CAUSE

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My remarks this evening will be divided into four parts.

First, because of the considerable importance of the Humean interpretation of cause as it is understood especially by the positivist, I will discuss some of the results of this interpretation in present-day thinking, especially among physicists.

Second, because I believe that much thinking about cause and effect today depends upon a nominalistic interpretation which is essentially idealistic, I shall devote a section to trying to answer the question, "What is real?"

Third I shall devote a section, all too brief, to giving a qualitative picture that provides evidence from physics of the existence of a microscopic level in the world which is a discrete degree separate from the world of human sensation.

Fourth I shall survey some of the items from a point of view based upon the Writings.

A fifth section is added consisting of questions that ought to be answered in a more complete treatment of cause.

SOME IDEAS ABOUT CAUSE FROM POSITIVISM

I begin my discussion of the subject[1] with an example of the concept of cause in the modern mind. Weizacker in *The World of Physics* says:

> By causality physicists as a rule understand simply the assertion that between two states of the same entity at different times, there exist a universal functional relation: "If the state of a closed system at a moment in time is entirely known, then its state at every other moment is in principle determined." (p. 84.)

[1] A complete treatment of causes would include a history of the subject. This would involve such things as the enumeration of four causes by Aristotle, of a whole hierarchy of causes under the scholastics, and later the treatment of occasionalism, the consideration of cause under the rationalists just before Swedenborg's time, then of the usages of the term by Swedenborg, and finally of principal treatments of the subject by Hume, Kant, Mill, and others. It must be admitted that such a study would be useful, but that study is not the purpose of this paper.

Tracing the origin of this statement [2] one sees that it is very much like a definition given by Laplace over a century and a half ago.[3] Its philosophical origin is attributed by most writers to David Hume. There are three properties of this definition of cause to which I wish to call your attention:

First: the relation of causality applies to "two states of the same entity."

Second: there is what is called a "functional relation"—which for most physicists means a mathematical relation.

Third: there is a temporal succession between a cause and its effect.

We would see in a complete study of cause that a significant meaning of cause in New Church philosophy other than merely instrumental or material cause is the cause and effect relation that exists between discrete degrees. And so our philosophical meaning of the word differs from the common usage.

The "functional relation" element has been attacked often enough in science. Cause as a result of the Laplacian formulation became identified with determinism, and in turn this determinism also became associated with materialism. Deterministic materialism for many was sufficient to explain nature.

There were two forms of this deterministic materialism. One followed the success of Newton's mechanics, writing its laws in the form of the mathematical laws of dynamics. The other was based upon the laws of probabilities which *were* laws and which *were* deterministic although in a somewhat different manner than those which follow Newton.

Typical of many statements about the laws-of-chance interpretation is the following:

[2] A useful reference, well annotated with detailed references including a long bibliography is *Causality, The Place of the Causal Principle in Modern Science*, Mario Bunge.

[3] *Theorie Analytique des Probabilites* (Paris 3d ed 1820). A translation of his statement is "An intelligence knowing, at a given instant of time, all forces acting in nature, as well as the momentary positions of all things of which the universe consists, would be able to comprehend the motions of the largest bodies of the world and those of the smallest in one single formula, provided it were sufficiently powerful to subject all data to analysis; to it nothing would be uncertain, both future and past would be present before its eyes." Lindsay and Margenau, *Foundations of Physics*, p. 517.

It was the great discovery of Charles Darwin that the apparent teleology of living organisms can be explained in a similar way by a combination of chance and selection. *The Rise of Scientific Philosophy,* Hans Reichenbach, p. 196.

This statement has two properties, namely: that teleological—that is purposeful—explanations are unnecessary; and that the functional law referred to in our first definition becomes here a law of probability or of chance. Later interpretations hardened until it was not as Laplace had said, "I have no need for the hypothesis of a Creator," or as in the above statement that an alternate explanation to a purposeful one "is possible," but rather that cause and effect and purposeful explanations are not only unnecessary but harmful.

It is true that this positivistic derivation and limitation of the meaning of cause is not accepted by many thinkers. But the fact remains that many scientists and people working in other disciplines as well as physics and biology have taken over this dogma.

Among those that I have read, expounding the positivist views, I interpret Richard von Mises as one of the moderates. He says for example:

Going back in the history of philosophy to the period before Kant, we find in David Hume a climax of enlightenment that has never been reached again. Hume broke with the dogmatism which, in a way, up to then had made it impossible even to discuss the relation between cause and effect. *Positivism a Study in Human Understanding,* p. 155.

And again:

Among the earlier treatments of the problem of causality Hume seems to represent the culminating point. *Ibid.,* p. 156.

