Zygon | *Journal of* RELIGION AND SCIENCE VOL. 3, NO. 2

THE ONTOLOGY OF EVIL

by Frank L. Lambert

THE ESSENCE OF EVIL

Evil, as seen by an individual, is a deeply unwanted interruption of his own preferred dynamic patterns of life and thought. This definition of evil is broad indeed. It must be so. It must include that which is merely a slightly irritating personal situation and that which is a nationwide calamity. The difference between these events, in terms of evil, is in the magnitude of the undesirability of the pattern interruption. But each individual embodies his hierarchy of magnitudes (as a result of many factors, of course). Consciously or not, he chooses his own borderline where discomfort blends into something more threatening: into what he calls evil. A barely discernible annoyance to a "normal" person is intensely foreboding to the paranoiac, while the destruction of an entire country—if it is the working of the Lord—may not be at all evil to an Amos. But we each partake of everyman. Evil is seen and defined by us as a serious, unwanted interruption of or threat to our own particular life patterns.

An automobile catastrophe, an undeserved demotion, the onset of cancer, a subtle verbal insult, or a robbery—each fits this description of evil befalling us. Such interruptions of our desired order amount to an unsettling *randomization* of our patterns. They may be temporary or prolonged. But they are each disordering. Slight or massive random-

Frank L. Lambert is professor of chemistry at Occidental College.

ization can be caused by the incursion of violent events in nature, or by the physical crossing of others' desired patterns with ours, or even from our learning of modes of belief and action that are contrary to what we believe to be most desirable for ourself and others.

But what of life in a disadvantaged environment without any possible escape? What of the death of a husband which may confine the young mother inexorably to a life of work until her children are grown? What of a Nazi tyranny which devises concentration camps for a race? These surely are varieties of evil. Yet the end results here are not a randomizing of life patterns or thought arrangements. Rather they typify the opposite extreme of crystallizing life into what can be a deadening subhuman order; the result more resembles the ceaseless and restricted vibrations of ions in a brittle salt crystal than the interplay of freedom and constraint in a living organism. This type of evil is excessive order—a *crystallization* into less mutable, less free patterns.

Randomization or crystallization, these are the immediate and opposite signs of evil in our lives: either too many unasked-for choices are thrust upon us or life is confined to what we see as a rigid and stifling order.

Sources of Evil: Some Traditional Approaches

Using such terms as "the Adversary" or "the Discreative," some modern theologians have reasserted the Pauline idea that demonic forces (including a devil) exist which are in opposition to God and which cause evil.[1] Still maintained by some conservative sects is the Augustinian concept that God's wholly good creation was corrupted by Adam's fall and that the the curse laid upon him is the source of evil for his posterity. Less conservative individuals would maintain that demythologizing the fall would still leave a core idea that a change occurred in man's world sometime in its past history.

Others, such as Niebuhr, offer no specific origin for evil, but implicitly discuss the evil caused by man as a universal inclination within him.[2] Brightman would say that "there is reality beyond man's will which makes righteousness hard."[3] Barth relates at least some evil not lying within man as having its source in *das Nichtige,* a chaotic realm which has its source in one aspect of the Divine life[4]—"the dark side of God."

Although these are serious attempts to solve a problem, they may not appear enlightening or convincing to many. Perhaps some clarification can result from looking at the physical world as it is commonly described by science and as it affects us.

Basic Statistical Thermodynamics: The Two Tendencies

Two irreducible properties of matter describe the behavior of any inanimate arrangement (any "system") of matter and energy. First, matter tends to occupy the lowest energy level (or lowest "quantum state") available to it. Second (and in opposition), if energy is at a constant level, matter acts so as to occupy any one of all of the possible quantum states with equal probability. The first property is *ordering* in the sense that it tends to restrict or confine matter and energy to the lowest energy level. In contrast, the second property is *dispersive* and *disordering* in that it is associated with randomness: a system may be found in any one of many possible equal-energy states at any given moment instead of being uniquely located in some single state.

In homely terms, all matter that is warmer than absolute zero tends to move toward the lowest available energy level; it goes downhill. This is the confining, ordering thermodynamic trend. But at the same time, matter-energy systems tend to occupy any one of the many available equal-energy states rather than congregate in one state or to be localized at one position in space. This second trend is randomizing; matter tends to be disorderly.

