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A Review of von Weizsäcker's *Am Anfang*

By August C. Rehwaldt

During the winter of 1919/20 Victor von Weizsäcker[1] delivered a series of lectures on natural philosophy at the University of Heidelberg. Because of conditions of war only a fragment of these lectures has been preserved. This was published under the title: *Am Anfang schuf Gott Himmel und Erde.*[2] The opening sentences of the lecture proper are: "We begin by referring to a particular historical document, the oldest, perhaps, in existence, the creation account of the Bible. We shall see that it contains all the most important problems of natural philosophy." This paper is an attempt to share some of Weizsäcker's thoughts.

Natural Philosophy

"The attempt to formulate a natural philosophy has as its basis the desire to know *what nature as a whole really is* and what our relation to it is. We can now say that at the end of our discussion we shall not know this; in fact, we can predict this with a great deal of certainty. So we ought to tell ourselves, as we begin: I know that everything I can say of nature will be less true, less great, and less perfect than nature itself."

Weizsäcker states clearly the direction his discussion is to take, particularly in relation to epistemology (*Erkenntnistheorie,* as the Germans call it). For six or seven decades previous to 1929 German philosophy concerned itself, for the most part, with the extension of Kant's *Erkenntnistheorie.* As a result, the philosophy (German) of this period was largely theory of cognition and never questioned the content of such experimental sciences as chemistry and physics, but instead concerned itself only with the form into which these sciences had been cast. It did no more than attempt to establish the logical assumptions on which the sciences were

[1] Viktor von Weizsäcker: research scientist, neurologist, practicing physician, lecturer, and philosopher. Died 1957. Grandson of Karl Heinrich von Weizsäcker, the theologian. After coming out of World War I, he expressed the hope that the world would finally turn to Christianity and realize it in all areas, also in the natural sciences.

[2] 4th ed. (Göttingen: Vandenhoeck & Ruprecht, 1957). 108 pages. DM 4.80.

established and maintained their position. Their content was for philosophy a *noli-me-tangere.* Thus philosophy yielded her ancient prerogative of being *the scientia,* with the right to view the world as a whole by her own methods and processes. It has placed the experience of the sciences on a throne that stands higher than the chair of the philosopher. This runs counter to the primary claim of philosophy to be the comprehensive knowledge. If some sort of natural philosophy is to be formulated, it will not do simply to affirm the truth of the experimental sciences. The natural sciences must be critically weighed, not only in a formal way but also as to content. We must be concerned about the claims of science. In fact, this is our first consideration. The question which interests us above all else is whether modern scientific knowledge is the only way to penetrate the inner regions of nature. It may be that there are points of view altogether different which will let us look behind the scenes. So the problem resolves itself into this: Is there a philosophic knowledge of nature? We recognize that this is a long-debated question, but we shall leave it at that. Perhaps it is more desirable under the circumstances "to start hares than to catch them," to quote the late Dean Gauss of Princeton.

Objectivity and Scientific Truth

It seems advisable to digress at this point and to leave Weizsäcker for the time being, for the one or the other may think that science is so solidly established, and is so objective, that no criticism is possible.

A very lucid analysis of modern science can be gleaned from the first fifty pages of Thure von Uexküll's *Der Mensch und die Natur.*[3] He points out some of the transformations of natural sciences during the past fifty years. Truth (this does not include revealed truth so far as this discussion is concerned) was once defined as being agreement between concept or perception and object or thing. This definition dates back to the Scholastics. An insurmountable difficulty appears with this definition. Each science paints its own picture of nature and reality. Which is to be the standard of comparison?

It was Francis Bacon who replaced this Scholastic definition of

[3] Bern: Franke Verlag, 1953.

truth with a new one. This new definition has been the unshaken foundation of science up to the present time. It was on this that modern science was founded and could develop into what it is today.

Bacon postulated that no knowledge exists which is not dependent on an ability to perform (to do), and conversely, there is no methodical performance which does not proceed from knowledge. Knowledge and ability are concepts which have no significance for Bacon unless they are conversely related to each other: *quantum scimus tantum possumus,* "the reach of our knowledge determines the reach of our ability," was his famous thesis. In this Sputnik age it is hardly necessary to mention the degree to which our ability to do has been extended by our scientific knowledge. But the converse is also true: *quantum possumus tantum scimus,* "only as far as our ability reaches, does our knowledge reach." Beyond our ability to do we can only set up uncertain conjectures which we can prove neither true nor false. Conjectures which we cannot put to the test through our abilities are unproductive for natural science. So here we see that the thesis of Bacon, put in this form, can tell us some essential things about natural sciences which man invented; for it delimits in bold strokes the framework within which man is confined with his inventive powers.

To show this we shall consider briefly how a scientific investigation proceeds. It functions about as follows: We assume there is some problem. First, presuppositions are invented, working hypotheses from which the searching and questioning of the phenomenon proceeds. But these working hypotheses are applicable only if they make assertions which concern themselves with something we can do, something lying within our practical capacity. If, for example, we say that two bodies cannot occupy the same space at the same time, we have a working hypothesis which concerns itself with the way in which we handle objects in space and time. This hypothesis delimits the space in which we can move and operate, inasmuch as it maintains that two objects cannot occupy the same space and that we cannot move them into the same space at the same time. If we begin with this assumption, we have at first no more than hypothetical truth (this is true provided . . .) on the basis of which the phenomena are interpreted.

