indeed, some progress has been made in giving these utilities a precise formulation. This general sort of attempt, as the debate between Clifford and James shows, takes one into the area called by some the "ethics of belief." (As the paper has so far been focusing upon the notion of utilities and their relation to action and the ethics of belief it may be well to warn at this point in the discussion that the notion of a theory's being true or false is not in question. The problem concerns only the evidence a scientist uses to decide if a theory is true, that is, how he confirms the assertion that an hypothesis is true.)

Much still needs to be done technically before the "purely scientific" utilities approach can be presented in a fashion adequate to the accepted procedures of science, but even at this stage of its development one may ask how these requirements could be justified as utilities leading to truth. This is a relevant and important question for with the addition of utilities to confirmation theory the spector is raised of a theory's turning out to be highly confirmed merely because of the great utility which would be attached to it if it were true when, in point of fact, it actually has little support. The danger of this approach has been evident ever since James argued that even if a person knew there were no god it would still be better to believe that there were, for more good consequences would follow from the latter belief. Furthermore, there are metaphysical questions raised by some of the purely scientific utilities, for example, how do we know that the universe is such that it is more likely to be explained truly by simpler rather than more complex theories?[2]

If the above has been successful in indicating some of the problems now being discussed in the area of confirmation of scientific hypothesis there should be little need to expand greatly on the possible implications for the Christian. One of the more difficult obstacles the Christian apologist has faced in recent times has been that of dealing with the rejoinder, "Your religion involves value judgments unsupported by rational evidence, while science deals with facts and with theories supported (confirmed) by those facts." Present research indicates that, on the contrary, all is not so simple in science itself, that perhaps there has been an "extra-scientific" or even "non-rational" element of value hidden in science all along and only now is this fact being brought to light. (Note that the word "non-rational" should, when used in this context, be distinguished from the word "irrational." This point is also important if one is to avoid begging the question as to the actual status of the confirmation procedures presently in use in science.) And in the event that this element should turn out to be fully rational—which now appears unlikely—that rationality has, up to now, been taken only on faith, for it may be said that it was not *known* that science was fully rational without remainder. It should also be emphasized that the discussion of utilities and values involved in confirmation is coming from within science and philosophy

of science and not from people particularly sympathetic with Christian theism. This gives, I believe, the line of investigation being discussed in this paper an advantage over the older, vaguer, and somewhat suspect accusations that having (or practicing) a science involves a value judgment, or that the scientist as an individual cannot escape himself, but is a mass of predilections.

Such an introduction as the one being given here should warn that besides the theories already discussed there are other approaches which have been suggested as to the proper rational reconstruction of the confirmation procedures used by science. Two others will be mentioned by way of example. The first is similar to the procedure involved in the notion of a crucial experiment. At the risk of oversimplification one might describe this view of Karl Popper as denying that an hypothesis is ever confirmed to any degree whatever, rather it is merely tested and rejected if it fails the test. Popper's view has been criticised extensively, especially on the grounds that having passed a series of tests is taken, in practice, as having lent inductive confirmation to the future correctness of an hypothesis. For example, A. J. Ayer has nicely expressed this by asking: "Why reject an hypothesis merely because it has been falsified once–perhaps this is just an infantile disease which many good hypotheses catch early in their lives, but to which they are immune from then on?" It may be though that Popper's account is descriptive of what has actually occurred many times in the history of science. Yet notwithstanding the fact that what has actually occurred in the history of science is both intrinsically interesting and suggestive of methods for rational reconstruction as well as of possible use for apologetics,[3] those working in this field are more concerned with the problem of discovering a rationally defensible confirmation theory. For this reason, and also because of the kind of criticism already indicated, Popper's theory will not be discussed further at this time.

On the other side of the ocean Toulmin has argued that there is no such thing as confirmation of a theory in scientific practice at all, that what look like experiments intending to confirm a theory are really only attempts to determine the scope of the theory. This suggestion seems to run the risk of reducing all theories to *ad hoc* ones, since they would not really be taken as projecting beyond the evidence already piled up for them. One would have to wait until the theory were tested in this new area before he could say that the theory applied. This raises an even deeper problem, for without the confirming ability of induction how could one decide of any experiment whatever, other than the one used in the initial test, that it was not actually an extension of the scope of the theory? In such a case then a theory could never be used to predict at all because a prediction would always be an extension of the scope of a theory.

There is one more major alternative which will be presented in this paper. Although still in a state of development it appears to offer several advantages. It follows the inductive approach espoused by Reichenbach and makes use of a theorem from statistics known as Bayes' Theorem. The use of the theorem of Bayes is not unusual in this connection. As applied here the probability—written $P(H \,\&\, E, T)$ in quasi set theoretic notation—that a given hypothesis (of a certain kind), H, with a certain kind of confirming evidence, E, is a member of the class of true hypothesis, T, is

$$\frac{P(H,T) \times P(H \,\&\, T,E)}{P(H,T) \times P(H \,\&\, T,E) \quad P(H,\overline{T}) \times P(H \,\&\, \overline{T},E)}$$

The first item of importance is $P(H \,\&\, \overline{T},E)$, the probability that *un*true hypotheses (of the same sort) will have this kind of confirming evidence, which is, of course, an inverse measure of the confirmatory value of the evidence. The term, $P(H \,\&\, T,E)$, can be determined by deduction alone and has a value of 1 while $P(H,\overline{T})$ is a logically determinable function of $P(H,T)$ –since $\overline{T}$ is the complement of T–and hence is determined as soon as $P(H,T)$ is determined.

The problem in applying Bayes' Theorem which has been an objection to its use is the term, $P(H,T)$, called variously "the antecedent, or prior probability" that an hypothesis of this sort is true. It is the probability of the truth of an hypothesis before any confirmatory experiments or observations are made. The frightening name, "prior probability" has caused some writers either to go into hysteria or to exhibit symptoms of withdrawal in the presence of Bayes' Theorem when it is used in this connection. One need not have this reaction, however, for several useful suggestions have been made for handling prior probabilities. Interest in the use of this theorem comes from the suggestion that the prior probabilities be determined by simple enumerative induction, a procedure already accepted in scientific methodology. In practice, one merely examines the history of sicience inductively to see which kinds of hypotheses have been successful in the past. Quite a list of these prior probabilities has been drawn up and they can be classified into several categories. A presentation of this list would lead too far afield, especially since it is the principle of justifying items on the list by induction that is of interest here; thus only three somewhat controversial examples from the category of the origin of the hypothesis will be mentioned: the circumstances of publication, e.g., where it is published; the education of the author of the hypothesis; and his established competence, or authority, in the field. It should be noted that in applying this suggestion to use simple induction in the establishing of prior probabilities one does not have to obtain a high probability, it is only necessary that it be greater than zero, for any non-zero probability can finally be swamped out by piling up higher and higher confirming evidence (i.e., $P(H \,\&\, \overline{T},E)$ will become smaller and smaller).

Implications for the Christian

The last proposed theory, that Bayes' Theorem be applied inductively, has several advantages. It is a fruitful theory in that inductive investigation can suggest new characteristics of true theories. It is a powerful theory for it can incorporate many, if not all, of the valid insights of the other theories (by inductively

establishing their soundness). And not the least of its advantages is that it is an objective theory. When determining scientific utilities it does not depend upon beliefs, bias, or prejudices whether they be aesthetic, social, or whatever; rather it allows the proposed utilities to be tested. This latter characteristic of the theory is important not only because it provides a way of preserving science's ability to discover truth, but also because it provides a possible protection for the practicing scientist who is a Christian.[4] Admittedly it is rather difficult today for a citizen of the Western world to believe that there is a real danger of a bias being built into science which could be used to bar an hypothesis suggested by a Christian from consideration by science. There is, however, enough evidence from the history of science in the Soviet Union to indicate that this danger is not completely imaginary.

Two points must be made at this juncture. The first is the general point that there is more work to be done on all the theories that have been presented before definitive conclusions can be drawn from them. The second point applies more specifically to the inductive theory and its relevance to the Christian: The use of Bayes' Theorem is based upon induction and induction is very much in question in philosophical circles today. It is not enough of a defence of induction to say that science itself is based upon induction for this would not defend the position, but would merely show that an attack upon induction is an attack upon science itself.[5] The situation today is worse than that indicated by a mere questioning of induction. There is a very prevalent attitude toward induction which if it were to gain dominance would undermine the objectivity of induction. Indeed, it is in reality an attack upon the objectivity of induction and is all the more pernicious for it is presented in the guise of a defence of inductive reasoning.

Two forms of this position have so far appeared: The earlier form is in the tradition of linguisticism, e.g., A. J. Ayer (*The Problem of Knowledge*—Penquin Bks. —pp. 71-75), Paul Edwards ("Russell's Doubts About Induction" *Mind* LVIII (1949)), and P. F. Strawson (*Introduction to Logical Theory*—London), and it merely asserts more or less blatantly that what we mean when we use the word "rational" is, among other things, that the person follow, when appropiate, inductive patterns of reasoning. The later and more disguised—but no less cavalier—form has been best expressed by J. Katz in *The Problem of Induction and its Solution* (Chicago) and can probably be most easily understood as a modern form of psychologism, especially since it tries to appeal to Hume's *Treatise*. This latter form seems to be based upon a principle something like the following: (1) "A person cannot be blamed for what he *cannot* help doing." (This principle need not be debated here.) To it they add a premise and draw a conclusion: "Since (2) a person cannot help but reason inductively (3) the proposition which is the result of inductive reasoning is therefore justified." This latter is a *non sequitur* and would be of little concern except that it is rarely stated explicity; it is only tacitly accepted. Even granting the second premise, it would only follow that a person ought not to be blamed for holding the inductive proposition; it does not follow that what is expressed by the proposition is true, that one has been shown to have adequate evidence for it, or that what has been asserted by the proposition has been justified. (Again it may be well to point out that the issue here is not whether induction is justified, but rather what would count as a valid justification.)

It is as if one were to argue, in the year 1984 after Orwell's "double-think" had obtained complete psychological success in making everyone so that they could not help but believe that grass is pink, that therefore the proposition, grass is pink, is justified. This illustration is not as far fetched as it might seem, for both forms of these so-called justifications are really invalid arguments from authority, in the one case from the authority of the *language* we use, in the other from the authority of the *users* of the language—or as the positivists used to say, "of the scientists of our culture circle." That this is an argument from authority can easily be seen from the fact that many human beings do not reason inductively in the appropriate circumstances, rather they reason invalidly or fallaciously. Yet this does not bother the proponents of the view; they have already picked as the standard those who reason as they do. It is not so far then from this position to Orwell's *1984*. It is only accidental to the position that what is now believed is valid. (One cannot help wondering if these sorts of arguments do not indicate a worship of man, for now man is the standard of rationality, rather than man being under a standard of rationality.)

This discussion of justification may seem to the reader to be about a rather recondite philosophical battle deep down in the darkness of philosophical induction, a long way from the bright and fair world of practicing science, but it reveals, I think, a well entrenched tendency in modern thought which is of potential danger even to the practicing scientist who is a Christian. For if these authorities of our culture circle can decree by *argumentum ad populum* which inductive, or anti-inductive, rule is "rational" they can just as easily (and just as subtly) decree what utilities are "rational" and hence what hypothesis of science are even worth taking seriously. And since the Christian is in the minority, both in the world and in the West, it would not be surprising if these authorities were at some future date to determine grounds of confirmation, which would leave the Christian theist in the wrong *a priori*. They might even be able, by such means, to delude him into rejecting elements of his own position which actually have as much going for them.

This paper has considered confirmation theory in the sciences by attempting to sketch in outline several contemporary accounts of the subject. Most of the time has been spent in this presentation, but enough has been said in the way of critical comment to indicate that even though these accounts are still very much in the works they contain possible dangers. It is for

this reason that I would hope that Christians will become interested and work in this area not only for scholarly and apologetic purposes, but also in order to ascertain how the criteria for confirmation are to be established so that the Christian who labors in science may avoid thinking that his science must, in some particular case, make him question special revelation and so that he may more properly perform his task of bringing glory to the Creator in the investigation of His revelation in nature.

FOOTNOTES

[1]Having raised the subject of game theory, I cannot refrain from remarking in passing that, upon careful reading, Pascal's "wager" does not appear to be as trivial as some later presentations have made it out to be. It is really quite in keeping with the tenor of modern philosophy of science, for one of Pascal's major weapons is the consideration of the risks involved in assuming that the world is a certain way.

[2]Science actually does use simplicity, and similar criteria, but one would like better grounds for accepting them than those just given. The inductive approach from the history of science which will be discussed later seems to be the best proposal so far given for avoiding these metaphysical problems; however, even here more careful investigation is needed to make sure that these problems do not arise again at some deeper level.

[3]It might be both interesting and profitable if an examination were made of the history of science in the light of present work in confirmation theory, especially of the infamous conflicts between the "church" and science. For example, it is now conceded that Galileo did not understand the experimental method (see *Galileo Galilei* by Ludovico Geymonat (N.Y., 1965), and that the Copernican system was mathematically equivalent to the Ptolemaic one. Also the biological, as distinct from the philosophical, theory of evolution might also be amenable to such an analysis in terms of confirmation. One wonders how much of the *historical* content of its propositions is actually confirmed by the expermental evidence available. Since contemporary phenomena provided the only empirical data it might be discovered that the only confirmed propositions of biological evolution are those which predict present day biological phenomena.

[4]There may be some Christians who would hesitate in accepting this protection from the fear that the position's being inductive places it too much in the tradition of empiricism. What is the origin of this fear and is it well founded? There are two pressures acting upon the Western Christian today which tend to influence him against an inductive approach. One is idealism from India which, coming through European philosophers such as Hegel, affected irrevocably the great "Christian idealists". The idealists' influence over Christian thought is still almost overwhelming especially their ideas of evidence, of logic, of infinity, and of system. This influence still exists even among many Christians who reject idealism as a system. (Interestingly enough, this idealism has had through Hegel an historically verifiable influence on pragmatism, the traditionally great enemy of Christian idealism. Indeed pragmatism has actually taken up some of its doctrines, e.g., the coherence definition of truth.)

The other pressure comes from ancient Greek rationalism which even began to influence the church soon after Apostolic times and whose view that man can in some way come to know, *a priori*, almost anything, including the material world, appears again and again, whether in Descartes or Leibnitz, Galileo or Eddington. When, however, the Christian realizes that these pressures are acting upon him and becomes aware that their origins are pagan he should not then rule out the inductive approach, *a priori*, but should judge it on its own merits, on the adequacy of its account of confirmation.

[5]Making this point does have another use, though, which is of some value; it indicates that an inductive analysis of confirmation drags no new metaphysical assumptions into science.

FROM THE CREATION OF THE WORLD

BY J. PHILIP McLAREN*

Christ dealt with the skeptic of his day who questioned his authority by sending them to the Scripture in which they were supposed to be expert. The Apostle Paul sent the skeptics he dealt with to the creation as a revelation of God. Today the Christian man of science must also send the modern skeptic to creation as a revelation of God if he is to present God adequately to the modern man of science. Thus we must be ready at all times "to give a reason *for the hope within us."*

They were learned men. After years of study they were sure they had all the answers. The Scripture was clear, Israel would have a king, but not this young upstart with no degrees and a questionable background. And thus it was that in the heat of discussion that morning, that the doctors of the Law demanded of Jesus, "Show us some sign that would lend authority to your statements."

Jesus responded to these men, "Look to the Scriptures, for in them ye think ye have eternal life." Christ was telling these men that in the very subjects in which they were expert they had the signs they sought. Yet these men were blinded and unable to see the truth about the Son of God.

The situation has not greatly changed. Today the doctors of physical and biological law come to us asking, "Show us some sign that God is."

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To the modern skeptic the Apostle Paul answers,

> Since the beginning of the world the invisible attributes of God, e.g. His eternal power and divinity, have been plainly discernable through things which He has made and which are commonly seen and known, thus leaving these men without a rag of excuse. These men deliberately forfeited the truth of God and accepted a lie, paying homage and giving service to the creature instead of the Creator who alone is worthy to be worshiped forever and ever, amen. (Romans 1:20 and 25 Phillips)

It is interesting that Paul who so frequently dealt with the intellectuals of his day did not in this passage send these men to Scripture. Since they did not accept Scripture it is apparent that Paul could not use as proof that which was not accepted as valid by both parties. The people Paul was dealing with did not accept Scripture as truth; thus it was useless for Paul to attempt to lead them to God by Scripture alone. It became necessary, therefore, for Paul to use revelation other than Scripture with which these people were familiar. In the first chapter of Romans, Paul explains to us that God has revealed Himself to man in at least three ways: (1) by the prophets in Holy Scripture, vs. 2; (2) by His Son Jesus Christ, declared to be the Son of God with power, vs. 4; and (3) by the creation of the universe, vs. 18-25.