Inanimate systems of objects and energy inevitably move toward a *stable* equilibrium or balance of the downhill (ordering) tendency and the non-localizing (disordering) tendency. Only in this non-anthropomorphic sense of movement toward an ultimate equilibrium does inanimate matter have "goal" or "purpose." Its unidirectional nature superficially resembles animate goal seeking. Matter's "destiny" is a stable equilibrium which involves a dynamic balance between the two fundamental thermodynamic tendencies that oppose one another.

Thermodynamics and Living Systems

In contrast with inanimate systems, which tend to move spontaneously toward a stable, unchanging balance point or equilibrium, all mature living organisms maintain themselves in *metastable* equilibrium at high energy levels. (Many metastable systems of inanimate matter are possible, but none spontaneously increases in enormous complexity and in energy content as does, for example, the infant as he develops to the mature adult.) Life in any form is a thermodynamically improbable arrangement of matter in that it consists of matter at a high energy level and maintained at a metastable, always imminently changeable, tension point between the two opposing tendencies of order and randomness.

A mechanical analogy involving a frictionless ball and equally fric-

tionless hills and valleys can clarify the contrast between a stable, an unstable, and a metastable equilibrium:

A stable equilibrium would be represented by Figure 1, in which the ball does not have a great deal of energy but ceaselessly rolls back and forth across the bottom of the valley and part way up the sides of the hills. This would be a moderate-energy system with some order, some

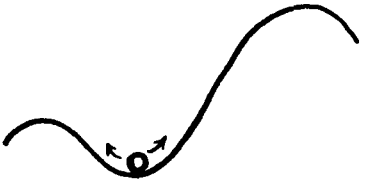

FIG. 1.—Stable equilibrium

restriction, but also many different possibilities for the position of the ball. If energy is removed from the ball to some outside reservoir, the ball would rest in only one position at the valley bottom, a low-energy, stable situation.

An unstable equilibrium would be shown by Figure 2, wherein the round ball is poised at the smooth top of a hill. This is not a probable resting place; the slightest sideward force on the ball would result in its rolling downhill. This is a high-energy situation with much potential for the ball to move to many positions on the hills. If energy is

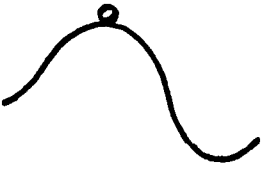

FIG. 2.—Unstable equilibrium

removed from the ball, it will fall to rest at the bottom of the valley. A lower energy situation than that shown in Figure 2 would obviously be one of greater order with no potential for variations in the position of the ball.

A metastable equilibrium would be a system in which the ball is prevented from dropping to a lower level by barriers of adjacent small hills, as in Figure 3. This differs from a stable equilibrium in that there are lower valleys than the ball's present position to which the ball could fall. Thus, a metastable equilibrium is comparable to an unstable equilibrium because a relatively small input of energy (or dis-

ruption of the system by "tunneling" through one of the small barrier hills) will allow the ball to drop to a lower energy level. In this sense, the metastable situation is one of tension between randomness and order, between the possibility of the ball moving to any one of a number of different positions on the hillside or the valley if tunneling could occur (a rough parallel to randomness) and the ball's continuing to be confined at a high energy level by the barrier hills (a rough parallel to complex order).

In relatively high energy systems, such as our earth with its sun, inanimate matter is greatly patterned and orderly only when there is little possibility for change. Such a tautology becomes significant when it is contrasted with the behavior of living organisms. Salt or sugar crystals have beautifully symmetrical shapes because of the strong attractive forces which hold their individual particles in regular array. But as a further consequence of these attractive forces, crystals lack the potential to change their rigid structures into radically new patterns,

FIG. 3.—Metastable equilibrium

or to move spontaneously through space. Conversely, inanimate matter which is capable of change or is freely mobile, such as the darting molecules in a gas or the particles of dust in a storm, shows little pattern. Great molecular "freedom"—in the sense of a number of different possibilities of position or momentum—does not ordinarily coexist with a great deal of order in material systems. Thus, the combination of great order *with* the possibility of change which is always present in the metastable organism is qualitatively improbable from the standpoint of thermodynamics.