We assume that the phenomena comply with the conditions of our hypothesis and adjust our attitude accordingly. If later it becomes apparent that our hypothesis is valid in case after case, it will eventually be ranked as a scientific axiom or principle. A brief review of the physics of gases and fluids will demonstrate sufficiently to what extent such an axiom concerning the *nature* of matter in space determines our scientific interpretation, our methods, and so our picture of nature.

It may, of course, happen that axioms which have been valid for centuries while investigations of certain phenomena were extended more and more, suddenly fail if the interpretation is pushed too far. Modern physics itself is an enlightening example of this (quantum theory; theory of relativity). This shows that axioms which were considered to be philosophical necessities *(Denknotwendigkeiten)* fare no better in science than any other axioms. As soon as they fail, science must devise new working hypotheses, and it must determine whether these can so interpret the phenomena that we can handle them and work better with them than we could with the former axioms. If a new hypothesis meets all the requirements, it will eventually be ranked as an axiom. This means that a new axiom has appeared, and since scientific axioms are to interpret phenomena of nature, new ideas and concepts will arise with them. But since we know nature only in terms of our scientific concept, this can only mean that in the end nature changes as the axioms change on which the interpretations are based.

The consequence is that the truth of scientific knowledge is determined neither by the axioms with which we begin nor by the object which we sought to grasp and understand by means of these axioms, but the criterion is whether our axioms are valid or faulty. Hence, in contrast to the Scholastic thesis, we do not establish truth by the criterion of agreement between concept and object, but the only criterion which can establish the truth and reality of the object is the failure or the validity of the axioms with which we operate.

At this point we can obtain a fuller understanding of the nature of a scientific experiment. This is very pertinent at this point. The authority of science rests largely on the scientific experiment. The experiment proceeds strictly from the known to the unknown. It attempts to interpret new phenomena on the basis of known

axioms, so that we can operate with, or use, or handle the phenomena. At the same time, however, whenever an axiom is applied thus, we are testing the axiom, i. e., the extent of its validity. Therefore, to experiment actually involves two things: first, we experiment with phenomena on the basis of our knowledge; secondly, we test or try our knowledge with the phenomena. The experiment shows man the framework or the boundaries within which he is confined with his inventions; it also shows man that he may not formulate any number and variety of hypotheses; thus it shows man the limits within which his inventions are valid. This is, in part, Uexküll's analysis of scientific truth and method. This shows how we arrive at something which we call truth but still does not answer the question: What is truth?

Meanwhile the objectivity of science has all but disappeared. The awe with which the popular mind approaches science is overdone. Such an analysis also makes it apparent that science does not so much make assertions concerning nature itself but rather concerns itself with the way in which the searching intellect views nature. We turn again to Weizsäcker.

GENESIS 1:1-8

In the beginning God created the heaven and the earth. And the earth was without form and void; and darkness was upon the face of the deep. And the Spirit of God moved upon the face of the waters.

And God said: Let there be light, and there was light.

And God saw the light that it was good, and God divided the light from the darkness. And God called the light day, and the darkness He called night. And the evening and the morning were the first day.

And God said: Let there be a firmament in the midst of the waters, and let it divide the waters from the waters.

And God made the firmament and divided the waters which were under the firmament from the waters which were above the firmament; and it was so.

And God called the firmament heaven. And the evening and the morning were the second day.

We are justified in designating Genesis 1 as natural philosophy, not so much because sun and moon, plants and animals, are mentioned but rather because the whole of nature is contrasted with

something which is not nature, namely, God. God and nature are distinguished. There is something which is not nature and yet stands in an intimate relation to every member of nature. In fact, nature is explained through this relation. Such an explanation is natural philosophy.

"In the beginning God created the heaven and the earth." This is the ultimate that can be asserted of nature. "The moment the first sentence of this far-reaching and momentous thought is put into words it is no longer a certainty but a problem. Anything recorded, that is, expressed in words, represents knowledge, which is subject to questioning, which is problematic. Ever since, human thinking has been filled with doubt and has contended over this first sentence."[4] With these words of Genesis 1 the line of battle is drawn in the age-old conflict between the theology of the Bible and natural science, between religion and reason, between faith and knowledge. One thing this theological or theocosmic world view and modern science have in common — the original question: Whence is this world? Where is it going? How does it exist? Both inquire about origin to satisfy an inherent need for explanation and knowledge. The next question would naturally be: What does creation really mean?

Concepts of Create

We refer to Genesis 1 as the creation account. It is that indeed, but the author by no means presents the activity of God uniformly through the idea of creation. Instead it is described by a wealth of meaningful verbs. We can distinguish two groups of activities. In the one, God remains with Himself; the activity pertains to Himself, reflects upon Himself. In the other, God reaches beyond Himself. The activity is away from God. It is directed toward the world and is exerted upon the world. The first group would include such acts as His inspection of creation and seeing that "it was good." The other would include the acts of creation as such. These are designated by the words "God created, God said, God divided."