The Greeks of Paul's day did not accept Scripture as fact. They knew very little about Jesus except perhaps that He was a rebel Jewish leader. But these men were extremely conscious of the universe around them. Three hundred years before Christ, Eratosthenes had measured the circumference of the earth to within one percent of its present value. Aristotle had correctly explained the phases of the moon, and many measurements of the celestial bodies had been made. The length of the year had been established to within a few seconds of its present value. Without a doubt the Greeks had made great strides in describing the universe. Mathematics and reason were highly exalted in Greek philosophy. These advances suggest that even at this early period of history the intellectuals were more interested in those things which could be seen, touched, smelled, heard, measured, and absorbed by the senses of man. In fact Aristotle claimed that all knowledge that man could receive had to be received through the senses. This left little room for revelation.

Paul, himself, might have been caught up in this idea that all which may be known must be absorbed through the senses, had he not met the Son of God personally on the road to Damascus. It was here by direct revelation that Paul was introduced to the Creator as a person . . . Jesus Christ. From that point in Paul's life he was able to place Scripture, Christ, and Creation in proper perspective.

The universe was not the only interest of the men of Greece. Paul referred to the men of Athens as "extremely religious," in that they had made altars to innumerable gods. (Acts 17:22 Phillips) In speaking to these men Paul mentioned that he brought the message of the UNKNOWN GOD which they worshiped in ignorance. Even though the Greeks exalted reason highly, they recognized a higher power who ruled the universe, and they longed to know Him. Philo, a Greek philosopher, writing several hundred years before Christ pleaded, "Oh, for a word from God that we might know Him!" It seems in answer to this plea that the Apostle John opens his book stating, "In the beginning was the WORD, and the WORD was with God and the WORD was God." (John 1:1 A.V.)

John hastens on to explain, "All creation took place through Him and none took place without Him." (John 1:3 Phillips) Speaking of Christ then, John claims that Jesus took an active role in creation. This claim is born out by the fact that Scripture quotes God as using the collective pronoun *us* in relation to the work of creating man; "Let us make man in our own image." (Gen. 1:26 A.V.) Furthermore, Genesis explains that it was the Spirit of God which brooded over the formless primeval world. (Gen. 1:2) Since all three persons of the Godhead were involved in creation, it may be safely concluded that creation was then the net result of God's handiwork, meaning all three persons working together.

In teaching school, teachers soon discover that students reveal a great deal about themselves through the pictures they create. In fact, creativity provides an excellent help in the analysis of a student's personality. The Bible tells us that the same is true of God. Going back to Paul's condemnation of the athiests in Romans chapter one, Paul informs us that God's very attributes of infinity, divinity, and power can be seen in creation. Since Scripture is true, we must conclude that creation is a direct revelation of God. Not that creation is God, but rather, that in the greatness of what He has created, man can learn of God.

The subject area dealing most with the things and the laws that God has created is science. Essentially science deals with matter, energy, and life, and the laws which govern them. In this definition of science we find that it is really a branch of Theology in that it studies one of God's revelations in a detailed manner. Unfortunately it is frequently studied as an end in itself rather than as a means to reaching and knowing more about God. Our schools and seminaries spend much more of their time studying theology and Biblical Literature, for it is true that these are direct revelations of God, but what about God's first revelation? I am afraid that we evangelicals are failing the world because we are attempting to use a part of God's revelation which the world will not accept as valid authority, namely, the Bible alone. We have at our disposal all of God's creation to draw upon in leading men to Christ. We thus fail mankind because we do not use God's first revelation in showing who God is and His relationship to man.

Many Christians are afraid of scientists because they feel that scientists are out to do away with God. This is not the case. First there are many born again men of science. Those men of science who choose to reject God do so for various reasons. Some reject God because in their materialistic scheme of things there is no reason for God. Others reject Him simply because they do not understand His attributes. Many reject

Him because Christians have not taken the trouble to accurately study and explain scientific data in the light of Scripture. This latter task demands men who are competent both in Scripture and science.

Scientists are not closed to the Gospel. In fact very few people may truly be said to be closed to the Gospel. It is often the method we use that turns people away from the Gospel. The Gospel is a modern message able to meet modern needs. It is as applicable today as it was on the first day of creation. It is we who have allowed ourselves to become outdated in our presentation of that Gospel. God's love has not changed anymore than has man, but the task of making others see His love has changed greatly since the time of Christ.

There are several things which might be done to help bring our message of hope up to date. First Christians must keep themselves up to date on world affairs. We must be alert to happenings in politics, world affairs, economics and certainly science, and the fine arts. We must be ready to meet any man on his own level. Paul said that he was all things to all men that by all means he might win some. Paul could talk with ease to any man in the middle eastern world of his day. I believe that it is equally important for the Christian of today to likewise be able to talk at ease on a large number of topics.

Second, that we as Christians be ready at all times to give a well thought out reason for the hope that lies within us. This is difficult for a person to do unless he has a living personal relationship with Christ. But for those of us who know Him, the task should not be that hard.

Third, that we young people who must minister to tomorrow's world prepare ourselves by fervently studying all three of God's revelations. That we tackle the problem of science as a revelation of God as earnestly as we have tackled Scripture and the life of Christ. Indeed that we give ourselves the background necessary to allow ourselves to use all three revelations. God has not intended to confine us in our presentation of the Gospel. He has meant for us to use every possible presentation which might win even one man. In our efforts we have often directed our work towards the down-and-outer, but we have had little concern for the up-and-outer, the person with high intellect and good education. We must remember that Christ died for him too.

The skeptic of today believes in a materialistic "law" which governs the universe. This is not too far from the unknown god of the Athenians. The real test for the church is the message we bring to the world about this natural "law". We can reveal that this controlling factor is God, Himself, or through our lack of preparation we can allow man to reject God for want of a clear explanation. We can show that it is God who guides and rules this universe. It is He who made and fills the infinite space beyond our own island universe. It is God who laid plans for the structure of the atom, and who holds the eternal destiny of man. Likewise, it is God who loved man and came to earth for the express purpose of giving man a new life, a life that would never end. Only an eternally powerful God could do that. (Col. 1:15-20)

In closing, I cannot overlook one of the most important facets of our ministry . . . the changed life. Paul tells us that when a man takes Christ to be the ruler of his life, he becomes a new creation. The very presence of this new life within the believer is proof enough for the existence of God. Dr. Ralph Wyckoff of the Department of Physics of the University of Arizona made the following statement at a convention of scientists in 1967 at the University of Notre Dame, South Bend, Indiana:

> There have, however, always been men of high and disciplined spirituality who have insisted on their direct experience of something greater than themselves. Their conviction of the reality of a spiritual life apart from and transcending the life of the body may not lend itself to scientific proof or disproof; nevertheless the remarkable transformation in personality seen in those who rightfully lay claim to such experience is as objective as tomorrow's sunrise. Millions of lesser men draw strength from the contacts they can make through prayer and meditation with this aspect of the inner life.

The world is seeking a Word from God. We have that word revealed to us in Scripture, in Christ, and in creation. Can we continue to deprive the world of knowing God through the things He has made?

Birth Control and the Negro Woman

And now across America, black people are raising even deeper queries: Is birth control just a "white man's plot" to "contain" the black population? Is it just another scheme to cut back on welfare aid or still another method of "keeping the black man down?"

The questions come mainly from the black ghetto (middle-class Negroes have accepted contraceptive practices well), and they come not only because of concern about "containment" and welfare cutbacks, but also because of a very prevalent idea that birth control actually means "black genocide."

—Mary Smith in *Ebony*
Printed in *His*, June 1968

Manners, Beards, and the Bill of Rights

But what informality today, is too often being made to stand for is the right to ask indiscreet questions, exploit social situations, put people on the spot, be intrusive from having an "outgoing nature." If today's nearest approach to formality is a worship of chic, of status, of in-ness, of a this-morning's knowledge of What's Done, the great sin of informality is a total indifference to what's not done, or at any rate shouldn't be. Rather be stared at in one's grandfather's green-from-age frock coat than in Hollywood sit above the salt in a sincere suit.

—Louis Kronenberger in *The Atlantic*
Printed in *His*, April 1968

BEHAVIORAL SCIENCE RESEARCH ON THE NATURE OF GLOSSOLALIA

E. MANSELL PATTISON, M.D.*

Glossolalia is an unusual pattern of aberrant speech. A review of the current research data from the work in anthropology, sociology, linguistics, psychology, psycholinguistics, and psychoacoustics provide a new source of data for examining the phenomena of glossolalia. It is a modification of the conscious connection between inner speech and outer speech, that may serve various psychodynamic functions. The meaning and function of glossolalia is closely tied to sociocultural context. The historic theological debates concerning glossolalia centered on etiology—divine or devilish. Such debate is irrelevant. Glossolalia per se *is not a spiritual phenomena, but it may be a consequence of deep and meaningful spiritual exercise.*

The widespread re-occurence of the practice of glossolalia, or speaking in tongues, in the United States in the past two decades has evoked widespread theological debate and piqued public interest. A spate of books on the subject have appeared, but almost all by theologians devoted to either "proving" or "disproving" the spiritual claims of glossolalists.[6,38,40,47,89,92,95] Their analysis of glossolalia is primarily confined to questions of biblical exegesis or theological interpretation. What behavioral science research they have quoted is almost entirely the few studies conducted at the beginning of the twentieth century. Thus, the nature of glossolalia has remained a topic of inconclusive debate.

Recently, however, glossolalia has attracted the interest of a variety of behavioral scientists. Recourse to this new data affords important information on the nature of glossolalia which should prove helpful in formulating a systematic scientific theory of this phenomena, as well as providing a more adequate basis for theological evaluation of it.

This paper will briefly review the variety of experimental studies which have been conducted on glossolalia, summarize our own research data on glossolalia, present a theoretical framework for the phenomena, and conclude with a commentary on possible theological implications of this data.

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I. History of Glossolalia in Western Religion:

The Christian tradition of tongue speaking antedates the New Testament Apostles. Glossolalia had been practiced for many years along with other ecstatic phenomena by the prophets of the ancient religions of the Near East. Prophets and mystics of Assyria, Egypt, and Greece reportedly spoke in foreign tongues during states of ecstasy and uttered unintelligible phrases said to be revelations from the gods. The Hebrew prophets appear to have similarly engaged in ecstatic states and practiced glossolalia.[4,39,66] So the practice was not unknown, in all probability, to the early Christian Apostles.[18]

In common with the religious scene today, there was ardent disagreement about the meaning of glossolalia among the early Christians. The onlooking crowd at the Pentecost experience recorded in the Acts of the Apostles thought the group of disciples drunk, whereas the Apostle Peter asserted that they had been speaking a new language. In subsequent debate during the next two centuries five different positions on glossolalia were taken by various Christians: 1) that the spirit of God was speaking through the person, i.e. God possession, 2) that the devil was speaking through the person, i.e. Demon possession, 3)that the person was given the supernatural ability to speak in a natural language, 4) that the person was given the supernatural ability to speak in a supernatural language, and 5) that the person was speaking in an oracular or cryptic manner which was a particular manifestation of a spiritual state.

Although the Apostle Paul warned against the enthusiastic excesses of first century glossolalists, the issue remained unresolved. But it came to a head over the practices and spiritual claims of second century followers of Montanus. Church councils then officially proscribed the practice of glossolalia. From then on until the 16th century glossolalia appeared sporadically, often in association with episodes of trances, hysterical states, and automatisms. In his classic history, R. A. Knox describes all such phenomena as types of "ecstatic" or "enthusiastic" behavior.[50] During medieval

times this was almost invariably taken to be evidence of demon possession.

With the advent of the pietistic revivals of the 17th and 18th centuries a new interpretation took hold. Dissatisfied with the intellectual rational concepts of religion, the pietists looked for direct human evidence for the existence and activity of God. Thus seizures, trances, automatistic behavior, and glossolalia were now taken to be manifestations of possession by God. Small sects sprang up which practiced a wide variety of such "enthusiastic" behavior. Huguenot children in 17th century France prophesied and allegedly spoke in foreign dialects. In the 18th century, Quakers and Methodists practiced glossolalia, and the 19th century saw the Irvingite movement in England.

In America, the "enthusiastic" movement spawned the Shakers. Glossolalia was practiced by the early Mormons, and a variety of indigenous sects took up and perpetuated glossolalia along with other more dramatic activities such as snake handling, fire eating, poison swallowing, and faith healing. Around 1900 came the beginning of the Pentecostal movement which became a major religious movement, and now is one of the most rapidly growing religious groups in America. What has attracted interest in the past ten years is glossolalia as practiced by members of the staid mainline denominations like the Episcopalians, Lutherans, and Presbyterians.

In reviewing these "enthusiastic" groups one notes a lack of uniformity of practice. Some sects practiced a whole gamut of trance states, automatisms, and hysterical symptomatology. While other sects practiced only one specific form of "enthusiasm," such as the quivering of the Shakers, or the glossolalia of the Irvingites. Likewise, glossolalia may be associated with full scale trance states or may be practiced by individuals during states of full consciousness with no other manifest changes in mien or behavior.

In the United States today, glossolalia is practiced by over two million people. Among the lower social classes, particularly in the primitive remote regions of the South, glossolalia is only part of a full range of snake handling, convulsionary, hysterical behavior. On the other hand, among urban middle and upper-class churches, glossolalia is practiced as an isolated phenomenon by physicians, college professors, captains of industry, even psychologists, who sit in full composure and dignity while speaking in tongues!

II. Glossolalia in Non-Western Societies:

Enthusiastic, ecstatic, mystic, possession, trance, and other kindred phenomena have long been of interest to anthropologists. Cross-cultural reviews of ethnographic data on glossolalia in particular have been published by L. C. May,[65] Jennings,[44] M. Eliade,[26] among others.[10,11,12,33,68] The practice was known in ancient India and China, and ethnographies describe glossolalia in almost every area of the world. May concludes: "As a rule, speaking-in-tongues and kindred phenomena are confined to those areas where there is spirit possession and where inspirational shamans hold forth. Glossolalia can be and often is the result of spirit-induced ecstasy making it possible for the inspirational shaman to cure, exorcize, and prophesy . . . speaking-in-tongues is widespread and very ancient. Indeed, it is probable that as long as man has had divination, curing, sorcery, and propitiation of spirits, he has had glossolalia."

In a subsequent re-analysis of the data, anthropologist Erika Bourguignon[10,11,12] notes that, as with Christian glossolalia, primitive societies practice glossolalia in a variety of forms and ascribe a variety of meanings to it. In some societies it is a concomitant of trance states, in other it is an isolated behavior. Likewise, it is variously interpreted as a possession by god or devil, the ability to speak in a foreign tongue, or the special gift of a supernatural tongue.

Interestingly, in both Christian and non-Western religions there is often an "interpreter" who volunteers from the audience to either translate the message into human language or verify that the strange tongue is actually some foreign language known to the interpreter. This has been termed "ermenoglossia." Investigation of the phenomenon has never verified the claim to speak in an actual foreign language unknown to the glossolalist. The glossolalist may use phonemes or fragments of a foreign language with which he may have had forgotten contact. Or if the divine message is to be interpreted, the "interpretation" has been found to actually provide consensual validation for a specific social conflict facing the group. For example, in the cargo cult movements the "interpreter" tells the "unconverted" in the audience what the glossolalia of the charismatic leader means. The interpretation validates the "rightness" of the cargo cult to the unbelieving and also demonstrates that the strange language is something that one can understand after "initiation."[107] In another study of an American millenarian cult, Festinger et al[27] found that the "audience" of cultic believers interpreted spiritual messages according to pre-set expectations of what they needed to hear in order to maintain their "congnitive coherence" in a setting where reality factors were stretching the credibility of their waiting for the soon-to-appear coming of Christ.

Linguistic comparisons of glossolalia and the "interpretation" reveal that the interpretation is not a translation. For example, I have often observed a brief glossolalic utterance translated into a whole paragraph of English. Or I have heard the same glossolalic phrases repeated by the same glossolalist in different services, but each time the identical glossolalic utterances are given a different translation. As noted above, the observational data which is available strongly suggests that the testimonials to the fact that the glossolalist has spoken in a foreign language unknown to him, does not represent a linguistic problem, but rather a phenomena of audience social psychology resulting in perceptual distortion.

There is no direct research on this aspect of glossolalia so far as I am aware. However, the now classical work on perceptual process by men like Solomon Asch and Leon Festinger indicate the crucial influence which

social expectation and the need for cognitive coherence play in the ordering and interpretation of our perceptions. Thus, we can at least suggest that the reports of audience observers "verifying" the foreign language of glossolalists is not an indication of either malingering or pretense, but an honest report of *subjective* auditory perception, which of course may be quite different from the objective linguistic patterns spoken.