Animate creatures have not been quantitatively treated by thermodynamics. They may never be. However, it is generally agreed that living organisms function as metastable dynamic flow systems, such as whirlpools or steady flames,[5] which are just now being essayed quantitatively. The overwhelmingly greater complexity of a plant or an animal than that of a flame is obvious. The flame takes in matter and releases altered matter and energy, but it contains relatively few subsystems and can tolerate only slight amounts of change in its input

or its environment. Even modest changes can upset a flame system so much that it cannot maintain its metastable equilibrium and it goes out. In thermodynamic terms, this means that the individual parts of the flow system (e.g., the fuel, oxidizer, and intermediate products) are no longer a complexly ordered, interacting group of substances which form a metastable equilibrium system at a high energy level. The individual substances still may be in metastable equilibrium, but they are no longer at a high energy level and they are no longer in complex interrelationship.

The animate is a metastable flow system with a staggering number of constant, yet dynamic, interdependent biochemical subsystems which make the creature capable of adapting to multifarious changes in its environment. The very large but precisely patterned molecules and the intricate but regularly occurring reactions are illustrations of the complex order in an organism. But, because the chemical systems in animate matter are at a relatively high energy level, they also have a large potential for changing or for becoming less ordered. Both complex order and the great possibility of randomness are combined in living creatures—a very improbable situation from the reference point of a crystal of salt or a mountain, or even an isolated DNA molecule.

The term "dynamic homeostasis"[6] has been used to encompass all the media and mechanisms by which the organism maintains itself within narrow physiological limits despite wide environmental variations. Such homeostasis prevents the metastable high-energy system of the animate from rapidly moving to a low energy level of stable, unrelating chemicals. Thus, the totality of homeostasis could be said to form the protective set of "hill barriers" which prevent a metastable system from becoming unstable (cf. Figs. 2 and 3). *However, both fundamental trends of thermodynamics underlie the behavior of every molecule which is reacting in the organism at every instant.* If the complex interaction of biochemical systems is massively impeded, or even if minute traces of toxins block a crucial physicochemical process, a vital group of subsystems may no longer be correlated. The "homeostatic hill" has been tunneled.

But it is this elegant interrelation of substances and cells, this physiological homeostasis, which is essential to maintenance of the metastable equilibrium. Separate, relatively non-relating groups of chemicals, whether in the liver or in the brain or in the hand, inevitably follow trends described by the thermodynamics for inanimate matter; and the chemical substances must move down from the metastable state toward the stable equilibrium. Death can be caused by either thermo-

dynamic tendency becoming dominant: by excessive ordering ("crystallization") so that there is limited adaptability toward stress, or by excessive disorder in any part so that the whole interrelated organism fails to function as a unit. And the death of the organism is the ultimate evil to the individual's physical being.

Goal or purpose in humans can be viewed from the physiological or the psychological vantage point. Physiologically, the mature adult is a clear example of homeostasis. His usual (conscious or unconscious) purpose is maintenance of his biochemical system at nearly the same level despite a changing environment. (A zoologist would put it more simply: "An individual organism's goal is to live.") Psychologically, man's purposes may vary widely (*vide infra*), but one common goal appears to be dynamic homeostasis on the mental level: a maintenance of already acquired and accepted patterns of individual and social belief and action by more facile acceptance of the new input which conforms to these preferred mental patterns.

By contrast, in the growing, truly creative, young person, purpose is evidenced by continual movement toward new metastable equilibria wherein new energy states are actively sought (a randomizing drive), and these states are incorporated in the organism, including its consciousness, by an increase in complex patterning (an organizing drive). Less generally, this statement of purpose simply implies the intake of food to build the physiology and of information to build the mental constructs according to the individual's preferred—*but consciously changing*—patterns. The physiological processes are largely but not absolutely automatic, of course. Biochemical homeostasis can be moved to a new metastable energy level by the youth who develops himself athletically. Mental homeostasis should be equally or more easily alterable, and this suggestion that such a mental homeostasis has physicochemical bases may well be more than an analogy. That memory, thought, and mental patterns are chemically based is not now a bold prediction. All results of brain action may be physically based, even though the ensemble as a whole may produce effects which are not predictable from simple physical science.