At the very first, the loftiest and the all-inclusive idea of bring-

[4] It is to be understood that all quotations are from Weizsäcker unless otherwise indicated. Translations and parentheses are by the writer of this article. Permission to print these translated passages has been granted by the publishers. The *CTM* thanks them for their kindness.

ing forth is asserted with the words "God created." We shall consider this as it is here isolated and stands all alone in verse one. "Here we are not told how God created. We know neither which divine attribute empowered Him to be Creator nor how He goes about the activity of creating. Nothing is said about motives or means or ways. Nor do we know whether we should ever think of Him as non-Creator. We hear only: 'In the beginning God created.'"

Verse 2 brings the first explanatory matter: "The Spirit of God moved upon the face of the deep." The text says, "The Spirit of God." This is the introduction, or the presupposition for the first creation about to begin, that God acts as a spirit. It is the presupposition for all creation, not only for these first creations mentioned here in Genesis 1, but also for the ultimate creation, the human nature of the Logos. According to Luke 1:35, the angel announces the birth of Jesus to Mary by saying: "The Holy Ghost shall come upon thee and the power of the Highest shall overshadow thee. . . ." The concept of the Spirit moving over the face of the primordial water is that of hovering or quivering. It introduces the creative act as an activity of the Spirit.[5] This becomes clear as the first creation emerges. "And God said: Let there be light, and there was light." God creates by speaking. Through speaking, through the Word, through a command, He becomes Creator. The creative act is a creating and commanding by the Spirit.

Sensual Perception a Presupposition

We leave our author to add that John sees it all clearly. "In the beginning was the Word, and the Word was with God, and the Word was God. The same was in the beginning with God. All things were made by [through] Him; and without Him was not anything made that was made" (John 1:1-3). All things of this temporal creation have their origin in the Eternal. Their temporal existence we call reality, that is, they have an existence which we can apprehend through our senses. We are well aware of the fact that this last statement is open to challenge, but we shall let it stand. These realities stand in a dual relation. On the one hand,

[5] Cf. Ps. 33:6; 104:30.

they exist in the frame of temporal and earthly events and so become members of a chain of events we call cause and effect; on the other hand, they are dependent on God's word of power in every moment of their existence.

If we were to review everything that some time or other has been said about reality, objectivity, and subjectivity, we would find, in the end, that the manifold phenomena, such as heat and cold, color, sound, time and space, have all been called illusions, evoked by the activity of our senses. Everything would be going in circles, and be turned end to end, and finally we would be at a loss what to believe. And when all is said and done, we would nevertheless return to the familiar point of view and insist: what we observe we know. If I observe that this desk supports my paper, then I know that it does. If I observe that the desk has collapsed, I know this also. All this may sound elementary, and it has neither proved nor disproved anything. But it is scientific. We may be quite confident about this. Genesis 1 takes for granted that anyone who reads the account can apprehend with the senses the realities of which it speaks.

Origin of Antitheses

We shall let Weizsäcker continue. The third mode of creation is presented next: "God divided." This is not mentioned in connection with the first creative act, for the creation of light was absolute, without any secondary effect. This dividing or cleaving or separating is not an essential element of the process of bringing into existence. Nevertheless it is of fundamental significance, for it makes the first reference to that which creation produced, the creature. The concept of dividing does not reflect upon the Creator, but the action is away from God and is directed toward the world. It does not enlighten us concerning the essence of God, the Creator, but it reveals something of the nature of the creature. This dividing is repeated on each succeeding day of creation. Each day's work produces two things in contrast with each other. At this point we might well be reminded of the fact that the Oriental religions quite generally present the dual principle as being primary, or original, and that the theology of the Bible overcomes this dualism by presenting it as being this-sided, temporal, and that it appears after having been created by God.

In contrast to all intramundane events, which are conditional, dependent, and relative, creation is unconditional, independent, and absolute. These are all negative assertions and cannot convey anything really positive. Now we are told that divine creation is not only a bringing forth, but it is also a dividing. With a cleaving gesture the Creator reaches into the chaotic world. He creates. He cleaves. He divides that which was a one into a two. He divides the light from the darkness; He divides the water from the water, that which is above from that which is below; He divides the dry land from the water. Thus our world comes into being, becomes a world of contrasts, of polarities and antitheses, a world of opposites. This antithesis, or being opposite, is a fundamental phenomenon in our world. We see it everywhere, especially in what we call nature. No matter in which direction scientific research proceeds or how far it goes, always at the end stands a polarity. In the final analysis the constitution of matter resolves itself into opposing forces. The atom is an aggregate of opposite charges. What is life but the struggle with death, and knowledge but a distinguishing between that which is true and that which is false? Our world is in fact a world of opposites because (as the creation account says) "He divided." To put it into philosophical language, we have discovered the problem of negation as a primordial phenomenon of science and so of nature, and as a primordial phenomenon of nature and so of science.

For the time being we shall not consider the implications of this principle of polarity. It will force itself upon us persistently as we continue. Instead, we shall let Weizsäcker summarize directly the fundamental concepts of natural philosophy which have emerged from the account so far. (P. 14 f.)

