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

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JOURNAL OF THE AMERICAN SCIENTIFIC AFFILIATION

A Proposed Biological Interpretation of The Virgin Birth

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The following statements constitute a plausible biological scenario for Jesus during embryological development. (1) God's activity in which he accomplished the Virgin Conception and Virgin Birth is describable in terms of natural created processes. (2) Jesus' conception, gestation, and birth were parthenogenetic. (3) Nonsexual God was incarnated into the human race as a female. (4) Jesus was not only conceived as a female but remained chromosomally such throughout life. (5) Through the natural process of sex reversal Jesus became male, not instead of female but as well as female, assuming the phenotype of a man while retaining the chromosomal badge of a woman. (6) Thus Jesus was born and lived as the androgynous Christ.

Parthenogenesis and the Female Incarnation

From the viewpoint of a biological interpretation of the Virgin Conception-Birth story of the Scriptures, parthenogenesis (reproduction by a virgin) seems to have been the basic natural process that God used to accomplish the physical aspects of the Incarnation. Such virgin birth among animals has been known for centuries. In fact, "the Greeks supported belief in occasional parthenogenesis in human beings by pointing out how widespread among animals was this method of conception."[1]

An Outline of Parthenogenetic Animal Groups

Phylum Aschelminthes
- Class Rotifera.[3,4] "Wheel animalicules" discovered by early microscopists; many species are parthenogenetic.
  - Order Bdelloidea. Apparently all females.
  - Order Monogonata. Some species are all females.
- Class Nematoda (roundworms).
  - Order Rhabditida. Several species of the terrestrial genus *Rhabdites*[5,6] and many of the parasitic genus *Strongyloides*[7] are known to be parthenogenetic. Gynogenesis occurs in the latter genus.
  - Order Tylenchida.[8] Many species of tylenchoid genera utilize variations of parthenogenesis.

Phylum Platyhelminthes (flatworms).
- Class Turbellaria.[9] Free-living flatworms of the genus *Bothrioplana* are parthenogenetic.
- Class Trematoda (flukes).
  - Subclass Digenea (endoparasitic flukes).[10] Species of the genera *Schistosomatum, Schistosoma, Fasciola, Fasciolopsis,* etc., have been reported to be parthenogenetic in both the adult and pedogenetic rediae, although some workers suspect the larval reproduction is better explained as polyembryony.
- Class Cestoidea (tapeworms). "Only recently has parthenogenesis been reported for tapeworms."[11] The single report involves a triploid tapeworm of the family Caryophyllaeidae parasitic on fish.

Phylum Annelida (segmented worms).
- Class Oligochaeta (earthworms).[12] "Parthenogenesis occurs in a few species."

Phylum Mollusca
- Class Gastropoda (snails).[13] Only two parthenogenetic species are known, one each for the genera *Campeloma* and *Potamopyrgus*.

Phylum Arthropoda
- Class Crustacea
  - Subclass Branchiopoda. Parthenogenesis is of common occurrence in this group.
    - Order Anostraca (fairy shrimps).[14,15] The genus *Artemia* is known to be parthenogenetic.
    - Order Diplostraca
      - Suborder Cladocera (water fleas).[16] The genus *Daphnia* is parthenogenetic.
  - Subclass Ostracoda (mussel or seed shrimps).[17,18] Parthenogenesis occurs in the fresh-water genus *Cypris*.
  - Subclass Malacostraca
    - Superorder Peracarida
      - Order Isopoda (sow bugs).[19] The single genus *Trichoniscus* has parthenogens
- Class Myriapoda (centipedes and millipedes)[20] Parthenogens occur in a few species.
- Class Arachnida. It is difficult to comprehend the immensity of this group which rivals the class Insecta in both total number of estimated species and number of individuals.
  - Subclass Acari. (mites and ticks).[21] The mites occur in great variety, adapted as they are to almost every kind of environment. Although not much studied to date, it is probable that they will account for more than a million species when they are finally described. Judging from the forms that have been studied, an immense number of parthenogenetic mites will be ultimately recognized. Parthenogenesis exhibits much variety in mites and parthenogenetic species, genera, and even families occur widely. It is likely that the subclass Acari has more parthenogens than all the other animal groups combined. The five orders Astigmata, Protostigmata, Mesostigmata, Metastigmata, and Cryptostigmata all have parthenogentic forms.
- Class Insecta. In this class, with its million or more named species, there are many examples of parthenogenesis.
  - Order Orthoptera.
    - Family Mantidae.[22] Some species are parthenogenetic.
    - Family Phasmidae (walking sticks).[23] Parthenogenesis is rather common and some species are unisexual, being without known males.
    - Family Blattidae (cockroaches).[24]
    - Family Acrididae (grasshoppers).[25]
  - Order Psocoptera. Mockford[26] lists 30 species of parthenogenetic psocopterans. They represent the 12 families listed and 20 genera.
    - Families Lepidopsocidae, Atropidae, Psyllipsocidae, Liposcelidae, Epipsocidae, Caeciliidae, Elipsocidae, Psoculidae, Philotarsidae, Lachesillidae, Peripsocidae, and Psocidae.
  - Order Thysanoptera (thrips). Some species are partly parthenogenetic and at least one thrips is wholly so.[27]
  - Order Embioptera (webspinners). One species of the genus *Haploembia* is parthenogenetic.[28]

Since the time of the Greeks, knowledge of parthenogenesis has expanded many times so that now most of the groups of multicellular animals are known to have representatives that exhibit unisexual reproduction in one form or another. This view is supported by Suomalainen, author of the major English publication on the subject of parthenogenesis in animals.[2]

> Parthenogenesis is a very common phenomenon in the animal kingdom, forms with parthenogenetic reproduction being found in most animal groups. It is consequently natural that parthenogenesis and cytological questions connected with it have been much studied, the respective literature being very extensive.

Some invertebrates (e.g., aphids) use parthenogenetic (unisexual) reproduction regularly, alternating with bisexual reproduction in seasonal cycles. Others (e.g., bees) use it to differentiate the sexes. Still others (e.g., certain flies) reproduce exclusively without benefit of males and exist as all-female species. Ants have few males in an overwhelming population of females. Certain fish and salamanders use a form of parthenogenesis known as gynogenesis in which sperm from males of the same or another species trigger the eggs to develop but contribute no genetic material to the offspring. Because most vertebrates practice biparental reproduction, many persons think of bisexual reproduction as the only kind of sexual reproduction. But parthenogenesis is genuine sexual reproduction because it also uses sex cells.

To answer the question of what groups and what species of animals are involved in parthenogenesis, I have made a survey of available literature and prepared an outline showing the major taxa which, for biological reasons, are known

Order Homoptera (bugs).
Superfamily Coccoida (scales). Nur[29] lists 33 species of parthenogenetic coccids. These represent the four families listed below and 22 genera. Families Margarodidae, Pseudococcidae, Lecaniidae, and Diaspididae.
Another source[30] names Coccidae as having parthenogens.
Superfamily Aphidoidea (plant lice).[31] Parthenogenesis is characteristic of this group. It consists of the families Aphididae, Phylloxeridae, Eriosomatidae, and Adelgidae, all of which have parthenogens. Some species lack males entirely. An aphidoid related family is Aleyrodidae which too may have parthenogens.
Order Lepidoptera. References to parthenogenesis in lepidopterans are few. Narbel[32,33] studied two virgin-birth species in the family Psychidae. They represented the genera *Apterona* and *Solenobia*. Another lepidopteran genus having parthenogens is *Tephrosia* and was reported by Peacock and Harrison.[34]
Order Diptera (flies).
Family Drosophilidae.[35–37] Many species demonstrate parthenogenesis, including the aptly named *Drosophila parthenogenica*.
Family Culicidae. A single mosquito species, *Culex fatigans*, has been shown to be parthenogenetic.[38]
Family Chironomidae. Some of these midges are parthenogenetic.[39]
Family Lonchopteridae. Most scissor-winged fly species have few or no males.[40]
Family Cecidomyiidae (gall midges).[41] The genera *Miastor* and *Oligarces* are famous for their combination of parthenogenesis with pedogenesis (reproduction by children).
Order Coleoptera (beetles).[42] This is by far the largest order of insects, including about half of the known species and subspecies of all animals. It is estimated that there are about 750,000 kinds of living beetles. Parthenogenesis is widely spread in the group and occurs in all three of the suborders.
Suborder Archostomata. Parthenogenesis occurs in one family.
Suborder Adephaga. Parthenogenesis occurs in one family.
Suborder Polyphaga. Parthenogenesis is known to occur in several families including Scolytidae, Ptinidae, Ciidae, Chrysomelidae, and the great family Curculionidae,[43] making in all some 80 forms known to be parthenogenetic in this suborder.
Order Hymenoptera. The peak of occurrence of parthenogenesis is found in this large order of some 125,000 species and subspecies. "All Hymenoptera thus far reported are parthenogenetic."[44] The large sample thus far studied justifies the expectation that parthenogenesis in one form or another is unanimous for the 125,000 named kinds of hymenopterans and will hold true for the 75,000 species which it is estimated remain to be discovered and studied. The great number of already investigated forms constitutes a broad spectrum of the order and includes representatives of many superfamilies and families. Slobodschikoff and Daly,[45] in their list of hymenopterans known to utilize the thelytoky variation of parthenogenesis, place them under 12 families: Diprionidae, Tenthredinidae, Ichneumoidae, Brachonidae, Trichogrammatidae, Signiphoridae, Eulophidae, Eucyrtidae, Cynipidae, Bethylidae, Formicidae, and Apidae.
Phylum Chordata, Subphylum Vertebrata.
Class Pisces.[46] Two genera of fishes have parthenogenetic representatives.
Family Poeciliidae.
Genus *Poecilia* (= *Mollienisia*), with one diploid gynogenetic "species."[47]
Genus *Poecilopsis*, with three triploid gynogenetic "species."[48]
Class Amphibia.[49] As in the fish, parthenogenesis is relatively rare in amphibians.
Order Anura. Parthenogenesis is naturally occurring with polyploidy in three genera of frogs, viz., *Ceratophrys*, *Hyla*, and *Odontophrynus*.[50]
Order Caudata. Parthenogenesis occurs naturally with gynogenesis and/or polyploidy in three genera of urodeles, viz., *Ambystoma*, *Eurycea*, and *Notophthalmus*.
Class Reptilia.[51] There is an extensive literature on parthenogenesis in reptiles, most of it pertaining to lizards.
Order Sauria. This group has many parthenogenetic species representing 6 families and 9 genera as follows:
Family Teiidae, genera *Cnemidophorus* and *Gymnothalmus*.
Family Lacertidae, genus *Lacerta*.
Family Xantusiidae, genus *Lepidophyma*.
Family Agamidae, genus *Letolepis*.[52]
Family Gekkonidae, genera *Lepidodactylus*, *Hemidactylus*, and *Gephyra*.[52]
Family Chamaelonidae, genus *Chamaeleo*.[52]
Class Aves.
Order Galliformes. The only two birds that are known to sometimes reproduce by natural parthenogenesis are the turkey[53,54] and chicken.[55]
Class Mammalia. Although there are no scientifically documented cases of naturally occurring parthenogenesis in mammals going to *full term*, there are a number of authentic reports of the early stages of such spontaneous unisexual reproduction in this class.[56] Several of these cases are given in the general text.

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or presumed to include parthenogens. As for the parthenogenetic species, even if I had a complete listing of them, it could not be published here as the number would run into hundreds of thousands. Some genera are included with the outline, as are a few pertinent data and the documentations.

Again and again, workers have observed spontaneous cleavage divisions occurring in unfertilized germ cells of many kinds of animals ranging from worms to human beings. This conclusion is supported by the reports of several investigators who found early embryos in various cleavage stages still attached to the ovaries of several kinds of virgin mammals. Examples of such preovulation pregnancy are given by Strassman[57] who worked on the ova of cats, L.Loeb[58] who used guinea pigs, and Krafka[59] who studied *human* ovaries.

initiate cleavage in unfertilized eggs. These he classified as 45 physical, 93 chemical, 64 biological, and 169 combinations of the above. It is clear that practically any kind of stimulus may serve to induce artificial parthenogenesis providing it has proper shock value and the egg in question is in a receptive condition. We may presume therefore that many cases of supposed natural parthenogenesis may result from physical or chemical contaminating environmental factors rather than from spontaneously acting endogenous stimuli existing within the egg. It seems evident however that eggs have within them all the potentialities of successful embryonic development and may respond to various stimuli to trigger cleavage. For these reasons a male parent is not to be regarded as an absolute requirement for successful reproduction.

Through the natural process of sex reversal Jesus became male, not instead of female but as well as female, assuming the phenotype of a man while retaining the chromosomal badge of a woman.

Other researchers worked on unfertilized mammalian ova following ovulation, eggs that had been released from the ovary and were encountered in the fallopian tubes or the uterus. Among these investigators were Chang[60] who studied ferrets, Pincus[61] who used the rabbit, and Austin[62] who worked on the rat. Because they all represented early embryological development, the cleavage stages observed by the six workers show that mammalian eggs, like those of lower animals, possess the inherent capacity to initiate cleavage without spermatozoon participation. This potential of the unfertilized egg to reproduce without male assistance is clearly demonstrated by artificial parthenogenesis whereby even animals that are not known to reproduce by natural parthenogenesis may respond to artificial stimuli. While no viable young were produced in any of the above cases, it seems to be the consensus of embryologists that given optimum environmental factors all animal species, including human beings, have the capacity to react positively to natural or artificial stimuli and to develop to full term. Repeatedly, artificially initiated development has been shown to be fairly easy to achieve, leading even to the production of living young.

The first experiments succeeded in inducing parthenogenesis in echinoderms and were performed by J. Loeb.[63] Since his pioneering work, the eggs of many species other than echinoderms have responded to a variety of stimuli with parthenogenetic development. These animals include annelids, silkworms, mollusks, and such vertebrates as fish, frogs, mice, rats, and rabbits. The artificial stimuli have included treatment with various acids, changes in salt concentration of the fluid in which the eggs were immersed, mechanical agitation of the immersing fluid, temperature shock by heating or chilling, electric shock, and mere pricking the eggs with a needle. Almost 30 years ago Peacock[64] had already counted 371 procedures that had been used to artificially

Experiments on artificial parthenogenesis in rabbits began when unfertilized eggs, left in a glass container, were found to have undergone what appeared to be spontaneous parthenogenesis involving a number of cleavage divisions. Pincus[65] then exposed unfertilized rabbit eggs to some of the treatments which had been successful for nonmammalian forms, including high and low temperatures, hypertonic and hypotonic solutions, and various chemicals. They all worked and he transferred the developing embryos to surrogate mothers. Next, Pincus and Shapiro[66] tried cooling unfertilized eggs within a rabbit's own fallopian tubes. The tubes of a virgin female were surgically exposed and cooling jackets were placed around them, chilling the eggs in situ. The cold treatment was effective and the virgin rabbit gave birth to live offspring. Later the cold treatment was tried by cooling the entire rabbit instead of just her fallopian tubes. Again the unfertilized eggs in the tubes were activated to embryonic development.

Returning to the subject of the probability of parthenogenesis in the human species, the observations of Krafka,[67] revealing the extraordinarily early cleavage divisions of unfertilized human eggs, developing even prior to ovulation, indicate a potential toward unisexual development that is as strong for humankind as it is for our fellow mammals. Such demonstration that the early stages of parthenogenesis are known to actually occur in human beings gives good reason to recognize that full-term parthenogenesis may also occur in our species.

Spurway,[68] the leading authority on the possibility of human parthenogenesis, supports this view and concludes that virgin birth is "probable among humans." She reached this conclusion after many years of research at London University. Aside from the reference given above, the results of her study were announced in a United Press release in

London, dated Nov. 13, 1955. Previously she had given a lecture on the subject entitled "Virgin Births." A résumé of this lecture was published by *Lancet* under "Annotations" and the title "Parthenogenesis in Mammals."[69]

> A rare event which is hard to prove is likely never to be reported at all if it is also an event which according to the common experience is 'known' to be impossible. . . . Possibly some of the unmarried mothers whose obstinacy is condemned in old books on forensic medicine . . . may have been telling the truth.

Beatty[70] takes a similar view. Referring to mammals in general and directing the application to human beings, he says:

> We have seen examples of experimentally induced parthenogenetic development in mammalian embryos in which the facts are undisputed. . . . How could the animals be identified? A little reflection shows that there are difficulties. . . . In man, unmarried mothers have sometimes claimed that no father was involved but the validity of such claims is normally ignored.

No doubt a parthenogenetically produced child of a married mother would be even more difficult to discover.

The recognition that parthenogenesis may take place in humankind makes it available as a suitable part of the proposed biological interpretation of the Virgin Birth story that is the subject of this paper. This explanation proposes that God's activity by which he accomplished the Virgin Conception and Virgin Birth is describable in terms of natural created processes. In this case the process was virgin birth which, translated into biological terminology, is parthenogenesis.[71] If Mary's conception of Jesus was parthenogenetic, the Holy Spirit may have provided by some natural means the triggering environmental stimulus, e.g., simple cold shock that worked so well in animal studies. According to our biological interpretation of the Virgin Birth, Jesus' conception was parthenogenetic, and because human beings have the same X-Y kind of sex determination found in other mammals, with the female homozygous and possessing two X chromosomes, Jesus was conceived as a chromosomal female.

Sex Reversal to the Androgynous Christ

Our proposed parthenogenetic interpretation of the Virgin Conception requires a chromosomal female offspring. Because this offspring was Christ, the Person of the Incarnation, both a female Jesus embryo and a female Incarnation were biologically necessary. This understanding is the basis for some of the statements made in the *Abstract,* viz., "(3) Nonsexual God was incarnated into the human race as a female," and "(4) Jesus was not only conceived as a female but remained chromosomally such throughout life." Because no animal can change the genotype that it receives at conception, Jesus remained female always in this chromosomal sense.

The Scriptures tell us that Jesus was conceived by and born of a virgin mother, thereby informing us biologically that the sex of the embryo was female. But the Bible also tells us that Jesus was born a phenotypic male. Because of this seeming contradiction, a Christian is likely to be confronted by a dilemma: the difficulty in understanding how Jesus, a female embryo at conception, could have been born a male child developed from that same female embryo. Clearly, the scenario of parthenogenesis producing a chromosomal female Jesus required *a subsequent sex reversal to the male phenotype.* How could this happen?

Biologists are generally agreed that sex reversal, like parthenogenesis, may sometimes occur in human beings as it does in lower animals. Among the vertebrates, complete sex reversal has been known for years in fish, amphibians, and birds but not until 1971 was it observed in mammals. In that year Cattanach *et al.*[73] discovered sex reversal in mice and in 1976 Fredga *et al.*[74] found sex-reversed wood lemmings. Until then almost everyone regarded such environmental factors as nutritional, and temperature levels and radiation to be responsible for sex reversal as well as for parthenogenesis.

It did seem conceivable that partial sex reversal to a pseudohermaphrodite status might result from enviromental causes, e.g., medical accidents in which hormonal drugs administered to a pregnant woman gave rise to sexual birth defects in the fetus. But it seemed unlikely that complete sex reversal could be accomplished in humans without genetic help. This view is in agreement with the new consensus in the field of human genetics that "in contrast to most vertebrates, mammalian sex development cannot be modified by manipulating the embryonic environment. . . ."[75] While in the past hormones superseded genes in importance in this field of sex reversal, an important recent advancement has restored genes to their primary role in sex determination. This recovery was made possible by an alliance, during the past decade, between genetics and immunology. The most interesting and helpful of the new developments resulting from this alliance was the discovery and characterization of the histocompatibility-Y factor. It is this gene that provides the key to understanding how the female embryo Jesus, with no Y chromosome, could have undergone sex reversal to be born a phenotypic male and the androgynous Christ.

According to our proposal, Jesus was androgynous in the unique way of being chromosomally female and phenotypically male at the same time, fully retaining the chromosomal and cytological femaleness received at conception. But Jesus was (1) *not* bisexual with respect to having any pathological conditions, morphological or physiological; (2) *not* hermaphroditic, possessing a double set of sex organs; (3) *not* pseudohermaphroditic, with a compromising, "in between," defective set of organs suggestive of both sexes; (4) certainly *not* bisexual from the viewpoint of sexual behavior patterns. Instead of having any or a combination of the above problems, Jesus was completely sex reversed and without physical or psychological imperfections, the Perfect Human Being.

The H-Y antigen that provides a biological explanation of how Jesus' sex reversal could have happened was discovered through standard immunologic procedures. By means of repeated inbreeding of laboratory mice, strains of strong genetic uniformity had been developed, strains that regularly accept tissue grafts of all kinds when they are interchanged among members of the group. In this instance, however, when female mice were given skin grafts from males of their own strain, the grafts were rejected. Such intrastrain rejection of male-to-female grafts indicates a male antigen to which

the females are sensitized. Subsequent research located the H-Y gene on the Y chromosome, hence the name.[76]

H-Y antigen has been found in several mammals, including the rat, guinea pig, and humankind, and it is expected that it will be found in all species of the class.[77] Recognizing that other genetic factors, and to a less extent environmental ones as well, may have influence on the result, many workers regard the presence or absence of H-Y genes as the primary factor in the determination of phenotypic sex in higher animals. The presence of the H-Y factor is believed to direct the first steps toward testis formation, and once this is under way testicular hormones take over the job of converting the nondifferentiated embryo into the male phenotype.[78]

But what part could the male-causing H-Y gene play in Jesus' sex reversal when this gene is known to be Y-linked and the embryo Jesus did not have a Y chromosome, possessing two X chromosomes instead? The solution is found in Wachtel's paper cited above.[77] While the H-Y factor is a male-determining gene and has its locus on the Y chromosome, it may be translocated to an X chromosome or even an autosome. In such cases the translocated H-Y fragment could be submicroscopic and not change in the least the karyotypic picture of the receiving chromosome.

In the context of the Virgin Birth, one of Mary's two X chromosomes, or one of her 44 autosomes, may have carried such an invisible but effective H-Y fragment. Any of her forefathers on either side of the family could have been the source of the translocation that she inherited and passed on to her virgin-conceived female-embryo Jesus who then, at about seven weeks of embryonic age and because of this H-Y gene, began to show sex reversal toward the male phenotype.

How could Mary have had an H-Y gene and still be a functional female? Again we turn to Wachtel and his fellow workers for a satisfactory answer. He describes the situation in the wood lemming where many of the XY young do not develop as males as expected, but as functional females indistinguishable phenotypically from their XX sisters. How is this possible since they all possessed an H-Y gene on their Y chromosome? These XY but female lemmings tested H-Y negative, showing that their H-Y factor had been inactivated. In fact the regulatory gene responsible for this inactivation occurs on the X chromosome. Its function is to serve as an inhibiting factor, in this case completely suppressing the expression of the H-Y gene wherever it is located. As for our proposed biological interpretation of the Virgin Birth, Jesus' progenitors may have had a regulatory gene similar to the lemmings' suppressor gene.

Before considering the possibilities of Mary's and Jesus' genotypes with reference to the H-Y gene and its presumed suppressing regulatory gene *S*, we should consider whether Jesus' parthenogenetic conception would have utilized a diploid or a haploid egg. Although the direct diploid-egg type of parthenogenesis is commonly used in animals, it seems certain that the haploid-egg form would have been required in Jesus' case. This conclusion is based on the fact that if a diploid egg develops parthenogenetically the genotype of the offspring will be identical to that of the mother. If developed from a diploid egg by parthenogenesis, Jesus would have been genetically and phenotypically identical to Mary and would have lacked the genetic ability to undergo sex reversal. But at birth Jesus was anatomically Mary's son, not her identical daughter.

Some Possible Genetic Scenarios

As for the details regarding the probable genotypes of Mary and Jesus, and the specific gametes produced by Mary, all of these possibilities are based on the translocation of the H-Y gene *H* from its usual Y position to an X or an autosome, along with a suppressor *S* gene on the X chromosome. A nontranslocation scenario was examined and shown to be negative.

The first scenario considered was based on independent assortment, with the *H* gene translocated to an autosome. With *H* standing for the H-Y gene and *h* for its absence, and *S* for the suppressor gene and *s* its absence, Mary's genotype was likely *HhSs*. Probably her father donated the *H* but he could not also give her an *S* because if he had had one it would have made a woman out of him. On the other hand, Mary had to have an *S* to inactivate her *H* and thereby allow her to become a woman. Of course Mary had to carry an *H* in order to pass it on to Jesus to insure complete sex reversal. Mary had to keep her *H* defused by her *S*, thus permitting her to function as a fertile female. As for the *S*, while Mary needed it Jesus could not use it. There had to be a way to eliminate it when Mary passed the *H* on to Jesus. Use of a diploid egg would have prevented sex reversal by forcing an *S* on Jesus.

The problem of how to get rid of the *S* gene may be solved by the use of the haploid egg. Using Mary's presumed genotype *HhSs*, four kinds of haploid gametes (*HS, Hs, hS, hs*) could have been produced by meiosis through the agency of independent assortment. Of these gametes, only the *Hs* had the right combination for use in Jesus' parthenogenetic conception. Upon activation by whatever environmental stimulus God chose, the ovum duplicated its *Hs* haploid set of chromosomes to *HHss*, Jesus' genotype, differing from Mary's *HhSs* by being doubly homozygous and lacking an *S* gene. Diploidization was achieved by omitting the cytoplasmic division of the egg following the duplication of chromosomes, thereby delaying the first cleavage division for a complete mitotic period.

There are other possible scenarios based on independent assortment that would have the *H* gene translocated to different autosomes, but our example represents the entire group. All would provide the same means of preventing the *S* gene from getting into Jesus' genotype, thereby allowing the masculinity that had been submerged in Mary for a generation to resurface in Jesus.

Transferring our attention to the linkage-crossover types of scenarios, we examine the situation in which the *H* and *S* genes are both on the X chromosome. In such cases it is customary to enclose within parentheses the genes that occur on an individual chromosome. Using this system and knowing that Mary had both an *H* and an *S* gene, it is supposed that Mary's genotype was (*Hs*)(*hS*), the (*Hs*) having come from

her father and the (*hS*) from her mother. In this case, Mary would have produced four kinds of gametes, of which two, (*Hs*) and (*hS*), retained the original gene combinations of her parents' gametes (= linkage). The others, (*HS*) and (*hs*), would represent new combinations of genes produced by crossing over during meiosis. Here the (*Hs*) gamete required for Jesus' parthenogenesis is a linkage product. Diploidization would have occurred as in the independent assortment example to give Jesus the same doubly homozygous genotype as before although expressed in linkage form as (*Hs*)(*Hs*). Note that Jesus' genotype differs from Mary's.

Our last example involves crossing over. If Mary's mother had given her an (*HS*) egg and her father an (*hs*) sperm, her genotype would have been (*HS*)(*hs*) and crossing over of genes at synapsis would have been required to get an ovum with the new gene combination (*Hs*) which was necessary for Jesus' parthenogenetic gamete.

REFERENCES

[1]H. Spurway, "Virgin Births," *The New Statesman and Nation* 50, 651 (1955)
[2]E. Suomalainen, "Parthenogenesis in Animals," *Advances in Genetics* 3, 194 (1950)
[3]C.W. Birky and J.J. Gilbert, "Parthenogenesis in Rotifers," *American Zoologist* 11, 245 (1971)
[4]R.D. Barnes, *Invertebrate Zoology*, W.B. Saunders, p. 144 (1963)
[5]Barnes, *op. cit.*, p. 159
[6]Suomalainen, *op. cit.*, p. 207
[7]R.M. Cable, "Parthenogenesis in Parasitic Helminths," *American Zoologist* 11, 268 (1971)
[8]Cable, *op. cit.*, p. 267
[9]Suomalainen, *op. cit.*, p. 216
[10]Cable, *op. cit.*, p. 270
[11]Cable, *op. cit.*, p. 269
[12]Barnes, *op. cit.*, p. 222
[13]Suomalainen, *op. cit.*, p. 213
[14]L.J. Milne and M.M. Milne, *Animal Life*, Prentice Hall, p. 236 (1959)
[15]Suomalainen, *op. cit.*, p. 207
[16]N.J. Berrill, *Biology in Action*, Dodd Mead and Co., p. 669 (1966)
[17]G. Moment, *General Zoology*, Houghton Mifflin, p. 368 (1967)

Jesus was androgynous in the unique way of being chromosomally female and phenotypically male at the same time, fully retaining the chromosomal and cytological femaleness received at conception. . . . Jesus was completely sex reversed and without physical or psychological imperfections, the Perfect Human Being.

Summary

In concluding this proposal, the following thoughts deserve emphasis: (1) The biological deduction from Scripture that Jesus was conceived as a female is based on the scientific knowledge that virgin-conceived offspring are chromosomal females. (2) Therefore the scriptural information that Jesus was born a male requires sex reversal to have occurred. (3) Having used the natural biological process of parthenogenesis to give Jesus chromosomal femaleness, God again used a natural biological mechanism to add the complementary sexual quality of maleness. This time God used the biological process of sex reversal which is fully supported by the known facts of genetics that have been described. (4) But in expanding the sexual identification of Jesus to include maleness, God did not strip away femaleness. Chromosomal femaleness was not involved in sex reversal; every cell continued to have its XX identification of womankind. (5) Thus the female embryo Jesus of the Virgin Conception and Incarnation became the two-sexed Infant of the Virgin Birth who was the androgynous Christ, bearing both the chromosomal identificaton of a woman and the phenotypic anatomy of a man. (6) If this proposal is correct, the inequity of the sexes taught under the Old Covenant has been transcended and no one can longer argue effectively against the ordination of women in the Church on the grounds that Christ was a man. Christ was also a woman.

[18]Suomalainen, *op. cit.*, p. 213
[19]Milne and Milne, *op. cit.*, p. 236
[20]R.M. Fox and J.W. Fox, *Introduction to Comparative Entomology*, Reinhold, p. 220 (1964)
[21]J.H. Oliver, Jr., "Parthenogenesis in Mites and Ticks," *American Zoologist* 11, 283 (1971)
[22]Fox and Fox, *op. cit.*, p. 349
[23]Fox and Fox, *op. cit.*, p. 359
[24]L.M. Roth and E.R. Willis, "Parthenogenesis in Cockroaches," *Annals of the Entomological Society of America* 49, 195 (1956)
[25]A.G. Hamilton, "Thelytokous Parthenogenesis for Four Generations in the Desert Locust (*Schistocerca gregaria* Forsk)(Acrididae)," *Nature* 172, 1153 (1953)
[26]E.L. Mockford, "Parthenogenesis in Psocids (Insecta: Psocoptera)," *American Zoologist* 11, 327 (1971)
[27]Fox and Fox, *op. cit.*, p. 373
[28]E.S. Ross, "A Revision of the Embioptera, or Webspinners, of the New World," *Proceedings of the United States National Museum* 94, 401 (1944)
[29]U. Nur, "Parthenogenesis in Coccids (Homoptera)," *American Zoologist* 11, 301 (1971)
[30]Suomalainen, *op. cit.*, p. 194
[31]Fox and Fox, *op. cit.*, p. 370
[32]M. Narbel, "La Cytologie de la Parthénogénesè chez *Apterona helix* Sieb. (Lepid. Psychides)," *Revue de Suisse Zoologie* 53, 625 (1946)
[33]———"La Cytologie de la Parthénogénesè chez *Solenobia* sp. (Lepidopteres Psychides)," *Chromosoma* 4, 56 (1950)
[34]A.D. Peacock and J.W. Harrison, "Hybridity, Parthenogenesis, and Segregation," *Nature* 117, 378 (1926)
[35]H.D. Stalker, "Parthenogenesis in *Drosophila*," *Genetics* 39, 4 (1954)
[36]H.L. Carson, "Selection for Parthenogenesis in *Drosophila mercatorium*," *Genetics* 55, 157 (1967)
[37]M.W. Strickberger, *Genetics*, Macmillan, p. 233 (1968)
[38]I.B. Kinsmiller, "Parthenogenesis in *Culex fatigans*," *Science* 129, 837 (1959)
[39]Fox and Fox, *op. cit.*, p. 394
[40]H.D. Stalker, "On the Evolution of Parthenogenesis in *Lonchoptera* (Diptera)," *Evolution* 10, 345 (1956)

[41]C.P. Hickman, *Integrated Principles of Zoology*, C.V. Mosby, p. 319 (1966)
[42]S.G. Smith, "Parthenogenesis and Polyploidy in Beetles," *American Zoologist* 11, 341 (1971)
[43]E. Suomalainen, "Evolution in Parthenogenetic Curculionidae," *Evolutionary Biology* 3, 261
[44]C.N. Slobodschikoff and H.V. Daly, "Systematic and Evolutionary Implications of Parthenogenesis in the Hymenoptera," *American Zoologist* 11, 273 (1971)
[45]Slobodschikoff and Daly, *op. cit.*, p. 275
[46]R.J. Schultz, "Special Adaptive Problems Associated with Unisexual Fishes," *American Zoologist* 11, 351 (1971)
[47]R.M. Darnell and P. Abramoff, "Distribution of the Gynogenetic Fish *Poecilia formosa*, with Remarks on the Evolution of the Species," *Copeia* 2,354 (1968)
[48]R.M. Miller and R.J. Schultz, "All-female Strains of the Teleost Fishes of the Genus *Poeciliopsis*," *Science* 130, 1665 (1959)
[49]J.H. Asher and G.M. Nace, "The Genetic Structure and Evolutionary Fate of Parthenogenetic Amphibian Populations," *American Zoologist* 11, 381 (1971)
[50]L.M. Beçak, W. Beçak, and M.N. Rabello, "Cytological Evidence of Constant Tetreploidy in the Bisexual South American Frog *Odontophrynus americanus*," *Chromosoma* 19, 188 (1966)
[51]J.P. Maslin, "Parthenogenesis in Reptiles," *American Zoologist* 11, 361 (1971)
[52]W.P. Hall, "Three Probable Cases of Parthenogenesis in Lizards (Agamidae, Chamaelonidae, Gekkonidae)," *Experientia* 26, 1271 (1970)
[53]M.W. Olsen, "Natural Parthenogenesis in Turkey Eggs," *Science* 120, 545 (1954)
[54]———"Twelve Year Summary of Selection for Parthenogenesis in the Beltsville Small White Turkey," *British Poultry Science* 6, 1 (1965)
[55]———"Genetic Control of Parthenogenesis in Chickens," *Journal of Heredity* 59, 41 (1968)
[56]O. Cuellar, "On the Origin of Parthenogenesis in Vertebrates: the Cytogenic Factors," *American Naturalist* 108, 628 (1974)
[57]E.O. Strassman, "Parthenogenetic Development of the Ovum as Observed in Vital Staining," *American Journal of Obstetrics and Gynecology* 58, 237 (1949)
[58]L. Loeb, "The Parthenogenetic Development of Eggs in the Ovary of the Guinea Pig," *Anatomical Record* 51, 373 (1932)
[59]J. Krafka, "Parthenogenetic Cleavage in the Human Ovary," *Anatomical Record* 75, 19 (1939)
[60]M.C. Chang, "Cleavage of Unfertilized Ova in Immature Ferrets," *Anatomical Record* 108, 31 (1950)
[61]G. Pincus, "Observations on the Living Eggs of the Rabbits," *Proceedings of the Royal Society, ser. B*, 107, 132 (1930)
[62]C.R. Austin, "The Fragmentation of Eggs Following Induced Ovulation in Immature Rats," *Journal of Endocrinology* 6, 104 (1949)
[63]J. Loeb, "On the Nature of the Process of Fertilization and Artificial Production of Normal Larvae from the Unfertilized Eggs of the Sea Urchin," *American Journal of Physiology* 3, 135 (1899)
[64]A.D. Peacock, "Some Problems of Parthenogenesis," *Advances in Science* 9, 134 (1952)
[65]G. Pincus, "The Breeding of Some Rabbits Produced by Recipients of Artificially Activated Ova," Proceedings National Academy of Sciences, Washington 25, 557 (1939). *Also* "The Comparative Behavior of Mammalian Eggs in Vivo and in Vitro. IV. The Development of Fertilized and Artificially Activated Rabbit Eggs," *Journal of Experimental Zoology* 82, 85 (1939)
[66]G. Pincus and H. Shapiro, "Further Studies on the Parthenogenetic Activation of Rabbit Eggs," *Proceedings National Academy of Sciences*, Washington 26, 163 (1940)
[67]Krafka, *op. cit.*
[68]Spurway, *op. cit.*
[69]Anonymous, "Parthenogenesis in Mammals," *Lancet* 269, 967 (1955). [A résumé of Spurway's conclusions. This was partly quoted by *Time*, Nov. 28, 1955, p. 63]
[70]R.A. Beatty, *Parthenogenesis and Polyploidy in Mammalian Development*, Cambridge Monographs in Experimental Biology, University Press, Cambridge, 131 pp. (1957)
[71]Parthenogenesis as a biological interpretation of the Virgin Birth is not a new idea. For many years it has been the obvious synonym used by many Christian biologists and theologians and their students. See Preston Harold, *The Shining Stranger*, Wayfarer Press, p. 85 (1967)
[72]J. Loeb, "The Sex of Parthenogenetic Frogs," *Proceedings National Academy of Sciences*, Washington 2, 313 (1916). *Also* "Further Experiments on the Sex of Parthenogenetic Frogs," *Proceedings National Academy of Sciences*, Washington 4, 60 (1918)
[73]B.M. Cattanach, C.E. Pollard, and S.G. Hawkes, "Sex-reversed Mice: XX and XO Males," *Cytogenetics* 10, 318 (1971)
[74]K. Fredga, A. Gropp, H. Winging, and F. Frank, "Fertile XX- and XY-type Females in the Wood Lemming *Myopis schisticolor*," *Nature*, London 261, 225 (1976)
[75]J.W. Gordon and F.H. Ruddle, "Mammalian Gonadal Determination and Gametogenesis," *Science* 211, 1265 (1981)
[76]W.K. Silvers and S.S. Wachtel, "H-Y Antigen: Behavior and Function," *Science* 195, 956 (1977)
[77]S.S. Wachtel, "H-Y Antigen and the Genetics of Sex Determination," *Science* 196, 799 (1977)
[78]F.P. Hazeltine and S. Orno, "Mechanisms of Gonadal Differentiation," *Science* 211, 1272 (1981)

A Christian Medical Society Statement on In Vitro *Fertilization*

The following statement on *in vitro* fertilization was passed by a vote of 60–2 (2 abstentions) at the 1983 Christian Medical Society House of Delegates convening in Boston, May 11–13, 1983.