The most remarkable aspect of a creative individual's existence is not the maintenance of his physical self and his system of mental constructs at a given metastable energy level—improbable as that dynamic homeostasis alone may be in an inanimate world. In a significant fraction of his goal-seeking activities, the more creative individual purposely moves toward new complex order and new possibilities for change, new metastable equilibrium valleys, some of which are at higher

energy levels than the initial state. (Higher metastable energy levels in mental processes would involve both increased order, such as the development of a more complex network of mental constructs, and increased possibilities of randomization, such as the retention of disparate or ambiguous input information which does not immediately fit any prior mental pattern.) These remarkable aspects of creative humans contrast even more starkly with the normative movement of inanimate systems toward the lower energy levels of more stable equilibria, like the inanimate ball which rolls down from the hilltop, releases energy to a reservoir, and achieves order but loses potential for change.

The less creative person infrequently searches for new physiological or mental metastable levels of complexity and, perhaps even more rarely, for such new equilibrium points at higher energy levels. Even the dull individual occasionally seeks the novel and the unsettling, but his over-all goal is to move toward more nearly stable equilibria at lower energy levels where mental pattern breaking is minimized either by rejection of new input information or by incorporating it incorrectly into already rigid mental constructs. His goal is more order, more stability, less possibility of randomization of concepts, and less uncertainty; but it is achieved by the loss of potentially useful new ideas and choices. On the other hand, the youth with vigor and an active mind spurns the rigid order of the dull and the aged, but sometimes he overlooks the difficulty and the necessity of setting up a homeostatic system at higher and higher energy levels. Ignoring the need for a complex system of constructs to cope with his eagerly accepted but random input, such a youth psychologically corresponds more closely to an unstable equilibrium than to a metastable system with some homeostatic guards against instability. He may have reduced the tension inherent in a feedback system with its complex patterns, but he has thereby accepted a life which may approach nearly complete disorder. (The parallels to freedom and political order in a society are apparent.) The mental constructs of an individual largely determine his impact on his environment: his use of the physical energy and the information available to him in interacting with the society and the material world about him.

It is because of evolutionary selection that modern man has the protective barriers of homeostatic mechanisms to preserve his metastable biochemical system. Through time, only those individuals with the more effective protective mechanisms withstood the vagaries of external and internal stress and were able to survive to breed. But al-

though natural selection has provided for homeostasis, it also provides for a certain degree of randomization. The selection of the bisexual randomizing of genes is an example at one level. The capacity for curiosity, for play, for seeking the new, is apparently a common attribute at the level of general behavior of the modern primates. It is not difficult to postulate why these traits of play among animals or, more importantly, why the trait of curiosity, coupled with cerebral processing to integrate the new input, by the early humanoid should be selected for in the evolutionary process.[7]

Those individuals with a slight excess over the low "normal" capacity of their protohuman group for seeking the new food, the new living space after disease, the better water supply, would have an advantage over their fellows in surviving radical changes in their environment. Consequently, it is not improbable that the present universal desire in youth for novelty and for change, even though it is repressed in some cultures, is a normal result of evolutionary selection. The mental-physical search for the novel would have had no evolutionary advantage past the age of maximal breeding and therefore would probably follow a declining distribution in the population older than thirty. Thus, with increasing age, we tend less frequently to seek new metastable mental equilibria where both ideational patterns and new input or mental processing, which might mean pattern scission, are held in tension—equilibria where the mental homeostatic mechanisms may be weak or not constructable, where the metastable situation may readily and quickly change to an unstable system.

Evil and the Unstable Equilibria of Life

Man variously defines evil as that which threateningly interferes with the particular values of his existing metastable physiological and psychological equilibrium. *But evil is always immediately possible if evil is merely a tipping of the scales of so nearly an unstable balance.*

A slight physical weariness or an ounce of alcohol which increases mental disorder just enough to upset a complex metastable conceptual relationship is enough to lead to a serious family argument—or the failure of an international conference.

Cancer is simply a cell growth which does not conform to the normal organizing tendencies of the human organism. An earthquake which kills thousands is no more and no less than inanimate matter corresponding to the trends described by thermodynamics. If the organizing tendency of the animate is not present to guide and control this relatively high-energy world, in the long run the scales will tip toward a disorder which will threaten human life, slightly or fatally.