Fundamental Concepts

> The first and principal concept is that of creation. This is, as it were, the egg from which all else must develop. It is the fundamental of all our knowledge. It asserts that the world is what it is, not of itself but of God. As now becomes apparent, it is not correct to distinguish between God and the world as we did earlier. God alone divides as He proceeds with His work of creation. Distinctions, i. e., negative and positive predications, can be made with respect to the creature, but not with respect to the Creator

Himself. He is without any negativism. He Himself, the Author of all distinctions, cannot be subject to distinction. This is essentially the idea of God on which all occidental science is based. It is impossible to understand this science fully unless there has been acceptance of the thought, or rebellion [Lucifer's] against the thought, that there is a Creator God. The magnitude and the consequence of this conflict is, after all, the magnitude and the consequence of this occidental science.

Inseparable from this fundamental idea is the more specific designation of the creative act as a creation of the Spirit through the Word, through the command: "Let there be." The manner in which the creative act follows is very decisive for the course which natural science takes. There is a fundamental difference between the act of creation and the intramundane events of nature. The act of creation creates a natural process but is itself not a natural process. Thus an event in nature takes on a peculiar character. It is created by the Spirit but is itself not spiritual. Nature as such is nonspiritual.

Nature as such is nonspiritual, and yet, Weizsäcker insists, it has spirit *(ist geistig)*, has genius. It shows this genius through all its sublime grandeur and variety. It points to the Spirit, its Creator. We add that this view is in accord with the Scriptures, e. g., Ps. 148; 98; 19:1-5, to mention just a few of the many passages which present the idea that nature has a message and a meaning; the Savior looked upon nature as being one grand parable. But from antiquity down to the present time the world view of many distinguished theorists of natural science in the West has rested on the denial of the Creator God. It has robbed His nature of its genius and has set up chance as its ruler.

Genesis 1:9-13

And God said: Let the waters under the heaven be gathered together unto one place, and let the dry land appear; and it was so. And God called the dry land earth; and the gathering together of the waters called he seas: and God saw that it was good.

And God said: Let the earth bring forth grass, the herb yielding seed, and the fruit tree yielding fruit after his kind, whose seed is in itself, upon the earth; and it was so. And the earth brought forth grass and herb yielding seed after his kind, and the tree yielding fruit, whose seed was in itself, after his kind; and God saw

that it was good. And the evening and the morning were the third day.

By the time we reach the third creation day we begin to wonder what the world looked like. Perhaps something should be said about this. But should it? We shall let our author continue from here. The realms of heaven and earth, light and darkness, exist as yet only in a very general way, or we may say, in a vague way. There is not the slightest suggestion in the account which might satisfy the curiosity of him who asks: "What was the world really like by now?" "Can anyone picture to himself a world made up of only light and darkness, heaven and earth, with nothing else that would so much as suggest any kind of form, not even a stone or a cloud or a star? Something had been created in principle, but it is something which cannot be grasped by the power of the human imagination but is cast in a form that demands superhuman powers of abstraction." At this point the world was something which still lay beyond the range of human experience. The world was still in process of becoming. We dare not go beyond the account. The text as it stands binds us, and we have no warrant to make any kind of explanatory statement beyond that which the text makes. We may not read present-day conditions into the text by way of explanation, not even intervals of time or measurement of time, in order to determine the length of these first days.

Origin of Individuality

The third creative day changes all this: this is the day of the creation of things. Moreover, these are temporal things *(diesseitige, sinnlichkonkrete Dinge)*, things which are concrete and within the grasp of our senses, things which make up the nature with which we are familiar. It is our world which takes form in response to divine command. The wet and the dry elements move apart; the firm land and the seas take their places; grasses and herbs and trees appear. Two primordial phenomena of nature make their appearance, the various elements and life, the inorganic and the organic. Now the account has us standing in the midst of nature. Its forms are familiar, and we are beginning to feel at home, for we can grasp these things with our senses. Before Weizsäcker enters into a consideration of the relation between the inorganic and the

organic nature, he prefers to discuss in a general way the problem of the origin of individuality or particularity *(Besonderheiten)* of the members of nature. This has a significant bearing on the understanding of the attitude of science toward nature, and we shall attempt to follow him in this discussion. The question which originally arises with the chaos problem: Origin from nothing or origin from something? forces itself upon us again with the origin of things. These things possess qualitative differences. What is the origin of qualitative individuality, or to put it abstractly: What is the origin of quality? The creation account states: "God created." As stated before, anything expressed in words becomes knowledge and problematic. If the word "God created" is accepted in faith, this faith will be followed by assent and approval reaching to the ultimate consequences. Next will follow knowledge, not the problematic kind but absolute. John 6:69: "And we believe and are sure. . . ." I know because I believe. But aside from faith the word "God created" will be received by natural reason immediately as a thought, together with its antithesis, naturally, for this is a world of opposites. Next this will be looked upon as immanent knowledge, as something problematic, as an explanation of nature. This knowledge becomes a function. In the case at hand it becomes science or an explanation of nature. Here are rudiments of the modern explanation of nature. We return to Weizsäcker more directly after this paraphrase.