In vitro *fertilization, IVF, may be morally justified when such a pregnancy takes place in the context of the marital bond.*

When IVF is advocated outside the context of marital commitment, such a procedure lacks moral justification.

Christian medical scientists differ on the moral worthiness of research with the human ovum and human sperm as a necessary part of perfecting techniques for in vitro *fertilizations.*

Our consideration of in vitro *fertilization is qualified by the following recommendations:*

1. Laboratory IVF research should not be supported or allowed unless such research is with the explicit *intent of embryo transfer and eventual normal pregnancies.*

2. Clinical IVF and embryo transfer is justified morally only *within the context of the marital bond, using "gametes obtained from lawfully married couples" as the recommendations of the Ethics Advisory Board of the Department of Health, Education and Welfare indicate.*

3. Finally, amniocentesis with possible abortion should not be an expected part of the clinical protocol.

This statement was adopted by the Christian Medical Society House of Delegates to provide a means of stimulating ethical debate and reflecting a sense of moral suasion.

A further development of this subject may be found in the *CMS Journal*, Vol XIV, No. 1 (Spring, 1983) by Robert M. Nelson, "The Ethics of In Vitro Fertilization and Embryo Transfer" (pp. 19–25, 32).

Living in Babylon with Darwin, Marx, Freud, and Deloria

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Now listen, you rich people, weep and wail because of the misery that is coming upon you. Your wealth has rotted, and moths have eaten your clothes. Your gold and silver are corroded. Their corrosion will testify against you and eat your flesh like fire. You have hoarded wealth in the last days. Look! The wages you failed to pay the workmen who mowed your fields are crying out against you. The cries of the harvesters have reached the ears of the Lord Almighty. You have lived on earth in luxury and self-indulgence. You have fattened yourselves in the day of slaughter. You have condemned and murdered innocent men, who were opposing you (James 5:1-6 NIV).

Preparing To Meet Our Neighbors In Babylon

It is common knowledge that marked disparities exist in the contemporary world peoples that are suggested by such categories as the "Third" and "Fourth" worlds, the "North" and "South" worlds, the "Developed" and "Undeveloped" worlds, or more bluntly, the "Have" and "Have-not" worlds. 20% of the world (North America, Western Europe and Japan) produces and consumes 65% of the world's goods and services.

Francis Schaeffer was asked once by college students if he considered it necessary to learn about the thinking and writing of non-Christians. His response emphasized that (1) though marked by human depravity that affects thinking, unregenerate scholars still bear to some degree the "image of God" with capability for discovery and insights; (2) though subject to limitations from a sinful nature, many non-evangelical scholars have discovered many facts and offered interpretations of aid to evangelical thought; and (3) though some Christians have sought to probe causes of human depravity operating through social and cultural circumstances of mankind, often evangelical Christians have been "part of the problem rather than part of the solution" to the various ills among mankind.

Reflecting upon the view that non-Christians have something to say to us who are evangelical, I began to both think and speak about this during a leadership role in the Middle East Christian Outreach's annual orientation seminar in Cyprus. Later while in Damascus, I was once more confronted with glaring examples of economic disparities between the "haves" and the "have-nots" of the Middle East. My mind began to take me back over the years when my wife and I have suffered traumas stemming from encounters with shocking impoverishment in the Third and Fourth Worlds. Perhaps several Christmas Day (the Christian world's "rite of intensification" for affirming giving and sharing presumably to emulate God's gift of His Son) experiences might epitomize something of our traumas:

(1) A Christmas Day in a Vietnam refugee camp in Thailand near the border of Cambodia where among indescribable conditions the Vietnam girls were being raped with impunity by the Thai guards who hate the Vietnamese.

(2) A Christmas Day among the impoverished Kor'ku tribal people of central India where the annual income per capita in 1980 was $140, and where one sleeps in rooms plastered by cow dung under mosquito netting to keep out rats from the bed.

(3) Christmas Days in Tehran and Beirut in the throes of hostilities and violence that appear almost daily in the news media.

From what has caused profound anguish to me, I have returned to the sensate America via Hawaii. The unabashed luxury and excesses immediately encountered has been "affluence shock" indeed, even to the degree that I have asserted to my wife that I do not think that I can ever, with conscience before my Lord and Savior, spend a holiday in what many American Christians deem to be just short of paradise! Further confirmation of our excesses came some time ago when I entertained a member of the Palestine Liberation Organization (PLO) at Geneva's Alexander Hall for an

evening meal. The slight-built youth in his mid-twenties (attending another school here in the States) expressed amazement at both the amount and variety of food served to Geneva students and the waste to be observed on that one occasion.

With such experiences in mind during my recent stay in the Middle East, I found myself reading the closing chapters of Revelation, including the dramatic and catastrophic destruction of Babylon as God's judgment. This infamous city, among other things, seems to be described as the ultimate prostitute who is pursued and sustained by the world's political and economic systems. Prostitution, in my opinion, can be considered as the awful exploitation of what is basic to human life; namely, procreation and maintenance. What the Apostle Paul affirms to be a basic principle for Christian interaction and relationship that bears upon the prostitution concept is his words to the Thessalonians:

> For this is the will of God, your sanctification: that you abstain from immorality; that each one of you know how to take a wife for himself in holiness and honor, not in the passion of lust like heathen who do not know God; that no man transgress, and *wrong his brother in this matter*, because the Lord is an avenger in all these things . . . (I Thessalonians 4:3–6 RSV).

I maintain that this fundamental prostitution idea addressed to Christians in the husband-wife dyadic relationship is what the inspired Apostle John views as mankind's rapacious exploitation of basic human needs; or, rather, the rape of the majority of mankind by an affluent minority. Even worse, the wealthy and wasteful minority has been the Christendom of Western Civilization (the one significant exception is non-Christian Japan). And this rapacious treatment is not at an end, for neo-colonialism, or economic imperialism, among the Third and Fourth Worlds is increasing the disparity between the "haves" and the "have-nots!"

It becomes obvious, then, that I envision the Apostle John's Babylon as mostly formed and sustained by the Western "Christian" political and economic systems that continue to monopolize the goods and services of our contemporary world. As a matter of fact, the discussions about "nationalism" and "modernization" held in the luxurious hotels—symbols par excellence of the prostitution—in the Third and Fourth Worlds to aid in "development" of "underdeveloped" peoples have frequently been the means for greater acts of rape. As a youth I was indoctrinated by evangelical Christians in the view that the Apostle John's Babylon is the Roman Catholic Church. Such an interpretation is to me now quite untenable.

As industrialization and colonialism accompanied exploration by Christendom in the Western world, especially in the 19th century, scholars questioned the growing exploitation that supported the rising affluence in the West. The traditional analyses included those by the Church whose leaders failed to employ alert and cross-cultural perspectives to assess gross inequalities supported by *The Protestant Ethic and the Spirit of Capitalism* (Weber). In fact most Christian theologians, with startling myopia, stimulated thinking that reacted to expanding prostitution of the world's peoples by either confirming the rape or by withdrawing from the battlefield to establish a sharp dichotomy between emerging science and conventional Christian orthodoxy.

There is pathos in the widely accepted view held by the Church of the 19th century that Western civilization represented the apogee of social and cultural evolution (although the term itself frequently was anathema to some Christians). This sophisticated ethnocentrism among Western Christian thinkers of that day may, in a certain sense, be suggested by the use and definitions held for "savage" and "pagan." One need not delve into European history of the last few centuries to discover the savagery in Christendom that climaxed in World Wars I and II! It is obvious to the most casual observer that the "savages" and "pagans" of non-Christian lands can learn new and more ingenious techniques of war and torture from the cultural zenith in Western Christendom!

With the pervasive absence of concern and compassion (some exceptions of course) for the rapacious exploitation by "civilized" Christendom of those "out there," disillusioned scholars withdrew increasingly from theological interpretations. There emerged in the European scholarly circles those who sought solutions related to empirical evidences forthcoming in youthful science seeking for the "truth;" the quest not yet the "end," but the "means," science sought solutions to human problems for it was not then committed to serving technology per se (Ellul).

Hence, among those not identified with, in many cases clearly opposed to, the Church's approach to mounting inequities in the world, I have selected quite arbitrarily four thinkers who seem to me to represent four basic positions and fields of learning that the haughty Church neglected. Of course, any person acquainted with the development of Western thought could easily challenge my selections and substitute four others with sound argument. Nevertheless, I insist that my four "neighbors" in our Babylon brought to influential attention, even though denied then and now by evangelical Christians, basic underlying assumptions that have guided the mental set of Western peoples, including devout Christians. The basic assumptions include (1) competition, (2) conflict, (3) anxiety, and (4) ethnocentrism.

Our Neighbor, the Biologist, Charles Darwin

Darwin, as everyone knows, is cited as the one who gave evolution widespread acceptance as an explanation for the "how" of the diversity and complexity of life forms as these became increasingly known in the 19th century. Somewhat lamely he seemed (under considerable "Christian" pressure no doubt) to suggest a weak deistic explanation as to the "why" of all this: the Creator established laws that took a rather vague course to eventuate in the highest and most generalized form, mankind.

Again as every schoolboy knows, Darwin adopted competition among the species of life as one of his key concepts for the process by which multiple forms evolved. Because he confessed that he had been greatly influenced by Thomas Malthus (who saw populations outstripping food supply with disasterous consequences), Darwin adopted a pessimistic scenario for mankind to explain the whole course of life upon the earth. One need not elaborate the well-known and over-

simplified phrase that has become every sophomore's explanation of Darwinianism: "survival of the fittest" (Herbert Spencer's term, adopted by Darwin).

Darwinianism undercut the controversy regarding the various human races' derivation from a common ancestor (monogenism) or from multiple ancestry (polygenism), since natural selection as a model comprehended both possibilities. This controversy was linked with racialist theories of human differences and with what became known as Social Darwinianism (better, Social Spencerianism). Such theories, however, misuse Darwin's ideas and hold that different classes in society have achieved their high or low status by natural selection; the rich and powerful attain theirs by virtue of advantageous variations and the poor and weak ("the miserable" of Malthus) by virtue of deleterious variations. Evidence for these propositions lay not in discovering the relevant variations but in the fact that the rich were rich and the poor poor—an exercise in circular reasoning still widely used to account for poverty today. Evangelical Christians tacitly or otherwise employ such thinking to support their non-biblical commitment to competition usually expressed in quantitative superlatives.

With this postulate of competition among evangelical Christians living in today's Babylon of humanistic materialism, White's thesis in *The Sacred Cow* is a logical consequence insofar as it goes. The tragedy is that the amazing response to unethical appeals for funds, supported by pious clichés, is an indirect exploitation of Third and Fourth World peoples who make the Sacred Cow in America possible. Even our Christian schools, whether seminaries or colleges, are committed to the assumption that education prepares for more successful competition in any and all areas of life. The "service" concept degenerates into something quite different than the explicit assertion of Jesus: "If anyone would come after me, he must deny himself and take up his cross daily and follow me" (Luke 9:23).

As any person engaged in athletics in education will affirm, competition does prepare one indeed for life, the life that Darwin viewed in natural selection and survival of the species. But I find it extremely difficult to reconcile this competitive assumption with this Pauline conclusion:

> Do nothing from selfishness or conceit, but in humility count others better than yourselves. Let each of you look not only to his own interests, but also to the interests of others. Have this mind among yourselves, which you have in Christ Jesus, who . . . being found in human form he humbled himself and became obedient unto death, even death on a cross (Philippians 4:3–5, 8 RSV).

Our Neighbor, the Sociologist, Karl Marx

Significantly, the competitive postulate in Darwin's natural selection ideas lay back of parallel views proposed by Marx in his militant opposition to religion as he observed it in Christendom. Any informed person knows that Marx rejected religion as a means of alleviating or correcting social ills; rather, he argued that religion is an "opiate" that numbed mankind's intellect making it improbable that a supernatural dimension bears upon therapies for human injustices. Just as we suggested with much oversimplification that our neighbor, Darwin, focused his thinking around competition among species, we may also (with some reservations of course) single out "conflict" as the core of Marxism.

Marxism states that social systems develop in accordance with laws. Unlike animals, human beings can produce what they need to survive (their means of subsistence). Through the division of labor the amount that can be produced is greatly increased, and a struggle develops over power to command and channel the surplus. Generally, the group that can monopolize access to strategic resources (the means of production) becomes the ruling *class*. Other classes are shaped by their relationship to the means of production. These relations of production are generalized throughout the society and give it its characteristics. This is the "materialist conception of history," which makes the nature of the productive system central to an understanding of the political and cultural aspects of the social system. Here are insights par excellence into the Apostle John's Babylon!

Marx outlined a progression of socioeconomic stages that he believed summarized the history of civilization: ancient, feudalistic, and capitalistic. He contended that the dominant cultural images of a society—especially religious institutions—reflect and support the economic system. In such thinking, it is no accident that a consumption psychology is found in all classes in a capitalist society. Self-image and self-esteem are similarly linked to materialism; one may visit in suburban homes of American evangelical Christians and observe their life-styles to document this view.

Perhaps one major weakness in our neighbor's suggestions

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in his conflict model for understanding society is that they do little to explain the viability and increased prosperity of the industrially advanced nations after two World Wars. Neo-Marxist thinking emphasizes the importance of vertical structuring of relationships between rich and poor nations. Third and Fourth World nations are increasingly viewed as misdeveloped (rather than undeveloped) appendages of the economies of developed nations. In essence, this seems to mean that there is an acceptable rationale for economic imperialism—for rapacious prostitution underlying the Babylon doomed for destruction in the Apostle John's scenario—that sustains what evangelical Christians in Western culture assume to be the "will of God."

Our Neighbor, the Psychologist, Sigmund Freud

While Darwin reacted to the Church's inepitude in explaining struggles for life among species, including mankind, with the assumption of competition, and Marx advocated his conflict model for understanding social ills, Freud epitomizes the consequences of both competition and conflict upon the individual personality. The paradox, of course, in his clinical and research findings is centered in and about the pervasive anxiety found among the affluent peoples of his day. In a certain sense, Freud's conclusions confirm the biblical assertion that "man does not live by bread alone," especially when that bread is eaten in abundance at the expense of impoverished and exploited others.

The fundamental prostitution idea addressed to Christians in the husband-wife dyadic relationship is what the inspired Apostle John views as mankind's rapacious exploitation of basic human needs—the rape of the majority of mankind by an affluent minority.

Finally we ought to note that Neighbor Marx offered a moral code that serves as a judgmental stance for much of Christianity as it affirmed economic prostitution in Western industrialization. Other than devotion to the communist cause, Marx sought for conscientious labor, concern for public health, high sense of public duty, humane relations toward others, mutual respect, honesty, truthfulness, moral purity, modesty, family loyalty and concern, an uncompromising attitude toward injustice (including dishonesty and opportunism), friendship and brotherhood, intolerance of national and racial hatred, an uncompromising attitude to enemies of peace and freedom, and fraternal solidarity among all peoples everywhere.

It goes without saying that Marx must have been influenced more than he perhaps would cared to have admitted by biblical ethics despite his disavowal of religion. Nevertheless in a quest for "classlessness" to emerge in social evolution, his basic notion of conflict seems to reflect what he saw institutionalized religion supporting in his affluent civilization; an affluence resting upon the exploitation of the "masses" wherever they may be. Under the colonial umbrella, the rape associated with the conflict found evangelical Christians unaware that they subscribe to the conflict model, in practice if not in statement. And modern missions by Christians developed programs and institutions seemingly naive as to their indirect advocacy of the conflict assumption.

Among others, the Apostle James addresses himself to the problem of conflict as did Marx in our Babylon. According to James:

> What causes wars, and what causes fightings among you? Is it not your passions that are at war in your members? You desire and do not have; so you kill. And you covet and cannot obtain; so you fight and wage war. You do not have, because you do not ask. You ask and do not receive, because you ask wrongly, to spend it on your passions (James 4:1–3 RSV).

So disillusioned did this atheist become in later life that he held that religion is an illusion and as such could not enable the disturbed person to cope with reality with effective therapy. In *The Future of an Illusion*, Freud became convinced that religion is a universal obsessional neurosis derived in the fantasies of childhood and reinforced by religious dogma. Why should one who had a devout Jewish father and was reared in a profound Roman Catholic culture come to this conclusion? Admittedly there is no simple or single answer, but a contributing influence must have been a combination of the competitive-conflict syndrome with racial prejudice and a hypocritical Victorian morality that he criticized in *Civilization and Its Discontents*. And what was his civilization? It was that dominated by institutionalized Christianity that served greatly as a gloss over what Pitirim Sorokin has labeled as "sensate" society and culture.

Freud's theory of personality postulated the division of the human psyche into three interacting areas: the id, the ego, and the superego—the balance among which largely determines the health of the individual or lack of it. To him, the conscious, preconscious (forgotten materials), and unconscious (repressed materials) were areas of the personality complexly related to the basic triad of id, ego, and superego. The pervasive energy at play in this complex structure is summed in Freud's concept of libido that is either released or inhibited at certain stages of personality development. Since the generalized energy, the libido, operates in each of the triad, the "healthy" personality is one wherein a balance between the polarities of the id (instincts) and the superego (culturally-conditioned "conscience") is executed by the intermediation of the ego.

At considerable risk of misunderstanding and castigation by colleagues who identify as I do with evangelical Christianity, I believe that Freud provides in his personality structure something of what Jesus had in mind in the exchange with

one of his skeptics. In such an exchange in Dr. Luke's inspired account, we read that eternal life may be achieved by the two commandments; the first is that man is to "love the Lord your God with all your heart, and with all your soul, and with all your strength, and with all your mind . . . " (Luke 10:27 RSV). Of course such instruction must be interpreted within the phenomenological articulation compatible with New Testament culture, not in terms of modern psychological specifications or even theory. Nonetheless, it seems highly suggestive that Luke had some idea about personality structure in which "mind," "soul," "heart," and "strength" corresponds roughly to Freud's "superego," "ego," "id," and "libido," respectively. In a "healthy" person these structures are balanced, whereas in a "pathological" person they are not.

While Freud did not specify in extended treatment the matter of competition and conflict, the neo-Freudians emphasized that Western Christianity is foundational for excessive value of these characteristics, as Weber anticipated in citing Calvinism for "The Protestant Ethic" supported by individualism. Hence, Erich Fromm writes about *The Anatomy of Human Destructiveness* and Karen Horney about *The Neurotic Personality of Our Time*. No doubt with overstatement and oversimplification, Horney seems unduly influenced by clinical practice that gives unbalanced data for her extreme conclusion; yet extreme competition and conflict that engulfs Western people—including evangelical Christians swayed by materialistic symbols for "self-actualization" (Maslow)—is an "unfailing center of neurotic conflicts."

Further, scholars generally agree that contemporary industrial society, resting on exploitation of "misdeveloped" peoples to accrue fabulous wealth, has elaborated the types of conflict possible. Both on individual and group bases, Western peoples in the "Protestant Ethic" are continually in competition for whatever may be desired. Institutionalized Christianity in Western culture has been a bulwark for such competition and conflict: consider contests between churches and/or their church schools for attendance, enrollment, finances, etc. It is pathetically amusing to see children subjected to competition in "finding a Scriptural reference first" somewhat reminiscent of what Jules Henry labeled for American education as "the absurdity of learning" in his *Culture Against Man*. And what aspiring young instructor in an evangelical school would be foolhardy or intrepid enough to challenge a grading system that is the example par excellence of competition among Christian students!

Our Neighbor, the "Animist," Vine Deloria, Jr.

Obviously in including Darwin, Marx, and Freud among our neighbors in Babylon, we have included those who shared completely the basic values and orientation, or worldview, of Western Christendom and culture. They were not among the "dispossessed" peoples or "have-nots" subject to prostitution of resources and services by our Babylon, although their views represented both influence and challenge by what they noted in their world. They may have been controversial in Christian thought but they are indeed neighbors by any standard that perceives institutionalized Christianity in Western affluent culture without ethnocentric lenses.

Now, however, we find it imperative to admit to our neighborhood in Babylon one that has been traditionally classified as "savage" or "pagan," although we have tried strenuously to exclude him from our Babylon by sophisticated, discriminatory rationales, often supported by pious cliches or scriptural texts removed from context. Born of Sioux Indian parentage in the Standing Rock Reservation of the Dakotas, Deloria reflects the continuing strength of Indian religion by the centrality of the religious theme best expressed in his *God Is Red* (and he is not talking about Communism!). Deloria may be cited as one of the most incisive and articulate spokesman for those raped by our Babylonian politicians and economists. What he says is echoed across the Third and Fourth worlds with increasing din and clamor.

Though trained in a theological school, and descended from a distinguished Sioux Indian family of scholars, clergymen, and warriors, Deloria rejects institutional Christianity as a corruption of the true spirit of Christ. Instead, he suggests that Indian religions, with their sense of place as opposed to time, and their belief in a sympathetic involvement in nature rather than a hostile adversary relationship to it, will attract white as well as Indian adherents. Indian religious practices will have to make accommodations to the scientific findings of present, Deloria argues, but the Indian view of nature and the supernatural remains valid. Indian religious leaders, like Deloria, have long been uncomfortable about the institutional face of Christianity while sympathetic to the life and teaching of Christ.

To be more specific, Deloria concludes that the largest difference between Indian religion and institutionalized Christianity is in inter-personal relationships. Indian society had a religion that taught respect for all members of the society. He reminds us that Indians had a religion that produced a society in which there were no locks on doors, no orphanages, no need for oaths, and no hungry people (the hungry Indians came with the Indian Reservations!). Indian religion taught that sharing one's goods with another human being was the highest form of behavior. The Indians have tenaciously held to this tradition of sharing their goods with other people in spite of all attempts by churches, government agencies, and schools to break them of the custom.

In Deloria's scathing views, institutionalized Christianity of our Babylon came along and tried to substitute "giving" for sharing. There was only one catch: giving meant giving to the church, not to other people. Giving, says Deloria, in the modern institutionalized Christian sense, is simply a method of shearing the sheep, not of tending them.

He scornfully and with much satire cites two events, one from "fundamentalist" Christianity and one from "liberal" Christianity. First, he attends to the "Fundamentalists":

> Perhaps the most important Christian event of our day was Explo 72, a giant rally held in June 1972 at the Cotton Bowl in Dallas, Texas, a city of brotherly love. It was conceived and carried out by Bill Bright of the Campus Crusade for Christ International, one of the many fundamentalist-oriented groups working on college campuses. More than 75,000 gospel-preaching, sure-enough young Christian came to Dallas to conduct a historic rally on behalf of fundamentalist Christianity.

> Unlike the feeding of the five thousand, Explo 72 had a budget of 2.7 million dollars and charged participants a twenty-five-dollar entrance fee, which was certainly an improvement over the New Testament way of doing things. But for the entrance fee enough potato chips were served to make a "one-ton potato chip," although apparently the Lord did not do so, preferring to serve individual portions. The event was billed as a religious Woodstock, and it was advertised on 800 billboards, 100,000 bumper stickers, and 5,000 T-shirts.
>
> The climax to Explo 72 came when the 75,000 assembled young Christians broke forth in a frenzy of religious devotion and began chanting football cheers. Gimme a J, "JJJJJJay," Gimme an E, "EEEEE," Gimme an S, "ESSSSSS," Gimme a U, "UUUUUUU," Gimme an S, "ESSSSS." Whatta ya got? "JESUS!!!!" The Sermon on the Mount must have seemed pale in comparison (*God Is Red*, pp. 233–234).

But Deloria insists that the confusion between Christianity as institutionalized in American culture—in our Babylon—is not simply a phenomenon of evangelical and right wing Christianity. The liberal counterpart has also made its contribution to making institutionalized Christianity relevant to the modern world.

> The Lutheran Youth Congress meeting in San Diego in 1972 originated the Jesus cheer later repeated at the Cotton Bowl. In 1970 the United Church of Christ in Chicago held an unusual ordination ceremony which indicated that it also had seen the light and was trying to make religion relevant to American culture.
>
> The ordained wore a multicolored vest with seventeen symbols representing "his concerns" sewn on it. Included were symbols of joy and sorrow, a black fist, a Star of David, a peace symbol, a herald's trumpet, and wheat seeds. Two leotarded dancers conducted a "moving prayer" against a background of shifting images projected on the walls of the museum in which the service was held. Kent Schneider, the newly ordained minister, "celebrated." He is director of the Chicago Center for Contemporary Celebration and will teach others to celebrate. "Celebration," he noted, "is an idea whose time has come." We'll drink to that.
>
> Celebration may be the name of the game over on the left wing of the Christian spectrum as football cheers seem to characterize the right wing. The Reverend Harvey Cox of *Secular City* fame, who is the liberal guru of the Boston area, decided in 1970 to combine all the elements of religion into one massive presentation. Choosing a congruence of holy days, Jewish Passover and Orthodox Easter, Cox gathered his disciples in "The Boston Tea Party," a converted warehouse discotheque near Fenway Park. A projector flashed images on the walls to represent pictorially the agony of Vietnam, while participants wrote graffiti on the walls of the building. A rock band called the Apocrypha played "I Can't Get No Satisfaction," and at daybreak the crowd rushed into the streets, chanting, "sun, sun, sun." Liberal Christianity had finally come of age. Right on, as the liturgy of the day related. (*God Is Red*, pp. 237–239).

A Contextualizational Reading of Scripture

As an evangelical Christian and a professional anthropologist with nearly four decades of intercultural research, I concur with Charles Kraft of the School of World Mission at Fuller Theological Seminary in his plea for an intercultural evangelical theology. My reasoning is based upon a fundamental postulate: the church of Jesus Christ is multicultural, and what is needed is to appreciate—better, to recognize—that our Babylonian affluence and prostitution are not congruent with a theology that is intercultural, or cross-cultural. A theology for the whole church must be developed and this is possible only through contextualization. By contextualization, Kraft in his magnum opus to date, *Christianity and Culture*, elaborates on a number of suggestions from the anthropological perspective that will contribute through contextualization to an intercultural theology. This, in turn, will enable us in Babylon to better understand our rape of other peoples as we have sought to explain through the eyes of four of our neighbors.

Kraft's first general recommendation is that we must distinguish between the data that we receive and work with from throughout the world and the interpretation of that data. As an anthropologist, I must be careful to distinguish between the data and the theoretical model with which I approach the data. I must also distinguish between the data and my interpretation of that data. It is also important for theologians to distinguish between the data and their interpretation of the data; after all, if one lives in Babylon, one has to justify one's lifestyle (and it's possible to "prove" nearly anything from Scripture!).

A second idea offered by Kraft is that Babylonian theologians must realize that while the biblical data are sacred and infallible, the Babylonian theoretical models and interpretations are not. Not only are the theologians' models and interpretations human, they are also bound by Babylonian culture. Without realizing it, most theologians have been using Western (usually Greek, for Augustine leaned upon Plato, and Aquinas sought answers from Aristotle, to name but two) philosophical models to interpret the biblical data. We in Babylon need to realize that there are other valid models for interpreting the Scriptures. For example, African and Middle Eastern philosophical models do provide valuable insights into understanding much of the Bible, especially the Old Testament. Because African and Middle Eastern cultures are "closer" to biblical Hebrew culture than our Western and affluent Babylonain lifestyle, the insights provided by their philosophical models must be incorporated into our theological processes. How else can we explain the discrepancy between the Gospel as the "power unto salvation to everyone that believes" and that over three-fourths of mankind, mostly in the raped Third and Fourth Worlds, have not experienced that "power" potential?

Another of Kraft's propositions is that anthropological insight can aid theologians in the area of relevance. Theologians generally, and particularly if they live in the cloistered quarters of Babylon, concern themselves with problems and issues on a philosophical level *while people live on a behavioral level* (as the definition of who is one's neighbor provided by Jesus in the "Good Samaritan" event). Much too much of our theological concern is done in the language of metaphysical philosophy with frequent tautological explanation. Theologians need to use the language of the behavioral science in terms of their approach to problems, their conclusions, and their articulation.

A further suggestion by Kraft is that for intercultural understanding and the application of that knowledge there is the need to distinguish between form and meaning, to be gained mostly by anthropological efforts. This is the very heart of a needed approach toward discerning cultural forms and meanings; this is what the anthropologist Clifford Geertz has most appropriately used to define culture as "a system of meanings" shared by a society. We in Babylon need to realize that cultural forms are important because of their meaning to a particular people and not in and of themselves. Cultural

forms derive their meanings from their cultural context and can be fully understood only in that context. A cultural form retains its meaning only in its own culture. Hence, the meaning of conventional Christian forms of worship, not to mention our interpretations of Jesus as a "culture hero" basic to the "Protestant Ethic" for our Babylonian prostitution of peoples outside our magnificent city, must be mystifying to those victimized by our affluence!

If we are going to respond to the insights offered by our four neighbors in Babylon, and if we are going to reach the world for Jesus Christ, we must make the gospel relevant to the people of the world. By this we do not mean that we alter the "Good News," for we have only that summarized by the Apostle Paul (I Corinthians 15:1–4). But, as James emphasizes, we need to discover what people's needs are and engage in demonstrations as to how the gospel relates through behavioral and social actions to their needs in their cultural setting, in brief, to emphasize through contextualization, concern and contribution.

through the eyes of those not living in our Babylon, for poverty is the distinguishing lifestyle of at least three-fourths of the world's people—that is, those not living in our luxurious suburbia of a prostitutional Babylon. This means, to cite but a sample or two from that ultimate source of our faith and conduct:

> I say this not as a command, but to prove by the earnestness of others that your love also is genuine. For you know the grace of our Lord Jesus Christ, that though he was rich, yet for your sake he became poor, so that by his poverty you might become rich (the Apostle Paul, II Corinthians 8:8–9 RSV).
>
> And a scribe came up and said to him, "Teacher, I will follow you wherever you go." And Jesus said to him, "Foxes have holes, and the birds of the air have nests; but the Son of man has nowhere to lay his head" (Matthew 8:19–20 RSV).
>
> What does it profit, my brethern, if a man says he has faith but has not works? Can his faith save him? If a brother or sister is ill-clad and in lack of daily food, and one of you says to them, "Go in peace, be warmed and filled," without giving them the things needed for the body, what does it profit? So faith by itself, if it has no works, is dead (the Apostle James 2:14–17 RSV).

The Church of Jesus Christ is multicultural, and our Babylonian affluence and prostitution are not congruent with a theology that is intercultural or cross-cultural. A theology for the whole Church must be developed.

My critique of our Babylonian neighborhood is not solitary, for Waldron Scott pleads for "a new reading of the Bible" in *Bring Forth Justice*. His impassioned call is to affluent Babylonian (he doesn't use the term but has the same idea) Christians. He notes, for instance, that the great and needed emphasis on justification by faith in Luther's work was most relevant in his cultural milieu that assumed the Church to be a corporate fellowship intimately linked with the society and culture of his day. Divorced from the present social condition today, this doctrine, conditioned by developments in Western (Babylonian) society and culture since the Renaissance, becomes a rationale for an individualism and self-reliance unknown in the New Testament. From such errors in parochial interpretation and monocultural perspective, we now have in Babylon those who speak of "The Culture of Narcissism" and the "Cult of Self-worship" (Lasch and Vitz).

The consequence attending this combination of affluence and self-centered preoccupation in Babylonian culture is a triad of loneliness, meaningless, and anxiety, according to Scott. It may come as a surprise to us that these problems of self are much less prevalent among the impoverished Middle Eastern peasants or slum-dwellers in teeming Cairo. Their problems are derived from rapacious injustice that fosters poverty, disease, and malnutrition. When one is starving, the meaning for life is to get relief from the hunger pangs (in the case of "the Good Samaritan," there is a significant absence of "preaching" or "witnessing" in this act of compassion!). It is so much easier to theologize with sophistication (and sterility) when one's stomach is full!

Therefore, asserts Scott, we must learn to read Scripture

Conclusion

The question that I cannot elude by becoming acquainted with my neighbors in Babylon, whether here at an evangelical institution of higher learning in professional status, or as a member of an evangelical church, or as a responsible person in evangelical missionary organizations is this: What do such acquaintances have to do with me? After all, I have a rather modest income and do not have any great clout in our Babylon of rape and affluence. I am constantly reminded that my fellow-Christians make great "sacrifice" as students in a Christian school, or as faculty and administrators at the school, or as parents who support the students at the school, to say nothing of those members of the "body of Christ" at large. Aren't we as Americans in general, and as evangelical Christians in particular, those people who surpass all others in generosity and "sacrifice" stemming from compassion as we learn of the plight of others wherever in the world? My answer tends to center in and about the following statement, and I leave my reader to identify with whomever is appropriate in his or her case:

> And he (Jesus) sat down opposite the treasury, and watched the multitude putting money into the treasury. Many rich people put in large sums. And a poor widow came, and put in two copper coins, which make a penny. And he called his disciples to him and said to them, "Truly, I say to you, this poor widow has put in more than all those who are contributing to the treasury. For they all contributed out of their abundance; but she out of her poverty has put in everything she had, her whole living" (Mark 12:41–44 RSV).

REFERENCES

Darwin, Charles. 1962 (1859). *On the Origin of Species by Means of Natural Selection*. New York: The Macmillan Company.

Deloria, Vine, Jr. 1969. *Custer Died for Your Sins*. New York: Avon Books.
——— 1973. *God is Red*. New York: Dell Publishing Company.
Eiseley, Loren, 1958. *Darwin's Century: Evolution and the Men Who Discovered It*. New York: Doubleday and Company.
Ellul, Jacques. 1967. *The Presence of the Kingdom*. New York: Seabury Press.
Freud, Sigmund. 1929. *The Future of an Illusion*. New York: Liveright Publishing Company.
——— 1961 (1930). *Civilization and Its Discontents*. New York: W.W. Norton and Company.
Fromm, Erich. 1973. *The Anatomy of Human Destructiveness*. New York: Holt, Rinehart and Winston.
Geertz, Clifford. 1973. *The Integration of Cultures*. New York: Basic Books.
Heddendorf, Russell H. 1973. "The Christian World of Jacques Ellul," *Christian Scholar's Review* 2:4:291–307.
Henry, Jules. 1963. *Culture Against Man*. New York: Random House.
Horney, Karen. 1937. *The Neurotic Personality of Our Time*. New York: W.W. Norton and Company.
Jennings, George J. 1958–59. "A Development Project and Culture Change in an Iranian Village," *Proceedings of the Minnesota Academy of Sciences* 25–26: 309–325.
——— 1967. "Some Comments on the Soul as Developed in Orthodox Christianity," *Journal of the American Scientific Affiliation* 19:7–11.
——— 1970. "Drug Use and American Culture," in Gary Collins (ed), *Our Society in Turmoil*, pp. 81–97. Carol Stream, Ill.: Creation House.
——— 1970. "Evangelical Protestantism as an American Subculture." Unpublished paper presented at the Annual Convention of the American Anthropological Association in San Diego.
——— 1972. "American Enculturation and Ethos." Unpublished paper presented at the Annual Convention of the American Society for Applied Anthropology in Montreal (Canada).
——— 1973. Review of Conrad M. Arensberg and Arthur H. Niehoff, *Introducing Social Change: A Manual for Community Development*. *Missiology* 1:126–128.
——— 1976. "Synoptic Comments on Religion, Ethos, and Science in American Culture," in Agehananda Bharati (ed), *The Realm of the Extra-Human: Ideas and Actions*, pp. 261–272. The Hague: Mouton publishers.
——— 1977. Review of Ashley Montagu, *The Nature of Human Aggression*. *Missiology* 6:260–263.
——— 1979. "'American Creed' Observed in Plymouth County," Le Mars (Ia.) *Daily Sentinel* (extended guest editorial, November 30).
——— 1980. "The Altruistic Ethos for Development Programs in the Third World." Unpublished paper presented at the Fifth Congress on Cross-Cultural Psychology at Utkal University, India.
——— 1980. "Our American Cultural Crises," *Journal of the American Scientific Affiliation* 32:196–189.
——— 1980. "Psychological Anthropology's Neglected Concept: Love," *Journal of the American Scientific Affiliation* 32:215–224.
——— 1981. Review of Johannes Verkuyl (trans. by Dale Cooper), *Contemporary Missiology: An Introduction*. *Journal of the American Scientific Affiliation* 33:47–49.
Kraft, Charles. 1979. *Christianity and Culture*. Maryknoll, N.Y.: Orbis Books.
Lasch, Christopher. 1978. *The Culture of Narcissism*. New York: W.W. Norton and Company.
Malthus, Thomas R. 1817 (1798). *Essay on the Principle of Population as it Affects the Future Improvement of Society*. London: John Murray.
Maslow, Abraham H. 1970. *Religion, Values, and Peak Experiences*. New York: Viking Press.
McLellan, David (ed). 1968. *Selected Works of Marx and Engels*. New York: International Press.
McLellan, David. 1974. *Karl Marx: His Life and Thought*. New York: Harper and Row.
Scott, Waldron, 1981. *Bring Forth Justice*. Grand Rapids, Mich.: William B. Eerdman's Publishing Company.
Sorokin, Pitirim A. 1941. *The Crisis of Our Age*. New York: E.P. Dutton and Company.
Spencer, Herbert. 1864. *Principles of Biology*. New York: D. Appleton.
Vitz, Paul C. 1977. *Psychology as Religion: The Cult of Self-worship*. Grand Rapids, Mich.: William B. Eerdman's Publishing Company.
Weber, Max. 1958. *The Protestant Ethic and the Spirit of Capitalism*. New York: Charles Scribner's Sons.
White, John. 1979. *The Sacred Cow: Materialism in the 20th Century Church*. Downers Grove, Ill.: Intervarsity Press.