The source of the tipping needs no personalization, no demon. It can be any person-related factor or any impersonal factor, such as wind or weather, in the individual's environment. It can be simply the momentary relaxation of the homeostatic or randomness-order tension by the individual himself. The natural trend of spontaneous processes for inanimate matter, either outside the individual or in his biochemical systems, will assure the occasional intrusion of disorder (under many physical circumstances) or "crystallization" (under some circumstances). Either can mean evil to the life patterns of the individual.

Disorder is the more common danger in a high-energy physical system. This would correspond literally to a society whose members interact with moving matter frequently, whether via automobiles or airplanes, dishwashers or power mowers. More subtly, but as literally, it also corresponds to the systems of chemicals which are in our bodies and brains. A high-energy physical system would be analogous to a high "cultural energy" society wherein new facts, new things, new notions are being widely spread without the presence of strongly countering unifying concepts.

The opposite result, crystallization, is characteristic of a low-energy system of matter. This would correspond to a society where there is little physical energy available for significant alteration of the environment or, less literally, little new information or divergent ideas with their potential for randomizing old mental or physical patterns. But this is not the energy-rich world of the animate; this is the world of the salt crystal and the snowflake. They are charming, but they lack the dynamic instability of the living being that permits it to change to different (and occasionally higher) metastable levels.

Usually, individuals are far more disturbed by interruptions of their chosen life patterns that are caused by other persons than they are by almost identical randomization caused by the forces of nature. A serious automobile accident can result from metal fatigue in our car's axle or from carefree teen-agers who run into us. Even if the physical results were the same, our emotional reactions to the two causes would probably be markedly different. Our especial sense of frustration at man-caused "evil" (which can mount to revulsion at the wickedness of the offenders) is basically due to the emotional impact of realizing that others do not share our desired patterns. That theirs are different implies a rejection of our values. Furthermore, the ease with which our chosen order is upset by other persons introduces (or reinforces) uncertainty and the always lurking fear of chaos in our lives. The majority of history's tyrants and politically "wicked" men were not trying to do anything but that which was good in their own eyes. Their evil lay in

their violent breaking of the established patterns of millions of other individuals.

Even if social or political evil is recognized simply as seriously unwanted pattern disturbance caused by others, there remains the question of a man's willing violation of his own previous ideas of the "good." Why do we find pleasure in the forbidden, or in the breaking of a code that we intellectually believe to be the best for us and for others? Why does man want to sin, to do other than his previously chosen "best"? The answer is twofold. First, as has already been implied in discussing the origin of purpose in man, we find pleasure in seeking new unstable situations—and this includes code breaking—because of a basic emotional feedback which was once (and may still be) an evolutionary necessity, a requirement for survival. Only those protohuman individuals in the past of the race who had the reward of a pleasurable psychological and advantageous physiological feedback ventured consistently beyond the established boundaries of primitive living—circumscribed as it was by a hostile environment and by the earliest taboos. Those singular creatures in whom play and rudimentary experimentation were emotionally rewarded were best able to survive new environmental conditions and to mate. We carry their genetic inheritance in the primal chemical and electrical programming of our brains: the search for new untested patterns, and thence for new metastable equilibria is the basis of creative human activity. We should not be surprised (or develop a theory of original sin) when this fundamental pleasure in code breaking conflicts with our culturally acquired programs of ethical codes. (In a narrow sense of life as only a pattern-maintaining system, the built-in tendency for pattern-changing is of course disruptive and could be called an aspect of original sin.[8] But insofar as life also requires pattern breaking to achieve new complex order, pattern breaking within limits is a good rather than a sin.)

Second, man wants to do less than his best whenever he drops from a high "mountain valley" of metastable mental equilibrium (where he holds ideational order and a multitude of choices in great tension) to a lower valley of lesser tension, or tunnels his homeostatic barriers to change the mountain valley to an unstable situation (where randomness is increased at the expense of complex order) or when he drops toward the stability of the lowest valley (where simple order predominates). Yet movement from a metastable to a less unstable equilibrium is a normal, spontaneous event in inanimate nature. It is only kept from occurring in the patterns of man's brain and behavior by a con-