Science Overcomes Quality

How does modern natural science explain the qualitative variety of the things of nature? Fundamentally in a very simple manner: it does not explain; instead, it denies. It seeks to do away with qualities by resolving them into quality-free, quantitative differences, into differential equations. This needs some illustration. A modern tendency is to eliminate the distinction between the animate and the inanimate. The bridge between the two is the virus, which from our present-day point of view exhibits characteristics of both the animate and the inanimate. If life is an aggregate of mechanical processes, if it is the outcome of the processes of chemistry and physics, then the next step is not difficult to take: there is no distinction between the animate and the inanimate. But life is an

individualistic phenomenon. It is, after all, being self, also among the animals. Yet the evolutionary hypothesis is based on the assumption that life is one — one direct line with lateral extensions at certain points on the line. If we pursue this thought to the end, we will finally arrive at modern mass psychology, mass action, mass thinking, mass welfare, and the like. The individual has disappeared and is lost among the quantitative qualities.[6] This, Weizsäcker insists, is the great and historical significance of the quantitative method of natural science. It is the direct consequence, he thinks, of eliminating God from nature, and of the denial that nature has spirit, or genius, to which we referred earlier.

> All that gives expression to nature, that contributes to her spirit, the realms of color, music and sound, life and beauty, meaning and purpose, disappears with the destruction of her qualitative multifariousness. The qualities become more and more scant, more faded and thinned out. This all happens, as though in a dream, by getting farther and farther away from the critical starting point: sensual perception and the capacity to experience objects directly. The world of science, of electrons and quanta, of structural formulas and differential equations takes us ever farther and farther away from that which can be experienced, from that which can be perceived with the senses. Moreover, as natural science apparently overcomes the multifarious qualities of nature and proceeds to explain them away by means of quantitative relation, it seems to forget what it was that it set out to explain. It had set out to explain the quality of things. It simply denies quality. . . .
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> But to return to the starting point: reason cannot comprehend the origin of things. Reason which struck out for itself does not dare to confess, "God created." Instead it says, "MY knowledge is too limited." But this admission of the limitations of human understanding is nothing less than a confession of the Unlimited. The one is impossible without the other. . . .
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> If objective nature cannot be apprehended as such, but only as subjective consciousness and appearances, fundamentally, then, every perception of objects becomes an impossibility. Then, in fact, none of the things exist in the mode in which the creation

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[6] "Being in the Minority Doesn't Necessarily Mean a Man Is Daft" (editorial), *Saturday Evening Post*, Vol. 230, No. 28 (Jan. 11, 1958). Shows an extreme.

> account sees them. If the essence of knowledge is no longer perception of object and reality, but consists in the overcoming of multifariousness and manifold qualities, then the objective of science is not knowledge but overcoming. This means that the purpose of science is negation for the purpose of affirmation, affirmation through negation. In this function of resolving and dissolving things, science is constantly affirming the Godhead. Nature did not create, nor did reason create. These two, not able to create, can only negate and mediate. The fact that they can do this and no more, that is their sole affirmation. And the fact that they *do* it is their confession of the Godhead. Thus every scientific explanation is a process of destroying. Each process of destroying implies a denial of a this-sidedness [temporality]. And each such denial is an affirmation of the Absolute, the Unending, the Unlimited. Here the name of God lives solely in negations. (Pages 33—35)

Intranatural Relation

All this is preliminary to a consideration of the third day of creation. The creation of the third day is, to put it into the language of today, the inorganic and the organic nature. Our discussion will be centered in these two, for the stars and the animals are left for a later day. We shall again confine ourselves to what is fundamental in this duality. The fundamental feature is that these two realms, the inanimate and the animate, appear separately. As was stated earlier, science would erase this distinction. In the account they appear as separate entities. The idea of a one, which then is divided into a two, does not appear here. The cleaving gesture is not used, but in the creation the dry earth, seas, grass, herbs, and trees follow one another in a simple manner, but first comes the inorganic and then the organic. This appears so simple and so natural to us, for the presupposition of vegetation is the dry land. This is a condition of life for vegetation. This is very appealing but at the same time of great significance: for here we meet for the first time an intramundane, or intranatural relation of something dependent on a certain necessary condition. This abstract concept is not stated in so many words, but it appears to be applied nevertheless. And the manner in which it is applied throws light on the whole creation account. What appears here for the first time is an intranatural process which has nothing recognizably

divine about it, so that the organic nature is not created outright, but the process which eventually produces it is divinely inaugurated.