This brief review of an extensive literature on both Christian and non-Christian sources barely indicates the wealth of evidence that glossolalia is an ancient and widespread phenomena. The phenomena of glossolalia, per se, has appeared in a variety of circumstances and has been ascribed a variety of meanings. Although the social meaning of the phenomena may vary, the behavior itself is remarkable for its ubiquity. The "strangeness" of tongues speaking thus can only be considered an artifact of cultural lack of awareness, as Jennings[44] has well decribed.

III. Socio-Cultural Aspects of Glossolalia:

The social function, and concomitantly the psychological significance, of glossolalia appears to vary with the particular social movement of which glossolalia is a part. Several examples will be given.

R. A. Knox[50] recounts the occurrence of glossolalia in the 18th and 19th century in traditional Christian groups where the experiential component of religious experience had been replaced by a chiefly intellectual religious practice. In this circumstance, the glossolalia was a means to re-establish an experiential base for religious faith. Concomitantly, this was during the age of an enlightenment when rationalistic criticism of Christian faith was in vogue. Thus the glossolalia was a "proof" of the existence of God, and a validation of the believer's faith.

In the cargo cults of Melanesia, the glossolalia likewise verifies the charismatic leader's claim to authority.[107] This seems to be a major social function of glossolalia as practiced by many shamans and priests as reported in many ethnographies.[10,26,48,68]

In the staid main-line churches of America, the function of glossolalia seems to fit more into a means of protest. It can also be seen as a recurrent infusion of experiential religion into denominations that have become mainly intellectual enterprises.[69,78]

By far the major practice of glossolalia, and all enthusiastic behavior, has been by the Pentecostal and Holiness groups. These groups are characterized by their marginal socio-economic position in society. As shown in a number of studies, the ecstatic behavior is both an outlet for repressed conflicts, and a means of justifying one's unique position in society as a possessor of truth and righteousness.[8,9,41,45,56]

The last variant, is the function of glossolalia in middle-class Pentecostal groups who do not occupy a marginal social position. In this situation, Gerlach et al suggest that glossolalia functions as a "rite de passage" —a technique of recruitment, a method of organization, and a means of demonstration of effect of behavioral change.[33] Here, the function of glossolalia is not to serve personal needs, or as mediating mechanism in relation to the larger society, but as a mechanism for nurturance of the social movement itself.[17,33,75,101]

IV. Personality and Psychopathology of the Glossolalist:

A major issue concerns the personality of the glossolalist. Is glossolalia a symptom of psychopathology? Are certain personality traits associated with glossolalia? The controversy was present in the early Christian church, debated throughout subsequent centuries, and remains relatively unresolved in most contemporary discussions. However, after reviewing the current data, I shall suggest that the contradictory claims and reports are an artifact of confusion between populations samples and socio-cultural variables.

Knox[50] has pointed out that the 18th and 19th century occurrences of glossolalia were hailed by adherents as a sign of spiritual and emotional strength and health, while religious and non-religious skeptics alike interpreted the phenomena as a sign of emotional instability or a manifestation of emotional illness.

In the early part of the 20th century several psychological and psychiatric studies of glossolalists were reported. Psychological studies by Cutten,[91] Lombard,[60] and Mosiman[70] concluded that glossolalists were probably emotionally unstable, and that glossolalia was a regressive pathological experience.

Several clinical psychiatric studies were also published.[63] Maeder[64] reported a case of glossolalia in a paranoid schizophrenic, Schjelderup[85] reported a case of tongue speaking in a neurotic during psychoanalysis, and Jean Bobon[7] reported three cases occuring during the course of psychosis. These reports linked glossolalia to psychopathologic conflicts.

Other early reports concerning glossolalia in the context of more normal life situations, including a case reported by Oskar Pfister,[77] one by Theodore Fleur-reported by Oskar Pfister,[77] one by Theodore Flourney,[30] and a discussion by Le Baron.[59] Carl Jung[46] vasion into consciousness of contents from the deepest levels of the collective unconscious as a positive preparation for integration of personality.

In our contemporary era the clinical reports have been based on larger and more diverse samples. In their respective books, William Sargant[84] and Jerome Frank[32] allude to glossolalia as a form of regressive abreactive behavior. Weston LaBarre[54] reported an extensive case history of southern snake-handlers who also practiced glossolalia. He concluded that these were examples of externalization of characterological conflict.

A series of more systematic reports have tended to support the view that glossolalia is a reflection of personality instability. Wood[106] administered Rorschach protocols to a group of southern Pentecostals and concluded that they had unstable personality structures. Lapsley and Simpson,[58] on the basis of interviews, concluded that glossolalia was a dissociative reaction occurring in persons with truncated personality development. Finch[28] comments on a case of glossolalia in

a psychotic reaction. Klaus Thomas,[96] in Berlin, found that all the glossolalists he saw in the suicide prevention clinic were either pre-schizoprenic or had experienced psychotic episodes.

In South Africa, Vivier[98] extensively examined glossolalists and a comparable group of controls. He found more histories of developmental conflict and life disturbances among glossolalists. Yet he concluded that personality-wise the glossolalists were not significantly different from the control group. Comparable conclusions were reached by Kildahl and Qualben[49] in a study in Brooklyn.

Closer attention to sample biases was made by Paul Morentz,[69] a psychiatrist in Berkeley. He noted that glossolalia tends to assume a different meaning in Pentecostal churches where it is part of the expected religious ritual, in comparison to its appearance among staid main-line churches where it is usually considered deviant behavior. Based on his interviews of 60 such latter glossolalists, Morentz found six dominant personality patterns: 1) hostility to authority, 2) the wish to compensate for feelings of inadequacy, 3) the wish to rationalize feelings of isolation, 4) the wish to dominate, 5) strong feelings of dependency and suggestibility, and 6) wish for certainty.

The two most careful and sophisticated studies yet conducted have failed to support the prior emphasis on psychopathology. Stanley Plog[78] in Los Angeles, on the basis of an extensive battery of tests has not found any typical personality patterns nor found a higher than expected rate of psychopathology. Gerlach and his associates,[33] in Minnesota, on the basis of several population samples find no evidence of unusual psychopathology among Pentecostal adherents. They conclude: "Most Pentecostals appear to be normally successful members of their families and communities . . . family relationships are more harmonious than normal in our society when all family members have had the full Pentecostal experience . . . most Pentecostals, though they are different in some behaviors are not 'sick' . . . they function effectively and cope adequately. However, this does vary somewhat from group to group, and we are investigating the possibility that some groups or churches do attract more 'troubled' individuals than others. It is possible that some groups in more depressed areas attract more deprived persons, or more aged lonely persons . . . it is possible that some churches stimulate in some personality types behavior which is maladaptive."

Sherrill[89] has noted that many glossolalists in the neo-pentecostal movement are well-adjusted individuals who are looking for an expansion of their life activities, while Sadler[82] criticized the psychiatric inferences of psychopathology in the Episcopalian Commission report on glossolalia by noting: "it is not necessarily dealing with the neurotic mind, but perhaps also with the creative, the positive aspect of the unconscious, the source of our artistic creativity."

To the reports cited above, I shall add my own rather unsystematic, but extensive observations over a 20 year period. In brief, my observations lead me to conclude that rather than being contradictory, the various types of reports and evidence cited above indicate that glossolalia is psychological phenomenon which bears no necessarily linear relationship with personality variables.

In common with the descriptions of Frank,[32] Sargant,[84] La Barre,[54] Schwarz,[86] and Knox,[50] I have observed glossolalia occurring as only one of many expressions of "ecstatic," "enthusiastic," and similar "regressive" behavior including snake-handling, dancing fits, hysterical convulsions, faith healings, etc. I have typically observed these as group phenomena in lower and lower-middle class persons in both urban and rural areas. In many of these cases I would classify the behavior as frankly dissociative or hysterical episodes of a clinically neurotic nature. In clinical terms I found that most of these people demonstrated overt psychopathology of a sociopathic, hysterical, or hypochondriacal nature. On the other hand, I have extensively interviewed middle-class and upper-class glossolalists who demonstrated no psychopathology. They were well integrated, highly functional individuals who were clinically "normal." My observations should not be construed as meaning that psychopathology is necessarily associated with social class. Rather, these class differences may reflect the personalities attracted to churches of that social strata . . . the same suggestion Gerlach et al make, and consonant with Morentz' observations. Indeed, I have found severe psychopathology among upper-class glossolalists and very normal lower-class glossolalists. I have also seen at least three cases of glossolalia in overt schizophrenic psychoses.

In taking all these observations into account, it would seem that glossolalia can be produced experimentally, as a by-product of psychotic disorganization, as a mechanism of expression of neurotic conflict, or as a normal expectation and behavior of a normal population. Thus, the phenomenon of glossolalia *per se* cannot be interpreted necessarily as either deviant or pathological, for its meaning is determined and must be interpreted in terms of the socio-cultural context.

This problem in relation to glossolalia is but one variant of a more general problem of interpreting ecstatic and possession states of behavior.[20,24,48] This has been widely discussed by anthropologists in terms of the cultural definition of normal behavior. A team of anthropologists and psychiatrists have addressed themselves to this problem of differentiating between psychopathological states and culture-bound behavior, which is pertinent to the glossolalist.[11] They begin with Hallowell's concept of the "culturally constituted universe" of the subject: "If this universe, as perceived by the subject, includes spirits that may possess human beings under certain circumstances, the 'knowledge' of this possibility informs the subject's behavior, although a certain latitude may be available to him in his manipulation of the background material. On the other hand, this knowledge and the attendant expectations are shared by a group, and the behavior of the subject will be recognized by the group as exemplifying the traditional 'knowledge' concerning the 'culturally

constituted universe' which is available to the members of the group, as it is to the subject. Their reactions, then, will provide support, awe, admiration, therapeutic measures, restitution, etc., whatever the cultural context provides for the behavior in question. It becomes 'possession' *only* when his cultural milieu contains the concept of possession, when his friends and relatives, seeing him act in this way, 'recognize' him to be possessed by the spirit or entity in question. The fact that he himself knows, and has previously known, that people may be so possessed is of importance in understanding how he has acquired his 'delusion' and how this belief by him and by the members of his significant reference groups encourage him to engage in this behavior. Where this belief system is not shared, where there is no belief in possession, the delusional content will still be derived from cultural sources, but group support for the delusion is lacking, and we are dealing with personal pathology. Here the delusion of being someone else represents a pathological view of the self; in cultural groups where the theory of spirit possession is a shared ideology, the 'delusion' is shared and we deal with culture, with religion and not personal pathology . . . it is, therefore, of considerable importance for psychiatry to be aware of the many diverse culturally constituted universes and not to restrict its understanding merely to its own culture-bound world."

To draw the inference from the above, when glossolalia is practiced as part of the expected ritual, we would not expect to find psychopathology, whereas in situations where glossolalia is not a cultural expectation, or the group is already part of a deviant subculture we would expect to find a correlation between glossolalia and psychopathology.

One final aspect of this problem merits comment. Many adherents of the glossolalia movement assert that the experience has made a change in the lives, has improved their style and quality of personality and life. Clinicians have been hesitant to accept such testimonials. Yet a careful study of non-pathological mystical experiences, such as in the work of Deikman[21,22] Ludwig,[61,62] Underhill,[97] Sedman,[87] and Salzman[83] have illustrated that mystical experience, often in a religious context, can be an integrative emotional experience that results in an altered life style with subsequent improvement in life adaptation.

In this vein, Gerlach and his anthropology team[33] comment: "There are many indications that the religious experiences involved in Pentecostalism increase the willingness to take risks, and to accept technological innovations. The conversion experience is a dividing line between Before and After. The experience of breaking with old religious patterns has been identified by many informants with a willingness to break with kinship, social, and economic patterns as well. To the degree that Pentecostalism increases self confidence, inspires people to work and save, to cooperate, to take risks and accept innovation and to break with old patterns, then it is indeed a religious motivation for socio-cultural change and economic development."

V. Psycholinguistic Aspects of Glossolalia:

With the survey of anthropological, psychological and socialogical data as background, I shall turn to our studies on the psycholinguistic nature of glossolalia. These studies were conducted on a small number of volunteers, whose speech was recorded both in normal conversation and during glossolalic speech. In addition, we conducted extensive interviews with the subjects to assay their personality structure and to investigate the personal meanings and function of glossolalia in terms of personality function. Our concern in these studies was to understand the mechanism by which glossolalia is produced and relation of glossolalia to intra-psychic structure and function.

5A *Structural Linguistics of Glossolalia*:

The ethnographic accounts noted above have generally been observational and not included linguistic data. However, a number of linguistic studies on American English-speaking glossolalists have recently been done.[13,14,71,72,102,105]

These reports vary somewhat in their specific technical conclusions, but in general there is consistency in the conclusions. The differences seem to stem from the fact that glossolalic speech varies in the degree of organization. Some glossolalia is very poorly organized and consists of little more than grunts and barely formed sounds, while other glossolalia is highly organized into systematic series of phenomes. Several linguistic studies, including our own, suggest that glossolalists develop their glossolalic speech from ill-formed structure to "practiced" and "polished" glossolalic speech. Thus the linguistic qualities of the glossolalia depends to some extent on the stage of development of glossolalia.

The following seem to be reasonable conclusions from the linguistic studies. Glossolalia, in at least English-speaking subjects, is composed of the basic speech elements of English. The major difference consisting of lack of organization of the basic phenomes into the syntactical elements necessary for intelligible speech. The para-linguistic elements of speech, pauses, breaths, intonations, etc. are markedly reduced and modified. Thus glossolalic speech tends to resemble the early speech qualities of young children prior to the organization of all the variables associated with adult language. Further, there is a reduction in the distribution of phenomes, i.e. a limited phonemic catalogue is utilized by the glossolalists. The conclusions of the linguists cited is that glossolalia presents the characteristics of partially formed language without the formal characteristics of language.

Indeed, many of the qualities of glossolalic speech are those found in the speech of young children, which George Devereaux[25] has outlined. A comparison of his outline of children's speech and glossolalic speech is striking. On this basis, one may suggest that glossolalic speech appears to be a regression to an early mode of speech in which vocalization is used for purposes other than just the communication of rational thought. This hypothesis receives further support from other data to be cited.

Another line of investigation has focused on the replication of glossolalia under experimental rather than religious contexts.

Al Carlson,[14] at the University of California, recorded two types of glossolalia, one type was recorded from glossolalists during spiritual exercises, and the other type was recorded by volunteers who were asked to spontaneously speak in unknown language without having ever heard glossolalia. These speech samples were then rated by glossolalists. The two types of glossolalia were not distinguished from each other. In fact, the "contrived" glossolalia received better ratings as "good glossolalia" than the actual glossolalia.

Werner Cohn,[16] at the University of British Columbia, took naive students to Pentecostal churches to hear glossolalia and then asked the students to speak in glossolalia in the laboratory. They were able to successfully do so. Their recordings were then played to glossolalists who described the glossolalia as beautiful examples.

In sum, the structural linguistic data suggest that glossolalia has specific linguistic structure based on the language tongue of the speaker, that the linguistic organization is limited, and that the capacity to speak in this type of semi-organized language can be replicated under experimental conditions. Thus, glossolalia does not appear to be a "strange language," but rather the aborted formation of familiar language.

5B. *Glossolalia as a Speech Form*:

Glossolalia as a speech phenomenon can be classed with other disordered patterns of language and/or speech, the final production being vocalizations in the forms of words or segments of words which have no denotative or referential sense. T. H. Spoerri[91] has described this speech as "unsemantical conglomerations of sounds" and "as sound externalized without sense which sometimes produces the impression of coherent speech." The terms "unintelligible," "meaningless," and "jibberish" have also been applied to the entities representing this type of speech. The entities resembling glossolalia are jargon aphasia, the schizophasia of the mental patient, the speech of the sleep talker and the neologistic stage of speech development in children.[34,37,55]

Although glossolalia may resemble jargon aphasia, the resemblance is in the final speech production alone, since there is no evidence that the glossolalist has an organic lesion in the brain. Similarly, the final vocal productions of schizophasia may resemble glossolalia, but as Spoerri has pointed out and as we have observed, the schizophrenic involuntarily produces his utterances, which have no purpose and stem from the disorder of thought processes. The glossolalist, however, actually constructs and creates his speech system with purpose and planning and can use his tongue voluntarily when he wishes.[14,77,91,105] He is also aware that his utterances do not communicate meaning to others. The sleep talker often alternates meaningful utterances with words which cannot be recognized.[81] Similar alternation occurs in glossolalia.[105] Lastly, glossolalia, as noted previously, has many characteristics of that stage in the development of speech when the child produces disorganized patterns of speech sounds i.e. nonsense words, which may be repeated over and over without any attempt to communicate.