There is in all of us an inclination to see the use of tangible weapons to fend off physical attack as more real, substantial and practical than the spiritual warfare described in Ephesians 6. But the most decisive battle in history was the one between Jesus and the powers of darkness; his was the supreme defending of us all. If in biblical perspective we truly see that and the relative indecisiveness of all military battles, we have basis for discerning what for us and those dearest to us is the critically needed defense: "They have triumphed over him (Satan) by the blood of the lamb and by the witness of their martyrdom, because even in the face of death they would not cling to life" (Revelation 12:11).

Dale Aukerman

"The Scandal of Defenselessness," *Sojourners*, February 1980, p. 26.

Complementarity and Christian Thought—An Assessment

1. The Classical Complementarity of Niels Bohr

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The relationship between Christianity and science has taken three major forms during the 20th century: the conflict theory, the compartment theory, and the theory of complementarity. If evangelicals are, in principle, unable to accept the idea that relevation in Scripture and nature ultimately conflict or that one does not do justice to either Scripture or nature by isolating one from the other, then complementarity needs to receive serious evaluation as the remaining alternative. This paper sketches the origins of complementarity in physics and indicates some application of Bohr's model in Christian thought. Several lines of criticism are considered that suggest the inappropriateness of this approach for questions involving science and religion.

Complementarity has been developed along two major lines. The first approach was offered by Niels Bohr in the 1920's to answer questions in the area of quantum physics. Bohr and his followers later suggested that complementarity can provide insights into issues that transcend the domain of science. In more recent years Donald MacKay has developed an alternative complementarian model based solely on logical considerations.

For about three decades many writers have viewed various aspects of the relationship between science and Christianity, as well as specific theological questions in complementarian terms, yet at the same time efforts have been made by an increasingly vocal school of thought to question the validity of complementarity, both at the physical level from which it emerged and at the science/religion level of application. This discussion has often been obscured by shifting sands of definition and interpretation, and the abstract nature of quantum mechanics, as well as a certain lack of clarity on the part of Bohr initially. Albert Einstein and many others have complained of the difficulty in grasping Bohr's ideas.

The "logical complementarity" model of Donald MacKay is considered in a subsequent paper.

The Roots of Bohr's Complementarity

Niels Bohr introduced the Principle of Complementarity to many of the world's leading physicists meeting in Como, Italy in 1927 to commemorate the 100th anniversary of Alessandro Volta's death.[1] As has often been the case with physicists, his comments transcended the typical scientific issues discussed at such meetings. Bohr offered a philosophical statement as a radical attempt to bridge the persistent and profound difficulties inherent in the description of physical entities in the quantum age.

The longest standing problem at that time dealt with the nature of light. One set of experiments enabled the propagation of light in space and time to be described by the mathematical equations of James Clerk Maxwell—the continuous wave model. Other experiments found adequate explanation only through a theory that characterizes light in terms of particles with discrete energy—the discontinuous quantum/photon model. All attempts to bridge the conceptual dilemma between these "dual" concepts had proved futile. The insights gained in the wave-particle experiments were considered mutually exclusive since light (or electrons) cannot exhibit both wave and particle properties simultaneously.

The difficulty of the situation is further illustrated by considering the nature of information gained from experiments on electrons. One type of apparatus allows the accurate measurement of the wavelength of a beam of electrons that has been accelerated to a given energy, but in so doing, does not allow the space coordinates of the electrons to be determined. With wavelength information, the de Broglie relation can be used to calculate the momentum of the electron and thus provide a description in energy-momentum terms. A different apparatus (perhaps involving clock-driven shutters and photographic film) can be constructed to obtain space-time information, but no information concerning energy-momentum values. Again, we may measure the energies of the radiation emitted when a group of atoms is excited but must refer to another experiment to gain information about the spatial distribution of electrons in the atom.

In these experiments on electrons, exclusion of information concerning one property does not arise because the kinds of information are antithetical or because each parameter cannot be measured to some degree in the same experiment. Rather, the problem is centered in the restrictions of the Heisenberg Indeterminacy Principle. This Principle proposes that the process of attempting to localize a particle in space (or time) imparts to the particle a momentum (or energy) with a magnitude that increases as we decrease the size of the space (or time) region under consideration. As we gain relatively exact information about one aspect, therefore, we forego the opportunity to gain exact information simultaneously about the other aspect.

Bohr's Complementarity Principle was advanced to resolve the apparent paradox of wave-particle behavior, as well as the inherent inability to simultaneously measure conjugate quantities, and, in general, to deny any expectation of gaining complete knowledge of matter or radiation in terms of a single set of concepts or any one type of measurement.

The following quotations set forth the general lines of Bohr's thought:

> The fundamental postulate of the indivisibility of the quantum is itself from the classical point of view, an irrational element which inevitably requires us to forgo a causal mode of description and which, because of the coupling between phenomena and their observation, forces us to adopt a new mode of description designated as complementary in the sense that any given application of classical concepts precludes the simultaneous use of other classical concepts which in a different connection are equally necessary for the elucidation of the phenomena.[2]

> Likewise we must be prepared for the fact that evidence obtained by different, mutually exclusive experimental arrangements, may exhibit unprecedented contrast and, even at first sight, appear contradictory. It is in this situation that the notion of complementarity is called for to provide a framework wide enough to embrace the account of fundamental regularities of nature which cannot be comprehended within a single picture. Indeed, evidence obtained under well-defined experimental conditions—and expressed by adequate use of elementary physical concepts—exhausts in its entirety all information about the atomic object which can be communicated in ordinary language.[3]

Ian Barbour has summarized Bohr's often vague argument in the following manner.[4]

1. We cannot avoid conventional (classical) ideas in describing the results of experiments that use apparatus and observations in space and time.
2. Since it is impossible to separate the object being considered completely from the process of measurement, we cannot view the object apart from the total experimental context.
3. Different experimental situations may require different models for explanation. These models are complementary rather than contradictory since they do not arise from the same experimental situation.
4. Conventional concepts drawn from the everyday world are not applicable to the atomic domain, thus preventing a unified picture of nature.

For about three decades many writers have viewed various aspects of the relationship between science and Christianity in complementarian terms, yet at the same time efforts have been made by many to question the validity of complementarity.

Initial Philosophical Reaction

The immediate response to Bohr's proposal was polite acceptance by most (but by no means all) of the physics community. Complementarity was soon incorporated into what was to be called the "Copenhagen" interpretation of quantum mechanics. It's broader implications were not lost on the philosophers whose mood at that time embraced an observer-centered epistemology and phenomenological style of theory construction. For the first time since the 17th century a significant group of philosophers were to find themselves in agreement with many of the eminent physicists of the time on the nature and aim of physical science.

> The two parties agreed that what had been wrong with classical physics was that, having espoused a realistic epistemology, it focused on the object rather than on the subject's operations. They agreed that, when properly understood, the new physics reduced the physical object to little more than the grin of the Cheshire cat. What remained were observers and observables, and the latter were not real properties of autonomously existing things but mere possibilities of observation. Not observations on something out there, but just observations. The external world was gone: only "its" representation was left. True the operationalist would grant reality to his desk and eventually also to the atoms that make it up, but he means by "reality" a set of human operations and aperceptions, not the aggregate of things outside the human mind . . . this covenant between physicists and philosophers was to last about two decades.[5]

Bohr's Grand Task

While Bohr is best known for the complementarian approach to the problems of quantum physics his vision was

far more encompassing. His "grand task" was that of establishing a unifying principle of knowledge that is capable of treating the problems of all the disciplines—whether psychology, anthropology, physiology, philosophy, physics or theology. In the Complementarian Principle, Bohr felt that he had the overarching unifying basis for discovering significant interrelationships existing among all areas of knowledge which had been hitherto obscured by the distinction inherent in forming human ideas.

> It is significant that . . . in other fields of knowledge we are confronted with situations reminding us of the situation in quantum physics. Thus the integrity of living organisms and the characteristics of conscious individuals, and human cultures present features of wholeness, the account of which implies a typical complementarity mode of description. We are not dealing with more or less vague analogies but with clear examples of logical relations which, in different contexts are met with wider fields.[6]

Again,

> The aim of our argumentation is to emphasize that all experience whether in science, philosophy, or art which may be helpful to mankind, must be capable of being communicated by human means of expression, and it is on this basis that we shall approach the question of unity of knowledge.[7]

> . . . the complementarity principle is a manifestation of a general thema in a sense which I have previously developed—one thema in a relatively small pool of themata from which the imagination draws for all fields of endeavor. When we devote attention to a particular thema in physics or some other science, whether it be complementarity, or atomism, or continuity, we must not forget that each special statement of the thema is an aspect of a general conception which in the world of a physicist or biologist or other scientist is exemplified merely in a specific form. Thus, a general thema θ, would take on a specific form in physics that might be symbolized by θ_ϕ, in psychological investigation by θ_ψ, in folklore by ϕ_μ, and so on. The general thema of discontinuity or discreteness thus appears in physics as the θ_ϕ of atomism, whereas in psychological studies it appears as the thema θ_ψ of individualized identity. One may express a given as the sum of its specific exemplifications, as symbolized (without straining for precision) in the expression:[8]

$$\theta = \sum_{n=a}^{n=z} \theta_n .$$

Origin of Bohr's Concept

Gerald Horton has found Bohr's ideas to be strikingly similar to those of William James the psychologist who wrote in 1890:

> It must be admitted therefore that in certain persons, at least, the total possible consciousness may be split into parts which coexist but mutually ignore each other, and share the objects of knowledge between them. More remarkable still, they are complementary. Give an object to one of the consciousnesses, and by that fact you remove it from the other or others. Barring a certain fund of information, like the command of language, etc., what the upper self knows the under self is ignorant of, and vice versa.[9]

Bohr's father, as professor of physiology at the University of Copenhagen, was deeply involved in the vitalistic/mechanistic debate over life processes and often brought those interested in philosophical questions to the family home. Bohr has acknowledged the influence of Hoffding and Kierkegaard during his formative years.

> Whatever the most prominent factors were which contributed to Bohr's formulation of the complementarity point of view in physics—whether his physical research or thoughts on psychology, or reading in philosophical problems, or controversy between rival schools in biology, or the complementary demands of love and justice in everyday dealings—it was the universal significance of the role of complementarity which Bohr came to emphasize.[10]

In his later years, Bohr expanded his complementarian approach to issues in biology, psychology, anthropology, politics and more broadly to the question of the origin of human cultures:

> The fact that human cultures developed under different conditions of living exhibit such contrasts with respect to established traditions and social patterns allows one, in a certain sense, to call such cultures complementary. However, we are not here dealing with definite, mutually exclusive features, such as those we met in the objective description of general problems of physics and psychology, but the differences in attitude which can be appreciated or ameliorated by an expanded intercourse between people.[11]

Bohr's Complementarity in Christian Thought

Although complementarity is hardly a household word in Christian (or non-Christian) intellectual circles, over the past 30 years a number of writers at the Christianity/science interface have included this topic in their work. In most cases, a more or less accurate description of the quantum basis for Bohr's concept is provided followed by a statement indicating the application of complementarity to disciplines where different aspects of a subject appear (or are) contradictory. Areas of religious paradox (Divine/human nature of Christ, love/justice, one/triune God) are cited as capable of being handled with this approach as well as points where science and Christian faith appear to come into conflict. One gains the impression that the "effectiveness" of complementarity in covering the conflicts in quantum physics is equally effective

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(and applicable) in handling science/religion conflicts and thus a useful weapon in the apologetic arsenal.

A. Smethurst views complementary language as encouraging the use of alternative approaches to particular questions:

> . . . the attempt to treat man's relation to God purely in terms of isolated individual souls denies the truth so strongly emphasized by St. Paul and St. John—that the individual is a part of a greater whole or organism, the Church, and that any true description of the relation of man to God must treat human beings not only as individual souls but also as members of one Body of Christ or branches of the one Vine . . . the old concept of the isolated individualism characteristic of classical physics, liberalism in politics and Victorianism in religion, has proved as untenable in physics as in politics and religion. . . . It is perhaps significant that Quantum Mechanics and statistical physics have developed contemporaneously with the Liturgical Movement in Christian theology and worship which emphasizes the corporate nature of the Church, rather than the individual in isolation.[12]

A. Van der Ziel provides two further examples of the complementarian approach in theology—the doctrines of the Trinity and the two natures of Christ:

> According to the Athanasian creed: we honor the one God in the Trinity and the Trinity in the unity, without mixing the persons or dividing the substance. Seemingly contradictory concepts are here used together. Any attempt to remove these contradictions would lead to confessing the Unity and denying the Trinity or to denying the Unity and confessing the Trinity. Facing this dilemma the Christian Church had no other choice but protecting both and that is what the short formula tries to do. It is thus not an attempt to explain the mystery surrounding God. On the contrary, it refrains from any explanation and thereby protects the mystery. . . . an example of complementary thinking.[13]

Van der Ziel warns, however, that the analogy between physics and theology is only one in "method of approach" and is incomplete because physics may ultimately find a resolution for its paradoxes while this appears unlikely in theology. For Van der Ziel "most Biblical exegesis that is true to its source uses a complementarian form of approach."

Richard Bube examined Bohr's concept over 25 years ago in this *Journal*. Finding paradoxes in theology that "exactly" parallel the situation in physics and noting scriptural language that "is the very same language as that of the principle of complementarity," he concluded:

> An understanding of the principle of complementarity demonstrates to us that the existence of apparent paradoxes in our theology cannot be used against the Bible as evidence of its falsehood; . . . (and) also shows us that we need not retreat from the complete Scriptural revelation by denying either the real meaning of man's responsibility or God's sovereignty as some have been led to do in order to remove from themselves what they considered to be the intolerable burden of the apparent paradox.[14]

Bube, in a more recent treatment, remarks:

> This principle of complementarity is not meant to serve as an excuse for accepting apparent contradictions or of terminating the search for a better understanding when it is possible to press on and achieve this understanding. But it suggests that there may be areas of knowledge—and this is true in physical science and in spiritual revelation alike—which are so profound or so complex or so removed from our ability to understand that the very best we may be able to do is to use several different models each from its own appropriate perspective . . . In fact, to attempt to describe reality in terms of only one member of a complementary pair or of only one aspect of a paradox may be destructive of effective action.[15]

Ian Barbour has provided an extended treatment of Complementarity.[16] In considering the use of the concept in non-physical situations he warns that these applications are "analogical not inferential" and that "there must be independent grounds for justifying in the new context the value of two alternative sets of constructs. He finds that . . . "it appears more dubious to refer to various disciplines as complementary, unless they are all assumed to analyze the same set of events."[17] "Thus science and religion are not simply two views of the same world—unless one subscribes to pantheism and denies transcendence—for God and the world are different modes of being, not different modes of knowing a single being."[18] The term "complementary languages" has been employed to describe human behavior in handling problems such as freedom vs. determinism. In some situations it is useful to evaluate man's acts from a causal perspective while in others (say daily affairs) his activity may be seen in terms of goals and thus be described in terms of freedom language. There is here the recognition of man's inability to describe diverse aspects of human experience within a single conceptual framework. Yet, significantly, Barbour adds: "Nevertheless the demand for coherence of thought, as well as the image of man as unitary being, seems to require us to analyze further the relationships between the aspects of man which give rise to such diverse languages."[19]

Christopher B. Kaiser has applied complementarity in a study of the two natures (divine and human) of Christ. Kaiser carefully considers Bohr's approach with that of the post-Nicene fathers of the church along eleven points of comparison. In finding a reasonable parallel between Christology and complementarity he questions why the parallel seems to work at all and whether it works the same in other relationships. Several directions for further research are suggested. Kaiser concludes his paper:

> Complementarity itself is a purely synchronic principle pertaining to the 'vertical' relation between 'modes' or 'levels' of being. While the study of complementary structures may raise questions about the connection between the God-world relation and Christology, the questions themselves involve a 'horizontal,' diachronic relation between the creation, Incarnation and eschatology, and so can only be treated properly in the context of an overall theology of history.[20]

The late Max Lemberg has, in a recent paper, called scientists to recognize the contribution that religion (qualities and values) brings to science. In appealing to Bohr's complementarian approach he states:

> Religion is more important for showing the direction and the major ends of human efforts while science shows the possible means available to us to achieve these ends; if this is correct, they are in fact complementary and both are essential for our ethics.[21]

> The concept of complementarity allows us to be more sincere and more complete human beings, provided that it not be accepted as another dogmatic and final solution. The conviction that all claims of being in possession of the final truth are unjustified and even dangerous to human brotherhood and humility has made me a Quaker. Teilhard de Chardin has shown us that, far from being a hindrance to the freedom of our souls, matter is in fact the complement, providing the handholds and footholds on the mountains of our spiritual climb.[22]

The statements above reflect typical complementarian applications that find their base in the ideas of Niels Bohr.

The Critics Speak

Although it was earlier suggested that the complementarian/Copenhagen perspective gained the tacit acceptance of much of the physics community and fit the mood of the prevailing philosophical school of the time, this "covenant between physicists and philosophers" was to last for only two decades. In Bunge's words:

> During this period the Observer displaced matter and God. But philosophers, if fond of logical analysis, cannot resist the temptation of critically examining philosophical assumptions, even their own pet hypotheses. So, while physicists keep the crude operationalist philosophy of the 1920's, most of the philosophers responsible for it have since changed their minds about lots of things . . . Today there are hardly any orthodox operationalists and phenomenalists left in the philosophical professions: operational definitions are acknowledged as deficient and phenomenalism is inconsistent with the use of theoretical terms . . . As far as most philosophers are concerned, the world is more or less tacitly allowed to run by itself. But contemporary physicists are like these die-hard positivists of the 20's and 30's, they have imbibed this subject-centered philosophy as undergraduates—and mind, not in philosophy courses but in physics courses . . . For the first time in history scientists have managed to out-dogmatize philosophers.[23]

However:

> . . . in recent years the tide has begun to turn, not only in philosophy but also in physics . . . The physicist of the latest generation is operationalist all right, but usually he does not know, and refuses to believe that the original Copenhagen doctrine—which he thinks he supports—was squarely subjectivist, i.e., non-physical . . . Many physicists are beginning to wonder not only whether the current theories are sufficient but also whether it would not be worthwhile to analyze and re-interpret them. Some heretics find obscurities and inconsistencies in them. Others go as far as wondering whether physical theories may not, after all, be about chunks of reality rather than about human actions . . . They are beginning to suspect that the official philosophy of physics—which is no longer held by philosophers—has gone too far in its eagerness to dispel metaphysical inscrutables. Surely physical hypotheses must be susceptible for experimental test, but why should they not concern the external world and why should they not explain how things work?[24]

While an exhaustive analysis is inappropriate for these pages, several lines of thought are sketched indicating the direction of the critiques. Karl Popper has long opposed the complementarian perspective. In developing a realistic interpretation of quantum mechanics through a series of theses, Popper strikes at several key concepts of the Copenhagen school. He argues that quantum mechanics is a statistical theory that can be used to provide (only) statistical answers to statistical questions, concluding that it is the probabilistic nature of quantum theory rather than the intrusion of the observer or any uncertainty principles that leads to a limitation in our knowledge.[25]

> . . . the view that a probabilistic theory is the result of lack of knowledge leads inescapably to the subjectivistic interpretation of probability theory; that is, to the view that the probability of an event measures the degree of somebody's incomplete knowledge of that event, or of his belief in it.[26]

Popper finds the Heisenberg equations to be "validly derivable statistical formulae of the quantum theory" that do set some lower limits to the statistical dispersion or scatter of the results and thus limit the precision of certain individual predictions. However, "in order to test these scatter relations, we have to be able (and are able) to make measurements which are far more precise than the range or width of the scatter." He asserts that the Heisenberg equations are valid for making statistical predictions about many particles, or about sequences of many experiments with individual particles, but that they cannot limit the precision of measurements of individual particles.

> Once we ascribe physical reality to measurements for which . . . $\Delta p \Delta q \ll h$ . . . there can be no question whether, according to the quantum theory, an electron can 'have' a precise position and momentum. It can.[27] Why did Bohr and his followers deny that $\Delta p \Delta q \ll h$ is possible? Because of the great quantum muddle, the alleged dualism of particle and wave: it is said that there are two 'pictures,' the particle picture and the wave picture, and that they have been shown to be equivalent or 'complementary'; that is to say, both valid. But this 'complementarity' or 'duality' must break down, it is said, if we allow the particle to have at the same time a sharp position and momentum.[28]

Regardless of one's position on the epistemological spectrum between naive realism and instrumentalism, the "truth" derived from a study of nature is of a different order from the propositional truth of Scripture.

Further Criticism

Margenau and Cohen also find the Copenhagen interpretation inadequate in terms of the prevailing interpretation of the Heisenberg Indeterminacy Principle. In demonstrating a number of major problems deriving from an "observer" or "operational" based uncertainty they find:

> For these reasons it is necessary to look deeper into the bases of indeterminacy and denounce the encrusted habits of visual pictorization of elementary events, to relinquish the attempt to explain quantum uncertainty in terms of the familiar notions of conventional particle trajectories or wave propagation . . . Although it is heresy to say so, we believe that there is no dualism, no complementarity in quantum physics.[29]

Mehlberg employs the term "Unreality Principle" to describe the surrender of observer-independent physical reality at the quantum level by the Copenhagen school of thought.[30] In this view, no statement ascribing a property to a micro-object is true unless the empirical verification of the statement is carried out. He notes that this attitude is not consistently held, even by physicists. Curiously, Heisenberg first offered the view that the nucleus of every atom (except hydrogen) contains protons and neutrons. His hypothesis clearly ascribes a spatial position within the nucleus to quantal species even though no measurement of this property has been made—a model that contradicts the Unreality

Principle. Other fundamental hypotheses associated with quantum theories are also seen to be inconsistent with the Unreality Principle. Mehlberg offers a modification of the Copenhagen interpretation that establishes the observer-independence of space-time in non-relativistic quantum mechanics.

Bunge lightheartedly views Bohr's position:

> The subjectivist wishes to exorcise Hamlet's ghosts by substituting 'To Look or not To Look' for 'To Be or not to Be.' This is what he does when he claims that the question of the real (autonomous) existence of atoms is meaningless or metaphysical, when he holds that the behavior of every atom—even the most forlorn atom in the center of Sirus—is determined by our measurement setups, and when he contends that the state of an atom will jump after the measurement interaction is over, just because the observer looks at the pointers. In this way the subjectivist summons more ghosts than those which haunted Hamlet. Indeed the claim that things acquire their properties just because we condescend to look at them is sheer anthropocentrism and, in order to be carried out consistently, it requires filling the whole cosmos with a staff of observers ever ready to take infinitely precise measurements of anything conceivable—just to keep the world going. And this is merely a modern version of animism.[31]

Bunge develops a formal realistic statement of quantum mechanics and challenges the Copenhagen school:

> . . . to (a) exhibit a consistent formulation of quantum mechanics based on perceptions and apperceptions and (b) to prove that such an interpretation is preferable to the realistic one, not only from the point of view of his philosophy, but also scientifically, in the sense that it facilitates our understanding of nature.[32]

Recently, Lande has argued that the wave-particle dualism of two equivalent pictures is untenable on methodological as well as physical grounds. The basic relations that are said to establish the empirical equivalence of the two theories lead to empirically wrong results in the relativistic domain and violate the postulate of independence of the arbitrary choice of reference system in the non-relativistic realm. Further:

> The wavelike looking diffraction patterns of electrons through crystals and through parallel slits in a screen can be explained by pure particle mechanics alone without reference to any wave interference.[33]

It appears that this changing scientific perspective has not generally been taken into account by exponents of complementarity writing on religious questions. Clearly, any break in the armor of the basic physical origins of Bohr's views should have implication for the broader application seen in Christian thought if the same concept of complementarity is used in both areas.

Feyerabend's Defense

It should be noted that Bohr has not gone undefended in recent times.[34] Feyerabend has penned a long argument supporting Bohr's perspective in light of current criticism.

> Popper's criticism of the Copenhagen interpretation, and especially of Bohr's ideas is irrelevant, and his own interpretation is inadequate. The criticism is irrevelant as it neglects certain facts, arguments, hypotheses, and procedures which are necessary for proper evaluation of complementarity and because it accuses its defenders of 'mistakes,' 'muddles,' and 'grave errors,' which not only have been committed but against which Bohr and Heisenberg have issued quite explicit warnings. His own view which . . . is relevant in probability theory is quite inadequate as a remedy for the special problems of quantum theory and too simplistic to be regarded even as a possible alternative to complementarity (let alone a preferable one)" . . . the first step in our attempt to achieve progress in microphysics will have to be a return to Bohr.[35]

In attempting to follow the flow of the debate one is drawn to suggest that the basic issue is epistemology and that the case, pro and con, for complementarity stems from one's position on the instrumentalism/realism question.

Bedau's Critique

In Christian thought, complementarity generally has been viewed as a harmonizing or integrative approach to those areas where science and religion or particular theological statements appear to be in conflict, and more broadly as a means for identifying valid multiple descriptions of common subjects. Bedau's analysis of science/religion complementarity suggests two major problems: (a) the identification of paradox between science and religion, and (b) the establishment of something analogous to mutually exclusive experimental arrangements with which to remove paradox.[36] Bedau is unable to find any "sense of paradox applicable to genuine difficulties relating science and religion" or that "the complementarist approach has brought to light any latent paradoxes hitherto concealed or hidden between science and religion." He suggests that the contrasting domains of application found in physics—the macro- and micro-realm—are not observed in other fields. The analogy to quantum mechanics fails in another sense in that it does not establish that concepts applicable in one domain give rise to paradox when applied in the other domain. More likely they will have no meaning.

Clearly, there are no experimental arrangements through which religious or scientific interpretations of "neutral" experiences can be produced. It has been suggested that "attitude" may be substituted for "experimental arrangement." Bedau finds:

> . . . that despite frequent reference to religious attitudes we have at present no empirical evidence to show that there is any one attitude common and peculiar to those who have religious beliefs or who accept religious judgments, much less that it is a necessary and sufficient condition of being in such an attitude to make or accept a religious belief, etc. The same is true I would expect, concerning the hypothesized scientific attitude; psychological science today knows nothing of the sort.[37]

The criterion that complementary statements be true in the same sense of "true" has little hope of being established in the realm of religion and science. Regardless of one's position on the epistemological spectrum between naive realism and instrumentalism, the "truth" derived from a study of nature is of a different order from the propositional truth of Scripture.

A further flaw in regarding science and religion as complementary in Bohr's sense is seen in Barbour's observation that "God and the world are different modes of being, not different modes of knowing a single being." God and man are two "distinct entities in Christian theism, not two modes of a single entity as wave and particle are two complementary modes of an atomic object in physics." Creator and creature are not analogous to two different experimental arrangements.[38]

Physicist-historian Stanley Jaki has recently criticized Bohr's epistemology:[39]

> . . . this celebration by Bohr of irrationality in nature . . . was a logical consequence not of quantum theory but of the Machist and pragmatist epistemology which Bohr grafted on it. As could be expected, Bohr, the pragmatist was not to renounce reason in a consistent manner. He was neither the first or the last on the long list of more recent philosophers and scientists who believed it possible to save something of reason while espousing ultimate reality. Like Hoffding, his philosophical mentor, Bohr never pondered the logical implications of the complementary presence of both the rational and the irrational in knowledge.[40]

> A harmony of relations or aspects, complementing one another, such was Bohr's epistemological message, a message void of reference to the ontological reality of anything harmonious.[41]

For Jaki:

> Bohr's pairs of complementarity resembled pairs of horns from which one could not even infer unambiguously either that they were rooted in the same head and were thereby truly complementary or that the head itself was real, and even more fundamentally real than the horns themselves. Complementarity forces a choice between assigning to nature the ability to choose, and purposively at that, or the physicist who constitutes nature through the choice of his observations.[42]

Conclusion

A variety of scientists, philosophers and theologians have raised substantial concerns with respect to the physical basis, internal consistency and philosophical implications found in Bohr's complementarity. In addition, the application of complementarity as an integrative tool for science-religion issues has been called into question along the following lines: (a) lack of identification of appropriate paradoxes, (b) no clear analogy to "experimental situation" in physics, (c) lack of a common notion of truth on scientific and religious assertions, and (d) placing God and man in the same order.

In the light of these observations the Christian apologist should use extreme care in asserting a complementarian approach based on an analogy to Bohr's handling of certain questions in quantum physics. An alternative complementarian approach based on logical considerations will be considered in a later paper.

REFERENCES

[1]N. Bohr, *Atomic Theory and the Description of Nature*. (N.Y.: Macmillan, 1934). pp. 54–55.
[2]*Ibid.*, p. 10.
[3]N. Bohr, *Atomic Physics and Human Knowledge*. (N.Y.: Interscience, 1963). pp. 111–112.
[4]I. Barbour, *Issues in Science and Religion*. (Englewood Cliffs: Prentice Hall, 1966). pp. 282–283.
[5]M. Bunge, "The Turn of the Tide" in *Quantum Theory and Reality*. (N.Y.: Springer-Verlag, 1967). p. 3.
[6]N. Bohr, *Essays 1958–1963 on Atomic Physics and Human Knowledge*. (N.Y.: John Wiley, 1963). p. 7.
[7]*Ibid.*, p. 14.
[8]As quoted in G. Horton, "The Roots of Complementarity," *Daedalus* 99 (1970) p. 1015.
[9]W. James, *Principles of Psychology*. (N.Y.: Dover, 1950, Ed.), I, p. 206.
[10]Horton, *op. cit.*, p. 1048.
[11]Bohr, *Atomic Physics and Human Knowledge*, pp. 174–175.
[12]A. Smethhurst, *Modern Science and Christian Belief*. (Nashville: Abingdon Press, 1955). p. 88.
[13]A. van der Ziel, *The Natural Sciences and the Christian Message*. (Minneapolis: Denison, 1960). p. 122.
[14]R. H. Bube, "The Relevance of the Quantum Principle of Complementarity to Apparent Basic Paradoxes in Christian Theology," *Journal of the American Scientific Affiliation* 8 (1956) p. 7.
[15]R. H. Bube, *The Human Quest*. (Waco: Word Books, 1971). p. 177.
[16]Barbour, *op. cit.*, chapters 10 and 11.
[17]*Ibid.*, p. 292.
[18]*Ibid.*, p. 293.
[19]*Ibod.*, p. 312.
[20]Christopher B. Kaiser, "Christology and Complementarity," *Reltg. Stud.* 12 (1976) p. 47.
[21]Max Rudolf Lemberg, "The Complementarity of Religion and Science: A Trialogue," *Zygon* 14 (1979), p. 352.
[22]*Ibid.*, p. 357.
[23]Bunge, *op. cit.*, p. 3, 4.
[24]*Ibid.*, pp. 4, 5.
[25]K. R. Popper, "Quantum Mechanics Without the Observer," in *Quantum Theory and Reality*. (N.Y.: Springer-Verlag, 1967) pp. 7–44.
[26]*Ibid.*, p. 17.
[27]*Ibid.*, p. 27.
[28]*Ibid.*, p. 28.
[29]H. Margenau and L. Cohen. "Probabilities in Quantum Mechanics," in *Quantum Theory and Reality*. (N.Y.: Springer-Verlag, 1967). p. 75.
[30]H. Mehlberg "The Problem of Physical Reality of Contemporary Science" in *Quantum Theory and Reality*. (N.Y.: Springer-Verlag, 1967). p. 45.
[31]M. Bunge, "A Ghost-Free Axiomatization of Quantum Mechanics" in *Quantum Theory and Reality*. (N.Y.: Springer-Verlag, 1967). p. 105.
[32]*Ibid.*, p. 116.
[33]A. Lande, "The Decline and Fall of Quantum Dualism," *Philosophy of Science*, 38 (1971) p. 221.
[34]P. Feyerabend, "On a Recent Critique of Complementarity: Part 1," *Philosophy of Science*, 35 (1968) p. 309.
[35]P. Feyerabend, "On a Recent Critique of Complementarity: Part 2," *Philosophy of Science*, 36 (1969) p. 103.
[36]H. A. Bedau, "Complementarity and the Relation Between Science and Religion," *Zygon* 9 (1974) p. 214.
[37]*Ibid.*, p. 219.
[38]Barbour, *op. cit.*, p. 293.
[39]S. L. Jaki, *The Road of Science and the Ways to God*. (Chicago: University of Chicago Press, 1978), Chapter 13.
[40]*Ibid.*, p. 201.
[41]*Ibid.*, p. 205.
[42]*Ibid.*, p. 205.

Christianity, Sociology, and the Moral Order

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Sociology is often regarded as anti-Christian. This paper argues that the new moral order that the founders of sociology sought to base on science was and is congruent with the teachings of Christ. The old moral and social order uprooted by the Enlightenment, though falsely labelled as Christian, was actually based more on pre-Christian, particularly Greek, worldviews. Specifically, the Great Chain of Being, the predominant cosmic legitimation of the old hierarchic social and political order, was essentially Greek and hence pagan. Thus, sociology, rather than denying the Christian message, can serve as an invaluable vehicle for helping to build a social, moral, and political order more congruent with genuine Christian teachings.

Sociology has often been regarded by Christians and others as being in conflict with basic Christian teachings. This impression of the anti-Christian nature of the discipline is based on several assumptions. First, sociology explicitly rejects supernaturalistic explanations of human behavior. Regarding social life as a natural phenomenon essentially similar to physical objects and events, sociology seeks to understand the characteristics and dynamics of social existence in ways that do not rely upon traditional religious modes of explanation. Auguste Comte, the founder of the discipline and coiner of the term "sociology," saw sociology as the culmination of an upward movement from theological to metaphysical-philosophical and finally to positivistic modes of understanding human behavior, the latter based on empirical observation rather than theological speculation or philosophical rumination.

Second, sociology has frequently arrived at types of explanations and implicit value orientations that seem at odds with traditional Christian moral teachings. The sociological study of deviant behavior, a prominent part of sociological endeavor, for example, generally tends to focus on causes of such behavior that are external to deviant people themselves. Thus, criminals are seen largely as acting on the basis of norms and values of particular subcultures, and/or as responding to lack of opportunity for success, and in other ways that either ignore, or implicitly or explicitly contradict, the prevalent traditional Judaeo-Christian view that criminal behavior is a manifestation of the sinfulness of individual offenders.

With respect to such forms of deviant behavior as homosexuality, the sociological perspective stresses that different societies and cultures label different kinds of behavior as deviant; hence, deviance is not a reflection of the abnormality and/or depravity of certain individuals, but rather the consequence of the fact that their behavior patterns happen to be regarded as deviant by the sociocultural system in which they live.

The relativistic approach toward deviancy conflicts with the prevailing Judaeo-Christian view of homosexuality and other kinds of deviancy as sin: the abnormal individual is fully responsible and must try to change so as to obey God's injunctions against various kinds of sinful action.

While such conflicts between sociology and Christianity undoubtedly reflect genuine divergencies of view regarding ontological and moral issues, there is a deeper level seldom if ever explored that affords the possibility of sociology serving as one means of actualizing and affirming genuinely Christian teachings. In this paper I explore and discuss a number of such possibilities.