> Here we are witnessing the birth of the natural science of the knowledge of a nature without God. . . . And as the account proceeds, it builds up its world after the manner of natural science chronologically, in that the natural presuppositions precede: the inorganic — organic, the plant — animal, the animal — man, and later, nature — history. A completely new principle is added to the concept of creation: the principle of naturally necessary interdependence of things. At no time does the account offer explanation. It remains narrative throughout while at the same time it contains the full germ or rudiment of explanation. . . .
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> The fully expanded explanation of nature rendered by the natural science of today can now be defined. We have already recognized two of its essential trends. The one lies in the negativism of its thinking, and the other consists in the overcoming, or explaining away, of the qualitative multifariousness of nature through the application of quantitative methods (i.e., by considering qualities exhibited by a mass of individuals rather than by considering individual and particular qualities). Both are closely connected. Now a third can be added. For now the peculiar direction which this process of overcoming takes can be indicated. It follows the principle of the natural interdependence of things. To explain means essentially to trace back to conditioning factors and to resolve and dissipate these. Thus the fundamental ideas of causality, force, and matter arise. Each phenomenon of nature is traced back to *something other* which reduces the phenomenon under explanation to nothing. We explain life by means of a dead mechanism, the movement of forces, and the chemical elements by means of electrons. As this is done, nature is uni-formed and becomes a oneness again, a quality-free primordial substance, a chaotic confusion of atoms. Thus we are again close to chaos. In fact, this process ends where it began. (Pp. 36—37)

Pantheism

In concluding the discussion of the third day Weizsäcker asks what has happened to the qualities which have been explained away? Does nothing remain of the spirit and the genius of nature to which we referred several times before? These are the real problems which concern natural philosophy. If these were burning questions thirty years ago, they are even more so today. These

problems are as old as the mechanistic explanation of nature, as old as materialism and the exact natural sciences. Equally old are the reactions, the countermovements, and the contradictions. We shall hear of these rather directly.

Artistic, moral, and religious emotions revolt against the consequences of the mechanistic conception of nature, no matter how inescapable they may appear.

> But one needs hardly to refer to such high-sounding words as morality and art and religion. There is something elementary within us that becomes ruffled. We harbor within a natural sympathy for some kind of uniformity in nature and feel that there is something human about the things of nature. A normal man will not be robbed of these feelings. After all, these things have their destiny, too, even if it is only a little cloud that forms in the blue sky on a summer day to go through fantastic shapes as it disappears within a few minutes under the heat of the sun. But it was there for a few moments, was a part of the great and unending nature which would not be complete without it. . . . So there is hidden in each tree a dryad, and a Pan in every block of stone. After all, the block has its own individual form and represents the unending law of nature no more and no less than a cell in the cerebrum of Aristotle does. This nature is beautiful beyond measure and is alive and powerful and violent. It creates and forms and brings forth and kills in greatest things as well as in the smallest. And if anyone said a thousand times it is all nothing but a host of atoms like a swarm of gnats, we would answer just as many thousand times that every gnat in a swarm is a wonderful creature, full of spirit and meaning and power, that loves and suffers and dies, it knows not how.
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> This, after all, is what is designated with the word *pantheism.* It is the frame of soul that does not say: God is spirit, but says: Nature has spirit, is spirit through and through. This is how the nature mythologist feels. Everything is the very opposite of the nature as it is conceived by natural science. This view we considered earlier. It does not always see something else back of things. Here is no negation of things. No, they are affirmed. Each thing is what it is. The tree is a tree, not a mechanism; man is man, not a machine. Here nothing is reduced to mathematics, abstracted to ideas, generalized into laws, but all is viewed as having singleness of purpose, idea, and meaning. . . .
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> This view of nature is heathen. While our natural science has

eliminated God from the world, here the world is deified, is made God. It is not the individual thing that is God, but quite the contrary. . . all taken together. According to this view God is the essence of reality, the *ens realissimum et generalissimum.* Therefore He is as incomprehensible as the total of reality and as unknowable. God is here beyond all realization and knowledge and understanding. One can only assert of Him that He is the All of nature, but otherwise nothing, absolutely nothing. For if I say: He is All, fundamentally then I say as much and as little as nothing. I do not know everything, do not know what that All is. This skepticism of the possibility of knowing God is designated as negative theology. That means, nothing is known of God but that He exists.

Thus we come to the final result. The natural sciences move from a created nature to a nature without God, from a nature without God to one without spirit and genius, from a nature without spirit to a nature without things and qualities. Together with this tendency we see a picture of nature emerge which is the very opposite: a nature that is God, a nature made up of things shot through with spirituality, meaning, and plan. These two views are in conflict with each other. But each of the two still maintains, somehow, a relation to God: natural science in that it is self-limiting, which is an affirmation of the Unlimited, the Unending; the nature of pantheism through its total spiritualization and total affirmation of sensual temporality. Just as these two views of nature fit together like bolt and nut, like plus and minus, just so they have in their relation to God something in common: the negativism of theology. Neither of the two can any longer definitely say what God is doing, as Moses can — fundamentally neither says anything about God that can be understood. (Pages 38—40)

GENESIS 1:14-19

And God said, Let there be lights in the firmament of the heaven to divide the day from the night; and let them be for signs, and for seasons, and for days, and years; and let them be for lights in the firmament of the heaven to give light upon the earth.

And it was so.

And God made two great lights: the greater light to rule the day, and the lesser light to rule the night. He made the stars also.

And God set them in the firmament of the heaven to give

light upon the earth and to rule over the day and over the night and to divide the light from the darkness; and God saw that it was good.

And the evening and the morning were the fourth day.

Origin of Science

The work of the third day has essentially circumscribed the whole of nature with the exception of man. The world has a two-fold content: the inorganic, the world of lifeless things; and the organic, the world of living things. Both groups recur separately on the fourth and fifth days. The fourth day concerns itself with the celestial bodies, and on the fifth day follows the creation of the animals. The celestial bodies concern us for the present.