The similarities of these various aberrant speech forms are superficial linguistic ones. For example, a neologism can be the product of brain damage, schizophrenic thought disorder, the undeveloped state of childhood language, a slip of the tongue in ordinary conversation, or the cleverly devised product of witty repartee. The significance of the neologism, then, cannot be determined solely by its linguistic characteristics.

As a linguistic phenomena, glossolalia seems to fit well in the stage of early language development. But that does not help much in understanding, for other adult language forms also employ this early phase type language. Examples include, jazz "scat" singing, onomatapoetic phrases, and indeed much of verbal "conversation" which is filled with much material that is communicative but would be meaningless jargon if reduced to structural linguistic analysis.[73]

5C. *Psycholinguistic Aspects of Glossolalia*:

A number of methods are available for analyzing nondenotative or "meaningless" speech such as glossolalia to determine its relationship to natural language systems and to discover the meaning it might have for the individual. These methods have been derived from a variety of psychological, linguistic, paralinguistic, and acoustical approaches to language and speech.

Historically, the first approach to meaning used methods derived from analytical psychiatry and psychology. Pfister,[77] the Swiss psychoanalyst, published a paper in the early part of the century on a few subjects who spoke in glossolalia. He attempted to explain the phenomenon through a psychological analysis of the patient. A 24-year-old male subject was analyzed in the following manner. Pfister had the subject utter a spontaneous speech which he wrote down. Then Pfister read it aloud and, at each individual word, encouraged free association on the part of the patient by asking: What comes to your mind in this connection? The final result in each instance was a connected speech dealing with childhood experiences and unfilled wishes. Standing behind each of the neologisms to which he had had the subjects free associate, Pfister found "painful thoughts which revived analogous experiences—for the most part infantile—repressed by consciousness but now brought forth in disguised form." Pfister was convinced that what to the outside sounded like nonsense words had considerable meaning to the individuals producing the words. Weinstein[100] has found similar meaning in the jargon of aphasics with brain injuries. The word association technique to neologisms or nonsense words has been used in recent years by I. Iritanti,[42] outside the psychoanalytic context, to determine the physiognomic or expressive features of "words" which do not have a referential or denotative sense. When a number of different subjects were asked to associate meaning to a number of nonsense words they frequently associated the same

or similar referent to the sound. Further, many of the nonsense words evoked an overwhelming consensus when the subjects were asked to choose between two polar referents for the sound.[104]

A second approach to glossolalia is linguistic, following the stratificational model of language and speech postulated by Lamb and Gleason in 1964.[57] They postulate that language is a system which relates meaning to sound through a series of codes, i.e., language encodes messages into speech sounds. The encoding process thus begins with an analytical operation, i.e., selecting the information stored in the cortical centers which are needed to respond and then synthesizing the information according to various subcodes into a language context which can then be projected as speech. There are four subcodes in the development of language. The first, the interface between experience and language, involves the *sememic* code. At this level, the meaning which stands behind words is first integrated and synthesized. At the second level, the meaning or the idea which is to be conveyed is organized according to grammatical rules through the *lexemic* code. At the third level, the lexemic code is organized into smaller units such as words through the *morphemic* code. Finally, in the fourth stage, the morphemic code is organized into the matrix of the actual phonemes or basis linguistic units of language, i.e., in English, vowels and consonants. This is the *phonemic* code. Each of the above subcodes is a set of rules which specify how units of the stratum above are to be encoded into the units of the one below.

Wolfram[105] and Nida,[72] for example, have studied the various subcodes of glossolalia. Studies on the phonemic strata indicate that the phonemes of the glossolalic utterance are closely associated with the language background of the speaker and that one would expect more diversity in the phonemic structure if different language systems were represented. Further, they have found a higher frequency of vowels, especially the vowel "a" than is expected in standard English. However, the mean for the number of consonants, vowels, and diphthongs is significantly lower than the total number of phonemes occurring in general American English, indicating a restricted phonemic code in glossolalia. Bernstein,[5] and others, in their investigation of restricted language code, has postulated that the "restricted" code conveys less information, is often used in ritualistic modes of communication, that it often tends to be impersonal in that it is not particularly prepared to fit a specific referent, and that the nonverbal component will be the major source for indicating changes in meaning. As will be seen later, these are all characteristics of glossolalia. The use of certain phonemes, e.g., vowels, to the exclusion of others and the way phonemes are organized in sequence, has been studied. Irwin[43] has found that during the first two months of life, 80% of an infant's vocalizations are vowels. However, at 30 months only 50% are vowels. Wepman,[103] using similar linguistic studies of the development of speech in children has postulated that each stage of development in childhood is mirrored in the various types of aphasia. He has hypothesized that for the adult, aphasia may be a regressive linguistic phenomenon. Similar psychodynamic interpretations of linguistic findings in subjects with articulation disorders of phonemes have been published by Rousey and Moriarty who feel that vowels transmit information about how certain drives (sexual and aggressive) are handled while consonants are considered to transmit the nature and quality of defensive behavior which the individual utilizes in establishing relationships.

Study of the morphemic stratum of glossolalia reveals that the phonemes are combined in primarily "open" syllables, i.e. that they begin and end with vowels. This characteristic is most prevalent in early speech development. Nida points out that there are frequently recurring groups of two or three syllables which appear to have the characteristics of words, but are not words since they do not convey meaning. These are "pseudo-morphemes." On the lexemic stratum there is apparently only a minimum of organization in glossolalia. Glossolalia, then, according to the linguists is organized in the phonemic and pseudomorphemic strata but to a limited extent on the lexemic stratum. There is, however, no structure on the sememic or semantic stratum, and it is this void that keeps glossolalia from being a natural language.

A third approach to "meaningless" speech involves the analysis of the speech process, a type of paralinguistic study devised by Freida Goldman-Eisler.[36] She has found that pauses in spontaneous speech are related to the information content of subsequent words. She feels that pausing is associated with verbal planning and selection, whereas continuous and rapid vocalization would be the result of practice and occur in the use of well-learned sequences of words. She has also shown that breath rate while speaking reflects the degree of excitation of the speaker—a high breath rate indicating excited states and low breath rate states of inhibition and control. A cursory examination of the "speech processes" of five of our subjects reveal two categories of glossolalia. The first category is "playful" glossolalia, characterized by rapid, fluent speech devoid of hesitation pauses and with an increase of breath rate and an increased syllable output per breath. The fast, fluent speech is indicative of habitual, well-learned sequences of speech which require little verbal planning or encoding, i.e., little cortical control. The high breath rate indicates a state of emotional excitement. The high syllable output per breath would indicate a sing-song or monotonous form of vocalization.

The second type of glossolalia may be classified as "serious." This type is characterized by a slower rate of speech with numerous hesitation pauses, a lower breath rate and a reduced number of syllables per breath. Using the Goldman-Eisler concepts, the presence of hesitation pauses would indicate some degree of encoding (probably encoding of intonational features to the phoneme clusters). The lower breath rate and the reduced number of syllables per breath would suggest more dramatic or expressive vocalization.

Still another approach to glossolalia, psychoacoustic studies, suggest that the suprasegmental or prosodic elements of speech, sometime labeled as intonation, may be helpful in telling us about the individual producing the utterance. Speech contains factual information in linguistic segments, but it also contains in its acoustic parameters considerable information about the individual speaker as well as what the individual wishes to convey about what he is speaking.[51] Starkweather[93,94] has taken recordings of speech and filtered them to remove verbal content. When this was done subjects could still relate the sounds they heard to the personality of the speaker and his emotional state. In similar studies, Kramer[51] has found that "a person's tone of voice, or manner of speaking, reveals aspects of both his relatively stable personality characteristics and his more transitory emotional states." Recent studies[23] indicate that the sounds we label as vowels are more apt to carry the intonational qualities of the voice than consonants. Some investigators[23] believe that the intonational features carrying the speaker's emotional attitude are encoded in the phonemic sequence which convey the denotative aspects of speech. These intonational features have been aptly labeled as the audio-integument of the phonemic clusters of words.[90] The acoustic parameters which make up the audio-integument of the prosodic features of speech are: 1) acoustic phonetic duration, 2) average fundamental voice frequency, and 3) average speech power.[76] The sound spectrograph is a device which can display and quantitate these variables in the "voice print" which it produces. In normal speech spectrographs one sees a rather clear demarcation between each of the vowel structures (formants) and between vowel formants and consonantal "noise." In the glossolalic speech spectrographs, formants, noises, and brief separations are present, but the rapid rate of speech almost makes them indistinguishable. In the spectrographs of "serious" glossolalia the voice print approximates normal speech. This may indicate that the individual producing this type of glossolalia is attempting to actually communicate something to the listener.

Since glossolalia is a nondenotative speech phenomenon, it is likely that a study of its prosodic features with the sound spectrogram might lead to some useful information about the specific emotional state of the speaker while engaged in his "tongue." It is already known from linguistic studies that glossolalia usually contains a preponderance of vowels when compared to natural English. Acoustic studies of intonation have revealed that vowels carry the tonal or emotional integument to a greater extent than do consonants. Fonagy[36] believes that speech sounds are preconsciously and purposefully autoregulated, i.e., selected to adapt to actual circumstances such as distance of noise level. Our tapes revealed just such an autoregulation in speech sounds as the speaker converted from natural English to glossolalia. In each of the tapes the individual's glossolalic speech was considerably softer and quieter than the normal conversational speech which had just preceded it. Nonetheless, it was still easily heard. It may be that the switching to a type of speech which contains more sonorous elements, such as vowels, requires less volume or loudness since the sonorous elements are known to be more resistant to noise and are not so easily absorbed by growing distance. There is also a change in style of expression as well as a difference in intonational patterns when the subjects change to glossolalic speech. Sonographic analysis may be helpful in defining and decribing more precisely the changes that occur. Work is presently underway to correlate acoustic variables with specific emotional states. The study of glossolalia awaits further development in this area.

5*D. The Stages of Glossolalia*:

Our study of five glossolalic speakers parallel the findings of Walter Wolfram[105] that development of glossolalia can be divided into two stages. The early process of acquisition of glossolalia may be labeled as the initiatory stage. The stage of individuation and eventual stereotopy of the utterances is the "habitual" stage.

Initially, the individual who pursues glossolalia has attended religious or quasi-religious meetings where the utterances are heard for the first time. There is evidence to suggest that if the individual wishes glossolalia for himself, he sets about to learn how to reproduce it. In some settings, the religious leaders may actually provide a few sample utterances asking the initiate to repeat segments of glossolalia after them. In some instances, the counselor will suggest that the initiate imagine "foreign words" and try to speak them. In other instances, a charismatic leader speaks in tongues and an impressionistic initiate may attempt to follow the leader whispering or talking to himself.

Glossolalic utterances which are heard are stored in memory until the decision is made to speak in tongues. The stored memory fragments may be brought into awareness and may even be practiced, i.e., recited over and over again to oneself until an acceptable form of glossolalia is mastered. With its mastering, "spontaneous" glossolalic utterances may be externalized for the first time. The glossolalic utterances may first be spoken under a variety of affective and emotional states. When spoken, the glossolalia may be similar to that of the group where it was learned or similar to the glossolalic leader who taught it. As the initiate speaks glossolalia on more and more occasions, the speech becomes more individualized until eventually the utterances are expressive of the personality and behavior of the speaker. With repeated use of "tongues" the speech becomes automatic and habitual.

5*E. Playful and Serious Glossolalia*:

The habitual glossolalic utterances we have studied contain numerous aliterations, reduplications, and repetitions of the various vocal segments. These are all characteristics of "expressive speech". This expressive quality of glossolalia is described by T. H. Spoerri[91] as "kuntsprachen" or "art speech." He points out that in our literary world there are many examples of

neologisms or private words which are used in various art forms. Most frequently they are used in poetry and prose as devices to express a feeling or a mood which cannot be expressed by common vocabulary words. One has only to look at the poetic works of James Joyce, T. W. Eliot, Theodore Roethke, Ogden Nash, etc., to see this phenomenon. In a sense, we have all experienced this sort of verbal behavior when we use curse or slang words rather than common everyday words, because the latter are insufficient to express our feelings or emotions. Several of our subjects reported that one of their favorite pastimes was creating new words for their glossolalic vocabulary. It is in this way that glossolalic speech begins to gradually differ from the initial vocalizations and become more unique and representative of the individual and his style of expression.

Although all glossolalia may be described as expressive, there are various categories or levels of expression from the more playful to the more serious. Bobon[7] points out that the adult, under the cover of various motives produces glossolalia or private tongues as an activity of play. This "playful" quality was observed in several of our subjects—one giggling and laughing while speaking in her tongue, the other clowning with arms outstretched in a christ-like fashion. In both of these samples of glossolalia, the individuals seemed absorbed in their own utterances and seemed to be taking some delight from listening to themselves. McDonald Critchley and others have observed this phenomenon in other circumstances and feels that individuals can receive aesthetic delight in their own vocalizations, i.e., that they enjoy words for their own sake, listening to the shape, color and sounds of the words produced.[15,53] The "playful" category of glossolalia is produced volitionally. It is characterized by rapid, fluent vocalizations of utterances, devoid of hesitation pauses and rendered in a monotonous or sing-song style. The breathing rate is regular and the individual usually appears relaxed and at ease.

At the other end of the continuum is the "serious" catagory of glossolalia. Here, the intonation pattern imposed on the automatic speech appears to reflect the strong emotional feelings of the subject. Often there are feelings toward others present. One subject, whose glossolalic speech became pleading and quite serious, made it clear that she was simultaneously wishing to herself that the interviewer might accept glossolalia for himself. In another case the subject reported using her tongue while simultaneously thinking about a very personal and troubling problem. In the serious category of glossolalia, the vocalizations are not rapid, hesitation pauses are present, and the intonation pattern is more variable and dramatic.

Experience with our subjects has revealed that one individual can move along the continuum from the "playful" to the more "serious" categories as the need arises. In both categories, the utterances may be produced volitionally and with intention. However, as glossolalia becomes more and more a part of an individual's life style, he may occasionally use it without awareness just as he might blink his eyes or tap his fingers without total awareness and volition.

5F. Conceptual Framework for Glossolalia:

As a form of learned, organized vocal behavior, glossolalia can be conceptualized as arising in internal cognition and then being externalized as audible speech. Earlier in the paper I described the linguistic model of transformation from language to speech. However, that model does not deal with the cognitive mechanisms involved. In cognitive terms, glossolalia appears to be a borderline phenomenon between inner speech and external speech.

Inner speech was first described by Plato as "thinking to oneself".[67] It is characterized by the articulation of inaudible sounds by means of which we think to ourselves. We use it to prepare for and to precede external speech, to mediate tasks and to express a variety of motivational or affective states.[29,108] Inner speech is believed to be characterized by a reduction in phonemes, by increased fragmentation of language structure and by underdevelopment and incompleteness of thought. Zhinkin[108] has pointed out that the flow of thought of inner speech changes is rapid. This inner speech is fragmented, underdeveloped and incomplete so that, if externalized, would be exteremely difficult to understand.

Developmentally, Vygotsky[99] has postulated that in the normal maturation of children, there is a gradual transition from verbalized private or egocentric speech to whispered and then to inner speech. Private or egocentric speech of children is the precursor of inner speech which is often quite expressive and may be characterized by endless repeating real or nonsense words. It is this function of inner speech which adults use when they contrive neologisms or nonsense words to express themselves more poignantly.

Inner speech may also subserve emotional needs. The "thought" that is brought into awareness and elaborated on through the process or vehicle of inner speech may be strongly affect laden. David Rapaport[80] has pointed out that part of the drive state or tension experienced on the unconscious level can be discharged or reduced by bringing memory traces to perceptual awarenesses—that is, through bringing ideas into consciousness. As Lord Brain has pointed out, "thinking is strongly emotional and may indeed be pursued for its emotional value." Next, not only are memory traces laden with emotion, but the vehicles through which they are carried, i.e., inner speech, also carry an emotional message. In addition to the affect in the thought of inner speech are certain qualities which convey emotions which are very much like suprasegmental or intonational features of vocalization. We experience this characteristic of inner speech daily when we ask ourselves questions, raise doubts, or express anger as we speak to ourselves without ever externalizing or making the utterances audible to others.

External speech may or may not be connected with inner speech. Usually it is, but not every act of speaking is a manifestation of thought. Speech, as in automatic speech, may be a reproduction of ready made

results of cognitive activity with little or no thinking required to produce the utterance.[3] Russian psychologists have studied automatic externalized utterances in relation to inner speech.[90,108] They find that if individuals are asked to repeat nonsense words and simultaneously carry out mental tasks (engaging the inner speech mechanism), the mental tasks are dealt with inefficiently at first, but as the individual's production of these words becomes more and more automatic, he becomes more and more efficient at simultaneous mental tasks unrelated to the utterances. Thus, as the speech material becomes more automatic, less cortical involvement is necessary and inner speech is gradually restored.