Sociology and the New Moral Order: Toward True Christianity

The old moral, social, and political order that was overthrown by the French Revolution has generally been regarded as "Christian." Looked at more closely, however, the hierarchic system that elevated a small elite to the top of a universal pyramid and relegated the vast majority to poverty and degradation, was a socioeconomic and political order that was based much more on pagan Greco-Roman than on Judaeo-Christian conceptions of the nature and order of the universe and humanity's relation to it.

The worldview upon which most of Western social and moral order has rested has been the Great Chain of Being, a view of the natural order in which God is seen at the "highest" point of the universe, having created multitudes of beings superior and inferior to one another, each according to their "degrees of perfection" and proximity and similarity to their Creator. This view of the natural order stemmed, as Arthur Lovejoy in his classic work has shown, from Plato's division of the world into the Realms of the Real and the Ideal. This led to Aristotle's resolution of the question of the relation of these two realms by asserting that they were related in terms of their "degrees of perfection." Aristotle's hierarchic way of regarding the natural order that stemmed from this resolution had tremendous, still-existing impact not only on the way we still tend to view people in terms of how "high" and "low" they are on the social ladder, but also upon the natural sciences that have developed on the foundations of Aristotelian conceptions of the hierarchic character of the natural order. Indeed, it is not too much to say that the Aristotelian elaboration of the Chain of Being in such works as *De Anima* was the first systematic scientific effort to understand and clarify "the manifold words of God in nature" and hence the foundation of all modern natural science.

The traditional moral, social, and political order that was overthrown by the French Revolution thus was based on Aristotelian conceptions. Beginning very early in Christian history, some believe as early as the Apostle Paul's efforts to explain the meaning of Christ to the Corinthians and other Greeks he was attempting to evangelize, Christianity has been interpreted in ways that have frequently allowed Greek conceptions of natural order to prevail over genuinely Judaeo-Christian conceptions. Much later, the Scholastics' effort to reconcile Christianity with Aristotelian philosophy was a continuation of such efforts at melding the Greek and Christian worldviews represented by St. Augustine's *City of God*, in which the Judaeo-Christian Kingdom of God and its relation to earthly existence is seen as a manifestation of Plato's vision of the relation between the Real and the Ideal realms.

The traditional socioeconomic and political order that the French Revolution sought to overthrow was nominally "Christian." All evidence suggests, however, that the actual day-to-day behavior of people, from the "lowest" to the "highest," as well as most of the values that informed the directions of their existences, were far from conforming to Christ's teachings. The cruelty and arrogance of those who believed that their privileges were decreed by God led to practices and systems in which the idea that all people are children of God and should be treated with respect and compassion was flagrantly contradicted and scorned. The evils of the traditional hierarchic order extended throughout the system and are too well known to need recounting here. The supposedly "Christian" world of pre-modern times more often was contrary to the teachings of Christ than in conformity with them. Cruelty and brutality took definite precedence over the compassion preached by the Lord.

In viewing the origins of sociology, it is therefore incorrect to view the discipline as arising primarily as part of an effort to replace a genuinely Christian socioeconomic and political order. Incensed by the injustices of the old regime but horrified by the excesses and disorders of the new, Comte, like many of his fellow *philosophes*, sought a new basis of moral order, one based on observation of human behavior and hopefully resulting scientific knowledge. Comte's efforts evolved into attempts to establish a Religion of Humanity, which was not seriously regarded by his fellow philosophers. His attempt led him to be ridiculed by the apparent contradictions between his evident earlier rejection of religiosity and the fervent character of his efforts to establish himself as the founder of a religion late in his life.

Perhaps the most significant sociological pioneer who took up Comte's quest for the creation of a new, more just, more scientifically based moral order was Emile Durkheim.

Building on the thwarted foundation of Comte's efforts, and enjoying an academic status and respectability that had eluded Comte, Durkheim undertook a systematic effort to comprehend and establish a moral system based on scientific understanding. While the specific nature of these efforts are too substantial a subject for the scope of this paper, Durkheim emphasized that morality stemmed from a human need to exist together and interact under the umbrella of a shared moral order that enables people to cohere peacefully and pursue common values and goals. While Durkheim's view tended to implicitly glorify the collectivity as the source of moral consciousness, and was in many ways contrary to Christian views of the origin and purposes of morality, it

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nonetheless constituted, one could argue, an advance over the nominally "Christian" but actually Graeco-Roman view that God had placed people in a hierarchic order superior and inferior, and hence in inevitable discord, with one another.

Sociology and the Morality of Compassion

Since the French founders, sociology has no longer been based on a search for a scientifically based moral order, at least not as deliberate an effort as evidenced by Comte and Durkheim. Nonetheless, it is my view that a good deal of sociological theory, research, and perspective of this century, while often not apparently Judaeo-Christian and frequently deliberately rejective of any religiosity of any sort, is nonetheless more congruent with genuine Christian teachings than many views customarily regarded as Christian.

Despite its claims and desire to be regarded as scientific, sociology is moralistic at its core. One of the prominent elements of the sociological outlook is its "debunking" character. Sociologists seek to look behind the facades of social life, particularly the justifications and legitimations the powerful and privileged use to rationalize their positions and perpetuate various kinds of injustices.

Viewing Christ's actions on earth, it is apparent that in many ways, Christ was Himself a debunker of the social facades of his time. His strongest anger was directed not at the sexual transgressors whom modern day fundamentalist Christians see as the greatest sinners, but at the wealthy and powerful, who oppress and otherwise callously disregard the needs of the poor and make a pretentious display of piousness while failing to act compassionately toward their fellow children of God who are in need. By providing a basis for understanding and unmasking the pretenses of the rich and powerful who are insensitive to the needs of the less fortunate, sociology can serve as a means of implementing Christ's compassionate teachings.

Relativism, Ethnocentrism, and Christian Teaching

Sociology stresses that values and norms are products of given societies, and that therefore peoples' actions should be viewed not from the perspective of absolute moral rules, but in relation to their particular cultures.

At first, this emphasis may seem to undermine and directly contradict the claims of the Bible to absolute moral authority. Although the relativistic approach may contradict claims that stress the infallibility of the Bible's moral teachings, at a deeper level the relativistic approach may serve as a basis for implementing rather than undermining Christ's teachings of compassion.

One of the foundations of Christ's moral laws is His statement that they can be summed up by doing to others what one would have wish to have done to oneself. This Golden Rule, according to Jesus as stated in Matthew 7: 12, "sums up the Law and the Prophets."

Many ostensibly Christian moralists have throughout Western history persecuted those whom they have regarded as failing to live up to Christian moral standards. "Heathens" and others have been subjected to all sorts of cruelty, and been slaughtered by the millions often in barbarous ways, all supposedly in the name of Christ. This tragic dimension of much of Christian history has caused many to reject Christianity itself, assuming that Christianity is largely a massive hypocritical rationale for sadism and oppression.

There is a deeper level seldom if ever explored that affords the possibility of sociology serving as one means of actualizing and affirming genuinely Christian teachings.

Implicit in the relativistic approach of sociology is something deeper than the idea that "all values and moral standards are relative." That deeper essence is the assumption that people are not to be relegated to a "higher" or "lower" level of humanity simply on the basis of their culturally-instilled beliefs and values. The self-righteous moralist frequently uses such cultural criteria as a basis for separating people into those worthy of being acted toward in a moral manner, and those "outside the pale" of humanity who, as "heathens," deserve only contempt and, in the extreme, to be subjugated and even exterminated. Such use of the category of "Christianity" as a means of legitimating exclusion and consequent inhumane action towards "outsiders" is directly contrary to Jesus' teaching that all people are children of God and all, without exception, should be treated as one would treat oneself. Christ's compassionate treatment of such sexual sinners as the woman at the well and the adulteress about to be stoned contrasts with his strong anger toward self-righteous hypocrites and such money-related sinners as the moneychangers in the Temple and the rich man who failed to help Lazarus. His deliberate use of the Samaritan in his Good Samaritan parable was meant to emphasize that even those who are customarily regarded as outsiders and enemies are to be considered as neighbors to be treated with compassion and mercy in the new moral order He has initiated.

Thus, rather than contradicting and undermining genuinely Christian moral values, the relativistic approach can help fulfill Christ's teaching by providing a basis for the recognition and affirmation that all people, despite outward cultural differences, are inherently valuable as children of God and must be treated as such. The relativistic perspective

implies, as Jesus mandates, that none are to be excluded from the compassionate imperative of God's love.

Empathy, Consequences, and the Golden Rule

Implicit in the Golden Rule is a need for two closely related kinds of capacities: the ability to empathize with others, and the knowledge of what the consequences of one's own actions are likely to be in the lives of others.

Empathy is not merely the ability to understand what others feel, but the capacity to actually experience what others experience. To be able to act toward others as we would have them act toward us requires that we, in sociological terms, "take the role of the other."

Sociological research and theory dealing with modes of interaction and the relation of the self to others, can provide an important foundation for the development of the empathic capacity necessary for carrying out Christ's Golden Rule mandate. Sociologists have long recognized that putting oneself in the place of others is a foundation of most social interaction. We continually adjust our actions on the basis of what we think and feel others think and feel about us. Cooley referred to this as "the looking glass self," and George Herbert Mead later referred to it as the process of symbolic interaction, in which the "self is an object unto itself."

Sociologists also find that the capacity to empathize with others is heavily conditioned by the position of those others in the social hierarchy. People lower than ourselves are subconsciously assumed to exist at a lower level of human feeling; hence, their sufferings cannot be comparable to our own. In the extreme, this can lead to a process of what I have termed in other studies "empathy failure," the tendency to relegate people to a subhuman level of existence as a prelude to absolving ourselves of guilt for acting callously toward them. We cease to care how they feel because we assume that they are on a lower level than ourselves, hence we do not need to empathize with them, as if the Golden Rule were not applicable to relations between ourselves and them. This attitude was quite basic in the Vietnam conflict, where American soldiers avoided guilt and were able to "live with themselves," in spite of the sufferings they inflicted on the Vietnamese, because the latter were seen to be, in the words of one soldier, "just gooks, you know, dinks. Subhuman. Killing them was like killing a cockroach."

By providing an understanding of the interactional process, sociology can provide a basis for understanding how, and in what ways and circumstances, the empathy failure phenomenon can be understood. Armed with such knowledge, Christians will be better able to overcome those obstacles toward treating all others as children of God, equally worthy of the empathic concern implicit in the Golden Rule.

Finally, the new moral order set forth by Christ and summarized by the Golden Rule as the fulfillment of "the Law and the Prophets" implies a capacity to understand the consequences of our actions in the lives of others. One of the most important aspects of sociological inquiry is its recognition that intended consequences do not always correspond to actual consequences. Robert Merton's concept of manifest and latent functions distinguishes between the stated, overt purposes of action, and the unintended consequences that often are the reverse of what was supposedly intended.

Latent function analysis can provide an important basis for implementing the Golden Rule. Sociological inquiry has shown the true, often negative, consequences of social actions and social behavior patterns. This is particularly relevant to actions that are manifestly in the service of God and Christ, but which, as we have seen earlier in this paper, frequently have distinctly unChristlike consequences. Applying the mode of analysis inherent in the latent function concept to a prayerful planning of our actions and programs can be invaluable in helping us to avoid unintended negative consequences of actions that may stem from genuine Christian zeal but may have effects on others that are contrary to Christ's teachings.

Conclusion

Sociology need not constitute an undermining of Christ's teachings; indeed, it may be an important, even indispensible, foundation for building and achieving the moral order inherent in the New Testament. By providing a basis for understanding and controlling for the distinction between behavior and actions that are genuinely in conformity with Jesus' teaching as opposed to those that are only labelled as such, sociology can serve as an invaluable means of actualizing God's will as manifest in the teachings of the Lord.

BIBLIOGRAPHY

Although this paper lacks direct references, the arguments are based on an interpretation of the writings of a variety of scholars in different fields. The most prominent among these, and the books most relevant to the argument, include: Arthur O. Lovejoy, *The Great Chain of Being* (Cambridge: Harvard University Press, 1936); Thomas Kuhn, *The Copernican Revolution* (Cambridge: Harvard University Press, 1937); Arthur Koestler, *The Sleepwalkers: A History of Man's Changing Vision of the Universe* (London: Hutchinson, 1959); and various works by Peter L. Berger, Ernest Becker, and Robert Bellah.

Newton's Laws as Allegory

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Fresh insight into scientific laws can be gained by viewing them as "allegories" within the universe as God's choral poem. Newton's laws serve as a principal example.

In an earlier article (Poythress 1983) I argued that the universe can be viewed as God's choral poem. Within that poem are many analogies and multi-dimensional relationships. In particular, the world "as poem" is (1) personally structured, (2) linguistically structured, (3) shot-through with metaphor and analogy, (4) utterly dependent on God, (5) undergoing development, (6) surprising in showing a triumph over chaos.

Since science can be viewed as a special system of allegories ("models") within the poem, the above features should at least at times characterize scientific laws. Let us see how Newton's laws in particular look from this type of perspective. As summarized by the *Encyclopedia Britannica* (1974: vol. 13, p. 19) Newton's three laws of motion are

(1) that a body remains in its state of rest unless it is compelled to change that state by a force impressed on it;

(2) that the change of motion (the change of velocity times the mass of the body) is proportional to the force impressed;

(3) that to every action there is an equal and opposite reaction.

Newton's Laws as Surprising

Consider first the motif of triumph over chaos: regularity in the universe constitutes triumph of order over chaos. Newton's laws are an example of this. The physicist and the engineer typically take for granted Newton's laws (or subtle modifications of them). The laws are "obvious," part of the texture of our thoughts. It is practically necessary to jump out of one's skin to go back to the 16th and 17th centuries. Before Newton "took over" the world, such things were not at all obvious. As long as people were still groping towards a solution, there seemed to be many possible answers. Only when one possible answer demonstrated its superior simplicity, accuracy, and efficacy did it manage to eliminate the others. Before Newton there were those who tried to account for motion in terms of an Aristotelian framework that invoked purposes and potentials. Others, including the early Newton himself, were attracted to Cartesian mechanism; they tried to account for all observable motions and changes in terms of underlying invisible mechanical linkages, involving no action at a distance. Moreover, Galileo's concept of inertia, further developed by Newton, had to triumph over the "obvious." It was an "obvious" fact in those days that some substances (such as fire and smoke) had an innate tendency to move upwards, others to move downwards. All motions on earth had an "innate" tendency to stop (because of friction, we would now say).

I want to reintroduce the surprise and wonder into Newton's laws. It is surprising, not "obvious," that they are fruitful and illuminating. Why should God have created a world in which *everything* (not just a few things for which it might be convenient) has the constancy in rest or motion indicated by the first law? Some philosophers of science have argued that the first law boils down to a stipulative *definition* of "rest." But the fact is that (1) such a "definition" does have *some* relation to our prescientific starting point in a vague, intuitive concept of rest; (2) this definition happens to be a tremendously fruitful generality. Why should it be possible to generalize so effectively?

Similarly, the second law of motion can be construed as a stipulative definition of "force." It gives a recipe for calculating net force on a material body. But again, (a) such a definition does have *some* relation to our intuitive starting point in kinesthetic sense of muscle tension and exertion; (b) the vector law for addition of forces, the linear force law for springs, and the inverse square law for gravitation, all have a surprising simplicity, showing the "unreasonable" fruitfulness of the definition. God has chosen, in these cases, a world of extraordinarily simple order, order adapted to the mind of man. To use Chesterton's language, the train has arrived at Victoria.

Newton's Laws as Metaphor

It is easy to see that Newton's laws are a kind of "allegory." With the help of certain further contextual explanations, the laws jointly set up a detailed mapping or correlation between positions, velocities, forces, and masses on the one hand, and mathematical equations on the other. The correlation links one aspect of the universe to another, just as John Bunyan's allegory links the experiences of growth, temptation, and sin in the Christian life to the story of a pilgrimage.

Newton's Laws as Personal

Consider next the personal character of God's poem. Can Newton's laws be seen as "personal" in some sense? If so, how? Of course, the laws are not *about* persons. But neither is all poetry. To say that poetry is personal is to suggest that poetry has authors and interpreters who are persons. It is, perhaps, also to suggest that poetic meaning itself is intelligible only in the context of persons, and that personal engagement is necessary on the part of the interpreter in order to discern, appreciate, and unfold the meaning.

To say, then, that Newton's laws are personal is, first of all, to say that the formulators and interpreters of these laws are persons. On one level, this is trivial. Within the history of human science, human persons are indeed the formulators and interpreters of scientific laws. But many people think that the laws existed, even without being *formulated*, prior to the existence of any particular person. So the laws themselves, prior to human formulation, would *not* be in any sense personal.

As a biblical theist, I do not agree with this point of view. "Law" may indeed exist before there are created persons. But to have a "law," to have something that "holds," one must have a law-*giver*. God as a person must order the world, must triumph over chaos, must hold it to a pattern, if we are to say that a law holds. Of course, philosophers and others have denied that the analogy between God and a human law-giver, or between God and a human designer, artist, or creator, holds up this far. I cannot at this time follow the argument down to its roots (but cf. Stanley Jaki 1980). So I will content myself with saying that, through the Bible, God has opened my eyes to see that the kind of "law" and the kind of conformity to law that this world displays clearly reveal a personal, omnipotent, eternal creator (Rom 1:19–20).

There is, then, a law-giver. But we must distinguish between what God ordains on the one hand and what man as scientist guesses that he ordains on the other. Newton's laws, uttered by man, are not *the* law. They are an analogical imitation or replication of an aspect of God's law for the world.

Many scientists proceed about their business quite competently, of course, without believing in God or invoking him (Laplace, "I have no need of that hypothesis"). Superficially, in the short run, they succeed. But they succeed because they live on borrowed capital. They know of God, as Rom. 1:18–20 points out, but hide the fact from themselves to save themselves from its psychic costs. They are like the hippy on an airplane ride who tells you that he doesn't trust anyone straight or anyone over thirty. He conceals from himself his reliance on the pilot. Likewise, scientists covertly rely on their knowledge that the universe-airplane is in good hands. In fact, if the universe is not governed by a person, there is simply no intelligible reason why *persons* can say anything intelligible about how it is governed.

Second, poetry is personal in that it demands personal involvement for its interpretation and appreciation. Are Newton's laws analogous? It might seem that science in general and Newton's laws in particular are in this respect at the opposite pole from poetry. Much poetry talks directly about persons and much science talks in mechanistic metaphors. Hence the one demands a *kind* of personal involvement not characteristic of the other. But even within the sphere of poetry, the mode of personal involvement and commitment depends on the particular poetic subgenre in question. And poetry is not without demands for "objectivity." One does not simply pour into a poem one's own views and one's own emotions. Moreover, precisely in the context of philosophy of science, Michael Polanyi (1958, 1969) argues that all human knowledge whatsoever is "personal." There is no knowledge without commitment, without interests motivating the search and the learning, and without a tacit background of contexts of life making each particular statement meaningful.

These are the principal ways in which Newton's laws are

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personal. But I will risk going a bit farther, even though my arguments become more tenuous. Even the specific *content* of Newton's laws includes or at least suggests some quasipersonalistic overtones. A person's initial understanding of these laws is mediated by the use of analogy with each person's broad personal experience as an individual in the world.

The use of "body" in Newton's laws to designate inanimate material things is much older than Newton. Yet even that use of "body" is not without its quasipersonal overtones. Newton's laws would be impossible without a key assumption. That assumption is that for many practical purposes entities like planets, bullets, balls, and rocks can be treated as wholes, with an integrity of their own. And the sense that we have of the integrity of an inanimate thing is analogically related to the experience that we have of the integrity of our own body. The Oxford English Dictionary rightly designates this use of "body" as "*transferred* from the material part of man to matter generally. . . ."

vides a poetic picture and framework to guide the interpretation of and organization of the calculations, as well as their application to new types of phenomena.

One of the aspects of quasipersonification operates in a noteworthy way in the third law, namely the idea of transformation of point of view. One of our human abilities is the ability to step into someone else's shoes. We can imagine what it is like living and seeing the world from another person's standpoint. This represents a deeply personal and in fact interpersonal capacity. As single individuals we are able to harbor, in our minds and lives, shadows or projections of the views of other persons, and this is an important and necessary foundation for understanding of and participation in social (interpersonal) life.

Newton's third law requires a structured transformation between two viewpoints, both distinct from the starting ego-viewpoint of the scientist-observer. As with the other two laws, the observer must be able to transfer the quasipersonal

I want to reintroduce the surprise and wonder into Newton's laws. It is surprising, not "obvious," that they are fruitful and illuminating.

But the quasipersonification of "body" is more obvious when one looks at the rest of the language of Newton's laws. The body remains at "rest," analogous to a human being's experience of resting. Then it is "compelled," analogous to compulsion on a human being. It is compelled by a "force," analogous to kinesthetic force of man's hand on someone else. In the second law, the concept of "mass" appeals to kinesthetic sense of heft. In the third law, the concept of action and reaction appeals at least vaguely to the analogy of reciprocity and interchangeability in the activity of two human beings.

What we are encountering here is the fact that the subhuman and even inanimate world has been created by God so that it is intelligible to us. As human beings we have access to the inanimate world. Of course, this inanimate world is not something equal to us. It is not something actually, literally human, or animistic. But neither is it something alien to us, something that we cannot identify with. We are made "of the dust of the ground." That is an observation not only, not even primarily, about atoms and molecules of our body, but about a kind of "kinship." It is not a mistake to quasipersonify material bodies. Rather it is good and *true,* provided we realize, as Newton did, the limited scope of the personification. At some level it is *necessary* to do something like this, because only so can we make anything intelligible to us. That which is absolutely alien has, by definition, no point of contact with us. Hence there can be no point of access to knowledge of it.

The combination of quasipersonification and quantification is what gave Newton's laws a kind of symbiotic power. The quantification reins in the flight of imagination involved in personification. Conversely the quasipersonification provides a poetic picture and framework to guide the interpretation of and organization of the calculations, as well as their application to new types of phenomena.

language of rest, force, and impulsion from himself to inanimate bodies. He must know what it is consistently to adopt a single "body's" viewpoint. That is, he must be able to hold in his intellectual grasp simultaneously all forces, velocities, and the mass of a single body. He must be able to distinguish them from other forces of other bodies. They are forces, velocities, and mass *from the perspective or viewpoint of* that body.

But now in the third law the observer is required in addition to become conscious explicitly of a transformation from one body's viewpoint to the viewpoint of another. Only if he knows how properly to make this shift will he be able intelligibly and correctly to use the third law as intended. The third law does not make proper sense if "action" and "reaction" are interpreted as two forces or impulsions acting simultaneously on a single body, or acting successively on a single body, or acting on two bodies successively, or acting on two bodies simultaneously, without the one body being the "source" for the force acting on the other. The two forces must, in a sense, be manifestations of the *same* structured phenomenon, but viewed from the perspective *first* of $body_1$ "feeling" the "compulsion" "exerted by" $body_2$, *second* of $body_2$ "feeling" the "compulsion" "exerted by" $body_1$. The model being used here is definitely the model familiar to everyone from his experience of shifting in his mind from the viewpoint and actions of one personal participant to the viewpoint and actions of the other.

Thus the formulation of Newton's laws appeals to personal experience and our personal ability to adopt others' viewpoints. The formulation itself depends on ultimately personal metaphors more than one might first expect. Of course,

growing familiarity with and continued use of the laws "purifies" one's understanding of them. The individual words come to have technicized meanings under the constraints of quantifiability. The development of habit and routine makes consciousness of any quasipersonal connotations unnecessary or even counterproductive. But the quasipersonal aspects are, I believe, capable of being reactivated when one tries to apply and extend the theory beyond the area of the routine.

There are two phases of scientific activity involved here. During the creative, imaginative, path-breaking phase, quasipersonal analogies operate. Then this phase is followed by a phase of increasing rigor and quantification. The vocabulary is technicized and loses its suggestiveness. Both phases, together with their mutual dynamic interaction, are necessary for the healthy growth of a science. The rigorous laws due to controlled models are the more familiar side of scientific enterprise. But how do we *arrive at* that final rigor? The pathway there is not itself "rigorous." Einstein (1934:4) puts it thus:

> The supreme task of the physicist is to arrive at those universal elementary laws from which the cosmos can be built up by pure deduction. [rigorous stage] There is no logical path to these laws; only intuition, resting on sympathetic understanding of experience, can reach them. [creative stage]

The two stages must in a sense be recapitulated in the experience of the learner of science. He learns the meaning of technical terms like "mass" and "force" by starting from more intuitive, quasipersonal senses of the terms, and gradually technicizing them in his mind.

Newton's laws are far from being the only instance, or even the most obvious instance, where quasipersonal associations from the imaginative, creative phase of science are buried beneath the surface. One can detect quasipersonal connotations in many other places in scientific literature simply by focusing on the verbs and words semantically derived from verbs. The verbs often connote personal activity.

Listen, for instance, to Edward O. Wilson describe visual processing, using language not too remote from the industrial assembly line:

> Vision, for example, *begins its journey* when the radiant energy of light *triggers* electrical activity in the approximately one hundred million primary light receptor cells that comprise the retina. Each cell *records* the level of brightness (or color) that *touches* it in each instant of time; the image *transmitted* through the lens is thus *picked up* as a pattern of electrical signals in the manner of a television camera. Behind the retina a million or so ganglion cells *receive* the signals and *process* them by a form of *abstraction*. Each cell *receives* information from a circular cluster of primary receptors in the retina. When a light-dark contrast of sufficient intensity divides the retinal cluster, the ganglion cell is *activated*. This information is then *passed on* to a region of the cerebral cortex low in the back of the head, where special cortical nerve cells *reinterpret* it. . . . (1978:74).

Or Feldman-Sears (1981:104) on wheat genetics:

> Hybridizations of this type are *facilitated* by the *shared* genome, which *acts* as a *buffer, ensuring* some fertility in the resulting hybrids. In such cases the different genomes, which are *brought together* from different parents, can *exchange* genetic material and *form* a new, *mixed* genome.

Or Rose (1981) on autoimmune diseases:

> Those that *invade* the body are usually *held at bay* by the body's immune defenses, an elaborate system that *stands guard* to *intercept* and *destroy* foreign cells. (p. 80)
>
> Instead of *damaging* the thyroid cells these antibodies *stimulate* them, *spurring* the thyroid to *make* more hormones. The *overproduction* of thyroid hormones *causes* symptoms of restlessness, weight loss and palpitations. (p. 82)
>
> They include macrophages, which *take up* antigens and *present* them to the lymphocytes in an appropriate way in order to *initiate* the immune *response*. The macrophages are also important phagocytic (*scavenger*) cells, *engulfing* and *digesting invading* microorganisms and other antigenic particles. (p. 82)

(Italics are mine.) Language with quasipersonal connotations is widespread in contemporary science.

Newton's Laws as Quasilinguistic

Let us now return to Newton's laws and consider another possible aspect of the analogy with poetry. Can Newton's laws be considered as linguistic in structure? It is obvious that Newton's laws are in one sense a piece of language. Yet it is not the usual practice to consider them as *at root* linguistic in nature. They can be paraphrased in many ways in English, French, or some other language, as well as represented by mathematical formulas. Therefore, being able to identify them *as* Newton's laws does not depend on the specific form or mode of linguistic expression. Nevertheless, it ought to be possible to obtain insight into these or other laws by reflection on language, since God's speech lies behind any human attempt to express the regularities of God's "poem."

I will here adopt tagmemic theory (cf. Pike 1967, 1976, 1977) as a linguistic approach convenient for analyzing Newton's laws. There are several competing linguistic theories in the academic marketplace today, and tagmemic theory is not by any means the most popular. However, in addition to other strengths, it has the advantage of presupposing a personal world in which persons are irreducible participants (Pike 1976:108). This fits in with my earlier concerns for the personal character of the world.

Multiple Perspectives

Another emphasis of tagmemic theory is that of multiple perspectives. Persons are capable of a multiplicity of perspectives (Pike 1976:122–123). Using various perspectives or frameworks as starting points, they are capable of producing more than one theory accounting for the same data. This immediately explains many otherwise very frustrating facts about the clash of different theories in the social sciences. For instance, it explains the apparent inability of the academic linguistic community as a whole to finally settle on a single theory as the "best." Sociology, anthropology, economics, and psychology are similarly beset with a plurality of competing theories, no one of which, in modern times, has been able to drive the others totally from the field. As Kuhn (1970) observes, competing models for understanding a given scientific domain may both be able to explain a large number of facts. Moreover, by sufficient "enrichment" and *ad hoc* means, they can account even for anomalies.

Our first reaction may be to give thanks that the natural

sciences do not produce the same kind of apparently permanent pluralism as exists in the social sciences. Except for times of "scientific revolution" studied by Kuhn, natural sciences tend to operate within the bounds of a single dominant model. Yet when we look more closely, we must admit that natural sciences also offer us at least some examples of multiple-perspective theories. Newtonian mechanics offers us the multiple perspectives in time and space defined by Galilean relativity. Special relativity offers us the perspectives defined by Lorentz relativity. Quantum mechanics offers us the wave perspective and particle perspective, transformable into one another by means of the duality of the uncertainty relations and commutation relations. The theory of gases offers us the perspectives of thermodynamics and statistical kinetic theory. And mathematics? Well, that is for my next paper, but there are often choices between a more geometric or more algebraic approach.

Newton's laws are far from being the only instance, or even the most obvious instance, where quasipersonal associations from the imaginative, creative phase of science are buried beneath the surface.

Tagmemic theory, then, would ask whether the phenomena treated by Newton's laws could not also be treated some other way. Can we, say, reformulate Newton's laws? Can we reformulate them slightly by changing our coordinate system by a Galilean transformation? Can we reformulate them more radically by introducing generalized coordinates? Only many years after Newton did Lagrange determine a generalized formulation of the laws. For a system with n degrees of freedom measured by generalized coordinates $q_1, \ldots, q_n$, Newton's laws can be formulated

$$\frac{d}{dt}\left(\frac{\delta L}{\delta \dot{q}_i}\right) - \frac{\delta L}{\delta q_i} = 0,$$

where $L = T - V$ is the difference between the kinetic energy T and the potential energy V. Can we reformulate things still more radically by replacing force by some other model, such as a geometric one (the general theory of relativity)? Or can we eliminate action at a distance (quantum mechanics)? Or can the model based on "force" and "compulsion" be replaced by a kind of "economic" model where "expense" is minimized (the theory of least or rather extremal action)? All the above transformations of perspective or uses of different models result in "successful" theories, which explain things. But in the process of trying out different models, there are bound to be many failures and dead ends. Nevertheless, even in our day we can still ask whether still other perspectives might result in useful insights or reformulations of laws of motion.

Contrast, Variation, and Distribution of a "Law"

I now return to tagmemic theory in order to derive a second tool for analyzing scientific laws. This second tool can give us a means of dealing with the limited nature as well as the reality of the knowledge embodied in a law. Tagmemic theory recognizes that there are units in language of various sizes and types. There are alphabetical letters, words, phrases, sentences, and so on. Each unit has a unity, integrity, and organization of its own, but it is also related to other units. According to tagmemics, our knowledge of a unit can be characterized by the intersection and interaction of three perspectives on the unit. These three are labeled the contrast, the variation, and the distribution of a unit (cf. Pike 1976:109, 112–113; 1977:2).

The contrast of a unit is its distinctiveness: what separates it from all other units. The variation of a unit is the range within which it may vary and still remain *that* unit. The distribution of a unit is the context or range of contexts in which it may occur. Thus, for the word "horse," its contrast is its distinctiveness over against other words, especially other nouns like cow, house, man, mountain. Its variation includes variation in pronunciation (sometimes "hoss") and variation in application (referring to various types of horses from time to time). Its distribution is like that of many nouns, though we do not expect to see it as the subject or a verb like "speak," "sell," etc. (For further exposition of contrast, variation, and distribution, see Poythress 1976:123–124, Pike 1977:1–3, 1980.)

Now let us look at Newton's laws in terms of their contrast, variation, and distribution. Newton's laws *contrast* with other possible laws (such as the Aristotelian theory of innate potentials). They are meaningful, intelligible, testable partly in terms of such contrast. The most stringent tests involve more precise formulations like the inverse square law of gravitation, because this clearly contrasts with many other possible formulas for force, and with formulas that might relate the various other properties and spatial relationships between two (or more) bodies. Newton's three laws, by themselves, are not open to such stringent tests because they are quasidefinitional in nature.

Newton's laws also have *variation*. That is, they apply to a large number of different particular cases. Just to what extent they apply to the very large, the very small, the very distant, etc., is not exactly known when they are first formulated. Hence the fact of variation expresses a limitation on the knowledge embodied in the laws. The laws are a "mere" generality (they do not give us the details of each system). And we do not know exactly how sweeping this generality will prove to be.

Finally, Newton's laws have *distribution*. They are distributed in many contexts. The context of ordinary language and ordinary experience is the tacit background from which the

particular words and over-all model involved in the laws gain their meaning. Moreover, the laws are also distributed in the context of one another. Each has the meaning that it does only when they operate *together*. Moreover, they have this particular meaning only as long as people are able to grasp what it means to go about measuring or calculating force, mass, velocity, and so on. The laws are dependent on a system of correlations between mathematics and standardized apparatuses for measurements of various kinds. Yet the apparatuses may change, be replaced, be restructured (replacing a spring clock with a pendulum clock or with a piezo-electric clock) without radical alteration of the purport of the laws.

We may say, then, that Newton's laws can be thought of as a particular piece of human language (more specifically allegory). These laws are a stanza of poetry interpreting an aspect of God's universe-poem. But on close inspection, it appears that this piece of poetry gains its significance from its interconnections with and interweavings with a larger and richer context of language. The stanza achieves its power as part of a group of stanzas. It is, moreover, one perspective out of many. We are able to adopt this single perspective, and simultaneously able tacitly to utilize a rich surrounding context defining its terms. By so doing we put Newton's laws effectively to work. Such is the unique gift of persons, of "poet-interpreters."

REFERENCES

Einstein, Albert. 1934. *Essays in Science*. New York: Philosophical Library.

Encyclopedia Britannica. 1974. 15th ed. *Macropedia* Vol. 13 (Chicago: Benton).

Feldman, Moshe, and Sears, Ernest R. 1981. "The Wild Gene Resources of Wheat," *Scientific American* 244 no. 1 (January) 102–112.

Jaki, Stanley L. 1980. *The Road of Science & the Ways of God*. Chicago: University of Chicago.

Kuhn, Thomas S. 1970. *The Structure of Scientific Revolutions*. 2ed. Chicago: University of Chicago.

Pike, Kenneth L. 1967. *Language in Relation to a Unified Theory of the Structure of Human Behavior*. 2d ed. The Hague—Paris: Mouton.

———. 1976. "Toward the Development of Tagmemic Postulates," *Tagmemics. Volume 2: Theoretical Discussion*. Ed. Ruth M. Brend and Kenneth L. Pike. The Hague—Paris: Mouton. Pp. 91–127.

———. 1980. "Here We Stand—Creative Observers of Language," *Approches du langage: colloque interdisciplinaire*. Publications de la Sorbonne. Série "Etudes" 16:9–45.

Pike, Kenneth L. and Evelyn G. Pike. 1977. *Grammatical Analysis*. Dallas: Summer Institute of Linguistics.

Polanyi, Michael. 1958. *Personal Knowledge: Towards a Post-Critical Philosophy*. Chicago: University of Chicago.

———. 1969. *Knowing and Being*. Chicago: University of Chicago.

Poythress, Vern Sheridan. 1976. *Philosophy, Science and the Sovereignty of God*. Philadelphia: Presbyterian and Reformed.

———. 1983. "Science as Allegory," *Journal* ASA 34:1.

Rose, Noel R. 1981. "Autoimmune Diseases," *Scientific American* 244 no. 2 (February) 80–103.

Wilson, Edward O. 1978. *On Human Nature*. Cambridge: Harvard University.

Reflexivity in North American Psychology: Historical Reflections on One Aspect of a Changing Paradigm

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The concept of reflexivity is both a very old and a very new one. In its broadest sense, it refers to something that we all take for granted implicitly if not explicitly: our human capacity to "reflect upon" the events and forces within and around us, and through the very process of this reflection, to have at least some active part in changing them.

Two very different but equally current examples may be offered: first of all, when members of *liberation movements* speak of the importance of doing "consciousness-raising" with their potential or actual recruits, they are acknowledging the fact that, once persons begin to question or "reflect upon" their previously taken-for-granted views and circumstances, they are on their way to transcending and reorganizing them in potentially powerful ways. This kind of socio-political evidence for reflexivity has led one sociologist, Anthony Giddens, to define reflexivity as "the rational basis for freedom."[1] Secondly, while the scope and power of such human reflection is obviously not unlimited, the emerging results of *biofeedback studies* suggest that it may even extend to aspects of our physiological functioning, previously assumed to be beyond conscious control. When persons are able to monitor their own bloodpressure, heart-rate, or brain-wave patterns with the aid of electronic devices, the resulting signals allow them to *identify* internal bodily changes and often learn to *control* them.[2] This too is an aspect of reflexivity.