Our eye, which had been occupied with the minutest products of vegetation, is by way of tremendous contrast suddenly directed upward and into the immeasurable world of space. The account brings us face to face with a startling element which leads us completely away from the presentation of the previous day's work. It is the creation of the celestial bodies, not just as such but as signs and as times [seasons] — the first concept of astronomy, astro-nomy.

We could already feel time in the first three words of the account: "In the beginning." Time, in general, was already there; the key for opening an understanding of the work of the fourth day lies in the word *sign,* a reference to reality. What is seen here is the first scientific concept which appears in the creation account. The celestial bodies do not merely appear as such, but they are a sign for us who strive for knowledge, who seek to know time. Equally important is that this knowing of time can involve no less than mensuration, or measuring of time through the spatial, the celestial bodies. What appears here is nothing less than applied mathematics, mathematical physics. At the same time we have the assertion here that time can be measured only by means of space. And the fact that astronomy is the infancy of natural science — as far as we know — has given a determining peculiarity to our science of nature. (Pp. 45—46)

Science in Function

In his introductory remarks to the work of the fourth day Weizsäcker refers back to the antithetical nature of the created

world. It is an innate tendency of man to seek to overcome this antithesis, to put back together where God has divided. We seek to overcome the *two* in favor of the *one.* This tendency has been carried to the ultimate by science in that it seeks to explain away multifariousness in nature and even seeks to explain away reality. All this is, in final analysis, uni-forming, as was stated before. Perhaps this is the time to say it. In our opinion this is the most critical thought which Weizsäcker expresses: man's attempt to overcome antithesis. "God divided." Could it be that we would take a more realistic stand if we bowed to this, if we simply affirmed the insurmountable contradictions and antitheses in nature rather than attempted to make nonsense into sense by main force? Let us put this problem up to Kant is the suggestion. This is not a good method; this is not a *therapia magna,* but it may get us somewhere. Kant's answer can be stated in three words: knowledge is synthesis. Synthesis is productive, leads somewhere. Analysis does not extend knowledge, but it does elucidate. Here, in this real center of Kant's philosophy, knowledge is synthesis. Here we have reached the very heart and core of modern science.

Earlier it was stated that the moment the thought "God created" was put into words it became problematic. A problem creates tension. With every assertion of the account the tension increases. We may call this the tension between mind and matter, or perhaps better, between nature and spirit and intellect. This tension cannot be resolved; we meet it again and again. The final multiplicity must be overcome by knowledge. Knowledge is meeting of nature and spirit. It is the conquest of that which is concrete to the senses through thought. To bring these two worlds together calls for a stroke of genius. Mathematics is just that. Mathematics furnishes the symbols by means of which thought can lay hold of the concrete. These symbols are numbers. We shall pass by the philosophy of this process and simply assert that by means of numbers the chasm between the intellectual and the concrete has been bridged. If we let our eye sweep the skies and then think of unending and illimitable space, we may wonder what mathematics will do here. Can it also master this? But unending space is no obstacle. With calculus the mathematician can master also this. Mathematics is an instrument of thought fully adaptable to all the

vagaries of any science. It is this synthesis which gives science such power and such potentiality.

The Synthesis of Science

Thus Weizsäcker explains why mathematics is the real foundation of physics. "Thus the mathematical picture of nature was developed by physics. It is a picture because it is a sign, a symbol by means of which thought can point to the concrete and represent it." Many will look upon this picture as the real thing, just as one might show a portrait of himself saying, "This is I." "The concrete itself cannot be apprehended by thought, but only that which symbolizes or represents the concrete. These symbols are the mathematical laws of nature. These laws themselves have no reality, but nature obeys them without fail and necessarily."

This relation of obedience between nature and her laws, with which we all are acquainted, was not alien to the Biblical author, as he described the fourth day of creation; it simply had to flow from his pen at the moment in which this scientific thought first flashed in his mind. Very explicitly he says — expressing the passive obedience actively — "the greater light to rule the day." What irony! At the first, the Creator Himself appoints the sun to rule the day and thus also establishes science. However, science becomes Lucifer. From century to century it becomes more powerful and independent. We have already seen this development of the sciences — there is something compelling about science. This compelling element is the truth of experience.

We shall return to a thought which had been dropped for the time being in the discussion of the third day. There we said that manifold qualities in nature are being overcome. Now, with mathematics on the scene, we can observe how these manifold qualities are dealt with by a qualifying science.

Results of Synthesis

We hinted earlier that this process of dequalifying is essentially a synthesis. "At first it would seem that the number of qualities is built up, at all events. Chemistry has, for example, an endless list of elements and compounds which are distinguished by color, consistency, weight, valence, etc. Quantitative science sorts out and eliminates more and more of these qualities until at the end of this

process only a few concepts remain, such as energy, matter, motion, space, time, causality." These are physical fundamentals. "What is the principle of elimination? What decides whether or not a concept is physically fundamental or not? The answer is whether it has objective or only subjective significance. The criterion is whether a given phenomenon is *outside* or *within* us. If it is within, it can evidently not be physically real, but only subjective. Red and blue, for example, are only sensations, but do not exist outside of me in space. There they are only wave lengths of 400 or 500."