From the theory just reviewed, a conceptual model of the transition from thought to speech can be formulated as follows: A residue of previous experience, i.e., a memory of a stored fact or an emotion or reverie is first stimulated to awareness. Awareness of thought may take the form of either visual or language patterns. If language is the vehicle, the material brought into awareness is organized on the sememic level and proceeds through the language subcode, through the phonemic matrix, to inner speech. Simultaneously, emotional tone, mood, etc., may be superimposed on the organizing thought–language, so that the phonemic sequences of inner speech will have an audio-integument, e.g., intonational features. Inner speech may be used for a variety of purposes including task solving, preparation and shaping of inner speech for communication to others, and for the purpose of speaking to oneself for a variety of reasons. In the transformation of inner speech to external speech, the muscular mechanism of respiration and vocal cords becomes active and audible speech, capable of being heard by other, occurs. The feeling tone state of inner speech, can be expressed through other motor pathways such as gesture, etc.[88] The steps between "awareness" and "externalization" may become so habitual that they become automatic. When this occurs, the inner speech mechanism is free to pursue thought and feeling states quite separate from the automatic phonemic sequences being uttered.

5*G. Glossolalia as a Borderline Phenomenon Between Inner and External Speech*:

Glossolalia initially utilizes the mediative or task orientation of an individual's inner speech. When the glossolalic phrases which have been heard and stored in memory are brought into awareness, they are practiced over and over again in inner speech until an acceptable form of glossolalia is mastered. With its mastery, the inner speech is reproduced externally and the spontaneous glossolalic utterance may be heard for the first time. With repeated use of his "tongue" his speech becomes more and more automatic, no longer requiring the use of the inner speech mechanism. The verbal part of the inner speech mechanism is used only in the initial stage of glossolalia and later in the habitual stage when affect and mood states arise which call for creation of more expressive words. When new words are not being made and the automatic utterances are spoken as in the serious category, the individual may simultaneously engage in inner speech mechanism with a number of thoughts and feeling states *while* speaking in tongues. It is our impression that the feeling tone of these thoughts in inner speech is encoded onto the automatic speech utterances. Sociolinguistic studies of individuals who use a restricted language code in their subcultures indicate that the intonational pattern or the audio-integument is more representative of what the individual is feeling than are the stereotyped words of the restricted code.

Alajouanine and Lhermitte[1] describe this beautifully in one of their patients who had retained her external stereotyped words but was seen to modify the utterance of the expression both as regards speed and intonation. At one moment it would be monotonous, although rapid; then it would become faster or slower according to the circumstances, and altered in intonation, which would become sometimes sad, sometimes even tearful–sometimes, on the contrary, satisfying or approving. They further point out that the "melody of speech" had come to superimpose itself upon the stereotyped utterance. During the use of glossolalia in this way, the speaker is engaging his "inner speech" mechanism while he produces automatic external vocalization. His inner speech is dealing with an affect-laden thought or thoughts rather than just listening to his own vocal productions. The feeling state surrounding the thought or "memory trace" implicit in the thought itself and in the suprasegmental aspect of inner speech (as mentioned previously) is encoded onto the phonemic combinations which are being produced for external vocalization. Thus, the feeling tone part of the "inner" speech is transposed to the phonemic sequences. Glossolalia, then, becomes a vehicle for conveying meaning through the intonational features superimposed on the externalized utterance.

5*H Intra-Psychic Aspects of Glossolalia*:

Glossolalia, as noted earlier, is but one of many motor, perceptual, and cognitive functions that may occur in "peculiar" states, i.e., behavior which seems to be out of character or outside the everyday expectations of society. Both in psychiatry and anthropology these states have been summed up in omnibus fashion under the terms "trance" or "possession state." Bourguignon and Pettay[12] note that in attempting to explain these phenomenon in psychological terms: "A variety of hypotheses have been advanced . . . hysteria, hypnosis, nonpathological dissociation, cultural learning, social learning, histrionics, and epilepsy . . . yet these explanatory catagories are themselves, on the whole, poorly understood and the argument tends to center on the question whether these states are to be considered pathological."

In a recent paper, Davidson,[20] a psychiatrist, concludes from his cross-cultural studies of trance states that psychiatry must exercise caution in interpreting behavior which has been outside the ken of traditional psychiatric investigations, lest we ascribe meaning to such behavior solely in terms of our own cultural biases.

In his recent review, *Altered States of Conscious-*

ness, Arnold Ludwig [61] has called attention to these phenomena as: "relatively uncharted realms of mental activity, the nature and function of which have been neither systematically explored nor adequately conceptualized." He defines altered states of consciousness as "any mental states, induced by various physiological, psychological, or pharmacological maneuvers or agents, which can be recognized subjectively by the individual himself (or by an objective observer of the individual) as representing a sufficient deviation in subjective experience or psychological functioning from certain general norms for that individual during alert, waking consciousness. This sufficient deviation may be represented by a greater preoccupation than usual with internal sensations or mental processes, changes in the formal characteristics of thought, and impairment of reality testing to various degrees." Ludwig goes on to note that altered states of consciousness may be produced by: "a wide variety of agents or maneuvers which interfere with the normal inflow of sensory or proprioceptive stimuli, *the normal outflow of motor impulses,* the normal 'emotional tone,' or the normal flow and organization of cognitive processes."

In glossolalia we have an interesting combination of preoccupation with the thought-speech process which interferes with both the normal flow of cognitive process (thought) and the normal outflow of motor impulses (speech). As a footnote, over 25 years ago Kubie and Margolin[53] reported on the hypnogogic influence of listening to one's own breath sounds, an observation which is related to the intense focus of attention by the glossolalist on his own voice.[15]

In concluding his analysis of altered states of consciousness, of which glossolalia is one instance, Ludwig concludes that they are: "final common pathways for many different forms of human expression and experience, both adaptive and maladaptive. In some instances, the psychological regression found in ASC's will prove to be atavistic and harmful to the individual or society, while in other instances the regression will be "in the service of the ego" and enable man to transcend the bounds of logic and formality or express repressed needs and desires in a socially sanctioned and constructive way."

Further theoretical elaboration has been provided by the work of Arthur Deikman on states of experimental meditation.[21,22] Although his work deals with perceptual function, Deikman's theoretical structure is most germane to the motoric phenomenon of glossolalia. Deikman focuses on the process of *"de-automatization* of the psychological structures that organize, limit, select, and interpret perceptual stimuli." The concept is derived from Hartmann's discussion of the automatization of motor behavior:

"In well-established achievements they (motor apparatuses) function automatically: the integration of the somatic systems involved in the action is automatized, and so is the integration of the individual mental acts involved in it. With increasing exercise of the action its intermediate steps disappear from consciousness . . . not only motor behavior but perception and thinking, too, show automatization . . . it is obvious that automatization may have economic advantages, in saving attention cathexis in particular and simple cathexis of consciousness in general . . . here, as in most adaptation processes, we have a purposive provision for the average expectable range of tasks." The process of de-automatization is developed by Gill and Brenman:[35] "De-automatization is an undoing of the automatizations of apparatuses—both means and goal structures—directed toward the environment. De-automatization is, as it were, a shake-up which can be followed by an advance or a retreat in the level or organization . . . some manipulation of the attention directed toward the functioning of an apparatus is necessary if it is to be de-automatized." On the basis of the above theoretical statements, Deikman concludes: "de-automatization may be conceptualized as the undoing of automatization, presumably by reinvesting actions and precepts with attention. Under special conditions of dysfunction, such as in acute psychosis or in LSD states, or special goal conditions such as exist in religious mystics, the pragmatic systems of automatic selection are set aside or break down, in favor of alternate modes of consciousness whose stimuli processing may be less efficient from a biological point of view but whose very inefficiency may permit the experience of aspects of the real world formerly excluded or ignored. The extent to which a shift take place is a function of the motivation of the individual, his particular neurophysiological state, and the environmental conditions encouraging or discouraging such a change . . . the content of the mystic experience reflects not only its unusual mode of consciousness but also the particular stimuli being processed through that mode. The mystic experience can be beatific, satanic, revelatory, or psychotic, depending on the stimuli predominant in each case. Such an explanation says nothing conclusive about the source of the "transcendent" stimuli. God or the unconscious share equal possibilitities here and one's interpretation will reflect one's presuppositions and beliefs . . . the available scientific evidence tends to support the view the mystic experience is one of internal perception, an experience that can be ecstatic, profound, or therapeutic for purely internal reasons."

From the above descriptions of the processes of de-automatization that accompany various altered states of consciousness we can conclude, based on our own observations and the reports we have reviewed, that the uses of glossolalia are numerous. In the subjects whom we studied, it is used voluntarily in many secular situations to reduce tension and anxiety through a number of thought and motor pathways. The playful category of glossolalia is particularly used for the indiscriminate motor discharge of affect as has been postulated by Rapaport. That is, the individual feels a general state of uneasiness or tension or restlessness and not knowing the cause seeks to relieve the tension through the motor act of rapid and fluid vocalization. Glossolalia may be used in this way either consciously or unconsciously. One of our subjects claimed that

during examination time, he frequently would burst into tongues and usually was not fully aware of it at first. A similar phenomenon occurs when other motor acts which are used routinely to release such tension (such as tapping one's fingers, crossing legs, etc.) becomes so automatic and habitual that the individual is often not fully aware that he is performing them.

The "serious" category of glossolalia may also serve to aid in the reduction of tension. As has been pointed out, some release of tension or discharge of affect can take place in the conscious awareness of a thought. In this category of glossolalia, there is discharge of affect through thought as well as through the motor act of speaking. In addition the encoding of the feeling tone of inner speech onto the external automatic vocalizations allows for projection of affect and tension, thereby reducing tension further. Thus, the automatic glossolalic utterances are used primarily in the serious type of glossolalia as a vehicle for the release of feelings experienced in inner speech through the audio-integument or intonational features imposed on the externalized utterances. The "serious" category of glossolalia provides a way of externally discharging extremely personal emotions and desires without revealing their content to others.

In subjects we interviewed glossolalia was often used to entertain oneself or relieve boredom while engaged in rote motor tasks such as driving the car or typing. In these and other instances subjects used glossolalia to avoid anxiety situations by blocking out the environment through listening to their own utterances and thereby altering the state of consciousness. During these times the individual is preoccupied with listening to his vocal utterances, his breath rate becomes regular and rhythmical and he appears relaxed to the point that his glossolalic speech becomes slurred. An altered state of consciousness probably occurs during these times. De-automatization can occur at any level in the transition from thought to speech. Thus, focussing on one's own breath sounds as alluded to previously could alter the state of consciousness. Or, the focussing of attention exclusively on the glossolalic utterance, i.e., the shape, tone, and color of the words themselves, may also alter consciousness.

In the above instances there seems to be a degree of regression in several aspects of ego function. Indeed in possession states or gross types of "hysterical behavior" glossolalia may occur with a marked degree of regression in most ego functions. In some glossolalists the regressive state is pathological, although in most instances of which we are speaking the regression is not pathological, but rather a regression in the service of the ego.[52]

In the cases of students whom we studied we were struck by the lack of regression of ego functions which occurred. These students were able to willfully launch into glossolalia with little change of consciousness or associated ego functions. Here we observe what might be termed a highly focal regression in the service of the ego.[52,61,62,79]

In fact most of the instances of glossolalia observed in the middle-class persons we have studied occurs with remarkably little regression of associated ego function. The glossolalic knows his "tongue" well, that is it is a familiar object to him. Because of this and his perception that it brings him closer to God, his "tongue" gives him security when he needs it. The restricted linguistic code of glossolalia, the predominance of vowel sounds, the egocentric "playful" quality of the utterance all suggest that glossolalia may be a focal thought-speech regression that is highly restricted to specific ego functions. Unlike gross trance states where more total regression takes place, glossolalia, when practiced as a speech phenomenon, is not associated with any measurable physiological changes as determined by galvanic skin responses or EEG tracings in the individual speaker.[74] Thus, glossolalia serves to "recharge" the batteries so that the individual may continue to function, or reaffirm his commitment to a style of living and adaptation to reality conflict.

VI. Summary of Behavioral Science Research Data on Glossolalia:

1) Glossolalia is an ancient and widespread phenomenon of most societies, occurring most usually in specific religious contexts, 2) glossolalia may occur as part of larger syndrome of hysterical, dissociative, or trance states, or it may occur as a discrete piece of behavior, 3) glossolalia is not necessarily correlated with specific personality variables, 4) glossolalia may be deviant psychopathological behavior or it may be normal expected behavior depending on the sociocultural context, 5) glossolalia is a form of partially developed speech in which the thought-speech apparatus of the person is employed for a variety of intrapsychic functions, 6) glossolalia may accompany psychopathological regression or it may be a form of healthy regression in the service of the ego leading to more creative modes of life.

VII. Possible Theological Implications:

At the outset of this paper it was noted that most religious discussions of glossolalia have been polarized. In both early Christianity and in non-Western religions throughout history it would appear that glossolalia and kindred ecstatic phenomena have been interpreted in terms of either divine or devilish supernatural forces.

In some current theological discussions, attempts have been made to bring in psychological explanations. Almost always these authors "explain away" glossolalia as merely a psychological phenomena to which little attention should be paid. Now in my discussion in this paper, there is a wealth of reasonable data which gives us an outline of the psychological, social, and cultural contexts within which glossolalia can be and is produced. Thus we need not invoke either divine or devilish supernatural forces to explain or justify the existence and function of glossolalia.

However, the fact that we have a credible scientific framework for explaining and understanding this behavior does not necessarily undercut its importance or value to either an individual or a religious group. Glos-

solalia can be useful and valuable as a media of spiritual exercise for an adherent. It has certain important values for at least Pentecostal groups. For glossolalic adherents in the main-line denominations, the phenomenon also has social functions although here it often is used in more destructive fashion on occasion.

Perhaps the most important distinction that should be made is between cause and consequence. Glossolalia is not *caused* by supernatural forces. However, glossolalia may be a *consequence* of involvement in deep and meaningful spiritual worship. Glossolalia does not miraculously change people in a supernatural sense, but participating in glossolalia as a part of a larger social and personal commitment may play an important role in the change of direction in participant's lives.

Thus our analysis may suggest that the appropriate theological discussion is not regarding the cause of glossolalia, but rather whether or under what circumstance the practice of glossolalia might prove useful or destructive to the goals of the church.

VIII. Summary

Glossolalia is an unusual pattern of aberrant speech. A review of the current research data from the work in anthropology, sociology, linguistics, psychology, psycholinguistics, and psychoacoustics provide a new source of data for examining the phenomena of glossolalia. It is a modification of the conscious connection between inner speech and outer speech, that may serve various psychodynamic functions. The meaning and function of glossolalia is closely tied to its socio-cultural context. The historic theological debates concerning glossolalia centered on etiology—whether divine or devilish. Such debate is irrelevant. Glossolalia *per se* is not a spiritual phenomena, but it may be a consequence of deep and meaningful spiritual exercise.

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My appreciation is due to Robert L. Casey, M.D. and Peter Ostwald, M.D. for their collaboration in the analysis of the glossolalia tapes reported in this paper. More technical reports on this data with their joint authorship will be published.

THE SCIENTIFIC REVOLUTION MISCONSTRUED:

A reply to David Siemens and others

DAVID C. LINDBERG*

I

Ignorance of the history of science has been the greatest stumbling-block for many who have attempted to describe the relationship between the Protestant Reformation and scientific developments of the 16th and 17th centuries. Non-historians of science, blissfully uninformed, rhapsodize about the transformation of scientific thought that occurred during this period, convinced not only *that* something dramatic happened, but also that they know *what* it was. This is the time, they tell us, when modern science began: Copernicus threw off the fetters of ancient astronomical systems; Galileo rejected Aristotelian physics and the scholastic method of disputation in favor of the teachings of the senses; finally, Newton brought intelligibility to the universe by formulating a science based upon mathematical law.