As these two preliminary examples imply, both the range and potential significance of human reflexivity phenomena are anything but trivial. Consequently, it might come as a surprise that the term cannot even be found as an entry in *Psychological Abstracts,* nor in the commonly-used encyclopedias and dictionaries of psychology. There are at least two possible reasons for this: the first possibility is that reflexivity has simply been denied or ignored as a significant psychological topic in North America. The second possibility is that the phenomenon has been recognized as significant, but called by other names, and perhaps investigated in a somewhat haphazard and uncoordinated fashion. In actual fact, both of these processes can be seen to have occurred in psychology. Indeed, more than one critic has argued that there has been a historical sequence since psychology's birth as a formalized discipline in 1879, beginning with a preliminary *acknowledgement* of the fundamental importance of reflexivity, followed by a period of its *denial,* and then more recently an emergent *return* to reflexivity-based theory and research concerns.[3]

A Historical Sequence

It is a matter of historical record that when psychology first emerged as a distinctive science, its paradigm (in Kuhn's sense of the term)[4] included the definition of psychology as the analysis of immediate conscious experience into its constituent elements,[5] and specified its method of study as that of "pure introspection"—a trained "looking *within,*" as one pioneer psychologist put it, "to distinguish (psychology) from the observation of physical science, which is *in*spection—a looking-*at.*"[6] Although the term reflexivity was never invoked in connection with this early paradigm in psychology, and although its defined range of "immediate experience" was of a carefully-restricted sort,[7] it seems clear that the capacity for reflexivity, as I have defined it, was a taken-for-granted feature of psychology's subject-matter and a condition of psychology's method.

All of this changed very dramatically in the second decade of the 20th century, when pioneer behaviorist J. B. Watson published his 1913 paper, "Psychology as the Behaviorist Views It," in which he stated that

> Psychology as the behaviorist views it is a purely objective experimental branch of natural science, Its theoretical goal is the prediction and control of behavior. Introspection forms no essential part of its methods, nor is the scientific value of its data dependent upon the readiness with which they lend themselves to interpretation in terms of consciousness.

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> The behaviorist, in his efforts to get a unitary scheme of animal response, recognizes no dividing line between man and brute. The behavior of man, with all of its refinement and complexity, forms only a part of the behaviorist's total scheme of investigation.[8]

In this quote are summarized what one historian[9] sees as the three major factors contributing to the revolution in psychology away from a reflexivity-based paradigm towards the mechanistic, natural-scientistic one which has dominated psychology almost up to the present.[10] First of all, the introspective method was unreliable: even carefully-trained introspectors, or "self-observers" often came up with conflicting conclusions when asked, for instance, to reflect upon an experimentally-presented stimulus. Consequently, Watson argued, it would be better for psychology to stop relying on such a methodology and to concentrate only on outwardly-observable behavior, which was more public and consequently more intersubjectively verifiable. Secondly, only human beings—indeed, only adult human beings—were capable of trained introspection. Consequently, psychologists who were interested in animal behavior (as more and more were in the wake of Darwinian arguments about the continuity of species) or in child development had no acceptable method for conducting their studies. By re-defining psychology's mandate as the study of outward behavior, Watson thus aimed at "a unitary scheme of animal response [which] recognizes no dividing line between man and brute"—or, one might add, between adults and children. Finally, the introspective paradigm was purely *structuralist* in intent: it aimed at a pure description of the "elements" of conscious experience, and showed no concern for elucidating *functional*, or causal, relationships which might then have practical significance for areas such as education, child-rearing, or industrial management.[11] Consequently, when Watson announced that psychology's "theoretical goal [was] the *prediction* and *control* of behavior," and that its methodology was to be that of objective experimentation, he was not only advocating a radical shift from a structuralist to a functionalist paradigm, but also voicing a uniquely North American frustration with a European-evolved psychology which had often dismissed any concern for practical application in psychology as "*ganz Amerikanisch*"—typically American![12]

In light of the above historical comments, the shift from an implicitly *reflexive* paradigm in psychology to one that more deliberately aped the extraspective, causal, and mechanistic assumptions of classical natural science is quite understandable. But in addition the entrenchment of this paradigm shift was substantially aided by the emergence of logical positivism and operationalism as dominant philosophy-of-science trends in the 1920's, both of which attempted to cleanse science of metaphysical (and by implication mentalistic) concepts by tying all theoretical constructs to sense-observable phenomena expressed in mathematical terms.[13] The results of all of this for psychology, between 1913 and the present, have been a distinctly mixed blessing. On the one hand, no one can deny the pragmatic fruits of psychological research, functionally and extraspectively understood, for concerns as diverse as diagnostic and selection-test construction, educational techniques, child management, and the rehabilitation of disturbed or socially-deviant persons. But in the process of pursuing such pragmatically-determined ends, and adhering to the received view of natural science in doing so, most North American psychologists simply came to ignore (if not actually deny) the significance of human reflexivity both in themselves and in their human subjects.

In the extreme case, psychological researchers regarded themselves as detached, unbiased observers of events that they presumed were determined by laws quite independent of their own human efforts to uncover them. In addition, they regarded their human research subjects as passively determined by such laws quite independent of any active reflection they might engage in during the research process. Such a view has, of course, been considered outdated in the philosophy of the natural sciences ever since Bohr's (1934) quantum postulate asserted that "any observation of atomic [and by implication, supra-atomic] phenomena will involve an interaction with the agent of observation not to be neglected. Accordingly, an independent reality in the ordinary physical sense can neither be ascribed to the phenomena nor to the agencies of observation."[14] But at least in the physical sciences, the actual research matter was not seen as having an independent "mind of its own," whereas in psychology (and the other human sciences) reflexivity poses a double problem within any research community determined to mimic the classical natural-science tradition: not only must researchers contend with the effects of their own human reflexivity on the research process; they must also contend with the reflexive processes in which their equally-human research subjects engage, and as a result of which the intended purity of the research endeavor is compromised.

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As psychologists began to recognize the extent of this double challenge (beginning around the mid-1950's), the most common response was to treat it as a methodological problem to be overcome, rather than an indication that psychology's mechanistic, causal, extraspective paradigm might have to be augmented, if not replaced, by one that accorded human reflexivity a more central place. For instance, it was generally assumed up until this time that as long as subjects could be kept ignorant of the true purpose of the experiment in which they were participating, they would be rendered nonreflexive and would deliver responses to the experimental manipulations as naively and spontaneously as an animal or a piece of non-organic matter. Hence the long tradition in psychology of giving research participants either incomplete or actually misleading information about the study in which they are about to participate.[15] Less attention was paid to the possibility that the investigator's reflections might also need to be controlled at the same time, in order to keep them from contaminating either the expression or the interpretation of the subjects' responses. The most sophisticated (and perhaps the only) research design in which both types of reflexivity have been routinely controlled is the so-called "double blind" procedure of chemotherapy studies. In experimental investigations of the efficacy of (say) a new anti-depressant for mental patients, it has become commonplace for neither the patients, nor the personnel who must judge their degree of improvement, to know which subjects are receiving the active drug, and which are receiving an inert "placebo" until after the experimental period is over—thus controlling for the contaminating effect of either the patients' or the personnels' expectation of improvement on the influence of the drug alone.[16]

But once we leave behind the closed environment, and the less-than-normally functioning minds of the residents of mental institutions, the power of subject-reflexivity (which has come to be known in the methodological literature as the "*reactivity*" phenomenon)[17] becomes much harder to control. First of all, it is usually impossible to administer experimental manipulations to all the subjects at once (unlike the drug given at meal-time to the entire ward of a hospital); consequently, one must contend with the rumor-mill by which speculative scuttlebut about the study is passed on from one subject to another. Secondly, it becomes much harder to conceal from subjects the knowledge that they actually are participating in a research project; for even if the true purpose of the study is disguised, the subjects' very awareness that they are in an experiment may set them reflecting upon its probable purpose in a way that renders them less than passive in their reactions. Both of these problems are compounded by the fact that the majority of research subjects in many areas of psychology are drawn from college-student populations. For not only is the average college campus a place where news of any local event is transmitted by a grapevine as efficient as that of a small town; it is also the case that college students, most of whom are of above-average intelligence (and many of whom are psychology students to boot) are capable of generating extremely ingenious reflections about the nature of the research in which they participate.

Irwin Silverman's recent work on *The Human Subject in the Psychological Laboratory*[18] gives a detailed account of the varying reflections (and consequent actions) of which such normal, intelligent human subjects are capable. Most, it turns out, are what are termed "good" subjects, motivated to deliver the "right" responses by a well-socialized awe of the scientific enterprise. Yet even this can backfire: Silverman reports the distress expressed to him by a colleague at overhearing a group of male students, waiting for his experiment, "conclude with much certainty and satisfaction that his attractive lady assistant strutting up and down the corridor on her chores was the independent variable. He decided it was probably useless to discard this group's data [as being atypically contaminated] because after all, he did *not* know what was in the corridor when he was *not* listening!"[19] In addition, a sizable minority of subjects, mindful of a supposed connection between psychology and psychoanalysis, tailor their responses in accordance with a fear that they are being analyzed for defense mechanisms which they might find too ego-threatening to have exposed. Said one subject about his handling of the Rorschach ink-blot test: "On one card I saw vaginas all over—but I wasn't going to tell *him* [i.e., the investigator] that—so I said they were caves."[20] In the methodological literature, such responses are usually subsumed under the term "evaluation apprehension."

Finally, a third sizable minority of respondents have been found to be what are called "perverse subjects"—those who, possibly out of anger at previous experimental deceptions, or at the grossly unegalitarian nature of the investigator-subject relationship, deliberately set out to scuttle the study as they perceive its probable intent to be. One experienced subject summarized his behavior in an experiment as follows: "After a while I just wanted to find out what the experimenter wanted to prove I *couldn't* do, so I could prove that I *could*."[21]

If reflexivity-mediated values are implicit in the concepts, methods, and applications of all scientists, then it is perhaps better to make them explicit than to ignore them and have them come creeping back unannounced and unaccounted for.

Reactions in the Psychological Community

In drawing together the implications of all this work on the phenomenon of reflexivity in psychology, I suggest that three different reactions have emerged in the psychological community. The first (and most common) has been a purely *methodological* concern: reflexivity (especially in subjects, but also in investigators) is seen as something which jeopardizes the validity of research conclusions, and consequently is something to be overcome by more and more sophisticated methodological controls, including, for instance, the conduct of "candid-camera"-like field studies in which respondents do not even know they are being manipulated or monitored. This response does not question the hegemony of the natural-sciences paradigm in psychology—it merely adapts it in light of the added "problems" of reflexivity inherent in the investigation of human beings by other human beings.[22]

Secondly, there has been a minority, but vocal, response of ethical concern: subjects are routinely deceived or underinformed in the interests of reducing their reflexive activity during the research process, and this is seen as a form of manipulation that is not only self-defeating in the long run (as more and more people find out that "psychologists usually lie")—but also morally questionable, both as deception *per se*, and especially in the substantial proportion of studies where that deception involves exposure of subjects to a very calculated (but false) manipulation of self-esteem, exposure to stress, or false expectation of benefits.[23] This response also does not seem to question the ruling paradigm in psychology: it merely notes that moral considerations may or should reduce its range of acceptable methods and/or research questions, and that this is a regrettable but necessary compromise.

The third, and most recently-emergent response is an *ontological* one which says, in effect, that human reflexivity, both in investigators and their subjects, is such a fundamental and pervasive psychological process that it makes more sense to develop a paradigm that takes it into positive account and works *with* it rather than *against* it. As one pair of critics put it, "[we must conceive of] man as an actor . . . it is not the person himself who [has been] the subject of analysis, but the character he plays. If man is indeed a self-directing agent . . . it makes eminent sense for the behavioral scientist to treat him as such."[24] Although such a statement may seem no more than an obvious truism to persons outside psychology, the extent to which it runs counter to the accepted paradigm can be seen in the comment of one reviewer that this is a "radically different premise . . . discrepant from an implicitly accepted notion of man as an emitter of responses, an organism to be manipulated and then monitored . . . and whose social nature and social content might be interesting, but coincidental."[25] In addition, such a view necessarily levels the traditional ontological gap that has been implicitly assumed between investigators and their subjects. As one critic in this camp expresses it,

> At the heart of most psychological theories is a fundamental distinction between 'scientist' and 'organism.' They provide different languages for the two, and imply that the 'scientist' is *psychologically* a very different kettle of fish from the 'subject.' Thus, in learning theory terms, the subject is 'being conditioned' while the experimental psychologist is 'testing hypotheses.' . . . [But] the difference between psychologist and subject is at best only a matter of level of abstraction . . . An acceptance of the need for reflexivity is intrinsically a denial of the doctrine that scientists think and are purposive while their subjects are mechanical and determined.[26]

Indeed, this kind of "ontological reform" in psychology often seems bent on a reactionary reversal of this past conceptual gap between investigators and subjects. There is a gathering rush of concern to attribute to (and explore in) subjects that degree of reflexivity (and, by implication, autonomy, rationality, and dignity) previously reserved for investigators alone. Conversely, (although somewhat more slowly), there is a growing concern to make investigators realize that they and their entire research endeavors are more passively at the mercy of historical, sociological, and ideological forces (of a sort formerly attributed only to their subjects) than they ever dreamed possible. In other words, psychologists are slowly being pressured to abandon the received view of science (and scientists) as trans-temporal, ahistoric quasi-Platonic "ideal forms," and to submit to a rigorously corrective dose of sociology of knowledge.[27]

Indeed, one sociologist, Alvin Gouldner, gives us a definition of reflexivity that nicely embraces both aspects of this dual process: he defines reflexivity as "self-awareness concerning the rules to which one submits and by which one is bound."[28] Using Gouldner's definition, we might say that psychology's human subjects are becoming (and being recognized as) increasingly self-aware regarding the hidden rules of the psychological research microcosm to which they tended formerly to submit without question: less and less are they docile "good subjects," and more and more are they feeding back their accumulating, reflexive awareness of the research process into alternative decisions about how they will behave therein—so much so that they are forcing psychologists (by default, if not out of conviction) into a changed paradigm. Analogously, but at the level of the macrocosmic scientific community, psychological investigators are slowly becoming more aware that they, too, are "subjects"—subject to paradigmatic, psychological, and even metaphysical assumptions about their subject-matter and their procedures from which they previously assumed themselves largely exempt.

Future Trends

It is too soon to predict what the final results of all this ferment will be. One clearly-emerging trend is towards research which is more collaborative with subjects and which is consequently more iterative, descriptive, and consumer-accountable in method, and more emancipatory in motivation.[29] But let me conclude by briefly treating two questions that *Christian* observers might do well to consider during this period of anomalous, extraordinary science in psychology. The first has to do with implications for theories of human nature, the second for views of the nature of science.

With regard to the former, it is nothing new for Christian scholars to wrestle with what Stephen Evans calls the "mechanistic/personalistic dilemma":[30] that is, the conflict between the received social scientific view of persons as totally material, determined entities and the scriptual

account of them as God-created, God-related, and at least partially free, creative, and accountable. But, to date, it is relatively rare for Christians to resolve this dilemma other than through a species of "perspectivalism" (also Evans' term) according to which the social sciences, including psychology, are left to regard and study human activity only in its determined, mechanistic aspects, while the pursuit of reflexivity-conditioned human activity, while admitted to be important, is relegated to the humanities.[31] This position is due not only to convictions about the "proper" (i.e., natural scientific) paradigm for the social sciences; it also seems to be based on the conclusion that if one *has* to choose between a model of persons as unscripturally passive and one which sees them as unscripturally *autonomous*, it is safer to choose the former. In Dooyeweerd's language, such thinkers seem to prefer the risk of flirting with the "science ideal" (the notion that the entire universe is impersonal and mechanistic) than with the "freedom ideal" (the notion that at least some people can transcend their own determinism and "play God").[33] At least (it is suggested) the former tends toward a well-regulated society in which impulsivity, hedonism and revolution are kept in check, and this may be somehow seen as more Christian than a view which concerns itself with the (equally biblical) themes of justice, individual calling, and the equality of all persons before the cross of Christ.[33] In point of fact, what we must all strive for is a unified (*not* compartmentalized, or "perspectivalized") view of persons which does *equal* justice to both their creaturely *and* their creative aspects, and to both their *imago Dei and* their fallenness. Clearly this will be a long time in coming.

Finally, with regard to differing views of science, there seems to be a tendency on the part of Christian social scientists to judge the received view of science (transtemporal, objective, value-free) as being somehow more compatible with a high view of the sovereignty, omniscience, and unchanging character of God than one that relativizes the scientific enterprise by an appeal to the sociology of knowledge and to the post-empiricist debate which has followed in the wake of Kuhn's *Structure of Scientific Revolutions*.[34] Indeed, such a position has recently been expressed by Donald MacKay, who seems to see any questioning of the ideal of objective, value-free knowledge (a questioning that I have tried to show is the inevitable result of a recovered respect for human reflexivity) as "symptomatic of the practical atheism of our day."[35] Yet, it can also be argued that a greater sensitivity to the "through a glass darkly" quality of all *human* (including all scientific) endeavors is not necessarily an attack on *God's* perfect knowledge, nor an attempt to relativize all efforts to arrive at reliable knowledge in the social sciences. At the very least, it seems to me that when well-trained, much-respected scientists begin (by very *virtue* of their intimate experience with science) to show a greater humility and historical relativity concerning their own efforts,[36] and a greater respect for the demonstrated reflexivity, autonomy and rights of their human subjects, we are being not more, but less objective when we ignore their conclusions in pursuit of an inflated but outdated view of the purity of scientists and the passivity of the human beings they study. In addition, if reflexivity-mediated values are implicit in the concepts, methods, and applications of all scientists, then it is perhaps better to make them explicit than to ignore them[37] and have them come creeping back unannounced and unaccounted for. In this respect, Christians are at a potential advantage over secular scientists in having a world-view with implications for all of life upon which they are called constantly to reflect. Surely it is time that we brought these "control beliefs"[38] to bear on the current preoccupation with reflexivity in psychology.

REFERENCES

[1]Anthony Giddens. *Studies in Social and Political Theory.* (New York: Basic Books, 1977), p. 28.

[2]See for example G.C. Luce and E. Peper. "Mind Over Body, Mind Over Mind." *New York Times Magazine*, Sept. 12, 1972.

[3]Allan R. Buss. "The Structure of Psychological Revolutions." *Journal of the History of the Behavioral Sciencies*, 1978, 14, 57–64. See also David S. Palermo. "Is A Scientific Revolution Taking Place in Psychology?" *Science Studies*, 1971, *1*, 135–155.

[4]Thomas Kuhn. *The Structure of Scientific Revolutions.* (University of Chicago Press, 1962, 1971).

[5]Wilhelm Wundt. *Outline of Psychology* (7th Ed.) Trans. C.H. Judd (3rd Ed, Leipzig, 1907), p. 2.

[6]E.B. Tichener, *A Textbook of Psychology* (New York, 1910), p. 20 (Quoted in Palermo, *Op. cit.*, note 3). (My emphases.)

[7]More specifically, psychology was seen as the study of the sensations, feelings, volitions, and ideas of the human adult.

[8]*Psychological Review.* 1913 (*20*), 158–177.

[9]Palermo. *Op. cit.*, Note 3.

[10]For a more detailed treatment, from a Christian perspective, of the emergence and consequences of this shift, see Mary Stewart Van Leeuwen, *The Sorcerer's Apprentice: A Christian Looks at the Changing Face of Psychology* (Downers Grove, Ill.: Intervarsity Press, 1982).

[11]*Ibid.* (For a more detailed treatment of the history of American functionalism and pragmatism in psychology). For a more general consideration of the "pragmatic criterion" in science and a debate about it relevance for social science, see Mary Hesse, *Revolutions and Reconstructions in the Philosophy of Science* (Indiana State, University Press, 1980).

[12]This is how Wundt is reported to have dismissed the American J.M. Cattell's proposal for thesis research on individual differences in reaction-time, whose potential usefulness in education and industry had captured his attention. See H. Misiak and V.S. Sexton, *History of Psychology: An Overview* (New York: Greene and Stratton, 1966).

[13]See Frederick Suppe (Ed.). *The Structure of Scientific Theories* (2nd Ed.) (University of Illinois Press, 1977), esp. parts I & II of the first section on "The Search for Philosophic Understanding of Scientific Theories."

[14]Neils Bohr. *Atomic Theory and the Description of Nature* (Cambridge University Press, 1934).

[15]Although this paper deals mainly with the *methodological problems* and *anthropological assumptions* implicit in the use of deception, there exists a growing literature on the ethical and legal implications of it as well. See Van Leeuwen, *Op. cit.*, (Note 10) for a summary of same and for the relevant bibliography.

[16]B.S. Glick and R. Margolis. "A Study of the Influence of Experimental Design on Clinical Outcome in Drug Research." *American Journal of Psychiatry*, 1962, *118*, 1087–1096.

[17]E.J. Webb, D.T. Campbell, R.D. Schwartz and L. Sechrest. *Unobstrusive Measures: Nonreactive Measures in the Social Sciences.* (Chicago: Rand-McNally, 1966).

[18]Irwin Silverman. *The Human Subject in the Psychological Laboratory.* (New York: Pergamon Press, 1977), esp. Ch. 2.

[19]*Ibid.*, p. 23.

[20]*Ibid.*

[21]*Ibid.*

[22]See for example, Robert Rosenthal. *Experimenter Effects in Behavioral Research* (New York: Appleton-Century-Crofts, 1966); R. Rosenthal and R.L. Rosnow (Eds.) *Artifact in Behavioral Research* (New York: Academic Press, 1966); Donald T. Campbell and Julian C. Stanley, *Experimental and Quasi-Experimental Designs for Research* (Chicago: Rand-McNally and Company, 1963), Webb *et al., Op. cit.*, Note 17; L. Bickman and T. Henchey, *Beyond the Laboratory: Field Research in Social Psychology* (New York: McGraw-Hill, 1972).

[25]See for example Herbert Kelman. *A Time to Speak.* (New York: Jossey-Bass, 1967); Arthur G. Miller, *The Social Psychology of Psychological Research* (New York: The Free Press, 1972); John Jung, *The Experimenter's Dilemma,* (New York: Harper and Row, 1971). Also Van Leeuwen, *Op. cit.* (Note 10), Chapter 2.

[26]Rom Harré and Paul Secord. *The Explanation of Social Behavior.* (Oxford: Blackwell Publishers, 1972), p. 313.

[27]Lloyd H. Strickland, "Priorities and Paradigms." in L.H. Strickland, F.E. Aboud, and K.J. Gergen (Eds) *Social Psychology in Transition* (New York: Plenum Press, 1976), p. 4.

[28]Donald Bannister. "Personal Construct Theory and Research Method." In P. Reason and J. Rowan (Eds.) *Human Inquiry: A Sourcebook of New Paradigm Research.* (New York: John Wiley, 1981), pp. 194–195.

[29]See for example Allan R. Buss, "The Emerging Field of the Sociology of Psychological Knowledge," *American Psychologist,* October 1975, pp. 988–1002.

[30]Alvin Gouldner. *The Dialectic of Ideology and Technology* (New York: The Seabury Press, 1976), p. 55.

[31]See Reason and Rowan. *Op. cit.* (Note 26) for many examples.

[32]Stephen C. Evans. *Preserving the Person: A Look at the Human Sciences.* (Downers Grove, Ill.: Intervarsity Press, 1978). See also Donald M. MacKay, *The Clockwork Image* (Downers Grove: Intervarsity Press, 1974) and *Human Science and Human Dignity* (Downers Grove: Intervarsity Press, 1976); Malcolm Jeeves, *Psychology and Christianity: The View Both Ways* (Downers Grove: Intervarsity Press, 1976); David G. Myers, *The Human Puzzle: Psychological Research and Christian Belief* (New York: Harper and Row, 1978); Paul C. Vitz, *Psychology as Religion: The Cult of Self-Worship* (Grand Rapids, Wm. Eerdmans, 1977).

[33]See especially Jeeves, *Op. cit.* and MacKay, *Op. cit.* (1976).

[34]A.N. Kalsbeek. *Contours of a Christian Philosophy.* (Toronto: Wedge Publishing Foundation, 1975); Herman Dooyeweerd, *In the Twilight of Western Thought.* (Philadelphia: Presbyterian and Reformed Publishing Co., 1960).

[35]In particular, see Vitz, *Op. cit.* (Note 30). Christian social scientists who, oppositely, try to correct what they perceive to be the abuses of the *positivistic* paradigm with regard to human freedom and dignity include Van Leeuwen, *Op., cit.* (Note 10), and David Lyon, *Doing Sociology: A Christian Perspective* (London: Intervarsity, In Press).

[36]Kuhn, *Op. cit.* (Note 6); Suppe, *Op. cit.* (Note 13).

[37]Donald M. MacKay. "Value-Free Knowledge: Myth or Norm?" *Faith and Thought,* 1980, *107,* 202–209.

[38]For a landmark and much-cited paper demonstrating such a revised view of psychology, see Kenneth J. Gergen, "Social Psychology as History," *Journal of Personality and Social Psychology,* 1973, *26,* 309–320. (Reprinted in Strickland *et al., Op. cit.* (Note 25).

[39]See Hesse, *Op. cit.* (Note 11).

[40]Nicholas Wolterstoff. *Reason Within the Bounds of Religion.* (Grand Rapids, Wm. Eerdmans, 1976).

An Evangelical Commitment to Nuclear Disarmament

As evangelical Christians committed to the Lordship of Jesus Christ and the full authority of the Scriptures, we are compelled by our faith to join with all people of the planet to work for an end to the nuclear arms race. Responsible voices increasingly warn us that we must either find a way to abolish nuclear weapons or be destroyed by them.

We acknowledge the presence of evil in the world and, as our response, choose to follow the Gospel. We worship the risen Lord who taught that God blesses the peacemakers. We pray for a renewed understanding of biblical peacemaking and the God-given ability to love our enemies. And we hope for the time when "nation shall not lift up sword against nation; neither shall they learn war anymore." (Micah 4:3, Rev. 21:4)

Because the Bible teaches that every human life is sacred, we dare not remain silent toward a nuclear arms race that threatens to deny that sacredness in one brief moment of nuclear nightmare. Because God's word commands us to feed the hungry and seek justice for the oppressed, we cannot ignore that the arms race is wasting vast resources that could be used to feed, clothe and educate the poor.

Biblical faith compels us to act with our prayers, our jobs and our votes. We will therefore commit ourselves to the following:

- *We commit ourselves to make the multilateral abolition of nuclear weapons one of the highest priorities of our political activity.*
- *We commit ourselves, as a first important step, to promote a verifiable nuclear freeze—a bilateral agreement between the US and USSR to halt all testing, production, and deployment of nuclear weapons.*
- *We commit ourselves to reexamine our jobs and our investments to assure that they are consistent with our peacemaking efforts.*
- *We call on the worldwide body of Christ to take a moral stand against any use of strategic nuclear weapons.*
- *We call on the leaders of all nuclear nations to renounce unequivocably and publicly the first use of nuclear weapons.*
- *We call on all national leaders to reject any policy or strategy that considers engaging an limited nuclear war.*

Finally, before God we covenant to be peacemakers in our personal lives, knowing that only when our homes, churches and denominations experience growing reconciliation can we with integrity summon presidents and premiers to seek peace among nations.

Knowing that the next two decades could be the most dangerous in human history, we determine that our voices and our lives will count for peace. As evangelical Christians, we covenant together to form a public witness working for a just and reasonable end to the nuclear arms race. ■

A statement of the Evangelicals for Social Action, 25 Commerce, S.W., Grand Rapids, Michigan 49503.

Notes on "Science and the Whole Person"—
A Personal Integration of Scientific and Biblical Perspectives

Part 21

Energy and the Environment (C) Christian Concerns on Nuclear Energy and Nuclear Warfare

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Concerns about nuclear energy and nuclear warfare arise from many sectors of society. Christian concerns are not necessarily unique, but they do have a unique motivation and source of guidelines. Nor are Christian concerns agreed upon by all Christians; rather there is a broad spectrum of concerns from Christians who advocate nuclear energy and, if necessary, even nuclear warfare, to Christians who condemn the development of nuclear energy and any consideration of nuclear warfare.

It is the purpose of this installment to explore the foundational principles upon which Christian concerns are based and to investigate some of the conflicts that have arisen in Christian circles.[1] In doing this we do not hope to arrive at a final consensus, but to provide a framework within which a consensus might be developed if Christians commit themselves to a pursuit of authentic empirical data, humble prayer, and a waiting upon the guidance of the Holy Spirit. Most of our discussion is directed toward the question of nuclear energy per se, but since widespread development of nuclear energy cannot be considered in a practical sense independently of the possibility of nuclear warfare, some consideration of nuclear warfare is included in the final section.

Nuclear energy is such a crucial issue precisely because it seems to many to be the logical extension of human exploitation of the physical universe to the final possible step. Arguments in favor of nuclear energy remind us of the trepidations with which human beings faced former major technological developments from fire, to coal, the railroad, electricity and the airplane; at each stage, they argue, people tried to stop the advance of progress because of fear of the unknown. They imply that human progress from energy sources found in wood, to those in coal, oil and gas, and now to nuclear energy, is both necessary and desirable; to turn back from the advance of such progress is sub-human and a denial of the human spirit. The fundamental question raised, however, is "What *is* the proper goal of human efforts?" Can we take for granted that larger and larger energy expenditures are the appropriate goals? Or is it not possible that current concerns about nuclear energy really had bona fide expression at much earlier stages of energy exploitation, insofar as they pressed then for a more comprehensive view of human beings in ecological balance with a finite environment?

Biblical Inputs and Their Interpretation

In this section we consider some of the major biblical inputs

to the issue of nuclear energy. Since such biblical inputs must be translated into action through the medium of interpretation, we also consider some of the interpretations that may be applied.

Creation

The biblical doctrine of creation leads us to see the entire created universe as depending for its origin and continuation upon the faithful and free activity of God. Nuclear energy may be seen as a totally natural aspect of this creation, and not an inherently unnatural or evil phenomenon. In fact nuclear energy is the universal and common type of energy found in the universe as a whole; all other types of energy are derived from it.[2] Since nuclear energy does not exist without radioactive waste, it follows that such radioactive waste is also an integral and natural part of the created order.

Since we have had no difficulty in seeing the energy stored in coal, oil and gas as God's providential supply for our energy needs, should we not regard nuclear energy in the same way? God's creation gifts are given to us for our responsible use for good; because human beings have already put into use the curse of nuclear energy in the development of nuclear bombs, should we forsake the blessings of nuclear energy that we can provide? Human beings have always experienced fear when confronted with the unknown, but fear for the Christian is to be overcome by faith in God. Certainly this is the case for our everyday fears associated with the use of fire, or electricity, or the automobile, or the jet airplane. Fear paralyzes, but faith activates.

But does the naturalness and commonness of nuclear energy in the universe have a direct bearing on human decisions to develop nuclear energy plants on earth? Nuclear reactions are indeed not intrinsically evil, but life on earth would not exist today except for the fact that nuclear reactions are placed far away from the earth. God may have used nuclear reactions in the process of creation of the universe, but He used one particular nuclear reaction in the sun to bring about life on earth, and He placed that nuclear reactor a safe 93,000,000 miles away! On the basis of God's activity in creation, would not solar energy be the obvious providential supply?

Whether a nuclear power plant is good or evil does not depend on intrinsic goodness or evilness because of creation, but on whether or not the plant is constructed and operated in a safe manner.[3] Fears of fire and electricity are well founded; unless proper circumstances are used, they can be destructive. Fear therefore has a positive quality, leading human beings to careful energy use. Furthermore there is a large difference between the extent of danger in space and time from nuclear energy compared to fire or electricity. Breakdowns in safety in the use of fire or electricity are harmful to a few in the immediate vicinity; breakdowns in safety in the use of nuclear power may prove harmful to many over a wide area in space and for a long period of time.

The possibility for the use of nuclear energy should not be unthinkingly translated into the conclusion that it is God's providential provision for us. If such a logical chain were adopted routinely we would be led to the untenable conclusion that everything it is possible for human beings to do is God's providential supply. Rather each possibility must be tested against other biblical guidelines for Christian living. Again, cannot one make an even stronger argument that God's provision of solar energy is indeed the providential action for which we should be thankful?[4]

The fundamental question raised is, "What is the proper goal of human efforts?" Can we take for granted that larger and larger energy expenditures are the appropriate goals?

Stewardship

Within the biblical context, the earth belongs to God, not to human beings. Human beings are God's stewards, caretakers of the earth, his deputies responsible for the earth and everything on it. The basic commandment yielding the "cultural mandate" of Genesis 1:26–30 is supplemented by Genesis 2:15.[5] The question, of course, is "What constitutes responsible stewardship of the earth?" We can rule out thoughtless exploitation of land or people for the benefit of a few, but the significance of this decision for the case of nuclear energy is not self evident. Is nuclear energy the thoughtless exploitation of the earth to increase the power and wealth of a few able to profit from this technology, or is nuclear energy essential to provide hope and potential for the poor of the world?

In one perspective nuclear energy is opposed because the earth itself is considered "sacred" and therefore must be preserved in its "natural" state. Theologically this view is clearly more pantheistic than Christian. It attributes intrinsic value to the given characteristics of nature, and views human activity as a violation of this value. In one form it fosters the myth of the noble savage living in a pristine environment; human civilization has destroyed the environment and corrupted the noble savage. In this perspective responsible stewardship requires that the environment be passed along in the same form it had when received, in order to preserve a benign environment from being ruined by human beings.[6] But in many areas the environment is clearly not benign, and human effort to improve them for the overall quality of human life has been consistently approved. There is no question but that open country and areas not affected by the grosser consequences of human commercialization play an important aesthetic role for human beings, but to absolutize this experience is both inconsistent and unjustified.

It is particularly misguided if used to arrive at the conclusion that the production of energy by any means can occur without affecting the environment. Every energy source has

its own set of benefits, costs, risks, and uncertainties, which must be evaluated as objectively as possible.[5] Furthermore an assessment of these risks must not stop at only the physical or even the aesthetic, but must include the full impact in the biological, social, psychological, and spiritual areas as well. If energy production seems certain to damage some aspects of the environment, lack of energy production may lead to such a chaos of unemployment, economic deprivation and social unrest that human qualities may be destroyed in the midst of a "preserved" environment. These are not easy questions, and we cannot always claim the answer of our preference.

Still responsible stewardship requires an informed and careful assessment of the risks. Pollution of the environment in any one of a variety of ways needs to be minimized. If energy is required to allow the poor to realize a more adequate style of life, the proclamation of "enough" is required on the use of energy by those who today already have had much more than their share.[4]

Human Fallibility and Sinfulness

An assessment of energy supply risks that does not include consideration of the fact that human beings are both fallible and sinful may well be illusory. A program that might be suitable in a perfect and sinless world is not liable to last very long in the real world in which we live. Energy supply systems must therefore be safeguarded, not only against adverse effects in the physical and biological areas, but also against the possibility that human beings may make mistakes and against the certainty that human beings will attempt to misuse the system in some way at some time. Systems with a larger capability for damage under human error or human sin are therefore less preferable than systems with less capability.[4]

The fears associated with nuclear energy stem in considerable part, therefore, not from the belief that nuclear energy itself is evil, but that human beings are sinful.[7] A technology that poses a risk of irreversible damage to the whole world and that is susceptible to misuse by human beings therefore requires enormous caution before it is accepted as the course of responsible stewardship.

Love, Justice, Freedom and Peace

The Christian is called upon to live in such a way that love is exhibited, justice is sought, freedom is preserved or gained, and peace is achieved. In the imperfect and sinful world in which we live, such an attempt to live out the life of Christ will not meet with perfect acceptance or success at any given time, but the Christian's calling is to be faithful.

One problem with nuclear energy is that it appears to be most useful to those nations who already have a corner on the energy market. Pursuit of the breeder reactor as a longrange goal, therefore, seems meaningful only to the developed countries as an act of selfishness.[4] What the non-developed countries need—and this is where the poor are living toward whom Christian concerns are extended, is a non-centralized power system. But nuclear energy demands exactly the opposite. For nuclear energy to be successful, we face increasing reliance on a small number of centralized power plants with the need for transportation of this power over great distances; such a system cannot work unless we move in the direction of an even more highly organized, centralized and technology-dependent society than we have at present.[8]

Will the development of nuclear energy lead to peace? Will developed nations with nuclear energy somehow supply energy to non-developed nations without it? Or is it more likely that the non-developed nations, seeing their small supplies of energy disappearing, often after exploitation in earlier years by the developed nations, will grow increasingly desperate and seek to retaliate against their self-centered neighbors? Nuclear energy seems so vulnerable: it magnifies the errors and sins of a few and places them on the shoulders of the many; it is uniquely suitable for sabotage and exploitation by terrorists; the disposal of nuclear waste is a problem of first magnitude.

The fears associated with nuclear energy stem in considerable part, not from the belief that nuclear energy itself is evil, but that human beings are sinful.