tinuous forcing together of order and disorder, by his application of unifying patterns to a disorderly world of notions and emotions, of matter and energy. Even momentary relaxation of his tension of holding randomness in a complexly ordered pattern may lead to a new metastable equilibrium of lower energy. Without overriding control, the chemicals inside and outside his brain tend to move down the energy hills toward stable equilibria. If the results of the relaxation are primarily physical, we call it laziness or weariness. If the creative tension is momentarily abandoned in the area of interpersonal relations, the results are frequently what we call evil. In any case, they are not due to the intervention of any new force or a dark underworld. They are simply animate and creative man abandoning his improbable metastable situation of mental tension for a more probable and more nearly stable equilibrium—the natural spontaneous process for an inanimate system of chemicals. But whatever man's goal is, it is not merely conforming to the natural behavioral patterns of inanimate chemicals.

The "demonic" (more in the popular sense than as used by Tillich)[9] is a convenient verbalism for any extreme assault or insult to our established metastable homeostasis and order-randomness balances. It can come from a chance concatenation of several events as a powerful impetus toward excessive order (pre-1939 Germany) or excessive randomness (1945 Germany). Similarly, chance combinations of body chemistry and random social influences can impel an individual to planned heinous acts or wild, amok destructiveness. No new category of biochemistry, psychology, or theology is needed to explain "demonic" events.

The ultimate origin of evil lies simply in the nature of the physical world. If the "big bang" theory is correct, in the *ab initio* creation of the world, we could say that God must have concentrated energy at a very high quantum level. Then, as a prime physicochemical attribute, he demonstrated an ability to create the ultimate in unstable equilibria. If he could create it, he could have maintained it. But it is the unusual characteristic of the human to maintain a far more modest metastable equilibrium. In this sense of correspondence, in words used by Tillich for a different meaning, God would thus be the true ground of our being.

Most probably, it is an unjustifiable extrapolation to relate thermodynamics to God's nature. Further, the "big bang" theory of creation may not be correct. But the source of evil (which we individually sense as a threat to our metastable, potentially unstable, order-randomness balance) is not a "problem" in the sense of being inexplicable. It is a

clear and simple concomitant of the physical world in which we live, a world which does not favor an unstable equilibrium of order and randomness in general.

However, there has been, during the past couple billion years of the earth's history, selected from a small fraction of the total interactions of matter and energy a most surprising chain of events, whose present structures are continuously connected by unbroken links back to the times of their origins, events that constituted increments to an ever rising structure or mountain range (in our analogy), whose high valleys provide new and occasionally even higher levels of metastable homeostasis in the evolution of life. This—the source, the always new definition and pursuit of the good—is the interesting problem, not the existence of evil.

NOTES

1. E. Lewis, *The Creator and the Adversary* (New York: Abingdon-Cokesbury Press, 1948).

2. R. Niebuhr, *The Self and the Dramas of History* (New York: Charles Scribner's Sons, 1955), p. 18 ff.

3. E. S. Brightman, *The Finding of God* (New York: Abingdon-Cokesbury Press, 1931), p. 186.

4. K. Barth, *Church Dogmatics* (New York: Charles Scribner's Sons, 1960), Part III, chap. i, 108; Part III, chap. iv, 366.

5. J. R. Platt, *The Step to Man* (New York: John Wiley & Sons, 1966), p. 146. Treatments of such steady-state systems in which there is a net process taking place inside the system or between the system and its surroundings are properly treated by irreversible thermodynamics.

6. A. E. Emerson, "Dynamic Homeostasis: A Unifying Principle in Organic, Social and Ethical Evolution," *Scientific Monthly,* LXXVIII (1954), 67. Emerson applies to social systems the term which Cannon emphasized for physiology in *The Wisdom of the Body* (New York: W. W. Norton & Co., 1932). (Emerson's paper is reprinted with minor changes in this issue of *Zygon.*—Ed.)

7. J. M. Burgers, "Curiosity and Play: Basic Factors in the Development of Life," *Science,* CLIV (1966), 1680.

8. F. L. Lambert, "Chaos, Entropy, and Original Sin," *Religion in Life,* XXXVI (1967), 259.

9. P. Tillich, *Systematic Theology* (Chicago: University of Chicago Press, 1963), III, 102. His demonic is usually a process phenomenon, not a state, e.g., an individual who has risen to a level of complexity and then drops down to a lesser state.