And what was the cause of this great awakening? Protestant writers have generally seen it as a product of the Reformation; Catholics have been more prone to stress the Christian world view in general; nontheists have tended to see it as an expression of a new "hedonist-libertarian spirit" of the Renaissance.[1] In the present paper, I am interested primarily in the former point of view, which I can illustrate with a sampling of recent claims. John Montgomery has written that "the simultaneity of the Copernican and Lutheran revolutions suggests a more than accidental relationship between them."[2] Henry Stob concludes that "it was Christianity that supplied the firm foundation for modern natural science, and that the Reformation was used by God so to delineate this foundation as to dispose men to build on it the vast new structure of science."[3] David Siemens has written in the *ASA Journal* that "it is a matter of record that science never developed anywhere except where there was Christian influence. . . . And it is also enlightening to note that the extension of science came mainly in the areas where the Bible was most often and freely read."[4] Finally, Robert K. Merton, author of the classic statement regarding the relationship between science and the Reformation, argued some years ago that, while Puritanism did not generate empiricism and rationalism, it sanctioned an empirical approach to nature and thereby "made an empirically founded science commendable rather than, as in the medieval period, reprehensible. . . ."[5]

The trouble with such views is that they are based on old stereotypes regarding the origin of modern science in the 16th and 17th centuries. If indeed one can discover in the scientific thought of this period a radical discontinuity inexplicable in nonreligious terms, then it is plausible, (though still not proved) that Christianity in some way served as the ground out of which this new science grew. Such is the contention of David Siemens, who believes that Galileo "is the man basically responsible for the founding of modern science," and that Galileo's thought, in turn, was nurtured in essential ways by Hebrew-Christian traditions.[6] Pronouncements of this kind are reassuring to the Christian community and always find a receptive audience, but, alas, they are false. They ignore the last half-century of research in the history of medieval and early modern science; they presuppose a pattern of development in 16th and 17th century science that simply did not occur.

Presumably my view of what *did* occur is called for at this point. Unfortunately, this is a question far too complex to be settled here. But perhaps I can achieve some of the same goals by undertaking the much more limited task of stating some of the things that the scientific revolution *was not*.

II

In the first place, during the 16th and 17th centuries there was little in the way of a radical *theoretical* break with the scientific thought of antiquity and the Middle Ages. On the contrary, recent research in the history of science has demonstrated the remarkable extent to which 16th and 17th century science grew out of and was continuous with strong Greek and medieval traditions.[7] If, for most of us, the intuitive impression that there was something dramatically different about the 16th and 17th centuries still lingers, this is simply because our preconceptions have been shaped by centuries of ignorance regarding ancient and medieval science.

Consider, for example, the Copernican reform of astronomy.[8] Not only was its motivation conservative—a reform—but Copernicus' astronomical criteria and heliocentric hypothesis were entirely of ancient origin.

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In his *De revolutionibus*, Copernicus describes in unambiguous terms his reasons for attempting an astronomical reform: (1) he was unhappy about the inability of the Ptolemaic system to "save the phenomena" exactly; (2) he was dissatisfied with the unsystematic character of Ptolemaic astronomy; and (3) he regarded the equant, which violated the ancient criterion of uniformity as abhorrent.[9] The first requirement, that of saving the phenomena, had been an essential element in astronomy since antiquity, and Copernicus was merely expressing the frustration that had been growing among astronomers for centuries and that had been communicated to him by his teachers at Cracow and Bologna in the 1490's.[10] But what of his other two reasons? Why should he have placed so much stress on system and uniformity? Very simply because during his student days at Cracow he had come under the influence of Neo-Pythagoreanism through the works of Marsilio Ficino and a Platonic society known as the "Brotherhood of the Vistula."[11] As a result of these influences, Copernicus applied Pythagorean criteria to the heavens from the very beginning of his astronomical career: thus nonuniformity in the form of the equant must be purged; arbitrary elements in Ptolemaic astronomy must be dealt with by drastic means; the universe must be harmoniously ordered. Among the most significant results of the application of this Pythagorean outlook was Copernicus' decision to locate the sun, which was an object of worship among Neo-Pythagoreans, in the central place of honor. His rapture over the result speaks volumes:

> In the middle of all sits Sun enthroned. In this most beautiful temple [i.e. the universe] could we place this luminary in any better position from which he can illuminate the whole at once? He is rightly called the Lamp, the Mind, the Ruler of the Universe; Hermes Trismegistus names him the Visible God, Sophocles' Electra calls him the All-seeing. So the Sun sits as upon a royal throne ruling his children the planets which circle round him.[12]

Nor are the personal terms used to describe the sun merely figurative; for Copernicus, as for the Pythagoreans, the sun is alive and divine.

So much for the astronomical criteria applied by Copernicus. Where did he get his idea of the structure of the universe? Again from the ancients:

> I pondered long upon this uncertainty of mathematical tradition in establishing the motions of the system of the sphere. . . . I therefore took pains to read again the works of all the philosophers on whom I could lay hand to seek out whether any of them had ever supposed that the motions of the spheres were other than those demanded by the mathematical schools [i.e. the Ptolemaists]. I found first in Cicero that Hicetas had realized that the Earth moved. Afterwards I found in Plutarch that certain others had held the like opinion. . . . Taking advantage of this I too began to think of the mobility of the Earth. . . .[13]

Indeed, Copernicus appears to have been aware of the complete heliocentric system devised by Aristarchus of Samos in the 3rd century B.C.; before his *De revolutionibus* went to press, he suppressed the following passage:

> Though the course of the Sun and Moon can surely be demonstrated on the assumption that the earth does not move, it does not work so well with the other planets. Probably for this and other reasons, Philolaus [a Pythagorean] perceived the mobility of the earth, a view also shared by Aristarchus of Samos.[14]

It is clear, then, that Copernicus was attempting no more than a purification of astronomy by a return to the astronomical and metaphysical principles of antiquity. The only thing revolutionary about his work was its long-range impact; one historian has aptly written of "the Copernican Revolution, to which Copernicus was not party."[15]

If Copernicus was indebted to ancient Greece, Galileo was indebted to medieval Europe. On the problem of falling bodies, where his greatest fame has rested, Galileo for the most part merely restated medieval conclusions. For example, his distinction between kinematics and dynamics, his definitions of instantaneous velocity and uniformly accelerated motion, his statement of the mean-speed theorem and the odd-numbers law,[16] and his graphical demonstration of the latter two theorems were all drawn from 14th-century traditions at Oxford and Paris. Galileo's only original contribution seems to have been his demonstration, employing the inclined plane, that freely falling bodies are instances of uniformly accelerated motion —though even that conclusion had been reached and published (probably unknown to Galileo) more than fifty years earlier by Domingo de Soto, a Spanish Dominican.[17]

Further examples of continuity between ancient, medieval, and early modern scientific thought are abundant and could be drawn from such fields as chemistry, medicine, optics, and magnetism.[18] Perhaps, however, the two instances discussed will suffice to illustrate the general point: the dramatic theoretical discontinuity that historians—and more especially non-historians and poorly informed historians—have perceived between ancient, medieval, and early modern science has been grossly exaggerated. Those who would continue to hold the contrary are forced consistently to ignore, downgrade, or find some subtle deficiency in ancient and medieval scientific thought.

III

Secondly, the 16th and 17th centuries saw no radical *methodological* break with Antiquity and the Middle Ages. I am well aware that such a statement may startle readers nourished on the popular stereotypes and clichés. In the popular view, science languished during the Middle Ages as scientists engaged in futile logic-chopping. In due time, however, scientists perceived the need for a new method that would include mathematical and experimental elements; the introduction and development of this method by Francis Bacon, Galileo, and Newton finally ushered in modern science.

Such a description is a travesty on the actual development of science. Mathematical and empirical elements were neither totally lacking from the methodology of ancient and medieval science nor universally present in the methodology of the 17th century. As Crombie and Randall have argued, 17th-century methodologists (and Bacon in particular) refined, but did not substantially alter the methodologies formulated

during the Middle Ages—and, indeed, similar discussions had been continuous since the time of Aristotle.[19] Thus Robert Grosseteste (d. 1253) and a host of followers discussed the formulation of generalizations by a process of induction, followed by the deduction of particulars from those generalizations for the purpose of experimental verification or falsification. In this twofold process, mathematical description was frequently held to play an essential role.[20] Crombie concludes that "the conception of the logical structure of experimental science held by such prominent leaders as Galileo, Francis Bacon, Descartes, and Newton was precisely that created in the thirteenth and fourteenth centuries."[21]

However, we are more concerned with the actual method employed by working scientists than with that described in abstract methodological treatises. Is it not true that this methodology, shared in common by medieval and 17th-century scientist, was practiced only by the latter? It is dangerous to generalize on the method employed by ancient, medieval, or 17th-century scientists; but it is reasonably certain that none of them ever employed the method formulated abstractly in a *tractatus de methodo*. The safest generalization one can make is that all employed methods appropriate to the questions they were asking. Consequently, in all periods we find an overwhelming variety of methods; and in no period were those elements traditionally regarded as characteristic of the 17th century utterly lacking. One need only mention the optical work of Ptolemy, Ibn al-Haitham, and Theodoric of Freiberg (a Greek, a Muslim, and a 13th-century Dominican) as illustration.[22] If there was a growing employment of experiment in the 17th century, it was not because scientists had finally recognized the need for a new and more fruitful method, but because mechanistic natural philosophy increasingly raised questions to which experiment was capable of giving an answer. As A. R. Hall has written with such perception, "The critical feature of seventeenth-century science was that it embraced new or revived ideas. . . . If anything, empiricism was adopted because it offered some promise of verifying these ideas."[23]

Consequently, it is absurd to maintain, as Siemens has, that "it is a matter of record that science never developed anywhere except where there was Christian influence."[24] Such a claim utterly ignores the scientific achievements of Greeks like Aristotle, Galen, Ptolemy, and Archimedes; of Muslims like Ibn Sina, Ibn al-Haitham, Kamal al-Din al-Farisi, and Ibn Badga. Indeed, it is difficult even to know what such a claim means. If Siemens is asserting that no scientist deprived of Christian influence engaged in the kinds of activities that characterize modern science or achieved any scientific conclusion of value, he is plainly mistaken. If, on the other hand, he is asserting that no such scientist discovered the whole truth about anything, then one must reply that neither did Newton. Finally, if Siemens intends that no large and vigorous scientific community developed outside of Christendom, two responses are possible: first, one can simply point to the activity at Aristotle's Lyceum or Hellenistic Alexandria and the Museum; secondly, if those are not sufficiently large scientific communities to satisfy Siemens, one can turn Siemens' sword around and thrust in the opposite direction, noting that nuclear warfare was never developed outside of Christendom either—which is simply to say that Christianity is not to be credited with everything that has occurred in Christendom.

IV

In the third place, scientific progress in the 16th and 17th centuries did not spring from the idea that nature could be rationally comprehended. If we must generalize, it is the contrary that is true. According to Siemens, "It was their belief in the incomprehensibility of the universe—excepting the heavens— that blocked both Greeks and Chinese from searching for a rational order in the material universe. . . . ."[25] Whatever may be true of the Chinese, Siemens' claim is not true of the Greeks. From Greek antiquity through the Middle Ages, the central aim of science was to gain an understanding of the essence of nature; as Aristotelians were prone to express it, one must proceed by induction from that which is "first in the order of knowing," i.e. from sense data, to that which is "first in the order of nature." The fundamental presupposition of this endeavor was that the underlying reality could be comprehended by the human intellect with absolute certainty. (It went without saying that the phenomena were susceptible to description.) This point is well illustrated by E. J. Dijksterhuis in his evaluation of Aristotelian natural philosophy:

> That he and his predecessors, on the ground of certain superficial sense-experiences . . . proceeded so readily to frame a theory of such general character, and that his successors accepted this theory so eagerly and uncritically, illustrates again the tendency, already noted among Greek thinkers generally, to underestimate the difficulty of studying nature. No matter whether they took a more or less empirical attitude towards nature, without a single exception they overrated the power of unchecked speculation in natural science.[26]

Thus if there was too little experimentation in antiquity, it was because Greek scientists felt that nature was so transparent to the human intellect that laborious empirical investigation was unnecessary. They had, not too little confidence in the ability of the human mind to penetrate nature, but too much.

This ancient ideal of science continued to hold sway in the first half of the 17th century. Francis Bacon and Descartes underestimated the complexity and opacity of nature; like Aristotle, their goal was to penetrate with absolute certainty to the ultimate reality.[27] Descartes could argue, for example, that the essence of matter is extension; matter, for him, was not an incomprehensible "given," as it was to become later in the century, but an entity capable of complete comprehension and precise definition. However, by the middle of the century the skeptical crisis, brought on by a number of factors including the existence of competing philosophies and the recovery of the works of the ancient skeptics in the latter half of the 16th century, had shattered man's confidence in his in-

tellectual powers and the comprehensibility of nature.[28] In Pierre Gassendi, one of the first scientists to accept the conclusions of skepticism, we see the dim outline of a new aim for science. Walter Charleton, speaking for Gassendi, writes:

> That the sounding line of man's reason is much too short to profound the depths or channels of that immense ocean, nature, needs no other evictment but this, that it cannot attain to the bottom of her shallows. It being a discouraging truth, that even those things which are familiar and within the sphere of our sense, and such to the clear discernment whereof we are furnished with organs most exquisitely accommodated, remain yet ignote [i.e. unknown] and above the moon to our understanding.[29]
>
> For insomuch as the true idea of nature is proper only to that Eternal Intellect which first conceived it, it cannot but be one of the highest degrees of madness for dull and unequal man to pretend to an exact or adequate comprehension thereof.[30]

If man's reason cannot plumb the depths, or even the shallows, of nature, what shall he do? He must restrict himself to a description of the surface appearances. Thus Charleton continues:

> We need not advertise that the zenith to a sober physiologist's [i.e. physicist's] ambition is only to take the copy of nature from her shadow, and from the reflex of her sensible operations to describe her in such a symmetrical form as may appear most plausibly satisfactory to the solution of all her phenomena.[31]

To a considerable extent Gassendi and Charleton spoke for the latter half of the 17th century—certainly for the 18th and 19th. Indeed, already in the 1630's, Galileo had expressed the same point in his analysis of falling bodies; gravity is beyond comprehension, and therefore one must restrict himself to a description of the phenomena:

> But we do not really understand what principle or what force it is that moves stones downward, any more than we understand what moves them upward after they leave the thrower's hand, or what moves the moon around. We have merely . . . assigned to the first the more specific and definite name 'gravity,' whereas to the second we assign the more general term 'impressed force' . . . .[32]
>
> At present it is the purpose of our Author [i.e. Galileo] merely to investigate and demonstrate some of the properties of accelerated motion (whatever the cause of this acceleration may be). . . .[33]

The notebooks of the young Newton reveal that he was heavily influenced by Gassendi and Charleton.[34] Thus very early in his career he adopted Gassendi's restrictions on the possibility of knowledge as well as his mechanistic natural philosophy. This outlook explains Newton's extreme caution in expressing hypotheses regarding the cause of gravity. He knew that his inverse-square law was an accurate mathematical description of the phenomena, but he recognized the impossibility of achieving equal certainty regarding the cause. Thus Newton writes that he "feigns no hypotheses" and that

> hitherto we have explained the phenomena of the heavens and of our sea by the power of gravity, but have not yet assigned the cause of this power. . . . To us it is enough that gravity does really exist, and act according to the laws which we have explained, and abundantly serves to account for all the motions of the celestial bodies.[35]

Newton here reflects the influence of skepticism. The human mind is unable to penetrate to the ultimate reality; nature is essentially opaque to human reason. It is legitimate, therefore, for the scientist to restrict himself to a mathematical description of the phenomena. There is no more characteristic feature of Newton's philosophy of nature.[36]

V

Finally, I must append a note of caution and clarification. I am not to be interpreted, in the foregoing argument, as maintaining complete continuity between medieval and early modern science. On the contrary, I regard it as quite legitimate to speak of a "scientific revolution" in the 16th and 17th centuries. My point is rather that the actual discontinuities between medieval and early modern science are not those traditionally assigned, and particularly not the three considered above; nor are they, in any meaningful sense, Christian in origin. Perhaps, in order to clarify, I might be permitted merely to enumerate a few of what I regard as the distinguishing features of 16th and 17th century scientific thought; however, let the conjectural character of what follows be quite clear: (1) Humanism, which encouraged the view that truth and value are to be identified with antiquity, led to the recovery of ancient philosophies like Pythagoreanism, atomism, and skepticism. (2) The skeptical crisis, already discussed, cast doubt upon the possibility of knowledge of the underlying causes. (3) A revival of Pythagoreanism by Marsilio Ficino and others late in the 15th century led (among other things) to an animistic natural philosophy and a stress on order and harmony. (4) The mechanical philosophy, based on the newly recovered works of the ancient atomists, was developed as a reaction against the animism of Renaissance Neo-Pythagoreanism as well as against traditional Aristotelianism. (5) An Archimedean approach to nature, introduced in the middle of the 16th century with the complete publication of Archimedes' works, stimulated the tendency to deal with nature mathematically. (6) A more critical spirit was fostered by the existence of competing natural philosophies and the skeptical crisis—though the absurdities of Cartesian physics should remind us to make no extreme claims in this direction. (7) Finally, a larger population and greater affluence gave rise to a larger scientific community and more rapid progress, thereby exaggerating all other differences between the Middle Ages and the 16th and 17th centuries. It appears to me that most, if not all, other distinctive features of 17th-century scientific thought are reducible to these.