Nuclear Wastes

Of all the problems associated with nuclear energy, that associated with the disposal of nuclear wastes poses some of the most difficult questions. These problems center on the fact that these wastes are potentially lethal long after their use in the production of nuclear energy is ended. Anti-nuclear proponents may stress that the wastes are toxic "forever" while pro-nuclear proponents may point out that the wastes are no more toxic than the ore used to make them after 500 years, but no matter how the time scale is measured, it is a long time compared to human life. All operating nuclear reactors and all nuclear fuel processing facilities will sooner or later become nuclear wastes; such plants have an expected operating lifetime of 30–35 years.[9] They must therefore be added to all of the low-level wastes, intermediate level liquid wastes, transuranic wastes, gaseous radioactivity vented during operation, high level liquid wastes, and spent fuel rods (each with about three years of operating life). Any attempt to dispose of these wastes safely over long periods of time seems to be a gamble that neither human accident or malice, nor natural catastrophe will remove the disposal barriers that prevent toxicity from these materials spreading through water, air or biomaterials.

The argument that the disposal of nuclear wastes is a problem that cannot be sidestepped because there already exist large quantities of high level nuclear wastes as byproducts of nuclear weapon production,[10] can hardly be used

effectively to defend the thesis that we ought therefore to increase the amount of waste through widespread use of nuclear energy. Indeed, as far as I can tell, no one today knows for sure how the nuclear waste problem can be effectively handled; opinions are neatly divided between those who have faith that the problem can be handled without any difficulties and those who doubt whether such longrange perfect solutions are possible in this imperfect and sinful world. On a theological level the issue can almost be reduced to a tension between trust in the delivering power of God on the one hand, and fidelity to the reality of the biblical picture of human nature on the other.

Unfortunately, however, the issue is not as simple as a choice between nuclear wastes and no wastes at all. In order to evaluate the danger of nuclear wastes, a comparison must be made with the toxic wastes generated by other alternative modes of energy production, as well as with toxicity to which human beings are exposed through natural occurrences and our general technological culture. Such a comparison calls for a fairly sophisticated risk analysis, which we consider in a little more detail in the following section. Here, however, we concentrate on the alternatives to the development of nuclear energy.

The most elementary realization is the simple fact that no method for the generation of electricity, which is the form of energy that nuclear plants produce, is perfectly safe. Burning of coal or oil causes lethal air pollution and increases the carbon dioxide concentration in the atmosphere with potential longrange climatic consequences, use of gas kills by asphyxiation and explosions, hydroelectric dam failures drown thousands, solar energy apparatus requires vast quantities of steel, aluminum and cement that add to general pollution in their production, and doing without energy althogether causes all kinds of human suffering and deprivation.[11] The total toxicity of nuclear wastes aged 100 years resulting from an all-nuclear United States electric economy would be several orders of magnitude less than the lethal doses of commonly used chemicals, such as arsenic, barium, hydrogen cyanide, which are annually present in the United States.[12] Furthermore it is reported that nuclear power plants release much lower quantities of radioactivity than coal-fired power plants, and also do not release the carcinogen that is the main cancer-causing ingredient in cigarettes, nor the large quantities of carbon dioxide, nitrogen oxides, and sulfur oxides; estimates place the risk of lung cancer due to coal-fired power plants at something like ten times greater than for nuclear plants.[12] The toxicity of nuclear wastes does decrease with time; the toxicity of chemical wastes such as arsenic, for example, lasts for as long as the earth does.

Attempts to analyze such relative risks are not easy. There are as many estimates of risk as there are estimaters. Clearly this appears to be a case where sufficient information is not available. Curious dilemmas continue to arise: typical estimates are that coal burning causes about 10,000 deaths each year in the United States, but this corresponds to "only" a 13-day reduction in life expectancy for the average American; a major increase in energy conservation by massive drives toward total structure insulation will increase radon exposure to the point (so it is estimated) that 5000 to 10,000 deaths might arise from this cause alone.[11]

Ethics of Risk Analysis

The fact that morality in action cannot proceed without a firm basis in empirical data is nowhere more evident than in attempts to resolve questions of risk with respect to nuclear energy. Since risk is inevitable in any course of action, guidelines to moral choices must be embedded in an understanding of the actual situation—a difficult and time-consuming task. Nevertheless, without such scientific evidence, truly moral choices cannot be made. Ethical principles supply guidelines for action when a given situation is at hand; the determination of what situation is at hand is crucial and cannot be neglected.

The human race has lived for its entire history in an environment exposed to radioactive radiation. This radiation has come from cosmic rays (such that the dose at Denver with its higher elevation is twice that in New York City), cosmogenic radioactivity (such as that used in C14 dating), and primordial radioactivity (for which levels are five to 20 times higher in eastern Brazil and southern India than elsewhere, without sure evidence of deleterious effects).[13] The average whole-body radiation dose from all natural sources in the United States is about 80 millirem.[14] Average medical and dental exposure is about 70 millirem. It is reported that no measurable health effects on either animals or man can be detected at all below about 10,000 millirem for human beings, although considerable debate exists concerning the effects of low-level radiation on the origin of cancer in human beings. Nevertheless, it is clear that additional radiation due to nuclear energy generation must be measured with respect to the amount of 100 to 250 millirem to which all human beings are exposed from natural causes.

To strive for "zero" radioactivity radiation is both foolish and intrinsically impossible. A radiation level that is of the order of or less than the naturally present level must be given

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the status of "effective zero" for all purposes of risk elevation. Similarly to strive for a system that is "perfectly safe" is both foolish and intrinsically impossible.[13] No human activity is perfectly safe; certainly we never let the empirical fact that thousands of lives are lost each week in the United States because of the automobile lead us to the conclusion that automobiles should be banned. Nor do we cease to fly in airplanes because we know that airplanes can crash, or cease to travel by boats because we know that boats can sink. More accidents happen at home than away. We have learned to live in a world in which "absolute safety" is recognized to be an illusion. We might philosophically desire it to be otherwise, but we do not order our lives in an effort to bring absolute safety into effect. We have learned to distinguish between the possibility of something happening, and the probability of its happening; when the probability is reckoned to be sufficiently small (by comparison with a balance of gains and losses), then we do not allow the possibility to hinder us.

As was mentioned earlier in our discussion of stewardship, an evaluation of risks must not involve only physical or biological risks, but must also include estimates of social consequences. This may be an even more difficult task. Consider, for example, the basic question, "Will the development of nuclear energy help the poor?" Will it reduce world-wide poverty, help keep the peace, and lead to justice and freedom for more people? One can imagine a number of possible scenarios, the acceptance of any one of which would lead to a relatively easy ethical decision about nuclear energy. If it could be shown that the development of nuclear energy would help the rich and harm the poor (evaluated on a world-wide basis), or even that nuclear energy would help the rich and neither help nor harm the poor, it would be a fairly direct choice to minimize its use and plan for its being phased out. If, on the other hand, it could be shown that the development of nuclear energy would particularly help the poor with minimal harm to all, there would be no difficulty in embracing its rapid development. It is not likely that such simple social scenarios are accurate.

Risks do not exist independent of the circumstances in which they are found or of the benefits that must justify them.[6] The danger of radioactive wastes cannot be considered in the abstract, but rather any risks of adverse health effects from such radioactivity must be measured in terms of the environmental pathways that would lead to their being assimilated by human beings. If wastes can be retured to the same (or better) level of risk as that posed by natural uranium ore in the earth's crust, little objection can be raised.

Actually human society functions more along the lines of "justifiable harm" than of "acceptable risk."[6] How indifferent can the majority be to the suffering of the minority needed to produce a good for the majority, and how indifferent can the minority be to the deprivation of the majority needed to preserve a good for the minority?[15] If any of us knew that a human being would die in order for us to have an hour's worth of electricity—and particularly if we knew that human individual involved—few if any of us would insist on having our electricity anyway. The harm involved would clearly not be justifiable. But if we are told that there is a 10% chance that a human being will die sometime in the next 10 years for our one hour's worth of electricity—particularly if that human being is only an abstract statistic—we may well conclude that the electricity needed to light the operating room, to warm the house for the elderly, or to cook the children's soup provides the basis to justify the harm. We need a far more acute consciousness of the harm that follows from all of the forms of our technological culture, and an evaluation of when this harm is indeed ethically and morally justifiable.

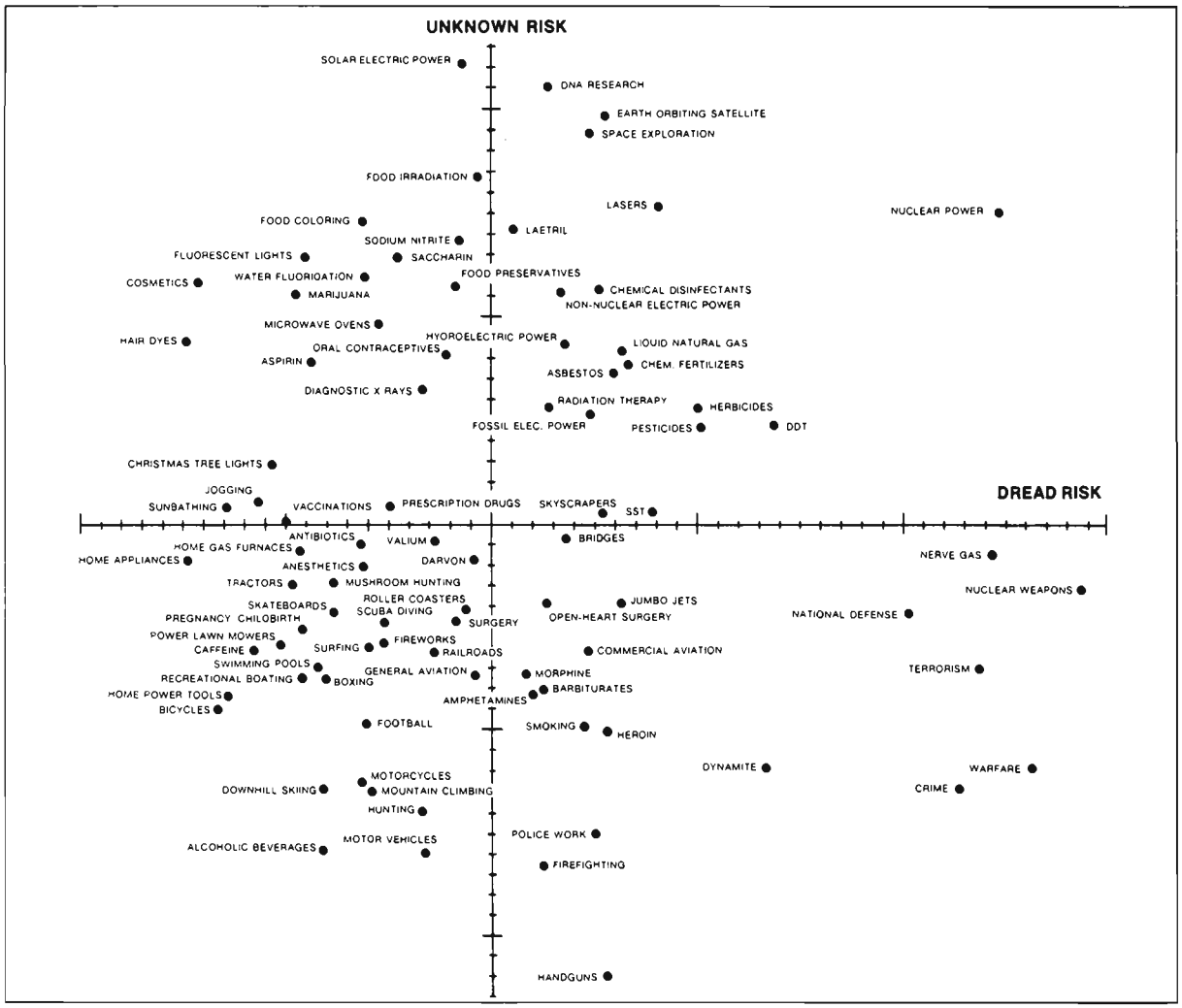
One problem with nuclear energy is that it appears to be most useful to those nations who already have a corner on the energy market.

Just as the existence of nuclear wastes due to nuclear weaponry does not lead unambiguously to the conclusion that we ought therefore not be unduly concerned about nuclear wastes due to nuclear power plants, so also the existence of radioactivity and chemical toxicity due to other methods of energy production does not unambiguously lead to the conclusion that nuclear energy is therefore justified. If indeed we measure acceptable risks to the environment in terms of the half-life or rate of decay of toxic elements in everyday use, we would be led to demand protection against the infinite-lived poisons such as mercury, lead, arsenic, chlorine, cyanide etc. which are part of our everyday activity. But we cannot simply conclude that because we have not demanded such protection, all is well and we must consistently add radioactive toxicity to the list. Quite the contrary: we might conclude that the case of radioactive toxicity has caused us to re-evaluate our whole standard of living and that major changes are needed, to which largescale development of nuclear energy is exactly the wrong contribution. If it is indeed true that any largescale expansion of energy production promises severe damage to the environment, the suggested response may well be to take another close look at just where we are going and where we want to go, insofar as freedom of choice remains an option.

With all their complexity and general neglect to date, the response needed to cope with physical or biological risks to human welfare is relatively simple. Because it is simple, it tends to command all of our attention, and we try to simplify it still further by considering only one kind of physical or biological risk rather than the many within which we daily live. We are much concerned about the effect on future generations of what we do today—and rightly so. If only we could bring equal concern to bear on the other risks that we are passing on to future generations: unsolved problems of starvation, poverty, and racism, then indeed our legacy for the future would be one of spiritually gratifying benefits.[6]

Nuclear Warfare

If such high concerns are raised about the development of



Parameters of Risk. Technologies and items were rated on characteristics that analysis showed could be represented by the two factors seen in the grid: dread and how well understood the risks are perceived to be. After Paul Slovic of Decision Research; reprinted from Jane Stein, "Assessing the Risk," *Mosaic*, September/October 1982, pp. 17-23.

nuclear energy power plants to supply the needs of the people of the world as we have discussed above, how great are the concerns that focus on the use of nuclear energy in warfare!

The basic Christian evaluation of warfare itself remains one of the great unsolved issues for the Christian community. Centuries of effort with models of a "just war" leave people unsatisfied. Certainly the full explication of Jesus' command to "Resist not evil" in the life of the Christian individual and community remains a provocative challenge. This is not the place to treat this basic question; it is important to mention its fundamental nature, however, in order for us to understand the specific response to nuclear warfare, and we will consider it further in the next installment.

It is often thought that Christian aversions to warfare stem from an unwillingness on the part of Christians to die for others; such an attitude is clearly unChristian and hence apparently open to unquestioned attack. It is important to realize, however, that the opposition to warfare that finds its heart in the center of responsible Christian thought arises not from an unwillingness to die for others if that be necessary, but from an unwillingness to kill others for any reason.[16] Complicating the whole situation, of course, is the realization that most wars are fought for reasons far from the ideals that are publically extolled, and using methods that violate Christian principles in many ways.

To many responsible Christians, entrance into a nuclear war is simply unthinkable.[17] Arthur Holmes, a Christian philosopher, says, "Strategic nuclear weapons have been denounced by Christian ethicists, Protestant and Catholic, as a crime against God and man; and tactical nuclear weapons could too easily trigger further escalation. I cannot see how a world war with modern weaponry could ever again be justified." And Lewis B. Smedes, a Christian ethicist, writes, "I cannot find in my imagination's storehouse anything to justify all-out nuclear war. . . . An all-out war, short of nuclear

In order to evaluate the danger of nuclear wastes, a comparison must be made with the toxic wastes generated by other alternative modes of energy production.

exchange, would still inflict such grotesque suffering on both peoples, along with their neighbors, that it is still all but impossible to foresee a justifiable provocation so terrible." This Christian concern does not take issue with Patrick Henry when he said, "Give me liberty or give me death," but it does when his statement is interpreted as, "Give me liberty or I will kill." Liberty is a precious gift from God. The Christian, however, does not regard it proper to maintain possession of gifts of God by using means that violate every aspect of his Christian commitment.

It is not clear how closely a nuclear energy development is tied to a nuclear weapon development program. If there were a close correlation between the two (and it seems as if such a connection is tenuous at best—or worst), this could play a major role in Christian evaluations of the options.

Summary

Some of the major themes in this discussion may be summarized as follows:

1. Consideration of development of energy sources needs to balance two perspectives: (a) Is nuclear energy the only option? and (b) All options have their risks and costs.

2. Good stewardship requires a complete risk assessment that includes not only physical and biological risks, but also social, psychological, aesthetic and spiritual risks.

3. Plans that are made on the assumption of human infallibility and perfection are doomed to early failure.

4. No method of generating electricity is perfectly safe.

5. Moral values and ethical principles are not a substitute for scientific evidence.

6. To desire non-degradation of the environment does not mean regarding the environment as intrinsically benign and sacred.

7. Justifiable harm is often the framework within which we must view human activities, rather than simply acceptable risk.

8. Added risks must not exceed naturally occurring risks.

9. Radioactive wastes are not as toxic as many chemicals in common widescale use.

10. Recognition of the universal presence of risks and harm in all methods of generating energy may lead us, not to accepting all methods because all are equally bad, but to re-evaluating our goals and methods to minimize these risks and harms.

11. Christian rejection of nuclear warfare does not arise from an unwillingness to die, but from an unwillingness to kill.

REFERENCES

[1]This installment is based on a paper presented at the 1980 Science, Philosophy and Religion Symposium, Kirtland Air Force Base, New Mexico.
[2]William G. Pollard, "A Theological View of Nuclear Energy," *Jour. ASA*, Vol. 32, No. 2, 70 (1980).
[3]Vernon J. Ehlers, "Gems of Wisdom and Wrong Conclusions," *ibid.*, p. 78.
[4]Kenneth A. Martin, "Biblical Mandates and the Human Condition," *ibid.*, p. 74.
[5]Everett R. Irish, "Perspective on Energy Technology Choices," *ibid.*, p. 112.
[6]Margaret N. Maxey, "Nuclear Waste: Beyond Faust and Fate," *ibid.*, p. 97.
[7]Robert Case, "Human Responsibility and Human Liberation," *ibid.*, p. 79.
[8]David A. Hoekema, "Does the Nuclear Option Make Sense?" *The Reformed Journal*, August (1979), pp. 18, 19.
[9]Ellen Winchester, "Nuclear Wastes," *Jour. ASA*, Vol. 32, No. 2, 83 (1980).
[10]William G. Pollard, "Not an Avoidable Problem," *ibid.*, p. 88.
[11]Bernard L. Cohen, "Far Greater Dangers than Nuclear," *ibid.*, p. 89.
[12]Everett R. Irish, "Benefits of Nuclear Power Outweigh Its Risks," *ibid.*, p. 92.
[13]David L. Willis, "Nukes or No Nukes? Absolute Thinking in a Relative World," *ibid.*, p. 102.
[14]Some reader may wish to know what a "millirem" is. A millirem is one thousandth of a rem. A rem is the amount of ionizing radiation required to produce the same biological effect as one roentgen of high-penetration X rays. A roentgen is a unit of radiation dosage equivalent to the quantity of ionizing radiation required to produce one esu of electricity in one cm^3 of dry air at 0°C and standard atmospheric pressure. Conclusion: for practical purposes it is a relative unit for comparison purposes only.
[15]Richard H. Bube, "How Simple Life Would Be If Only Things Weren't So Complicated!" *ibid.*, p. 65.
[16]Richard H. Bube, "The Foolish Alternative," *Journal ASA* 21, 134 (1969)
[17]*Eternity Magazine*, June 1980, "When would war with the Soviet Union be justified?"

TOPICS FOR DISCUSSION

1. If you were asked to estimate the use of energy on earth for the next thousand years (assuming that the present age continues that long), how would your plot of energy use vs time look like?
2. What is your reaction to the following set of propositions:
   (a) God is good.
   (b) Everything that God makes is good.
   (c) God made nuclear energy.
   (d) Nuclear energy is good.
   (e) There is no reason that mankind should not use nuclear energy.
3. Would you want to live within 2 miles of a nuclear energy plant? Why, or why not? Would you rather live within 2 miles of a coal-fired electricity producing plant?
4. Consider the consequences of the following possible models for the relationship between human beings and the natural world:
   (a) Human beings are a disease of the natural world.
   (b) Human beings are in constant warfare with the natural world.
   (c) Human beings are a part of the natural world.
   Is any of these views biblically defensible? Construct your own model.

5. When someone in your family suggests that the next energy-consuming product be added (whether toaster, hair dryer, oven etc.) to the household, will your sense of Christian stewardship cause you to stop and question the purchase?
6. Increasing technological development seems inevitably to be associated with large increases in the amount of chemical and radioactive wastes that burden the ecology. Is there a lesson in this for future planning?
7. It is suddenly discovered that your drinking water contains radioactive wastes that are not biologically harmful but would contribute about 50 millirem radiation dose in normal usage. Would you stop drinking the water? Move away? Demand that the radioactivity be reduced to 10 millirem?
8. Does it trouble you that some lives will be damaged and lost in order to provide you with the energy that you demand? How many lives would have to be damaged or lost per year in order for you to get concerned? To change your lifestyle?
9. Should particularly Christians be willing to incur risk to their lives and health to provide needed energy for others?
10. List the five most serious problems that we are passing along to our children and to their children.
11. A Christian is manning the "big button" when word comes that nuclear warheads are on their way to the United States from the Soviet Union in a first-strike attack. Can that Christian push the button to send nuclear warheads against the Soviet Union in retaliation?

Computers, Robotics, and The Church

The history of mankind and the history of mankind's machines cannot be separated. From the Roman machines of war to the manufacturing machines of the Industrial Revolution the attitudes and possibilities of each succeeding age have been closely tied to the proliferation and dissemination of increasingly more sophisticated machinery. Today we are confronted by machines that not only replace the need for human or animal muscle but can do many tasks that once called for human intelligence. The result has been a worldwide technological revolution that is radically altering the workplace as well as what we do with our leisure time, how we learn, and possibly even how we define what it is to be human. The microprocessor technology that has precipitated the current flood of games, small computers, and robotics is creating sweeping changes in the way we live, think, and do business. The clear challenge to the Church is to minister to those who are displaced by this revolution, to effectively use this technology in the work of the Church, and to serve as prophet as humankind separates what ought to be done from what can be done.

In this paper I point out several ways in which computers and robotics have become relevant to the work of the Church. Four areas are examined. First we discuss the use of computers in biblical study and research. Next we survey ways in which computers can be used to improve the efficiency of local church administration. We then look at the changes in industrial society created by the use of computers and robotics and the challenge these changes present for ministry. Finally the philosophical and ethical questions that are being raised by the massive information storage capabilities of modern computers and by ongoing research in artificial intelligence are explored.

Computers As A Tool In Biblical Study

In the last few years several articles have appeared in both popular magazines and academic journals on the use of computers for biblical study. The ability of computers to process vast amounts of data quickly and exhaustively has opened exciting possibilities for biblical researchers. In an article entitled "Content Analysis, Computers, and the Scientific Method in Biblical Studies," J. Arthur Baird states:

> When one edits the Biblical text to include the critical information desired and then puts all of this on computer cards and eventually magnetic tape, the computer becomes a living data bank where instant, accurate, and massive recall enables the researcher to ask the computer questions which could not be answered in a lifetime of unaided human research.[2]

Baird goes on to say that one of the most fruitful uses of the computer has been in the production of concordances and describes three "levels" of concordances that are now available. The first level consists of the familiar listings of every word in a text for reference purposes. The other two levels have been made feasible only through computer assistance and are used to help identify patterns that are important in both higher and lower critical analysis of Scripture.

Another recent use of a computer in biblical research was the Genesis project at Israel's Technion Institute.[4] In this study two computer experts and a biblical scholar programmed a computer to do an exhaustive linguistic analysis of the book of Genesis in the original Hebrew. The question under consideration was whether this book was the work of one man (conservative Christians and Jews have traditionally attributed the authorship of the first five books of the Bible to Moses) or a variety of writers whose narratives were interwoven to produce the book that we now have.

> Two narrative strains that scholars have long considered distinct because they employed different words for God turned out to be linguistically indistinguishable when methodically compared by the computer. A third strain—designated "Priestly" because of its preoccupation with ritual and genealogy—did stand apart. . . .

The Genesis project illustrates an important point in the use of computers for biblical research. The computer did not provide a final answer to the question of authorship but it did serve as a useful tool to challenge accepted theories and thinking.

We should also not overlook the value of microcomputers as a study tool for pastors and laypersons. One possibility is that of computerized theological libraries that could be accessed from a home or church computer through a telephone (modem) hookup. This would allow a pastor who lives far from a seminary or university library to have immediate access to the tools he needs to continue his personal study and growth.

Computers are already being widely used in public education. Many of the ideas that have been tested and proven effective in public education could be used by the Church to design computer-aided instruction in Christian education. With appropriate software, computers can be used as entertaining and patient teachers. Bible quizzes, Church school lessons, simulation games, Scripture memorization drills, etc. can all be computerized. *Newsweek* has recently reported on a product called "The WORD Processor," a computer program that gives one access to the entire King James Version of the Bible.[7] Anyone with a minimum of computer knowledge can use this product as a computerized concordance that will search out specific Bible passages or specific words.

One estimate predicts that half of America's homes will have a computer by 1987.[6] The development now of quality software by churches, denominations, and seminaries will offer possibilities for Christian Education that have never before existed.

Improving The Efficiency Of The Local Church

There are many areas in which small computers could have an immediate impact on church administration. Computers could be used to keep financial records; provide a database of information on each member's interests and talents; prepare bulletins, sermons, and newsletters; regulate utilities; and maintain mailing lists.

A local church functions in many ways like a small business. There are records to keep, people to contact, paperwork to process, and budgets to meet. Currently available software products could be used by a church to do many of these tasks. Several good word-processing programs exist that could be used by a church staff to produce error-free sermon notes, bulletins, and newsletters. Book-keeping programs written for small businesses might also be appropriate and useful tools for keeping records of a church's monthly income and expenses. Several programs are on the market that could be used to maintain mailing lists and print address labels.

Churches also have unique needs that will require computer software written specifically for their use. For example, a church might like to keep a profile of each member that included not only name and address but also information on individual talents, church experience, and interests. Then when someone was needed for a specific task, such as leading a small group in a certain geographic section of a parish, the computer could print out a list of all church members already living in that area who had the proper training and experience for the job. A computer could also analyze data for the pastor each week and provide him with a list of possible visitation candidates, based on factors such as church attendance, anniversaries of the death of loved ones, or other pertinent data.

Most church buildings have many rooms that are used only a few hours a week. A computer could be programmed to regulate heating and air conditioning so that rooms in use maintain an appropriate temperature, and energy is not wasted on empty rooms.

The technology needed to do all these things exists now. The cost of a microcomputer and appropriate software is within the reach of most moderately sized churches. Far from making the ministry of a church seem mechanical or impersonal, computers would make church workers more efficient, giving them more time for human-to-human contact.

Ministering To The Displaced

Even if the church were to avoid using computers as a tool in education, research and ministry, it cannot avoid the impact this technology is having on society. Although computers have created thousands of new jobs for programmers, data entry operators, and analysts they have also caused jobs to disappear. We are moving from an industrial society to an information society. A long list of employees—such as typesetters, office workers, and factory workers—are finding that their jobs either no longer exist or have been radically changed by computers and robotics.

Microelectronic devices incorporated into products in the place of mechanical parts cause labor requirements to plummet. Automated assembly lines increase production while reducing the number of workers needed. One study of a General Motors plant reported a 20% increase in production and a 10% decrease in workforce because of the introduction of robot welders.[9] We are entering a period in history that may be characterized by jobless growth. Production will increase in many industries while the number of human workers needed declines.

White collar workers are not immune from this phenomenon. Areas such as banking and insurance that rely on printed paper for most of their transactions are moving to more efficient electronic methods for storage and transfer of information. A recent report predicts that 30% of the jobs in the French banking and insurance industries will disappear during the eighties.[10]

The human cost of automation is graphically illustrated by a study published in *The Futurist* of 44 typesetters who were "replaced by a computer."[8] Surprisingly, economic hardship, although severe for many of the typesetters, was not the principle problem that had to be faced. The psychological impact often completely overshadowed the financial impact. Established family relationships were altered as wives left the home for outside jobs to help support the family. Many of the former typesetters experienced depression, personality changes, and physical illness. Feelings of uselessness, frustration, and loss of personal worth and pride were common.

Those who take seriously the responsibility of the Church to minister to individuals in pain or need cannot help seeing the implications. We will observe, in this decade, a massive change in industrial society. Great numbers of workers will lose their jobs. Few of these displaced workers will be retrained for the new jobs which technology creates. The result will be spiritual pain in addition to financial loss. The Church should be prepared to respond.

Philosophical And Ethical Questions

Computer technology brings with it many questions whose answers we dare not leave in the hands of technicians and bureaucrats. Ethical considerations abound as we survey what is now or soon may be possible through the use of computers and robots. The massive information storing capabilities and increasingly more efficient access methods of modern computers have already made it possible for your government, your bank—or almost any other interested party with the proper connections—to monitor many aspects of your personal life. Financial records reveal what you spend your money on and where you go to spend it. Telephone records reveal to whom you talk. Employer's records reveal what you do and how well you do it. Creditor's records evaluate your moral character and dependability. Who should be given legal access to these records? How do we protect them from unauthorized users or those who may try to change or manipulate them for their own purposes? Such questions are not just technological and legal problems but ethical ones. Christians engaged in computer, legal, and governmental professions should take the lead to see that these concerns are addressed in ways consistent with the biblical belief in the importance of the individual.

Robotics present many other questions that *will* be answered by

someone during our century. The progress in microcomputers has been such that it is already feasible to dedicate a large number of powerful and compact computers to the control of a single robot. Within the next twenty years robots will be able to perform many, if not most, of the manufacturing operations that now require human skills.[11] Understandably the current pervasive fear of robots is that they will take jobs away from humans. While robot labor will certainly replace human labor in many areas, the long-term effect need not be a negative one. Indeed the primary ethical considerations may not be those of machine versus human but of the powerful versus the powerless. Consider the following quote from James Albus, one of the nation's leading robotics researchers:

> It is premature to worry about robots eliminating work as long as there exist such overwhelming problems as providing food, clothing, shelter, education, and medical care for millions of people living in desperate poverty.
>
> The problem is not in finding plenty of work for both humans and robots. The problem is in finding mechanisms by which the wealth created by robot technology can be distributed as income to the people who need it . . . If everyone owned one or more robots, everyone would be financially independent regardless of whether [he] had a job or not. . . .
>
> I believe we have it within our power to create an everyperson's aristocracy based on robot labor. The question is, do we have the wisdom to develop this technology in such a way that everyone benefits?[11]

That wisdom could possibly come from the prophetic ministry of the Church.

In a more spectulative vein Irving Hexham, assistant professor of philosophy of religion at Regent College in Vancouver, British Columbia has stated that, "Literature on robotics is nothing less than a debate on the meaning and purpose of existence."[5] For years science fiction writers have speculated on the issues that artificial intelligence (AI) may soon bring about. For example, what happens when a relationship develops between a human and a machine? What rights should a robot have? If its intelligence approaches or surpasses humankind does it also have a soul? What is the difference between man and machine, between God's creation and technology's creation?

Joseph Weizenbaum brought many of these fanciful questions into reality with a computer program called DOCTOR that parodied the response of a nondirective psychotherapist in an initial psychiatric interview. The patient communicated with DOCTOR by means of a teletype. Many of these people who conversed with the system refused to believe that the computer did not really care about their problems. In addition a number of practicing psychiatrists seriously believed that the DOCTOR computer program could grow into an automated form of therapy.[13] Such anthropomorphizing of what was, in reality, meant to be only a demonstration of a limited language analysis program goes far beyond the present state of AI research. Such misconceptions, however, serve only to highlight what Weizenbaum calls "the enormously exaggerated attributions an even well-educated audience is capable of making, even strives to make, to a technology it does not understand."[13]

Whole computers can now be put on a silicon chip the size of a fingernail. The possibility exists of computer-designed three-dimensional computer chips, too complex for human designers to comprehend, whose internal structure would be patterned after the human brain itself.[1] As computers become "smarter" clear lines must be drawn between human and artificial intelligence—between decisions a machine may make and decisions that humans must make.

Conclusion

The Church, on all levels, is already caught up in a technological and social revolution that it must both participate in and be prophet to. On the local parish level computers may be used to the advantage of the Church—and the people displaced by this technology must be ministered to. On the academic level computers have become exciting new research tools—and the harbinger of complex philosophical and ethical questions. Those of us with commitments to both the Christian faith and computer technology must continually challenge each with the other.

[1]Alexander, Tom, "Computers on the Road to Self-improvement," *Fortune*, Vol. 105, No. 12 (June 14, 1982), pp. 148–160.

[2]Baird, J. Arthur, "Content Analysis, Computers And The Scientific Method in Biblical Studies," *Perspectives in Religious Studies*, Vol. 4, No. 2 (Summer 1977), pp. 112–125.

[3]Clapp, Rodney, "The Ubiquitous Computer: Is It Coming to Church, Too?" *Christianity Today*, Vol. 26, No. 16 (October 8, 1982), pp. 72–75.

[4]"Did One Person Write Genesis," *Newsweek*, Vol. XCVIII, No. 13 (September 28, 1981), p. 59.

[5]Hexham, Irving, "Learning to Live with Robots," *The Christian Century*, Vol. XCVII, No. 19 (May 21, 1980), pp. 574–578.

[6]Hill, Harland, "Get A Computer," *The Christian Ministry*, Vol. 10, No. 1 (January 1979), pp. 29–30.

[7]"The Holy Bible, High-Tech Version," *Newsweek*, Vol. XCIX, No. 13 (April 5, 1982), p. 53.

[8]Gilchrist, Bruce and Ariaana Shenkin, "The Impact of Computer on Employment," *The Futurist*, Vol. 15, No. 1 (February 1981), pp. 44–49.

[9]Main, Jeremy, "Work Won't Be the Same Again," *Fortune*, Vol. 105, No. 13 (June 28, 1982), pp. 58–65.

[10]Norman, Colin, "The New Industrial Revolution," *The Futurist*, Vol. 15, No. 1 (February 1981), pp. 30–42.

[11]Steier, Rosalie, "The Robot Revolution: An Interview with James Albus," *Communications of the ACM*, Vol. 26, No. 3 (March 1983), pp. 179–180.

[12]Strasma, James, "Church Computers: Proceed With Caution," *The Christian Ministry*, Vol. 10, No. 3 (May 1979), pp. 31–33.

[13]Weizenbaum, Joseph, *Computer Power And Human Reason*, W. H. Freeman and Company, San Francisco, 1976.

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A Sociological Analysis of the Gospel of Luke

There has been a continuing discussion among evangelical Christians who are sociologists about the issue of a distinctive Christian sociology. Recently (June 1982), George W. Barger discussed the issue again in *Journal ASA*.[1] The consensus seems to be that there is not a distinctive Christian sociology. I would like to enter this debate by asserting there can and should be a biblically based sociology.

While obviously not a complete modern empirical sociology, biblical sociology does cover *crucial concepts* such as power, authority, social stratification, social order, social conflict and social change. And biblical sociology provides a *value context* for the operation of these concepts in life. Biblical sociology does not allow one to maintain an objective neutral value stance. Commitment to change unjust social conditions is a part of biblical sociology.

The following is a first attempt to make an analysis of basic sociological concepts in the gospel of Luke. Brief definitions of these concepts are:

1. *Power*—"the ability of an individual or group to realize its goals and impose its will despite the opposition of others."[2]
2. *Authority*—the socially legitimate exercise of power.
3. *Social Stratification*—"the differential distribution of power, prestige, and property."[3] In lay terms, the rich and poor in a society, with the rich usually engaging in exploitation of the poor.
4. *"Racism"*—for the Jews, a religio-cultural ethnocentrism because they were chosen of God; Gentile and Samaritans were inferior to Jews.
5. *Social Order*—the relatively harmonious functioning of a social system based on established structures and norms of conduct.
6. *Social Conflict*—a person or group challenges the status quo functioning of a society and attempts to introduce new sources of power and authority, new rules for the distribution of resources.

From a Christian perspective social order may reflect creation design: God created humans as social beings and established social institutions, such as marriage and family, to provide structure and order for society. Since the Fall, however, one might argue that sin has been institutionalized into the social order resulting in rather stable patterns of exploitation in a social system. Now social order may reflect both creation design and institutionalized sin.

From a Christian perspective social conflict may reflect the Fall: sin disturbed the social order established by God and introduced alienation and exploitation. But since sin has been institutionalized into the social order, social conflict may be necessary to bring about change in the patterns of exploitation that exist in a social system.

One can understand the biblical position on social order and social conflict only if one understands the New Testament use of *cosmos* or "the world." Stephen Mott asserts that "this word refers to the order of society and indicates that evil has a social and political character beyond isolated actions of individuals ... Whereas for classical Greece *cosmos* protected values and life, ... in the New Testament, *cosmos* represents the twisted values which threatened genuine human life."[4]

Mott's biblical analysis of the social dimension of evil and the social dimension of the Kingdom of God is superb in my judgment. It is must reading for anyone who wishes to develop a biblical sociology.