A rapid view of the history of physics will show that it has been engaged in a persistent transformation of objective phenomena to subjective imagery. Color has already been mentioned. There is no sound in space. Out there is eternal silence, endless night: only motion of the masses, restless surging of matter. As we attempt to render the picture of nature as it is viewed by physics, we are compelled to affirm the very phenomena it would explain away. What is silence but the antithesis of sound, and night but the opposite of light? Matter, too, is disappearing. It is only an illusion of the senses. Physics is being transformed more and more into mathematics of motion. Such matter has left only two irreducible basic qualities, expanse and motion, and in motion a hint of a third — indispensable time. The concept of substance has been completely replaced by the concept of function.

Disappearance of Objective Reality

Even the last two qualities, space and time, have all but disappeared. This is all that is left on which the concreteness of physics rests so that we can somehow, at least, form a picture of it. This is a fundamental problem of the present day. Our three-dimensional Euclidian space, and our time, which is measured by this space, no longer possess the unquestioned reality in the mind of the modern physicist which had been ascribed to it since Euclid's time. Our units of measurement (which are the presupposition for the assertion that two bodies have the same size, or that two bars of steel have the same length) stretch and shrink and under certain conditions disappear altogether. The theory of relativity has resolved objective space and time.

"We feel that this last phase of physics is the logical end result of a process that began with a nature without God, which was followed with a nature without spirit, which was followed by a nature without things, and finally a fourth nature without any concreteness appears, a nature that is unobjectifiable. This non-Euclidian space of modern physics cannot be sensibly visualized *(ist nicht mehr sinnlich anschaubar)*. We can think this space, can construct and operate with it mathematically, but we cannot perceive it with our senses" or picture it in our minds.

With the development of nuclear research, scientific thinking has become more and more transcendent and moves in a realm that lies beyond the powers of human imagination, and concerns itself with that which is no longer objectifiable. Eddington, the great English astronomer and physicist, touches upon this problem when he explains the function of mathematical symbols. He also makes frequent reference to this problem in his work *The Nature of the Physical World*.[7] This same problem was discussed by Paul Freiherr von Handel at the University of Munich in 1946.

> In a general way, the present situation is characterized by the strange discovery that in all of modern physics we are daily and constantly employing concepts which are fundamentally incomprehensible, incomprehensible in the sense that they are not objectifiable, not real. But this does not keep us from arriving at concrete, in fact, very drastic consequences with the results of our physical experiments. . . . In the space-time, four-dimensional continuum it becomes apparent that the movement of a body with the speed of light is characterized by the circumstance that its spatial measurement shrivels to zero and its mass becomes infinitely great . . . the end result of the quantum theory forces us to question the objectifiability of the things outside of us.[8]

Conclusion

We shall forgo a discussion of the analysis of sensation and the physiology of the sense organs and all the related problems, which, to a certain extent, are attempts to justify the modern subjective point of view. "It is a confusing and disconcerting picture" which

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7 New York: Macmillan, 1929.

8 "Physik und Erkenntnistheorie," *Zeitwende*, XVIII (26, 1946/47), 399 to 414.

science conjures up, "in which the 'real' world becomes a thought and the familiar world of our senses becomes an illusion."[9]

Weizsäcker sums up some of the final conclusions by asking a few significant questions:

> If the *subject* is the measure of things, does not the object become imperceptible; is not that which I perceive only my imagery; the world of science only a world of fancy? True. That is how it is. Are not these mental pictures of mine merely symbols of something which is incomprehensible? Yes, that, too, is true. Is not, then, the mathematical structure of physics only a work of art, something artistic, a fabrication? This, too, is true. Has not science, then, become the sister of poetry, which also engages in artistry? This cannot be denied. Did not science set out to be knowledge, that is, did she not seek to grasp reality, absolutely and without limitations, and is it not a fact that science is only a stage which represents the world, but is not the world? Yes, this, too, follows. Does science actually stand higher than faith—or does she, perhaps, stand lower in the end? This is open to question. Is the form into which science has been cast indispensable, or could there be, in the end, another form equally true or just as untrue? Is science not merely one of the many ways of expressing that which could also be stated otherwise? (Pages 53—54)

We conclude this with a brief statement from Uexküll.

> Finally I should like to point out briefly . . . that the revision of our picture of reality has an extremely great and practical significance. In fact, how man pictures to himself the reality in which he lives and operates has always been a determining factor as to what he desires and plans. What man dares, or what may cause him to shrink back with fear, in the end, depends on what he considers to be real and what he does not consider to be real. And today, somehow or other, we have a presentiment that our picture of reality is false and that on the basis of a wrong picture of reality we act wrong. How otherwise could anyone explain the ever-increasing and hopeless confusion which man with all his planning and deliberate calculations has achieved in this world?[10]

Milwaukee, Wis.

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[9] Wolfgang F. Pauli, *The World of Life* (Cambridge: The Riverside Press, 1949), p. 4.

[10] Uexküll, p. 12.