A number of recent authors (including David Siemens in the ASA Journal*) have argued that Christianity was one of the principal factors in the formulation of a new and viable science in the 16th and 17th centuries. This view of the relationship between Christianity and the progress of science springs from a misunderstanding of the scientific revolution of the 16th and 17th centuries.*

NOTES

[1]The most vocal recent supporter of the "hedonist-libertarian" view (and author of the phrase) is Lewis Feuer, *The Scientific Intellectual* (New York, 1963); among his forerunners he numbers such men as John W. Draper and Andrew

Dickson White. For a slashing attack on Feuer's book, see the review by Donald Fleming in *Isis*, vol. 56 (1965), pp. 369-70.

[2]"Cross, Constellation, and Crucible: Lutheran Astrology and Alchemy in the Age of the Reformation," *Ambix*, vol. 11 (1963), p. 65.

[3]"A Firm Foundation for Modern Science," *Christianity Today* (October 22, 1965), p. 13.

[4]"The Sources of Science," *Journal of the American Scientific Affiliation*, vol. 18 (1966), p. 85.

[5]"Science, Technology and Society in Seventeenth Century England," *Osiris* vol. 4 (1938), p. 453. For other literature expressing a similar view, see Robert K. Merton, "Puritanism, Pietism, and Science," *The Sociological Review*, vol. 28 (1936), pp. 1-30; Dorothy Stimson, "Puritanism and the New Philosophy in 17th Century England," *Bulletin of the Institute of the History of Medicine*, vol. 3 (1935), pp. 321-334; R. Hooykaas, "Science and Reformation," in *The Evolution of Science*, edd. Guy S. Metraux and Francois Crouzet (New York, 1963), pp. 258-290. See also the debate between Hugh F. Kearney and Christopher Hill in *Past and Present*, vols. 28-32 (1964-65).

[6]Siemens, *op. cit.*, p. 84. Note his abstract as well as his text.

[7]See, for example, Marshall Clagett, *The Science of Mechanics in the Middle Ages* (Madison, Wisconsin, 1959). A. C. Crombie (see n. 19, below) has also been a vocal spokesman for the continuity view, though he has overstated the case.

[8]The most useful book on Copernicus is undoubtedly Thomas S. Kuhn, *The Copernican Revolution* (Cambridge, Mass, 1957).

[9]See the Preface and Book I. The equant is a point other than the center of the orbit, with respect to which the angular motion of the planet is uniform. Copernicus' view is clearly revealed by the following quotation from his *Commentariolus* (1512): "Yet the planetary theories of Ptolemy and most other astronomers, although consistent with the numerical data, seemed likewise to present no small difficulty. For these theories were not adequate unless certain equants were also conceived; it then appeared that a planet moved with uniform velocity neither on its deferent nor about the center of its epicycle. Hence a system of this sort seemed neither sufficiently absolute nor sufficiently pleasing to the mind. Having become aware of these defects, I often considered whether there could perhaps be found a more reasonable arrangement of circles, from which every apparent inequality would be derived and in which everything would move uniformly about its proper center, as the rule of absolute motion requires." (*Three Copernican Treatises*, tr. Edward Rosen [New York, 1959].)

[10]The dissatisfaction at Cracow with Ptolemaic astronomy is illustrated by the *Commentary* on George Peurbach's *New Theories of the Planets* by Albert Brudzewski, Cracow's most noted astronomer in the 15th century.

[11]See Eugeniusz Rybka, *Four Hundred Years of the Copernican Heritage* (Cracow, 1964), chap. 7. On the Hermetic movement, of which Neo-Pythagoreanism was one facet, see Frances Yates, *Giordano Bruno and the Hermetic Tradition* (Chicago, 1964).

[12]Book I, chap. 10. C. G. Wallis's translation of *De revolutionibus* in the *Great Books* series is exceedingly untrustworthy. A good translation of the Preface and Book I, by John F. Dobson and Selig Brodetsky, appeared in the *Occasional Notes of the Royal Astronomical Society*, vol. 2, no. 10 (1947). Kuhn quotes extensively from this latter translation.

[13]Preface of *De revolutionibus*, Dobson and Brodetsky translation.

[14]Quoted by Thomas W. Africa, "Copernicus' Relation to Aristarchus and Pythagoras," *Isis*, vol. 52 (1961), p. 407.

[15]*Ibid.*, p. 409.

[16]The mean-speed theorem asserts that the distance traversed by a body undergoing uniformly accelerated motion is the same as the distance traversed by another body moving for the same length of time at the mean speed of the first body. The odd-numbers law asserts that a body undergoing uniformly accelerated motion, beginning from rest, traverses three times as much space in the second unit of time as in the first unit of time, five times as much space in the third unit of time, and so forth; this is mathematically equivalent to Galileo's statement that $s \propto t^2$. Both conclusions were reached at Merton College, Oxford, by about 1330 and were widely known throughout the later Middle Ages; cf. Clagett, *op. cit.*

[17]On medieval mechanics in general, see Clagett, *op. cit.* An excellent study of Galileo and his relationship to the medieval mechanical tradition is Ernest A. Moody, "Galileo and Avempace: The Dynamics of the Leaning Tower Experiment," *Journal of the History of Ideas*, vol. 12 (1951), pp. 163-193, 375-422.

Soto published his conclusions in his *Super octo libros physicorum questiones* (Salamanca, 1555). Traditionally it has been held that Galileo could have had no access to Soto's conclusions, but recently William A. Wallace, O.P., who has been investigating Soto's work, has called attention to the fact that the above work of Soto was published in Venice in 1582 and was circulating in northern Italy during Galileo's student days and, moreover, that Galileo mentions Soto's name in his student notebooks; cf. Wallace, "The 'Calculatores' in Early Sixteenth-Century Physics," unpublished paper.

In all fairness, I should point out that Galileo's work on projectile motion was more original than his work on falling bodies; nevertheless, even on this problem, Galileo was the culminating figure in a long medieval tradition.

[18]See, for example, my forthcoming article, "The Cause of Refraction in Medieval Optics," *British Journal for the History of Science*, vol. 4 (June, 1968).

[19]A. C. Crombie, *Robert Grosseteste and the Origins of Experimental Science* 1100-1700 (Oxford, 1953). John Herman Randall, Jr., *The School of Padua and the Emergence of Modern Science* (Padua, 1961). On Bacon's methodology, see also Paolo Rossi, *Francis Bacon: from Magic to Science* (Chicago, 1968).

[20]For example, see Roger Bacon, *Opus maius*, IV, dist. 1, chap. 3.

[21]Crombie, *op. cit.*, p. 3. Even Crombie's most forceful critic, Alexandre Koyre, has conceded this much; cf. Koyre, "The Origins of Modern Science: A New Interpretation," *Diogenes*, vol. 16 (1956), p. 13. If Crombie overstates the case for continuity (Koyre's concession notwithstanding), it is an equal overstatement to argue that the 17th century was the scene of a revolution in methodology.

[22]On Ptolemy's optical work, see A. Lejeune, *Euclide et Ptolemee* (Louvain, 1948); Lejeune, *Recherches sur la catoptrique grecque* (Bruxelles, 1957). On Ibn al-Haitham (Alhazen), see Matthias Schramn, *Ibn al-Haythams Weg zur Physik* (Wiesbaden, 1963); cf. my "Alhazen's Theory of Vision and Its Reception in the West," *Isis*, vol. 58 (1967), pp. 321-341. On Theodoric, see William A. Wallace, O.P., *The Scientific Methodology of Theodoric of Freiberg* (Fribourg, Switzerland, 1959).

[23]*From Galileo to Newton* (London, 1963), p. 104.

[24]*Op. cit.*, p. 85.

[25]Letter to the Editor, *Journal of the American Scientific Affiliation*, vol. 19 (1967), pp. 125-126. If Aristotle was not seeking the rational order in the material universe, what *was* he doing? One might wish to argue that he did not find it, but surely not that he failed to search for it.

[26]*The Mechanization of the World Picture*, tr. C. Dikshoorn (Oxford, 1961), p. 72.

[27]On the aims of Baconian and Cartesian science, see the doctoral dissertation of ASA member Robert E. Snow, *The Problem of Certainty: Bacon, Descartes, and Pascal.* Indiana University, 1967.

[28]On the skeptical crisis, see Richard H. Popkin, *The History of Skepticism from Erasmus to Descartes* (New York, 1964).

[29]*Physiologia Epicuro-Gassendo-Charltoniana: Or a Fabrick of Science Natural, upon the Hypothesis of Atoms* (London, 1654), p. 127. As Peter A. Pav has pointed out ("Gassendi's Statement of the Principle of Inertia," *Isis*, vol. 57 [1966], p. 26), Charleton's work is frequently a literal rendition of Gassendi's *Animadversiones* (1649). I have modernized Charleton's orthography and punctuation.

[30]Charleton, *op. cit.*, p. 128.

[31]*Ibid.*

[32]*Dialogue Concerning the Two Chief World Systems*, tr. Stillman Drake (Berkeley/Los Angeles, 1953), p. 234.

[33]*Dialogue Concerning Two New Sciences*, tr. Henry Crew and Alfonso de Salvio (New York, 1914), pp. 166-167.

[34]See Richard S. Westfall, "The Foundations of Newton's Philosophy of Nature," *British Journal for the History of Science*, vol. 1 (1962-63), pp. 171-182.

[35]*Mathematical Principles of Natural Philosophy*, tr. Motte-Cajori (Berkeley, Calif., 1960), p. 546.

[36]I am not here adopting a positivistic interpretation of Newton; Newton was indeed interested in the cause of gravity, but he recognized the provisional nature of any such hypothesis, whereas he knew that certainty could be obtained in a mathematical description of the phenomena. On Newton's attitude toward hypotheses, see Aexandre Koyre, *Newtonian Studies* (London, 1965). (*continued on page* 96)

LETTERS TO THE EDITOR

Adam and Fossil Man.

Many thoughtful Christian people find themselves somewhat confused by the statements of anthropologists who, while professing an evangelical faith, hold views regarding the origin of man which play havoc with the traditional biblical picture of early human history. Since this picture has always formed an essential part of the theological basis of the Plan of Redemption, it is disturbing to see it being undermined without the provision of a well defined alternative.

Christian anthropologists often have little hesitation in attributing to fossil remains which are held to be geologically ancient, a status that to all intents and purposes places them so nearly within the family of man that it becomes difficult to see exactly how Adam's remains would be distinguished from them if they were ever found. For while it is true that they are usually said only to *anticipate* man, the implication is that a real continuity exists between them all and that this continuity bears witness to an evolutionary trend that led ultimately to the emergence of an individual corresponding to the biblical Adam. Some hold that the continuity was genetic up to, but not necessarily including, him. At this point it is allowed that there may have been a discontinuity. But one cannot escape the feeling that very few will be fully satisfied until even this discontinuity has been removed. The goal is to complete the series with as small an increment of change between each candidate as is possible, so that to any hominoid living at the time the sudden appearance of Adam would have caused little stir since he must have differed so little in appearance from the rest of the community.

Thus Adam as the progenitor of an entirely new order ceases to be the sharply defined figurehead of the human race whose initial innocence and subsequent fall is a matter of such vital importance in evangelical theology. He seems merely to have appeared on the scene by physiologically normal processes and thenceforth to have slowly displaced all competitors. Maybe he had a far superior intelligence, but otherwise it would at first have been hard to single him out from among his contemporaries.

No one is willing at the present time to state precisely when the biblical Adam first showed up, nor even in what geographical location. His nature is similarly ill-defined. We do not know whether he was in fact a fully developed and highly intelligent adult male of modern type, or merely a slightly more advanced "primitive" who showed promise. And the idea that Eve was derived directly out of him, as Genesis says, is not seriously considered since it would make the original Adam so completely unlike his predecessors, physiologically speaking.

When we try to relate to Scripture this hazy picture of the past with its enormously expanded time frame, we run into difficulty because as we pass back in time from Abraham towards Adam in the biblical record, we find no obvious break at which we might say, Beyond this point we are entering prehistory. Much has, of course, been made of the gaps in the biblical genealogies as though they were capable of accommodating these tremendous stretches of time—far exceeding the total span of human history since it began in the Middle East. But this overlooks the fact that these "gaps" are not really gaps at all since they are filled in elsewhere in Scripture. Were this not the case, we could never have known of their existence in the earlier portions of the record. We only discover them when we observe the data provided subsequently which reveals the previous omissions by supplying the names to fill out the record. There may *be* gaps elsewhere, but the writers of the Old Testament certainly reveal no awareness of them as they have done in the known examples.

Meanwhile, it is somewhat frustrating to be told that we have quite misunderstood the Old Testament in its earliest portions when at the same time we are not being provided with even the suggestion of a new interpretative key. Even if such a key were very tentative, it would be welcome as serving for a basis of discussion. Failing this provision, rapport between the more conservative among us and the Christian *avant-garde* becomes more and more tenuous. We reach a point where we are barely on speaking terms . . .

The situation has, however, clarified itself to this extent that the two alternative views (the older and the more recent) can at least be set forth with a sufficient measure of logical precision that their implications may thus be examined.

First of all, certain simple assumptions have to be made. Of any particular fossil one must assume either that it *is* human (i.e., truly belonging within the family of Adam), or that it is *NOT*. If it *is*, it must be *since* Adam for he was the first human being. If the fossil is deemed very old, then either Adam was very, very long ago and the biblical chronology for the period before Abraham's time is being entirely misinterpreted, or the method of dating the fossil is somewhat at fault.

If it is *NOT* in Adam's line but is much more ancient, then one must allow a long period of time prior to Adam's appearance. This can be provided for either by treating the "days" of Genesis as geological ages, or by interposing a break between the first and second verses of Genesis 1.

According to Genesis, Adam came into being by a direct creative act of God, bringing into the world a creature who was later to be restored to view in Christ, the Second Adam. He was therefore uniquely related to God and possessed a physical constitution which was of such a nature that God could indwell him with propriety and express Himself through him with fulness and dignity. This is an absolute requirement in that the first Adam must be such that the Second Adam in the Person of Jesus Christ reflected him faithfully *as true man*. In that case, between Adam and his descendants on the one hand (no matter how degenerate they may at times have become—and Neanderthal could be one of these), and fossil hominoids

not of Adam's line on the other, there is an absolute discontinuity.

Then what is to be said of all the fossil forms which far antedated the appearance of true man and yet increasingly seem to have approached him in appearance?

Perhaps they can be considered as precursors of Adam in the sense that God may have worked towards the creation of Adam in a stepwise fashion. Their existence at each stage of the process may merely indictate that the total environment (climate, flora, and fauna) was more and more nearly what God intended it to be as a setting in which Adam was to undergo his "education". Animals capable of domestication, plants of potential use to him, a climate in which his body and his mind would function at their maximum effectiveness—these things were being prepared, each stage of preparation being occupied by such man-like forms as were best adapted to it, becoming more man-like as the environment was more nearly ready to receive the crown of creation who was to have dominion over it.

But whatever their appearance, there is no way of knowing whether they housed a human soul. A jaw bone or a cranium, a limb or even a hand that suggests refined articulation—these things cannot of themselves determine the precise relationship of their possessors to the family of Adam. Even evidence of some "Culture" would not be completely decisive since many animals show that they have the ability to learn patterns of behavior which are far from instinctive—and Culture is by definition just this. Possibly the only cultural "proof" of humanness is evidence of religious belief such as the making of fetishes or providing the dead with supplies for a life to come. In the final analysis it is still true that all fossils are foundlings. Even the burial together of an adult female and an infant would provide no absolute proof that they were related as "mother"and "child". Genetic relationships cannot yet be established by the study of bones. It is an argument from analogy and its force depends very largely on the initial bias of the investigator. Physical anthropologists cannot at the present time state with certainty whether there are genetic relationships between any fossil hominoid and the first human being. But they could perhaps look for other reasons than evolutionary ones as to why these hominoids assumed more man-like forms as time went on.

In the meantime, the present situation can be summarized somewhat as follows. If fossils are positively identified as of truly human origin, they must be post-Adam because he was the *first* human being.° And if they are very ancient, then so must Adam also be. In this case, either we are quite misunderstanding the biblical chronology—or the fossils are somewhat being dated erroneously.

On the other hand, if such fossils antedate Adam by hundreds of thousands of years, then the days of Genesis are not "days" but ages, or there is a hiatus in time between Genesis 1:1 and the first day of the week of creation.

It seems to me these are the issues. We cannot simply leave the matter here, however. We have a responsibility not merely to show where the generally accepted interpretation of Genesis is at fault, but to provide a coherent and theologically valid alternative which, though of course tentative, will serve as a basis for further discussion and subsequent refinement. The issue is by no means a dead one.