The Kingdom of God represents a new religio-socio-political order based on new norms to replace the old social order based on institutionalized sin and legalism. Its introduction inevitably conflicts with the existing social order. The Jewish social order is characterized as follows by Juan Mateos:

> The high priests were the official representatives of religion and worship who had charge of the temple, the *religious* and *political* center of Israel. All Jews over twelve years of age, including those who had lived abroad (and they were many), had to pay an annual temple tax equivalent to two days' work (Matthew 17:24). For the maintenance of the clergy they also had to pay ten percent of the harvest (Mt. 23:23). Besides this, the temple received gifts (Mark 7:11) and abundant alms, above all from the rich (Mk. 12:41), not to mention the livestock market for the sacrifices and the currency exchange (Mk. 11:15). All this turned the temple into a great *commercial* racket administered by the high priests. They represented the political and religious power, and were at the same time an important financial group to be reckoned with.
>
> The city of Jerusalem was practically supported by the large temple revenues, especially at seasons of pilgrimage—three times a year—when besides the Palestinians came Jews from the diaspora and foreigners as well (John 12:30). The second group in the Council was made up of Senators (elders) who were laymen chosen from among the aristocratic families. For the most part they were the great landowners and were the backbone of the Sadducee Party, to which the high priests belonged ...
>
> The Pharisees had immense authority over the people ... In spite of all their observance of religious rules, the Pharisees loved money and exploited the simple folk under the pretext of piety (Mt. 23:25–28; Mk. 12:40; Lk. 11:39, 16:14).[5] (Emphasis added)

Sociological Themes

The main themes of the gospel of Luke were revealed to Mary by God at the time of her conception and during her pregnancy.

1. Jesus' Kingly power and authority: "the Lord God will give to him the throne of his father David, and he will reign over the house of Jacob forever; and of his Kingdom there will be no end" (1:32–3).[6]
2. Disruption of the pattern of social stratification and abuse of power and authority: "He has scattered the proud..., he has put down the mightly from their thrones, and exalted those of low degree; he has filled the hungry with good things, and the rich he has sent empty away" (1:51–53).

John the Baptist states similar concern about the misuse of power and authority to engage in economic exploitation. John proclaims: "Bear fruits that befit repentance.... and the multitudes asked him, 'What then shall we do?' And he answered them, 'He who has two coats, let him share with him who has none; and he who has food, let him do likewise." Tax collectors also came to be baptized, and said to him, "Teacher, what shall we do?' And he said to them, 'Collect no more than is appointed you.' Soldiers also asked him, "And we, what shall we do?' And he said to them, 'Rob no one by violence or by false accusation, and be content with your wages' " (3:3–14).

In regard to the three temptations of Jesus, I interpret the essence of the temptations to be the misuse of legitimate power and authority.

1. The temptation to turn stone to bread: use His power to meet His own personal needs (4:2–4).
2. The temptation to allow Satan to give Jesus the "authority and glory" of the "kingdoms of the world:" gain power and authority the easy way, avoid the cross (4:5–7).
3. The temptation to jump from the pinnacle of the temple: demonstrate His power in a spectacular public relations effort to gain popularity with the people (4:9–12).

"And Jesus returned in the power of the Spirit into Galilee ..." (4:14). What would be a legitimate use of His power? Jesus had refused to use His power to meet His own needs, to gain the authority of the world's kingdoms the easy way, to demonstrate His power in spectacular fashion. Now hear this:

> "The Spirit of the Lord is upon me, because he has annointed me to preach good news to the poor. He has sent me to proclaim release to the captives and the recovering of sight to the blind, and to set at liberty those who are oppressed." (4:18–19).

Sociological Analysis

Early in His ministry Jesus directly challenged Jewish religious ethnocentrism. He said, "And there were many lepers in Israel in the time of the prophet Elisha; and none of them was cleansed, but only Na'aman the Syrian" (4:28). What! The Gentiles—recipients of the grace of God?? The Jews got the point. "When they heard this, all in the synagogue were filled with wrath" (4:28). The Jews took Jesus to

a cliff outside the city to throw him over. Jesus had directly challenged their false sense of religious-cultural superiority, a courageous proclaimer of truth no matter what the cost.

Soon the people recognized Jesus as one who spoke and acted with authority. As He ministered in the synagogue. "And they were astonished at his teaching, for his word was with authority" (4:32). "For with authority and power he commands the unclean spirits, and they come out" (4:36).

The pattern has already been set early in the gospel of Luke. The issues of power and authority, social stratification, "racism," and even Jesus' impending death have been sharply focused in the first four chapters. The rest of Luke is really unnecessary to a good sociologist. One should be able to "predict" what will happen on the basis of what has already happened.

From Luke 4 through 10:20 Jesus' power and authority were main themes. When Jesus told the paralytic that his sins were forgiven, the scribes and Pharisees asked, "Who is this that speaks blasphemies? Who can forgive sins but God only? (5:22). Jesus replied, "But that you may know that the Son of man has authority on earth to forgive sins" (5:24).

Again and again Jesus demonstrated His power as He healed people and even raised a widow's son from the dead. After Jesus had demonstrated His power and authority numerous times, He "called the twelve together and gave them power and authority over all demons and to cure diseases, and he sent them out to preach the kingdom of God and to heal" (9:1–2). This they did.

But soon they were faced with the temptation to misuse their power and authority as Christ was when Satan tempted Him. "And an argument arose among them as to which of them was the greatest" (9:46). When they entered a Samaritan village that did not receive them, James and John said, "Lord, do you want us to bid fire come down from heaven and consume them? But he turned and rebuked them" (9:54–55).

Then Jesus sends the seventy out with the same power and authority He gave the twelve. They, too, became intoxicated with their power. "The seventy returned with joy saying, 'Lord, even the demons are subject to us in your name!" Jesus replied, "do not rejoice in this, that the spirits are subject to you; but rejoice that your names are written in heaven" (10:17–20). From this point on in Luke, little is said about power and authority. Instead the focus is on sin, forgiveness, love, serving, etc.

However, the power-authority confrontation between Jesus and the Jewish leaders continues without let up. In nearly every chapter after the fourth, the Pharisees or scribes are mentioned. The confrontation comes to a climax shortly before the crucifixion. As Jesus approached the city of Jerusalem, He wept over it for he foresaw the judgment about to fall on the people. Then in anger he entered the temple (the seat and center of Jewish religio-politico-economic power) and drove out those who sold. Then daily he returned to the temple to teach (19:41–47). The chief priests "sought to destroy him," but did not dare to act, "for all the people hung upon his words" (19:47–48).

"One day, as he was teaching the people in the temple and preaching the gospel, the chief priests and the scribes with the elders came up and said to him, "Tell us by what authority you do these things, or who it is that gave you this authority" (20:1–2).

Jewish religious authority was the basis for social order. Jesus was perceived as a dangerous threat to that authority. The people recognized Jesus as a religious leader with great power and authority. Jesus fearlessly told parables against the Jewish religious leaders. "The scribes and the chief priests tried to lay hands on him at that very hour, but they feared the people" (20:19).

The temple incident (Chapters 19–20) provides the first mention of the chief priests in Luke. The chief priests represent the pinnacle of Jewish religio-political authority. Jesus' invasion and occupation of the temple was the crowning insult to Jewish authority. The chief priests would have acted immediately to silence Christ, but Jesus was so popular with the people, they could not touch Him in public. The die was cast, however; the death of Christ was just a matter of time.

Jesus takes full advantage of the impotence of the chief priests. He returns to the temple daily to teach; "And every day he was teaching in the temple, but at night he went out and lodged on the mount called Olivet. And early in the morning all the people came to him in the temple to hear him" (21:37–38). In Matthew the "Woe to the Pharisees" chapter is given during this time period; in Luke it comes earlier in Chapter 11.

Jesus was an aggressive social activist who often took the initiative in confronting the Jewish religious establishment. He was not content just to do good to the common people though He obviously did much of this. Exploitation sanctioned by religious authority had to be exposed publicly. Jesus was relatively kind when dealing with the personal sin of the prostitute, the woman caught in adultery, etc., but He was almost vicious when dealing with groups associated with sin which had been institutionalized in the social structure. He

Bethany Lifeline

Bethany Christian Services, a Christian social services agency headquartered in Grand Rapids, Michigan, has recently initiated an exciting new program. "Bethany Lifeline," a toll-free telephone hotline manned by volunteers trained in crisis pregnancy counseling, is the most extensive of its kind in the country.

When a woman with an unplanned pregnancy dials the Lifeline number, 1-800-B-E-T-H-A-N-Y, a counselor will talk with her about the value of her life and the life of her unborn child. When ongoing counseling is needed, the caller will be referred to the nearest Bethany branch office or to another pro-life agency in her area.

"Our goal is to reach young women with unplanned pregnancies who need to be made aware of alternatives to abortion and to counseling services available to them," says Gordon Ellens, program supervisor. "Throughout Bethany's history, we have experienced that if a young woman receives care and counseling, she often chooses life for her child rather than the abortion she was originally intending to pursue. We at Bethany feel that we must reach out to more young people with this life-saving information."

Bethany's counseling helps unmarried pregnant women evaluate if life for the child means single or married parenthood or the release of the child for adoption. Whatever their decision, Bethany's staff is ready to help.

The agency has twelve offices in ten states staffed by social workers trained to support women with unplanned pregnancies. All pregnancy counseling services are free of charge. For more information about how you can assist in the Bethany Lifeline program, contact Gordon Ellens, Bethany Christian Services, 901 Eastern Avenue, N.E., Grand Rapids, Michigan, 49503, 1-800-B-E-T-H-A-N-Y.

forthrightly introduced conflict in order to expose and challenge this patterned exploitation.

What about social stratification? How did Jesus deal with the inequality associated with power, prestige and property? Of course, the term social stratification is not used in Luke, but the closely related topic of the rich and the poor is treated at some length. Some reference to this theme was made earlier in the essay.

The early perspective of the rich and poor in Luke continues throughout. There is never a clear cut statement of approval of the rich or riches. Riches are the result of covetousness. In Luke's version of the Sermon on the Mount the theme is "Woe to the rich" (6:24), "Blessed are the poor." The rich end up in hell (16:19–31). You cannot serve God and mammon (16:1–13). For those who are rich, they are exhorted to "sell their possessions" (8:22–34), "distribute to the poor" (18:18–25). Some riches are due to exploitation (3:10–14; 19:8).

By contrast the poor are always spoken of positively; they have the gospel preached to them (4:18; 7:22); the poor are blessed (6:20,21); the poor are to be ministered to (14:13).

Jesus is not neutral on the inequality that flows from social stratification; He clearly and unequivocally takes sides.

Conclusion

Jesus was a social activist in two ways: negative condemnation and positive vision. He confronted and exposed evil, especially social evil or institutionalized or structural sin: He cleansed the temple. He lived and preached the Kingdom of God—a new social order; He took over the temple and taught this new truth to the people daily.

In our day Martin Luther King also did both. He confronted and exposed institutional racism, and he had a dream of racial harmony for American society.

There is a similar spiritual and social agenda for all of us no matter what the time or place. Hear H. Richard Niebuhr:

> Not only Jews but also Greeks and Romans, medievalists and moderns, Westerners and Orientals have rejected Christ because they saw in him a threat of their culture . . . ancient spiritualists and modern materialists, pious Romans who charge Christianity with atheism, and nineteenth century atheists who condemn its theistic faith, nationalists and humanists, all seem to be offended by the same elements in the gospel and employ similar arguments in defending their culture against it.[7]

[1]Barger, George W. "A Christian Sociology?" *Journal of the American Scientific Affiliation*, 34:101–104.
[2]Hess, Beth, *Sociology*, Macmillan, New York, (1982), p. 600.
[3]*Ibid.*, p. 603.
[4]Mott, Stephen C. "Biblical Faith and the Reality of Social Evil." *Christian Scholars Review*, 10:225–240.
[5]Mateos, Juan, "The Message of Jesus," *Sojourners*, (July, 1977), pp. 8–16. The Mateos article is an introduction to a new Spanish edition of the New Testament. Mateos is a Jesuit scholar in biblical studies.
[6]All Scripture references are from The Revised Standard Version of the Gospel of Luke.
[7]Niebuhr, H. Richard, *Christ and Culture*, Harper and Row, New York, (1951), pp. 4,5.

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The Spirit of Wilderness and the Religious Community

Nineteenth-century Americans conceived of nature as purity itself—a representation of God's perfect goodness. In literature, the transcendentalists spoke often of the "moral influence" of nature, while in the visual arts, the cosmic aspects of wilderness was "depicted" by Durand, Bingham, Cole and others.

One rainy New Mexico afternoon, in an old adobe library surrounded by cottonwood trees, I came upon a rare find: a complete set of volumes from the Sierra Club's wilderness conferences. Even the dust jackets was intact.

I wandered for hours through the chronicles. It was all here in these "Federalist Papers" of the wilderness movement: What was wilderness? How should it be preserved? How much could be compromised?

One phrase kept catching my eye, not only for how frequently it was expressed by the participants, but for how seldom it is heard today: "the need to preserve wilderness for its spiritual values."

Few speakers troubled to define what these "spiritual values" were. They took it for granted that the audience, having sojourned in desert, mountain and forest, knew firsthand what was meant: the silence and solitude afforded by backcountry; the sense of awe it inspired; the way it could alter a traveler's soul as much as his sinews.

No one accorded them more prominence than author and naturalist Sigurd Olson during the Club's 1961 Wilderness Conference:

> I am happy to talk about the spiritual values of wilderness because I feel they are all-important—the real reason for all the practical things we must do to save wilderness. In the last analysis, it is the spiritual values we are really fighting to preserve.

In recent years, however, spiritual values seem to have fallen from the constellation of reasons to protect wilderness. Other traditional rationales—recreational, ecological, economic—have tended to displace the less measurable qualities of wild country with charts, visitor-use graphs and cost-benefit analyses.

"We must not be apologetic about our spiritual motivation," warned one participant during the 1953 conference, perhaps foreseeing that intangible values, gossamerthin when compared to board feet of lumber, would be increasingly slighted in the trend to quantify wilderness.

Their eclipse is ironic, however, for it is spiritual values that have the capacity to galvanize the largest potential and untapped constituency on wilderness's behalf, one heretofore unmoved by arguments based on conservation or recreation: the religious community.

"They don't solicit us, we don't solicit them," explained one national Sierra Club leader recently, summarizing the role religious institutions have played in wilderness preservation. "They just haven't been involved in any identifiable way."

Such mutual indifference can be overcome, but it seems to me it will begin by environmentalists taking the first step, bringing to the attention of religious communities, which seem to have forgotten the importance of wilderness, the quieter gifts of desert, mountain and forest:

• *Silence:* What draws people back to wild country? "Most of all was the silence and sense of removal," suggested Sigurd Olson during one wilderness conference. "These were spiritual dividends, hard to explain, impossible to evaluate, that brought them back time and

again." But this "great primeval hush," which acts as an aesthetic balm, has often served as a theological bridge as well. Within the Judeo-Christian tradition alone—for Old Testament prophets, Desert Fathers and monastic orders—the silence of wilderness has been an invaluable catalyst for prayer and contemplation.

• *Solitude:* Only by going alone, John Muir counseled, "can one truly get into the heart of wilderness." The isolation and seclusion found in wild country, merely a restorative tonic for some, has long kindled a sense of reverence in others. Wilderness solitude provided the common crucible for Muhammed in a cave on Mt. Hira, for Buddha in the forests of northern India, for Jesus in the Judean desert during those 40 days and in withdrawals to desert and mountain throughout his ministry. It is "the most sublime state a human being can aspire to," proposes English author Malcolm Muggeridge, "being in the wilderness alone with God."

• *Awe:* Historian Wallace Stegner once chronicled wilderness as a source for the "birth of awe." The terrain, the unshepherded wildlife, the sense of possible peril, all combine to overwhelm. "Our emphasis in wilderness," remarked naturalist Howard Zahniser, "should be our humility rather than our dominance." This quality of wild country can have a profound religious dimension, the Hebrews' 40-year wandering in the Sinai Desert being one epic example. By dissolving, on a daily basis, the hubris that separated humans from God, the wilderness provided an arena of reconciliation. Wild country has always served to remind people of their limits, and it remains—in contrast to manicured parks, gardens and other cultivated landscapes—the one setting that a sojourner is unable to claim as his own handiwork.

These spiritual values make wilderness a theological reservoir, an arena that can be at least as faith-nurturing as any sanctuary built of brick or steel. Perhaps more significant, it is just such qualities as awe, silence and solitude that have drained from the life of many religious institutions preoccupied with meetings, fund raising and administrative work. Wilderness provides one of the rare contemporary wellsprings for a restoration of contemplative values.

During a panel discussion at the Sierra Club's 1967 Wilderness Conference, one of the participants—a Unitarian minister—was asked why the church "doesn't get into this [wilderness preservation] battle all over the land and put its weight behind the whole effort?"

The minister replied that there was no reason why it could not; support could indeed be forthcoming.

But it hasn't happened. Some churches, stung by criticism from historian Lynn White and others who have blamed the Judeo-Christian tradition for the "ecologic crisis," have wrestled with their alleged culpability by focusing attention on a variety of environmental problems: pollution, pesticides, overpopulation. But seldom has their concern extended to wilderness.

Particularly from the pulpit, wilderness is evoked primarily as a metaphor, usually to describe a state of disorientation or despair, not as a living, life-restoring reality to protect for future generations. The oversight is not so much a matter of contempt—as though backcountry travel still hinted of dalliance with Pan—as of neglect: Wilderness simply has not been an element in the theological consciousness.

And this is where environmentalists can come in, challenging those clergy and their congregations unfamiliar with wilderness to discern its *breadth*—its importance as a reservoir not only for wildlife, natural cycles and genetic diversity, but for intangible bounties as well.

The environmentalists' burden, obviously, is not to provide some kind of ecclesiastical gloss: Religious communities have their own rich resources from which to fashion affirmative approaches to wilderness.

But it is not too much to expect those more familiar with backcountry's spiritual values to illuminate for others. In speaking of awe, silence and solitude, environmentalists will not only be speaking a common language with the religious community, but helping to recall the role played by wilderness throughout history in fostering reverence and humility.

This they could do in practical ways by speaking in houses of worship or addressing religious forums. Environmentalists who are also members of religious denominations could craft within their own spiritual traditions a vision of stewardship that includes wilderness.

A recent article in *Sierra* (September/October, 1982) explored possibilities for building coalitions; the authors pointed out the unlikely array of organizations that have already joined in specific environmental efforts: ranchers, labor unions, medical associations, civil organizations.

The account mentioned only secular groups. But the time has come to enlist others in the effort to preserve the few remaining islands of wild country. Wilderness will remain vulnerable to economic pressures until there evolves a far more broad-based acquaintance with its power to refresh the human spirit. Religious communities have a long-neglected role in helping to keep intact those places where, as David Brower has written, "the hand of God has not been obscured by the industry of man."

Wallace Stegner once sketched the untrammeled regions of desert, mountain and forest as "a part of the geography of hope." What should not be forgotten is that wilderness has always been, as well, a part of the geography of faith.

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A Communication Model of Human Exploration and Discovery

Today many people envision scientific knowledge as completely impersonal, thereby being free of all human values and of all risk. Scientific knowledge, from this point of view, bears no similarity to other human endeavors such as art, philosophy, or religion. This perspective has filtered down to the general public where it is widely accepted. It's adoption by secondary school students and college undergraduates may partially account for declining enrollments in science courses. For this reason I have for the last two years taught an undergraduate seminar at New Jersey Institute of Technology entitled *Aspects of Scientific Creativity* that presents an alternative to this dehumanized portrait of science. In this endeavor the epistemology of the physical chemist and later sociologist of science,

Michael Polanyi, was particularly helpful; he envisioned the scientist to be a whole person continually engaged in the exploration of external reality, such exploration taking place in the context of communication with other human beings and physical reality. The following model of the scientist as a communicating explorer is intended to capture Polanyi's central insight that science is a unique but nevertheless personal activity, for to use Polanyi's own phrase: all knowledge, even scientific knowledge, is *personal knowledge.* The model is schematically portrayed in Figure 1 where the human mind, represented by three subsystems interacting hierarchically with one another, is actively engaged in ongoing communication with external reality. Students taking the seminar on scientific creativity found the Figure to be helpful in providing a visual summary of the complex, personal nature of scientific investigation.

The three subsystems that represent the human mind's functioning as an explorer are deeply embedded in personal commitments often tacitly rather than explicitly held. These three subsystems are: (a) the core of the mind, those ultimate commitments that tacitly undergird all mental activity; (b) one's theories and conjectures about external reality; and (c) the particular mental models that one uses in describing the external world. All three subsystems of the mind are deeply embedded in a theoretical outlook on the world. All aspects of science, the data chosen, the problems considered, the priorities established, the investigative methods used, and final interpretations given are fundamentally related to a particular theoretical structure. And when we, as scientists, *indwell* such a theoretical framework in order to gain knowledge, we are only tacitly and subsidiarily aware of all the details of the framework, for they point beyond themselves to a new whole, an integrated perspective that provides their meaning.

> *Indwelling* is the activity of knowing whereby the mind dwells in a coherence or integration latent in some object (or teaching or person) in order to interiorise it until there is a structural kinship between the knowing subject and the object known.[1]

By utilizing such a structure of tacit and subsidiary awareness we can actually know far more than we can tell. Such indwelling knowledge is intimately related to the community aspect of science, for we best acquire such tacit skills when we live and work in a community of knowers who affirm a common vision of reality.

What is the nature of commitment in science that establishes the personal character of scientific knowledge and makes it similar to art, philosophy and religion? Scientific commitments may be characterized as either ultimate or working in nature. Science is totally dependent upon certain ultimate or fundamental commitments for its very existence. These basic beliefs come to be believed as the scientist, acting as a whole person, encounters experience in its totality. As such they cannot be "proved" but are yet truly rational for they are genuine personal responses to the totality and richness of the flow of human experience. Such commitments are truly ultimate in that there is no higher or wider system for which they can be derived. A classic example of such an ultimate commitment "is the conviction that there is order in the universe which we would have to assume in order to prove; but without such a conviction we could not believe that the universe is accessible to scientific inquiry."[2]

It is under the motivation and guidance of these ultimate commitments that the scientific community develops its working commitments, the particular paradigm-structure of theory and natural law that are used to describe a restricted region of reality. Such working commitments, or explicit scientific theories, are provisional in nature; they are continually tested against experience that brings about both enhancement and modification. The provisional nature of all scientific theories

> is itself grounded in the ultimate belief in the contingency of the universe, i.e., that the universe might have been otherwise, that it could well have been different. It is belief in the contingency of the universe that is also the determining ground for the conviction that in our search for order and regularity in the universe we cannot do without experimental questioning and nature itself, and that our understanding of the order and regularity of the universe which we formulate in natural laws and theories may well have to be changed.[3]

Thus we see that it is under the controlling power of ultimate commitments that working commitment, or theories develop. But another factor also plays a role.

Theory formulation is greatly aided by the human mind's ability to construct specific models of particular phenomena being observed.[4] Such models are imagined mechanisms or processes that are postulated by analogy with familiar mechanisms or processes. They help one make sense of specific perceptions, but they are not literal pictures of reality. Models are learned from the scientific community as well as being derived from specific observations. From such models of reality an overall theory is built that describes, ties together, and in some sense explains the nature of the relationships between phenomena. Existing theories guide all model building. As models develop they can enhance and alter such theories. Note that the personal character of scientific knowledge manifested as an integration of ultimate commitments, working beliefs or theories, and models in dialogue (communication) with external reality can itself be pictorially modelled as Figure 1 indicates.

The personal character of scientific knowledge is again seen in the respective roles that human communities, the scientific community and the whole society, playing in developing and maintaining a framework of commitments, ultimate and working, as well as specific models of portions of reality. As Thomas F. Torrance points out:

> . . . the framework of belief is embodied in the existence and continuity of a scientific community, that is in groups of like-minded scientific inquiries or in the world-wide community of scientists who share a common belief in the existence of reality and its intelligibility, and who exercise among themselves control through mutual criticism and conjoint verification of their work, in the course of which their common beliefs are tested and clarified and deepened. It is only within the continuity of such a supporting community and the tradition it carries that the basic beliefs are transmitted from generation to generation in such a way as to give power and thrust to its search for deeper and deeper understanding. But all the time the community's normative beliefs (working beliefs or theories, parentheses mine) are, or ought to be, steadily re-examined in the course of this expansion in understanding, so that they are continuously put to the test and reappropriated.[5]

Furthermore the scientific community does not devise and maintain its commitments independent of the larger society it is embedded in. Indeed the whole structure of scientific authority as we have envisioned it would collapse if separated from the larger society's ultimate commitment to such basic trusts as:

> . . . the belief in obtaining the truth by free discussion and free inquiry. Every scientist is a part of the government of science and participates in formulation of ongoing scientific understanding. There is no absolute central authority to arbitrate controversy. Issues are settled by debating them in the forum of public opinion. This manner of settling disputes and establishing consensus is a heritage common to our general democratic institutions.[6]

Second and corollary

> is a belief in the reality of the truth and our obligation and capacity to discover it. A community that resolves its disputes by free discussion and inquiry is dependent upon the belief that humans can recognize and share a rational and universal standard.[7]

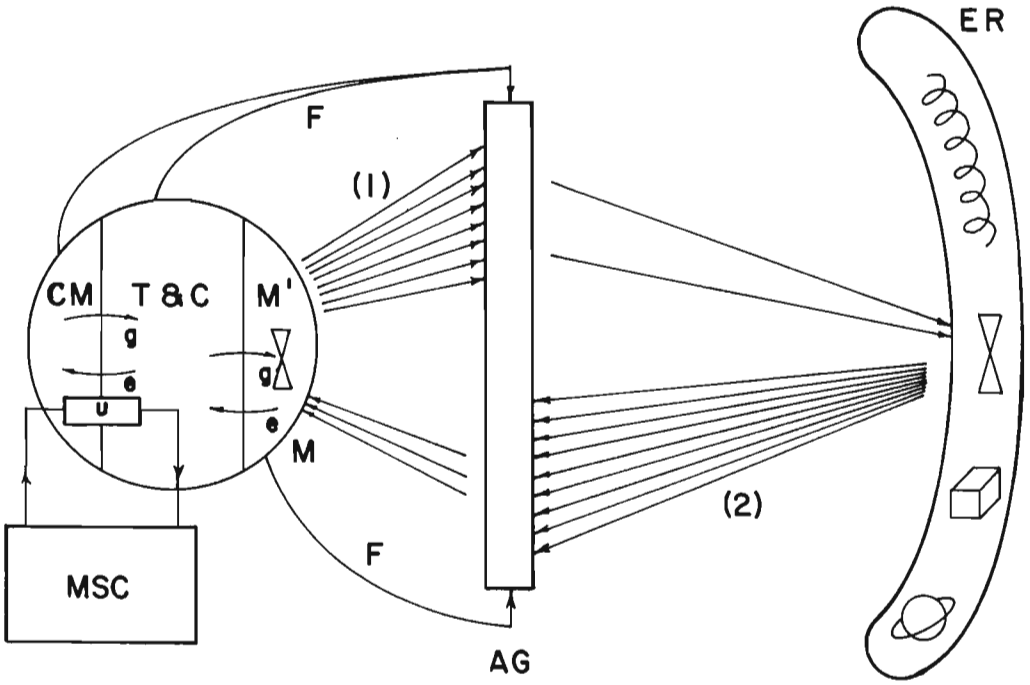

Figure 1. A Communication Model of the Human Explorer

ER—External Reality.

M—The mind of the human explorer, the level of mental organization, can be thought of as three subsystems interacting hierarchically with one another. These mental systems are: (a) *CM*—The core of the mind, those ultimate commitments (basic presuppositions) that tacitly undergird all mental activity. Without belief (rarely made explicit) in some basic presuppositions, human thought about oneself and external reality is impossible. Such ultimate commitments are responses to the totality and richness of all human experience; they provide essential motivation and guidance to all acts of human communication with external reality. By their tacit direction particular paradigms of theories are formulated; these theoretical structures enable the communication process to become specific and concrete. (b) *T & C*—Theories and conjectures about external reality. These working commitments come about as the thinker attempts to understand and to find order with respect to one's communications with external reality. In their formulation guidance is provided by one's core presuppositions about the external world; they can, in turn, alter and enhance specific core presuppositions. (c) *M'*—Specific mental structures, models that the mind uses to represent a portion of the external world that is being communicated with. These models come into being as a result of observations interacting with theory; they are guided by theories and can enhance and alter specific theories.
g—Guides.

e—Enhances and Alters.

AG—The attention grid (a mental filter). This grid consists of three layers build up by Feedback, *F*, from the three subsystems of the mind. The function of the attention grid is twofold: (a) The specific mental structure generates many affirmations and questions (1); the attention grid selects out for transmission to external reality those that are in harmony with one's basic presuppositions, theories, the models of immediate experience. (b) Much information reaches the observer from external reality (2). The attention grid excludes all information not relevant to one's models of immediate experience, theories, and basic presuppositions.

The communication process between the human explorer and external reality can be of several specific forms:

(a) Observation. A simple, one-way message from a physical object or another human being.

(b) An Experiment. (1) Messages that assume the form of measuring processes directed by human theories and conjectures at external reality. These messages are designed as "questions" expressed through measuring processes. (2) Responses are specific "answers" (usually quantitative) to the given measurement probes. These responses, guided by one's theories and conjectures about physical reality lead to further measurement probes. The signals *1* and *2* are *not symmetric* in the sense that in principle, *1* is structured freely by the mind and *2* is structurally determined by the inherent order of the object under investigation. *2* represents the completion of a feedback loop with respect to the human communicator; such loops are essential to all true communicative acts.

(c) A Personal Encounter. (1) Message from one person to another consisting of affirmations and questions. (2) Responses from the other person consisting of both affirmations and further questions. These affirmations guided by one's theories and conjectures about the other person lead to further messages. The messages *1* and *2* are symmetric in the sense of both intrinsically being structured freely by human minds. *2* represents the completion of a feedback loop with respect to the human communicator, such loops are essential to all true communicative acts.

MSC—The metasystem of culture, the matrix of human values and basic presuppositions unique to a given culture.

U—Undecidability. Basic questions that are undecidable from within the context of the observer's core presuppositions and theories.

This dependence of science upon the values and experience of the larger culture has been stated in striking fashion by Victor F. Weisskopf. He has . . .

> pointed out that science itself has its roots and origins outside its own rational realm of thinking. In essence, there seems to exist a Goedel's 'Theorem of Science,' which holds that science is only possible within a larger framework of non-scientific issues and concerns. The mathematician Goedel proved that a system of axioms can never be based on itself, in order to prove (decide upon, parentheses mine) its validity, statements from outside the system must be used. In a similar manner, the activity of science is necessarily embedded in a much wider realm of human experience.[8]

In other words the methodologies, tactics, and presuppositions of science do not arise entirely from within science; in order to decide upon their validity, resources from outside science must be used. As an example scientists often use the criterion of simplicity in evaluating theories; by simplicity is meant the possibility of finding a conceptual point of reference that unifies a wide variety of experience by the use of a minimum number of primary concepts and interelationships. Does not the justification for this belief in the simplicity of scientific descriptions of the world come from the ultimate belief that the universe is harmonious and beautiful, a view long held to be true by the larger culture's philosophers, religious prophets, and artists? This dependence of science upon the values of the larger culture is represented in Figure 1 by the metasystem of culture which resolves questions that are undecidable from within the scientific communities ultimate and working commitments.

Up to this point, the discussion of Figure 1 has concentrated upon developing a rationale for the human mind portrayed as a structure of commitment systems interacting hierarchically with one another. But Figure 1 has one other important aspect, for human mind does not exist in a vacuum but is in continual communication with external reality. This communication between the human mind and external reality, by means of the attention grid, is filtered through a matrix of the mind's basic presuppositions, theories, and models of immediate experience. This filtering causes both the questions and affirmations one addresses to external reality and one's observations of external reality to be deeply influenced by the activities of the commitment-embedded structure of the human mind. Accordingly neither one's observations nor one's questioning of external reality are independent of the ongoing activity of a human mind. It is in this sense that all knowledge is personal knowledge, for knowledge cannot exist independent of the person seeking it. But to affirm that all knowledge including scientific knowledge is personal is not to downgrade it, for such knowledge can be truthful in that it faithfully though not exhaustively represents that portion of reality that is being focused upon.

In summary, Figure 1 presents a model of the human explorer in which the mind represented as three interacting subsystems is in ongoing dialogue with physical reality. It is an attempt to capture the most significant aspects of human exploration and discovery. What has been argued is that the observations, experiments, and personal encounter present in all acts of discovery are not performed in a random or haphazard manner; they always are guided by models of external reality formulated by the mind; these models in turn are guided by structures of working commitments, that is, one's theories and conjectures about external reality. Furthermore one's models and theories concerning reality are not created through the evaluation of objective data alone but also are formed and molded by the core of the mind, the framework of a person's ultimate commitments as to the nature of reality. It is this framework of ultimate commitments that motivates one in the integration of cognitive and volitional insights and urges. Biblically this core of ultimate convictions is called in the Old Testament "the heart" and is thought of as the center from which springs the deepest motivations that guide us as human beings in continual dialogue with God and all His creation. From the heart springs one's deepest personal commitments concerning the ultimate rationality of all reality, one's standards of intellectual and moral integrity, and, finally, one's criteria for intellectual beauty. All these play a key role in guiding theory formulation. Such theories, in turn, guide the creation of specific models of external reality. Note that communication flow between the three subsystems of the mind is two-way. The success of specific models can both enhance and alter the theories or working commitments that guide the formulation of models; and, in turn, the resulting success or failures of theories can both enhance and alter those ultimate commitments that guide theory formulation.

[1]Thomas F. Torrance, editor, *Belief in Science and in Christian Life*, The Handsel Press, Great Britain, 1980, "Notes on Terms and Concepts" by Torrance, p. 139.
[2]Torrance, *Ibid.*, "The Framework of Belief" by Torrance, p. 19.
[3]Torrance, *Ibid.*, "The Framework of Belief" by Torrance, p. 20.
[4]I.G. Barbour, *Myths, Models, and Paradigms*, Harper & Row, New York, 1974.
[5]Torrance, *Op. Cit.*, "The Framework of Belief" by Torrance, p. 21.
[6]R. Gelwick, *The Way of Discovery*, Oxford University Press, New York, 1977, p. 46.
[7]Gelwick, *Op. Cit.*, p. 46.
[8]V.T. Weisskopf, "The Frontier and Limits of Science," *American Scientist*, 65, p. 411 (1977).

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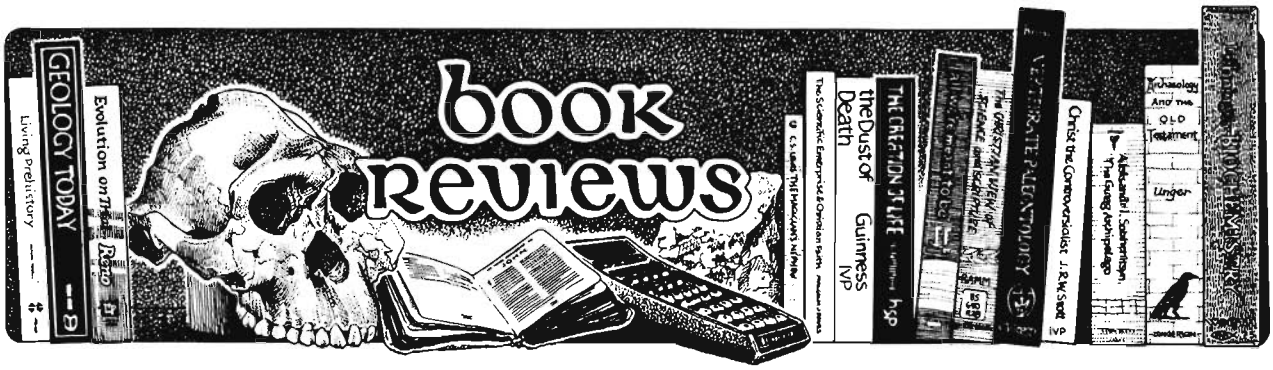

HANDBOOK TO HAPPINESS—A GUIDE TO VICTORIOUS LIVING AND EFFECTIVE COUNSELING, by Charles R. Solomon, Tyndale House Publishers, Wheaton, Ill., 1979, $3.95.

The author, Charles Solomon, is the founder and executive director of Grace Fellowship International (GFI), which is an organization incorporated (in Denver, Colorado) in 1969 "for the express purpose of implementing a spiritual counseling ministry." The focal point of this ministry—and this book—is what Solomon calls "Spirituotherapy." One of the main presuppositions behind Spirituotherapy is that all of human behavior can be explained by the trichotomous constructs of soul, spirit, and body:

> The *soul* might be called our self-consciousness or the vehicle through which we relate to others, actually our psychological makeup. The *spirit* is our God-consciousness or the facet of our makeup by which we relate to God. The *body*, of course, is the means by which we relate to the world or our environment through our five senses. In summary, we relate to others through our soul, to God through our spirit, and to our environment through our body. The soul is composed of the mind or intellect, the emotions or affections, and the will or volition. Similarly, the spirit has the functions of intuition, conscience, and communion.

Solomon, in his Spirituotherapy, believes that spiritual growth is at the heart of all counseling. Evangelicals who enjoy studying Bible typologies will probably find his analysis of the "stages of spiritual growth" to be highly provocative.

Toward the end of the book, Solomon cites testimonies of people who have gone through Spirituotherapy's program. According to Solomon, the program's success is measured in terms of a "transformed life," brought about largely through a "deliverance from enslaving emotional symptoms, which is contingent upon . . . studying the Word . . . and *total* surrender" to God (if this totality is lacking, Solomon states that the counselee must be told to "go out and suffer some more;" subsequent to this, it is the Holy Spirit who becomes the "Master Therapist" for this person while he/she is at GFI).

Because of numerous simplistic and/or debatable assertions by Solomon, this reviewer has great difficulty taking this book seriously. Although space prohibits listing all of these statements, these two are typical examples: (1) "The identity crisis really started back two generations where those in their forties today did not receive from their parents an active faith in Jesus Christ;" (2) "The underlying cause of every phobia is a faulty faith."

This reviewer also has a negative reaction to Solomon's sweeping attacks on psychotherapists—both Christian and non-Christian. Although constructive criticism is welcome and needed, Solomon is unnecessarily harsh and categorical in his condemnation.

Readers who like the counseling books of Jay Adams will probably like this book as well; readers who dislike many of Adams' anti-psychological statements will in all probability also dislike views of Solomon's such as: "To attempt therapy in the realm of the psyche or mind is folly since it is merely symptomatic treatment;" "The use of psychology should stop with understanding. Attempting psychological treatment or psychotherapy is an exercise in futility."

Although this reviewer's reading of this book has not helped him in his counseling with college students and other counselees, Solomon's books will no doubt continue to sell well among fundamentalist evangelicals (*Handbook to Happiness* has gone through at least seven printings, and Jay Adams' books always sell very well). Unfortunately, many evangelical psychotherapists are put on the defensive by Solomon and Adams, and the end result is that once again evangelicals use up valuable time and energy fighting each other rather than joining forces to fulfill the scriptural mandates of our Lord and Savior Jesus Christ. We need fewer battles and more high-level exchange of ideas among Christian professionals.

Reviewed by Howard Shirley, Professor, Psychology of Religion and Pastoral Counseling, Conception Seminary College, Conception, Missouri 64433.

BEYOND BUDDHISM by J. Isamu Yamamoto, 1982 Inter-Varsity, $5.50 PB, 141 pp.

This American author had a devout, serene, peaceful Buddhist grandfather and a Christian mother. He tells of the personal suffering he had to endure during World War II because of his Japanese forebears. He decided to follow Christ, who accepted suffering, but did not succumb to it. He preferred to go *beyond Buddhist* peace based on passionless benevolence; he chose the compassionate way of the cross.

The author rejects the idea that all religions lead to the same summit by different paths; the goals themselves are

quite different. He prefers the Christian future life to the Buddhist samsara (continuous round of death and rebirth); he finds the notion of a just karmer (dependence of the future on the present, which is governed by the past) attractive, but he rejects the Buddhist deliverance by nirvana (annihilation of the separate self at death) in favor of the Christian eternal life, beginning here and now, "as it is in heaven"—a different summit.

Always in search of a personal Creator, he cannot be satisfied with Buddha. This confession is given toward the end in a chapter on "Jesus Christ." It is preceded by an informative survey of Buddhism, beginning with the life and times of the historical Buddha, including his ethical teachings such as the Four Holy Truths and the Noble Eightfold Path. He discusses its three major philosophies: fundamentalist Theravada Buddhism (Hinayana—little vehicle) prevalent in Sri Lanka (Ceylon); popular, compassionate Mahayana (great vehicle) Buddhism; and Vahrayana (diamond vehicle) Buddhism common in Tibet and Mongolia-Tantric Buddhism emphasizing meditation techniques. The history of Buddhism is outlined: its removal from its native India, its acceptance as one of China's three major religions—prior to antireligious actions of Maoist communism, its absorption in Japanese culture as Amidist and Zen sects. "Contemporary Buddhist Movements" include Chinese Buddhism in Taiwan and Hong Kong, various new Japanese sects (Reiyukai, Rissho Koseikai, Soka Gakkai) and particularly the traditional Zen ("means different things for different people" e.g., compassion leading to detachment; or "the life, the truth, and the way;" or a koan like "the frog jumped into a pond, Plop!") popular in the U.S., and the Buddhist Church of America (50,000 members).

Reviewed by Raymond J. Seeger, NSF retired, Bethesda, Maryland.

THE SPIRITUAL NEEDS OF CHILDREN by Judith A. Shelly, et al., InterVarsity 1982; pb. 148pp; $4.95

This is a challenging book on the often neglected spiritual concerns of children as a phase of whole-person health! The author of Part I (and editor of Part II), an associate director for Nurses Christian Fellowship, has prepared a table relating Piaget's Stages of Cognitive Development to spiritual development; a professor of nursing has a complementary one related to Erikson's eight stages of man.

The first part, "Spiritual Growth and Development," is largely a theoretical discussion based primarily upon surveys such as that of the Lutheran church of 1970, NCF studies of three church groups (1981), et al. The results are all informative, but hardly objective inasmuch as the sampling method is not obvious; moreover, there is no evidence that the questions employed were definitive or independent—nor is there any indication as to probable error in the conclusions. (An advertised feature of the book is the inclusion of 25 drawings by children (ages 4–11); the adult interpretations are not convincing.)

Part II, "Spiritual Assessment and Intervention" is practically more valuable because it contains experiences of workers in the field; for example, recognition of spiritual needs by a regional director of NCF, images of God by a pediatric hospital chaplain, suffering of children by the general director of the Christian Medical Society, dying children by a coordinator for Handi Vangelism, feelings of inadequacy by a staff nurse.

In an appendix there are listed 48 characteristics of spiritual concerns, distress, and despair, which are not sharply differentiated. A helpful appendix is included on the Nurses Christian Fellowship.

Reviewed by Raymond J. Seeger, NSF (retired), Bethesda, Maryland.

SIGN OF THE KINGDOM, by Leslie Newbigin. Wm. B. Eerdman, 1981. 70 pp.

A book on missiology by Leslie Newbigin immediately attracts attention. His provocative analyses and biblical insights are helpful even to those who disagree with him. This slender volume contains three lectures given in 1979 on the theme that would be dealt with at the World Council of Churches conference in Melbourne, 1980.

A very personal book in which Newbigin describes his "sense of nausea" over inadequate theological statements, *Sign of the Kingdom* gives a historical sketch of the predominant themes in conciliar Protestantism, a brief study of the biblical materials concerning the Kingdom of God, and then addresses some burning issues of contemporary missiology.

The sign of the Kingdom to which Newbigin refers is the church. Not the church as a self-serving society, but as a continuation of the ministry of Jesus Christ. The church is a sign of the Kingdom "in the same sense in which Jesus was a sign of the Kingdom" (p. 45). As he spells this out in crisp succinct language, he takes issue with Liberation Theology, the Church Growth school of missiology, liberal theology, and pietistic spirituality.

Newbigin rejects capitalism as being based in gluttony and materialism, and Marxism as oppressing people now in order to produce a future utopia. He advocates radical obedience to the sovereign God, the King of history. He calls the Church to serve the God who acts justly, rather than to adopt programs of justice, since the Kingdom is defined and determined by the King, not by slogans.

This book is refreshingly candid and direct. It is a Christ-centered call to the church to be faithful to her King while being a communtiy "for the world."

Reviewed by Joseph M. Martin, Professor of Missions, Edward Lane Bible Institute, Brasil.

THE ENVIRONMENTAL CRISIS: THE ETHICAL DILEMMA edited by Edwin R. Squiers, AuSable Trails Institute of Environmental Studies, Route #2, Big Twin Lake, Mancelona, Michigan 49659, 375 pp.

Unless this is the first book review column you have ever read, you are acquainted with all of the faults associated with symposium volumes. *The Environmental Crisis* shows that being avowedly Christian does not guarantee that a symposium publication will be coherent, well put together, and up-to-date. Nonetheless, some of the twenty-six essays were valuable, at least to me. I would like to mention five of them in particular.

The book is loosely divided into three sections. The first, "Environmental Ethics" includes essays by Loren Wilkinson, Laurence C. Walker and Keith Yandell. Wilkinson writes clearly and originally about what the Bible and church history have to say to use about our relationship to the environment. Walker, a forestry professor, whose essay is entitled "Selfishness and the Environmental Ethic," cites Robert Louis Stevenson as finding Thoreau's attitude to be basically selfish, expounds on the reasons for identifying Thoreau as such, and proposes that many environmentalists have the same attitude. He continues by arguing persuasively for clearcutting, the use of prescribed fire, and herbicide spraying, under some conditions. Yandell uses the tools of logical philosophy to examine the currently popular idea that the adoption of a non-Western world-view is necessary for sound environmental practices, and finds the idea wanting—Buddhism won't work as the source of an acceptable environmental ethic.

The second section includes four essays on "Ethics and Environmental Policy." The third contains two papers on "Ethics and Energy" that I found especially stimulating. The first of these is "The Ethics of Strip-Mining Coal in Montana," by Wesley Granbers-Michaelson. This author points out the parallels between historic exploitative colonialism and some present-day events. Vernon Ehlers proposes twenty theses for a Christian stewardship of energy resources, which, it seems to me, are biblically, ecologically and economically sound.

I have not mentioned several other excellent essays, nor a few that range from the trite to the ridiculous. In sum, a book of definite, if limited, usefulness.

Reviewed by Martin LaBar, Visiting Professor, Bryan College, Dayton, Tennessee 37321.

THE DIVINE INSPIRATION OF HOLY SCRIPTURE by William J. Abraham. Oxford University Press, 1981. 126 pp. $27.95.

One repeatedly debated doctrine, especially among evangelicals, is the inspiration of Scripture. One recent offering in this debate that has received much attention, especially by reviewers, is W. Abraham's attempt to articulate an evangelical account of inspiration following the tradition of Wesley, Clarke, and Asbury that avoids what he perceives as pitfalls in the widely-held view of B. B. Warfield and J. I. Packer. Couched between a relatively lengthy introduction and a postscript are five short chapters in which the author attempts this mammoth task.

The first and longest chapter contains Abraham's critique of the Warfield position with its emphasis on inerrancy, which, he suggests, neither stands in continuity with earlier tradition nor is internally consistent, the former because it rejects the dictation theory of preceding generations and the latter because it presupposes that very theory.

After critiquing three English alternatives to Warfield (Chapter 2), the author presents his own theory (Chapter 3), suggesting that the key to understanding divine inspiration is found in the principle of analogy in human inspiration, a key that other theories have overlooked. Hence, God "inspires in, with, and through his special revelatory acts and through his personal guidance of those who wrote and put together the various parts of the Bible" (p. 67).

With this model in mind, Abraham then shows his evangelical commitment by defending the proposition that divine revelation includes not only historical acts but also interpreta-

Books Received and Available for Review

(Please contact the Book Review Editor if you would like to review one of these books.)

H. Andelin, *All About Raising Children* (Bantam)

J. Barr, *Holy Scripture: Canon, Authority, Criticism* (Westminster Press)

B. Caprio, *The Woman Sealed in the Tower* (A Psychological Approach to Feminine Spirituality)

E. Costello, *Signing: How to Speak with Your Hands* (Bantam)

P.C. Craigie, *Ugarit and the Old Testament* (Eerdmans)

W. Denton and J.H. Denton, *Creative Couples: The Growth Factor in Marriage* (Westminster)

S.L. Jaki, *Angels, Apes and Men* (Sherwood Sugden)

G.A. Kennedy, *Greek Rhetoric Under Christian Emperors* (Princeton University)

A.D. Lester, *Coping with Your Anger: A Christian Guide* (Westminster Press)

J. McDowell and J. Gilchrist, *The Islam Debate* (Campus Crusade)

R.H. Nash, *Social Justice and the Christian Church* (Mott Media)

U.S. Owens, *And the Trees Clap Their Hands* (Faith, Perception, and the New Physics) (Eerdmans)

W. Pannenberg (trans. by G.H. Kehm), *Basic Questions in Theology*, Vols. I & II (Westminster)

J. Rifkin, *Algeny* (Viking Press)

J. Salk, *Anatomy of Reality* (Merging of Intuition and Reason) (Columbia U. Press)

L.B. Smedes, *Mere Morality* (What God Expects from Ordinary People) (Eerdmans)

A. Storr (ed.), *The Essential Jung* (Princeton)

H. Thielicke, *Living with Death* (Eerdmans)

W.A. Visser't Hooft, *The Fatherhood of God in an Age of Emancipation* (Westminster)

G.S. Wilmore, *Black and Presbyterian* (The Heritage and the Hope) (Westminster)

tion mediated through inspired human agents (Chapter 4). In the final chapter, the author turns to the biblical data in an attempt to show the affinity of his theory with scriptural statements. The postscript is both a summary and a challenge to the evangelical community to build upon his Wesleyan tradition in developing a doctrine of inspiration that is more adequate than Warfield's.

Abraham is to be lauded for his attempt to nudge conservatives beyond their often unbending dogmastism and for his willingness to offer a fresh approach to the issue. Although his suggestion is worthy of consideration, it retains some of the very problems that he sees in Warfield. Abraham rejects the idea of divine speaking as a proper basis for an inspiration theory (p. 58), but then lapses into the same category himself (p. 66 and Chapter 4). Similarly, he criticizes inerrancy as necessarily presupposing dictation, but then defends scriptural "reliability" with the very logic he has dismissed: "God . . . is omniscient and infallible. Therefore what he inspires will bear significant marks of truth and reliability" (p. 68).

Actually, the basic deficiency of the book is its brevity. The attempt to cover the territory in 118 pages results in gaps in reasoning patterns. It is doubtful that anyone will be swayed from inerrancy to Abraham's "reliability" by this work, especially at the unaffordable price of $27.95.

Reviewed by Stanley J. Grenz, Assistant Professor of Theology, North American Baptist Seminary, Sioux Falls, South Dakota.

A WORLD OF DIFFERENCE by Thom Hopler. Inter Varsity Press, 223 pp. $5.95, 1981.

This book arrived in my mailbox about the time my wife and I were considering re-instituting our contacts with international students at a nearby state college. Thom Hopler's insights into cross-cultural ministries are certain to affect these relationships.

Thom's notes and tapes were assembled and edited by Inter Varsity Press personnel with the aid and support of Mrs. Hopler, and published posthumously. Thom speaks from deep personal commitment to reach other cultures with Christ's message, and cites numerous examples of his experiences and methods. As a specialist in urban ministries for IVCF working in Newark, N.J., he had ample opportunity to exercise his commitment in an urban setting. He brought two Christian teachers in Newark public schools together, canvassed the neighborhoods to find Christian families and their churches, and together were able to ease two teachers preaching Muslim theology out of the school system. Later a new principal was assigned to the school who, it turned out, was a Christian. Cooperatively, they were able to significantly improve the level of education. Thom weaves many more such experiences into the book.

The editors have organized the book into three sections: A Cultural Survey of the Bible, Genesis through Acts; Communicating Christ Today where many of his experiences are described; Christ Beyond Culture. Each section has new insights into familiar words and practices.

I heartily recommend Thom's philosophy and methods.

Reviewed by Robert Carlstrom, Huntington, N.Y.

SCIENCE AND THE QUEST FOR MEANING by Donald MacKay. Wm. B. Eerdmans, Grand Rapids, Michigan, (1982), 75 pp, $3.95

This small book addresses two questions concerning meaning; has science destroyed meaning and what does science mean? After answering the first question in the negative MacKay proceeds to articulate areas where science enhances meaning. These lectures are not aimed so much at their obvious detractors such as Monod and Dawkins (who would claim that science has discounted traditional meanings) but more subtly toward those who react against science's supposed destruction of meaning by rejecting science, such as Theodore Roszak. These two issues concerning meaning congeal around this emphasis.

In the initial segment MacKay defends three features of the scientific approach that particularly offend the modern romantic like Roszak: (1) an emphasis on the facts, (2) a spectator's standpoint and, (3) making the world impersonal. These are all defended in a balanced way that recognizes the excesses of scientists in these areas that have so fueled the fires of their critics. The last part of this lecture affirms that the meanings of the Christian worldview are not threatened by the modern notions of chance and reductionism (and its logical partner determinism). The ideas on reductionism (nothing-buttery) have been developed by MacKay in more detail in his other writings and are concisely reviewed here. The piece on chance and how it is erroneously viewed as " . . . some kind of capricious agent—an alternative to the God of order . . . " is particularly interesting.

The second half of the book is concerned with the meaning of practicing science and might alternatively have been entitled the validity of practicing sicence. It begins by defending the thesis that science is rationally undergirded by the Christian view of the cosmos: that the God of order upholds the universe according to rational (therefore knowable) laws. MacKay sees miracles interpolating in this orderly scheme if we keep in mind God's overarching plan of redemption as well as His rationality. Assuming that science is a worthwhile endeavor, MacKay shows how an increased accountability and awe result from increased scientific knowledge. Before summarizing this half, MacKay interjects his ideas on the debate concerning objectivity or the nature of scientific truth. He sees science's claim to objective truth as legitimate and particularly legitimate for the Christian whose objectivity is based on a God who is outside of His creation.

One would certainly welcome a more detailed treatment of this subject from the author. The book ends with a comment on the temptation of the scientist to ignore his moral responsibilities.

Among the many admirable features of this book is the inclusion of the discussions that followed these ideas when they were presented as the Pascal Lectures at the University of Waterloo. The discussions are interesting from the standpoint of seeing people's reaction to MacKay's ideas and also to have some clarification from the speaker on how his ideas relate to those of other scholars (such as the ideas of J. Ellul as brought out in one discussion). Though many of these ideas have been presented elsewhere by MacKay, their conciseness and clear format in this book make it well worthwhile. The personal witness to MacKay's genuineness given by John North in the introduction is the icing on the cake we so welcome when one considers the eminence as a scientist and as a Christian Donald MacKay has attained.

Reviewed by Gary M. Doolittle, Molecular Biology, University of Oregon, Eugene, Oregon.

COSMOS AND CREATOR by Stanley L. Jaki; Scottish Academic Press (1980) xii + 168 pages; $7.50 paper.

This book is an argument that the concepts of the Cosmos and the Creator must be held together in order for either to be fully meaningful. The Introduction states the claim of the book to be "that he who says cosmos must say Creator in the traditional sense if man's sense of reality, purpose, and consistency deserve more than lip-service." The last sentence in the book is: "In a very crucial sense, one must first say Creator in order to say Cosmos."

Chapter 1, "An Uneasy Fashion," deals with several cosmogonies, outlining the Big Bang, steady-state, and oscillating universe theories. The cosmos is seen as something "radically given" to the cosmologist, and modern science is seen as making room for, and in fact requiring, a Creator. The second chapter, "The Cosmos of Science," centers on the idea and role of beauty in scientific theory.

> In facing up to such a universe—thoroughly coherent, strikingly specific in space and in time, in its entirety and in its details, and exclusive in its oneness—the most reasonable attitude seems to accept it as something given, and given by a Creator.

Third, "The Dogma of Creation" concentrates on the foundational role that creation must play in Christian theology, as it does in the Scriptures.

Next, "A Bookish Philosophy" examines philosophical trends and underlying assumptions. The starting point for philosophising should be God, as Creator of the world. The claim is that scientific development is pushing philosophy relentlessly in that direction. Finally, "A Trap or a Home" looks at the relationship of the universe to man.

> It was only within Christianity as a social matrix, that there arose the broadly shared conviction that existence, cosmic and human, was not a trap, precisely because the universe could be viewed as a home once Creator and creation were in full view.

In particular, with respect to the popular interest in Extra-terrestrial intelligence, only (Christian) theists can look forward with confidence to potential encounters, since only they could realistically expect such beings to understand a common brotherhood "based on common dependence on the Creator."

At times complex subjects are treated in a summary fashion (as is necessary to handle the material in a monograph of this size) but the book is stimulating and well-written. The importance of creation in science, in philosophy, in theology, and in philosophy, in theology, and in popular thought, is well recognized by readers of this *Journal*. This book will reinforce such thinking.

Reviewed by David T. Barnard, Director of Computing Services and Associate Professor of Computing and Information Sciences, Queen's University, Kingston, Ontario, Canada.

A LOVING GOD AND A SUFFERING WORLD by John Tal Murphree, InverVarsity Press, Downers Grove, Illinois, 1981, 126 pages, $4.50.

Subtitled "A New Look at an Old Problem," *A Loving God and a Suffering World* deals with a theme currently being discussed in both the religious and secular press. Kushner's *When Bad Things Happen to Good People* has been on the best seller list for months, and *Why Me? Why Mine?* by Paul Andrus addresses the problem from a religious stance.

The author, John Tal Murphree, with degrees in theology and philosophy, is currently professor of evangelism at Toccoa Falls College in Georgia. He approaches the topic in diffident and gingerly fashion, chronically reminding the reader that there are no panaceas to suffering. Since no explanation of pain is totally satisfying, a tentative judgment is all that is possible in this world.

This thorny problem with universal appeal simply stated is this: if God is good and all powerful, why is there suffering in the world? Murphree's theodicy is written in terms a layman can understand. He is a good writer with a penchant for cogent and clear analysis. May this book have many readers—theist and atheist alike.

Murphree seeks to deal with both the intellectual and emotional problem of suffering while admitting that the latter is the most difficult. He writes for both believers and skeptics of Christianity.

At certain points in the book, the reader will feel like arguing with Murphree. But the author is insightful in anticipating objections and seeking to answer them.

The author believes that the best possible arrangement for humans is moral freedom and its corollary of evil. Since God wanted to create free humans, suffering is inevitable because people will sin. If humans are not free to engage in acts that produce pain, they are not free.

Murphree says "freedom means that I can make a choice that is uncaused by any factor other than my ability to choose." This is not a very satisfying definition and is more semantical than substantive. The intellectual problem that this presents for the positivistic behaviorist is how a construct like freedom interacts with such forces as heredity and environment. This is not discussed.

Ultimately, the only answer to the problem of evil and suffering is that God decreed it so and that His glory is thereby enhanced. Why God made such a world, the Apostle Paul implies, is a question that should not be directed at the Creator. He is the Potter, we the clay.

Reviewed by Richard Ruble, John Brown University, Siloam Springs, Arkansas 72761.

FROM BEING TO BECOMING: TIME AND COMPLEXITY IN THE PHYSICAL SCIENCES by Ilya Prigogine. Freeman, San Francisco, 1980, 272 pp, $12.95

This book explains some of the recent advances in understanding the role of "time and the laws of change" in physics and chemistry, and discusses some of the philosophical implications of the new ideas about time that have resulted from this research. Historically, a tension has existed between classical and quantum mechanics on the one hand, which are deterministic and reversible, and thermodynamics (and human experience) on the other, which are non-deterministic, probabilistic, and irreversible. The apparent irreconcilability of these two approaches has led some physicists (Einstein, for example) to argue that the irreversibility of thermodynamics is an illusion, and that the future states of systems are strictly determined by the laws of mechanics. However, recent advances in mechanics have shown that, while the deterministic equations of mechanics are not wrong, deterministic concepts have only a limited validity when applied to most complex (i.e., non-trivial) systems. Instead, it is more useful to treat such systems probabilistically.

Prigogine explains and develops this tension between the mechanical and thermodynamical branches of physics, and highlights his own work aimed at making sense out of the dilemma. His fundamental conclusion is that the proper way to reconcile the two approaches is to understand them as *complementary* descriptions of physical systems. As with the wave/particle complementarity in Quantum Mechanics, neither one of the complementary pictures alone provides an exhaustive description of nature.

Prigogine includes an extensive discussion of how this complementarity can be developed mathematically—and discusses its rather subtle implications for how "time" is understood in physics. Along the way he also discusses his Nobel-Prize winning work dealing with self-organizing and other non-linear systems, reviewing how "dissipative structures" are predicted to form spontaneously under certain conditions, with applications for chemistry, physics, biology, and even sociology.

The book, then, is a good review of Prigogine's work, and includes numerous references to the original literature. Its level, unfortunately, is still rather advanced, presupposing a familiarity with classical and quantum mechanics. Readers without this background will miss most of the force and beauty of the arguments presented—but still might benefit from the conclusions, and from the discussions of dissipative structures.

Despite the book's technical content, it is nevertheless important to a wider audience because of the many indirect ways that it comes to bear on issues of science and religion. The evidence presented for the limitations of deterministic descriptions for nontrivial systems provides new input into the determinism/free will discussions and suggests that determinists may have to modify or soften their positions. The recent advances in understanding "dissipative structures," which spontaneously order themselves in far-from-equilibrium situations, not only have implications for models of biological and social evolution, but also pose new questions about the compellingness of design arguments for the existence of God. The discussion of dissipative structures also gives qualitative and quantitative flesh to the idea that "the whole is greater than the sum of its parts," and provides a good basis for explaining in what ways biology is more than "just chemistry." Dissipative structures can be viewed in fact as a sort of vital principle, and it would be interesting to explore the implications of a new vitalism formulated along these lines.

Reviewed by Kurt Wood, 23 Ave Charles Flahault, 34100 Montpellier, France.

THE APOCALYPSE UNSEALED by Robert F. Riggs, New York: Philosphical Library, 1981, 312 pages, $18.95 cloth.

This book is the first dabbling in the field of biblical exegesis by the author, who claims to be an MIT alumnus and a professional inventor, writer, and engineer. His main thesis is accurately capsulized on the jacket notes:

> The theme of this work is that the Revelation of Saint John is an accurate prophecy of significant historical events in Christendom and Islam from the first century until the present time. The final chapters reveal the Advents of the nineteenth century Persian Prophets Bahá'u'lláh and the Báb, and prophesy cataclysmic events that may occur in the present century.

In other words, Riggs reads the Apocalypse through the prism of his commitment to an Islamic sect, Bahai, founded in the nineteenth century by a "prophet," Bahaullah, who has been hailed by his followers as the fulfillment of the yearnings of all the great world religions, and with whose appearing the "New Age" in which the "Brotherhood of Man" could

become a reality had dawned.

The author utilizes quotations from Bahaullah's writings, references to beliefs of ancient astrologers, and an intricate system of numerology as support for his attempt to fit the biblical text into his religious understanding of world history. For example, Riggs views Revelation 19:13 as a prophecy concerning the coming of his nineteenth century Messianic claimant in that "The Word of God, *O logos theou,* has a literal value of 927 and an archetypal value of 9, the number of Bahá" (p. 220). The universal significance of the Bahai faith and its founder is similarly to be discovered in the Apocalypse in that the seven churches of the opening chapters "represent seven Divinely revealed Faiths," namely and in order: the Sabaean, Jewish, Hindu, Zoroastrian, Buddhist, Christian, and Muslim religions (p. 49).

It is obvious that Riggs' book with its fanciful scheme is of little value as a serious attempt to exegete Revelation. The Christian who firmly believes in Jesus of Nazarath as God's complete and unique self-disclosure will react strongly against both the author's thesis and his manipulation of the inspired document. The book may have some value as a primary source for the study of Bahai beliefs, but unless one is interested in religious studies, *The Apocalypse Unsealed* is not worth reading and much less worth buying.

Reviewed by Stanley J. Grenz, North American Baptist Seminary, Sioux Falls, South Dakota.

BETWEEN TWO WORLDS by John R. W. Stott. Wm. B. Eerdmans, Grand Rapids, Michigan, 1982, 357 pp., $12.95 (cloth)

Preaching is the bridge that connects the world of the biblical authors with the world of contemporary Christians: this is the thesis of Dr. Stott, rector emeritus of All Souls, London, and Director of the London Institute of Contemporary Christianity. Hence the subtitle of this book: "The Art of Preaching in the Twentieth Century," which begins with the dictum, "Preaching is indispensable to Christianity." Michael Green, editor, notes in his preface, "The standard of preaching in the modern world is deplorable. . . . What is now needed is a revival of confident, intelligent, relevant, biblical preaching."

In the first chapter, "The Story of Preaching: a Historical Sketch," the author reviews concisely God's speaking through the prophets, His Son, and the Holy Spirit. He concludes, "In the western world the decline of preaching . . . is a symptom of the decline of the Church." "Contemporary Objectives to Preaching" are analyzed as due to the anti-authority mood ("to 'preach' has come to mean to give advice in an offensive, tedious, or obtrusive manner . . . there is no such thing as a truth which is absolute and therefore universal."), the cybernetic revolution, and the Church's loss of confidence in the Gospel. A Christian response is that

> preaching is unique and irreplaceable; . . . too many sermons are written in the imperative mode, whereas the religion of the Bible is written large in the revealing language of the indicative mode. . . . The anti-authority mood makes people unwilling to listen, addiction to TV makes them unable to do so, and the contemporary atmosphere of doubt makes many preachers unwilling and unable to speak.

Next follows a discussion of "The Theological Foundations for Preaching," "Biblical expository," i.e., convictions with respect to God, Scripture, the Church, and the pastorate. The author notes, "There is much uncertainty in the modern Church about the nature and function of the professional Christian ministry." He recommends a "ministerial" team-approach including full-time and part-time, clerical and lay, stipendiary and voluntary, male and female.

The paramount need is to regard "Preaching as Bridge Building" across the cultural gulf between the two worlds (greater than that currently between C.P. Snow's two academic cultures). The extreme conservative and the extreme liberal (radical) are quite dangerous unless they are bridged. One must not ignore either truth or relevance; the eternal Christ must be presented as our contemporary. We must be concerned with the major themes of human life, ethics for Christians, social and political issues. The author urges the development of a Christian mind and its use, particularly the handling of controversial issues.

In order to accomplish this objective a preacher must respond to "The Call to Study" and the need to pray. Biblical study should be open-minded and comprehensive (inductive, i.e., from particular texts to general principles). Dr. Stott recommends cumulative study over short periods, and, for modern relevance, reading and resource groups leading to responsive commitment of authentic love. He advocates "more cooperation between clergy and laity in the process of sermon making." He makes practical suggestions on "Preparing Sermons," e.g., choosing a text, meditation on it, isolation of the dominant thought, arrangement of the material, including an interesting introduction and a motivating conclusion. He recommends writing a sermon for precision, but delivering it enthusiastically from notes—immediately after prayer.

The last two chapters deal with the preacher as a real person, his sincerity (meaning what he says and doing it) and his earnestness (feeling what he says), his courage and his humility ("pride is without doubt the chief occupational hazard of the preacher"). A preacher's humility should comprise "a humble mind (being submissive to the word of God), a humble ambition (desiring an encounter to take place between Christ and His people), and a humble dependence (relying on the power of the Holy Spirit)."

This readable book is highly recommended! It is replete with historical incidents and biographical notes.

Reviewed by Raymond J. Seeger, 4507 Wetherill Rd. Bethesda, Maryland 20816

Letters

Thoughts on "Unity in Creation"

In regards to the "Unity in Creation" theme (*Journal ASA*, 3, 1–19 (1983)), it is *overview* that affords us a glimpse—if not outright observation—of Unity's manifestation and cohesiveness.

Leegwater, Dooyeweerd (as mentioned by Russell Maatman), and others, whose unity views take detours at "Modality Street" and "Physical Entity Lane," have fallen victim to the trap that lies in wait for the mechanically-logical mind: the trap of *number*.

To view Unity as is, was and will continue to be for the foreseeable future, the mind must rise above "number" or else be forever bogged down in the legalism of quantum weirdness and the endlessness of combinations allowed by physical mechanics—or both.

The object is to truly see the entire forest and not become exhausted and frustrated trying to count the number of super-sub-atomic particles (and their colorations) in each and every leaf within the stand of trees.

True, in order to innovate and manufacture, the physicist and chemist must know the characteristics of their building blocks. However, in many cases, while the human mind envisions the overall unity of a particular motion or a particular molecular structure, often lost is the vision of how the motion or structure fits into the grand scheme of on-going creation.

What to do . . . what to do . . .
Stood at the station,
so engrossed with the schedule;
never turned around
to see my train go by.

I shall now present a personal "overview."

Perhaps the 'Unity' concept can be brought into clearer focus if, for the sake of discussion, we all accept a premise:

All that is is all.

Now, reduce "all that is" to a base identity and you'll have:

All that is is energy.

And even in its simplest form, energy did not (and cannot) come about as a result of self-motivity, not at a "Genesis stage." The only explanation left:

All energy that is is God.

From the simplest equation to the most profound and complex truth to be realized by man:

God is.

Here, in this declaration, we have complete Unity of Creation. Here we have the *only* reality. This is, as we perceive it, the true matrix of overwhelming order and physical discipline. The closer we look, either out into the Universe or within the atom, it becomes crystal clear that the sense of orderliness of creation is not of random happenstance but of Divine guidance, a guidance that is necessary to eliminate chaos and ensure structural achievement. Hence individuality; hence difference.

Simple enough.

However, where does human *free will* come to being tolerated within the "Unity" scheme (God's Law)?

Man does have the ability to challenge God's Law (the physical operation guidelines of Unity as we are able to comprehend) and does so on occasion. How can such actions on man's part fit into a unified-operative reality?

Would not man be at odds with God's Unity—thus causing disunity in the Universal "Garden of Eden"?

Definitely yes, in the theological-religio sense. But, in viewing from the "mountain of accommodation," let us observe another premise:

Everything that exists in creation is reciprocal.

Everything that concerns God and nature is reciprocal. Man can either work in united harmony with God, or work against Him. Man can either work to destroy, or work with God to create.

Man on earth is co-creator with God and he is co-destroyer also. As time progresses, man will reach out and colonize the Universe; "co-creation" and "co-destruction" will also cross the galaxies.

This is not to say, though, that a Unified Creation is not capable of absorbing the motions—the thrashings about—of man. Create as he may, man still cannot out-perform God. Destroy as he is wont, and still man will come in second-best.

Man can surely create to great degrees within the parameters of God's Unity—but, when absolute challenges are thrown against the Unified Law of Reciprocity, man will forever fail.

From whence the first wave of energy was set into motion by the Will of God, right to the present, the Unified Creation has never once suffered an aberration of intent.

This . . . what we perceive . . . came from God. So that we may better understand what has taken place, God's Will transitioned into Word, and that Word was manifested as flesh and blood—to explain the law of unity and to instruct man by example. Was it not Jesus who truthfully and clearly gave us the first interweavings of the tapestry that is made up of life as we now live it and life in Heaven? Was it not Jesus who told us to avoid stumbling over and being preoccupied with those things that are going on about us in this world, but instead to turn our full attention to God in Heaven. Jesus did, in fact, tell us in no uncertain terms that what we have here and now is but a small sliver of time in the overall immenseness of God's creation. The Unity of Creation was never more clearly pronounced than through Jesus Christ. Finally, to perpetuate the Word and to strengthen the new hosts of it, man, God unleashed the force of forces within man and upon the earth, the Holy Spirit.

In conclusion, all of what I've remarked on serves to reenforce the Unity of Creation—to keep man and Universe close to God the Creator. There is a theological ramification to the "Unity" concept, though, an admonition that cannot be overlooked by any Christian: Remember, everything is reciprocal. We can either love God and work with Him in life everlasting or we can do the opposite and come to learn and experience the reciprocal of God's Will—Hell.

P.S. Your magazine is a rewarding pleasure to read. God's strength to you and your staff in the future.

Donald N. McKay

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Founded in 1941 out of a concern for the relationship between science and Christian faith, the **American Scientific Affiliation** is an association of men and women who have made a personal commitment of themselves and their lives to Jesus Christ as Lord and Savior, and who have made a personal commitment of themselves and their lives to a scientific description of the world. The purpose of the Affiliation is to explore any and every area relating Christian faith and science. The *Journal ASA* is one of the means by which the results of such exploration are made known for the benefit and criticism of the Christian community and of the scientific community.

A closely affiliated organization, the **Canadian Christian and Scientific Affiliation,** was formed in 1973 with a distinctively Canadian orientation. The **CSCA** and the **ASA** share sponsorship of the publication. **CSCA** subscribes to the same statement of faith as the **ASA** and has the same general structure. However, it has its own governing body with a separate annual meeting in Canada.

Members of both organizations endorse the following statement of faith: (1) *The Holy Scriptures are the inspired Word of God, the only unerring guide of faith and conduct.* (2) *Jesus Christ is the Son of God and through His Atonement is the one and only Mediator between God and man.* (3) *God is the Creator of the physical universe. Certain laws are discernible in the manner in which God upholds the universe. The scientific approach is capable of giving reliable information about the natural world.*

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"Upholding the Universe by His Word of Power" Hebrews 1:3

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