°That Adam was the first man and Eve the first woman is born out (a) by I Cor. 15:45 (". . . the *first man, Adam* . . .") and Acts 17:26 (". . . hath *made of one* all nations of men for to dwell on all the face of the earth. . ." so the Greek), and (b) by Gen. 3:20 ("Eve . . . became the mother of all living. . . ." so the Hebrew).

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Glossolalia

George Jennings' paper on glossolalia serves to demonstrate that, like many psychological experiences, glossolalia is complex. The more he and others study the phenomena and attempt to correlate all the data into an organized pattern of explanation, the better. Glossolalia participants should have no fear of a thorough explanation of their experience.

At the same time, as a glossolalist, I must insist that the non-glossolalist must not think that he can come to a complete understanding of the phenomena by looking at the mere externals from the outside in. The statement, "That bizarre utterances occur in non-Christian cultures emphasizes the fact that the practice is not self-authenticating," is misleading. The practice is not self-authenticating so far as its externals are concerned; but to the participant, the Holy Spirit bears a witness that is as self-authenticating as one's consciousness of existence. It is not ethnocentrism that leads the Christian to insist that his experience has an ultimately unique element, but rather it is the witness of the Holy Spirit.

I think that all who write (and who read) papers on the psychological factors in glossolalia should familiarize themselves with the psychology of conversion literature that exists, and reflect upon it. In Ferm's book alone (*The Psychology of Christian Conversion*) one sees that *psychologically*, Christian conversion is nothing unique. Similarly, much of this literature ties conversion to emotional instability, *etc.*, as Jennings and others tie tongues to emotional instability. But, no Christian is going to admit that his conversion can be reduced to a mere psychological experience that occurred because of emotional instability. He rather suspects that the psychologist doesn't really understand and is just rationalizing.

The uniqueness of Christian glossolalia, like Christian conversion, is in the witness and operation of the living Spirit of God. To ignore this essential factor is to fall into a reductionism that must forever come short of the truth.

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(*Letters continued on p.* 96)

BOOK REVIEWS

ANCIENT ORIENT AND OLD TESTAMENT by K. A. Kitchen, *Chicago: Inter-Varsity Press,* 1966

The author of this major evangelical contribution to biblical scholarship is a Lecturer in Egyptology at Liverpool University. In the field of Egyptology he is the author of *Suppiluliuma and the Amarna Pharaohs,* and the forthcoming *The Third Intermediate Period in Egypt,* as well as numerous articles in scholarly journals. In the area of biblical studies Professor Kitchen has contributed important articles to *The New Bible Dictionary,* and the article "The Aramaic of Daniel" in the recent work, *Notes on Some Problems in the Book of Daniel.* Forthcoming are two promising titles, *Hittite Hieroglyphs, Aramaeans and Hebrew Traditions,* and *The Joseph Narrative and its Egyptian Background.* The present volume was first published in a German translation in 1965 as *Alter Orient und Altes Testament.*

On the basis of his acquaintance with Near Eastern literatures in general and with Egyptian literature in particular the writer criticizes the artificial standards of the prevailing documentary hypothesis of the Bible. He points out that the criteria used to establish separate documents in the Pentateuch would make nonsense if used in analyzing Egyptian texts. He also criticizes certain aspects of form criticism which seeks to isolate various literary genres and establish their *Sitz im Leben* ("situation in life") contexts.

A positive contribution of the author's study is a comparison of the covenant between Jehovah and Israel in Exodus 20 ff. with various covenants from the ancient Near East. An analysis of the component elements reveals that the Sinai Covenant is similar to covenants of the late second millennium but not to those of the first millennium, thus supporting the Mosaic date of the Covenant against critics who would place it later.

An original suggestion of Kitchen (first proposed in the article on "Chronology of the OT" in the *New Bible Dictionary* in 1962) is a serious attempt to resolve the seeming impasse between archaeological data and biblical data for the date of the Exodus. Since Israel is first mentioned as being in Palestine in a stele of Pharaoh Merenptah c. 1220 B.C., the latest date for the Exodus must come at least some 40 years prior to this. The destruction of various Palestinian cities in the 13th century B.C. and the mention of Racameses as one of the store cities built by the Hebrew slaves (Exodus 1:11) favor a "late" date for the Exodus c. 1280 B.C.

On the other hand, I Kings 6:1 says, "In the four hundred and eightieth year after the people of Israel came out of the land of Egypt, in the fourth year of Solomon's reign over Israel . . . he began to build the house of the Lord." According to W. F. Albright Solomon reigned 961-922, and according to E. R. Thiele 971-931. [A recent article, Eric Uphill, "The Date of Osorkon II's Sed-Festival," *Journal of Near Eastern Studies,* 26 (1967), 61-62, would place Solomon's death between 930-925.] Adding 480 years to Solomon's fourth year we have an "early" date for the Exodus c. 1448-1438.

Most conservative scholars have favored the "early" date. Cf. Merrill F. Unger, *Archaeology and the OT,* ch. 12; Samuel Schultz, *The OT Speaks,* pp. 48-49; Gleason Archer, *A Survey of OT Introduction,* pp. 212-23; and John Rea, "The Time of the Oppression and the Exodus," *Bulletin of the Evangelical Theological Society,* 3 (1960), 58-69. A few have inclined to the "late" date, widely adopted by archaeologists and non-conservative biblical scholars. Cf. C. de Wit, *The Date and Route of the Exodus;* J. A. Thompson, *The Bible and Archaeology,* pp. 62-63; and Charles F. Pfeiffer, *Egypt and the Exodus,* p. 38.

Kitchen points out that if one were to add all the individual genealogies from Exodus to I Kings one would get a total of over 553 years, and not just 480. He further notes that in other Near Eastern chronologies the ancients arrived at totals that were larger than the elapsed time by adding up the reigns or genealogies of rulers, some of whom lived not consecutively after each other but in part contemporaneously with each other. The figures of 480 or of 553 plus years may perhaps be taken as aggregate sums larger than the elapsed time of some 300 years permitted by the "late" date for the Exodus.

One of the most striking features of the work—which may dismay some lay readers but which will delight serious scholars—is Kitchen's thorough documentation, evincing a comprehensive grasp of all of the major areas of Near Eastern research.

Reviewed by Edwin M. Yamauchi
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BASIC TYPES OF PASTORAL COUNSELING, Howard J. Clinebell. Abingdon Press, 1966

In this book Clinebell has performed an extremely valuable service for those interested in the area of Pastoral Counseling. The reader will find a very broad sampling of different theories and approaches to counseling as well as hints about applying these techniques to a wide variety of situations. The book is especially notable for the degree of sophistication that Clinebell exhibits regarding current trends in the fields of psychotherapy and counseling. Many of the newer concepts and theories in this area are presented and related to the area of pastoral work. The author combines a well balanced presentation of theory with specific, down-to-earth information about how to apply the theory in practical situations. He leads the way in pastoral counseling by indicating that the old model of pastoral counseling which involves a combination of Rogerian and Freudian techniques is now in need of revision. Clinebell opts for what Perry London in his *Modes and Morals of Psychotherapy,* as well as others, have dubbed "action therapy." Action therapy refers to a number of new approaches to psychotherapy which

break away from the insight model and stress various kinds of problem solving, learning theory, social learning, social interaction and related approaches to treatment.

Clineball rightly points out that the minister who clings to the old model and perceives his role of counselor as taking place only within the confines of an hour in the pastor's study for certain selected individuals each week results in a very limited approach to the area of pastoral counseling. He makes clear in Chapter Two and throughout the book that the minister, in all of his contacts with people in the life of the church, can have a therapeutic and redeeming influence that extends far beyond the confines of the pastor's study and counseling "sessions."

The book is well written and a pleasure to read. Seldom is it possible for a reviewer to recommend a book with equal enthusiasm for the beginner as well as for the advanced student in a field. However, this can be safely done with Clinebell's book. His approach is sufficiently insightful and creative that the professional in the field will find a number of new ideas and will benefit from the surveys of current trends in psychotherapy as applied to pastoral counseling. In addition, the book, for the most part, presents ideas with sufficient clarity and completeness that even the beginner can very readily follow the points being made. The book is well indexed and contains a number of references for further reading which will guide the interested student in his further pursuit of the subject. As is the case with many of the other writings of Clinebell, this book is destined to be a classic and should be on the shelf of every pastoral counselor.

For those interested in learning what the field of pastoral counseling is all about in order to be better laymen, as well as for the pastoral counselor and professional psychotherapist, this book is highly recommended.

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TWO CONCEPTS OF RACE. HUMAN LIFE ZONES: THE ROAD TO ACADEMIC INTEGRATION. Valle, M. M., Lima, Peru: Institute of Human Studies, 1964.

Reviewed by James O. Buswell III.

Valle's works over the years have championed and attempted to propagate the thesis of environmental determinism in his own particular ecological emphasis upon temperature, or thermal zones. He seeks to discredit traditional racial taxonomy by describing the "two concepts of race," *morphorace*, by which he refers to the racial designations according to morphology such as Caucasoid, Mongoloid, and Negroid; and *thermorace*, or divisions of mankind according to temperature zones.

A certain confusion in taxonomic usage is indicated throughout. For example, in the early pages he speaks of *morphorace* taking man "out of the sphere of natural life, isolating him from the world of plants and animals . . ." To illustrate this he points out that

> . . . we cannot speak of Mongoloid, Caucasoid or Negroid plants and animals, e.g., a Caucasoid animal, a Mongoloid insect, or a Negroid fish, since we would openly fall into absurdities. It is apparent that the classification of man into Mongoloid, Caucasoid and Negroid has been stamped on the concept of *race* as an arbitrary and forced division only applicable to *Homo sapiens*. (p.9)

One could as well point out that we cannot speak of an Airedale Eagle, a Terrier insect, or a Collie fish; or that the classification of dogs into Dalmatians, Terriers, Spaniels, Hounds, etc., has been stamped on the concept of *breed* as an arbitrary and forced division only applicable to *Canis familiaris*. What Valle fails to appreciate is that to whatever extent it is valid, the concept of *thermorace* is and has long been incorporated in most detailed anthropological considerations of the characteristics and distributions of *morphoraces*.

Of course, it is perfectly legitimate for anyone to abstract such a particular ecological aspect of human race for purposes of specific emphasis. But to offer it as "a new specialized meaning" and improvement over against other "arbitrary" categories which are "irrelevant to the biological order of life" is, at best, overdoing a good thing.

Even though temperature is important in human ecology and has some formative influence on race, Valle's limitation of consideration to this one feature as of primary importance to man throughout all of his history neglects the balanced appreciation of "environment" as a complex combination of interrelated influences such as human culture and social selection, altitude, occupation, famine and nutrition, not to mention growth rates, immunities, and other features of environmental adaptation.

The general thesis, then, while containing some valuable points of emphasis, is indiscriminately applied, both to physical as well as cultural features, and is pushed far beyond legitimate or realistic bounds. The author traces

> the distribution of certain linguistic sounds, finding in warm regions a greater frequence of soft, liquid sounds, written with abundant vowels; in contrast, along the cold belts, we discovered a stronger, fricative or guttural pronunciation using abundant consonants. (p. 54)

The scientific methods of linguistic analysis and the historic study of comparative linguistic would sustain no such findings.

Valle quotes as "two of the greatest American race specialists" (p. 49) J. C. Nott and G. R. Gliddon, whose writings of a hundred years ago were based upon the notorious pseudo-scientific proposition that slavery of Negroes was justified because of the inherent inferiority of this race. He also quotes recent anthropologists to support his thesis. It is significant to note that these quotations may be seen in two categories: (a) those who treat environmental influences upon race in the perfectly normal way of modern science which combines "morphorace" and "thermorace" in their methodology without specifying the distinction in terms; and (b) those who write more specifically of the influence of environment upon race and are quoted by Valle out of context because their conclusions do not agree with his, or else because he does not understand them in the first place. As an example of the lat-

ter, the following is taken from Valle, p. 56 followed by the text from Boas, including the passages omitted by Valle:

> Our results are perhaps what Franz Boas was incessantly seeking. "Climate and soil exert an influence upon the body and its functions, but it is not possible to prove . . ." "Here belongs the attempt to explain history as determined by the nature of the country in which the people live. A relation between soil and history cannot be denied, but we are not in a position to explain . . ." "The frequent occurrence of similar phenomena in cultural areas which have no historical contact suggests that important results may be derived from their study, for it shows that the human mind develops everywhere according to the same laws. The discovery of these is the greatest aim of our science. To attain to it many methods of inquiry and the assistance of many other sciences will be needed." (*Op. cit.*, p. 637)

Turning to Boas, F., *Race, Language, and Culture*, p. 637, we find the essay "The Aims of Ethnology" in which Boas in 1888 was already assessing the reliability of contemporary methods in the study of human culture. Notice the original sentence order:

> The frequent occurrence of similar phenomena in cultural areas that have no historical contact suggests that important results may be derived from their study, for it shows that the human mind develops everywhere according to the same laws.
>
> The discovery of these is the greatest aim of our science. To attain it many methods of inquiry and the assistance of many other sciences will be needed. Up to this time the number of investigations is small, but the foundations have been laid by the labors of men like Tyler, Bastian, Morgan, and Bachoffen. *As in other new branches of science there is no lack of hasty theorizing that does not contribute to healthy growth. Far-reaching theories have been built on weak foundations. Here belongs the attempt to explain history as determined by the nature of the country in which the people live.* A relation between soil and history cannot be denied, but we are not in a position to explain *social and mental behavior on this basis* and anthropo-geographical "laws" are valid only as vague, empty generalities. Climate and soil exert an influence upon the body and its functions, but it is not possible to prove *that the character of the country finds immediate expression in that of its inhabitants.* (Emphasis mine.)

Boas goes on to show the fallacy of contemporary examples of this thinking. Far from "incessantly seeking" such explanations, Franz Boaz was actively debunking all such unilateral attempts to interpret human history in simple correlations.

Perhaps this will suffice to indicate the general unreliability of the author's applications of his thesis and the lengths to which he will stretch reference to scholarly authorities to support his views. Where modern scientists make mention of environmental and climatic influences upon race Valle considers them to be following him. Where they disagree with him he quotes with no conscience for context. (See Franz Boas, *The Mind of Primitive Man*, 1938 edition, pp. 189-193 for his mature conclusions on environmental influence.) Furthermore Valle clearly misunderstands the substance of some of those whom he quotes as, for example, the "relics of a culture stage" discussed by Nordenskiold confused with "the mental preference of the inhabitants," (p. 55); and his total misunderstanding of Dobzhansky's use of "culture" in *Mankind Evolving* (1962), (pp. 36, 120-121), and of Carlton Coon's contributions on race (pp. 64-65, 122-127).

It is unwise for a reviewer to impugn the author's motives. One may only wonder at the implications of the following:

> It is wise for most people to cling to their own optimal habitat, harbinger of biological success to their descendants. If not already there, they should plan to return to the climate to which they belong, particularly when they perceive the first ominous warnings of deterioration and disorders. (p. 39)

In conclusion we can do no better than to quote from M. F. Newman's review in the American Anthropologist (April, 1956) of Valle's major work *Observations on Geography*. The review is reprinted as an appendix to the present work. Newman speaks with reference to Valle's attempt to show the effect of climate upon culture:

> In the reviewer's opinion, the demands of sound, scientific procedure regrettably lack fulfillment here. Research into the influence of environment upon man cannot move out of the logical assumption stage until the environment itself is recognized as the multifaceted intertwined complex it is, and until we can distinguish the specific effects upon man of at least the major facets. (p. 105)

Reviewed by James O. Buswell III, St. John's University, Jamaica, N.Y. 11432.

Lindberg—continued from p. 91

Even Hooykaas, who would agree with Siemens' general point regarding the close relationship between the Reformation and the rise of science, recognizes the antirationalism of 17th-century scientific thought, when he writes: "In their antirationalism the spirit of the Reformation and the spirit of experimental science show a close affinity." (Hooykaas, *op. cit.*, p. 267.)

Letters—continued from p. 93

Concerning President Bube's "The Relationship Between the ASA and the Scientific Community"

As a nominal member of the ASA, I found my interest and enthusiasm about the association strikingly increased. Prior to this, my feeling had been that the association was largely parochial and non-significant with regard to the factors listed in your article. Other colleagues have indicated similar feelings and have long since dropped their membership. Your action is commendable and can be enthusiastically supported; I suspect that it will have repercussions but that the net effect will be exceptionally profitable.

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School of Medicine
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One area of President Bube's note in the March, 1968, issue leaves a question in my mind.

In one sentence he hopes we will "break clear of the dry bones of arguments about creation, evolution, Adam . . .," etc. In the next sentence he challenges us to "faithfulness to His Word."

It seems to me that "creation" and "Adam" at least are pretty crucial items, hardly "dry bones," and are decidedly vital to "faithfulness to His Word."

Leon W. Gillaspie
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