There is a curious mixture in these remarks that "dogma was disposed of," that now "cause can be discussed," that this was an "early treatment" of the subject, and finally it was a "culminating point"—all within the space of three sentences. This quotation illustrates the sort of connecting link that the average worker in the disciplines today has with philosophy.

Not only has positivism made of cause and effect a very limited relation dealing with the same entity in successive times; it has made this relation identical with determinism. Therefore, the

reputation of cause and effect among many depends upon the status of determinism. Space does not permit our going into determination and its relation to cause. But it should be noted that to this treatment of cause, in addition to leading to its denial as a useful concept, similarly threatens a whole array of other concepts. In particular, there are such concepts as substance, quality, force, energy or power, potential, and actual state—all of these can be found to be contested. One would have little difficulty in finding many who express with a high degree of hauteur and finality that these terms are "outmoded" or do not stand up under "serious critical thinking."

There is an important example of this in the case of a book by Ayre, *Language, Truth and Logic*, which "has in Oxford since the end of the second world war acquired almost the status of a philosophical Bible." Later in a revised edition of this work which branded metaphysics as nonsense Ayre modified his point by explaining, for example, that the word "meaning" itself has other senses than that which he used—and he now "allows the possibility that metaphysical statements may have meaning in these other senses" (quotes from Joad). Thus metaphysics cannot be discarded even under logical positivism as understood by an extremist. Joad comments:

> As the exponents of the doctrine have grown older, the doctrine itself has grown milder and Professor Ayre now tells us (in the Introduction of the 1948 edition of *Language, Truth and Logic*) that it is only to *one* proper sense of the word "meaning" that the verification principle applies. There may, it now appears, be other senses of the word "meaning," and he allows the possibility that metaphysical statements may have meaning in one of these other senses. Indeed "for the effective elimination of metaphysics" the principle "needs," we are now told, "to be supported by detailed analyses of particular metaphysical arguments" (the detailed analysis, by the way, is far from always forthcoming). Joad, *A Critique of Logical Positivism*, p. 11.

Joad continues—and this is an important point relating to the history of thought—

> But it is not the milder form of the doctrine, which allows that metaphysics may not be nonsense, that interests students. What has struck their imagination is the grandeur of the original assertion that metaphysics is nonsense! *Ibid.*, p. 11.

And now, to return to our main subject—if causality as a principle be challenged, what takes its place?

It cannot be denied that many situations arise in science wherein the data that are available can be arranged according to the laws of probability. Thermodynamics is a curious mixture of cause-and-effect relations and purely statistical ones. Quantum theory makes more use of probability arguments than of cause and effect. The case is apparently similar with respect to the theory of evolution in the biological sciences.

The constructive argument cannot debate the usefulness of statistics in science any more than it can debate the utility of statistics to an insurance company. The argument does arise, however, when one considers the grounds for belief in causality as a *principle*, or on the other hand in the laws of chance *in principle*. Each of these is a philosophical judgment.

The historical fact which one must face today is that philosophy is scorned. Along with this, cause and effect is denied as a respectable explanation by many. And finally the laws of chance are advanced not as a method but as a doctrine in principle as to how the universe operates. Both the denial of causality and the affirmation of the laws of chance are philosophical and not scientific judgments.

The grounds for these judgments remain as problems for New Church philosophy today. Within the church and without the church, the young scientist or the old scientist, the young humanitarian or the old humanitarian will take a step forward in his intellectual development—even if he does not care personally for philosophy as a pursuit—if he will come to see that such universal judgments as those which concern cause and effect as a principle in creation or on the other hand the laws of chance as a principle in creation are both equally beyond science and one cannot in all intellectual honesty scorn philosophy and make at the same time a judgment regarding such universal principles.

Relation of Ontology to Cause

Ontology is defined as the science of being. Now the literature of science is filled with discussions on cause which have nothing to do with being in the sense in which I understand that word. A

very large part of the discussion originating in Heisenberg's indeterminancy principle has to do with the mathematical formulation of data which defines what in physics is called a "state." While it is no doubt true that the rank and file among physicists accept quite naively that these states represent physical objects in some sort of condition in space and time, the philosophers who follow Heisenberg deny in principle that we can ever go beyond knowledge about these "objects" gained by laws of probability.[4] By "in principle" is meant not that the laws of probability are a refuge in dealing with large numbers of objects because we are ignorant of cause and effect relations as applied to the individual—which is the common sense and usual interpretation—but that because of the very nature of nature itself, it acts according to the laws of probability. This is their interpretation.[5]

Now, I realize that many will be asking, "What is the indeterminancy principle?" or "What is state?" I assure you that each of these concepts occurs in modern physics. Interpretation used

[4] Werner Heisenberg's ideas are to be found in an early statement by him in English in *The Physical Principles of the Quantum Theory*, 1930, Chapter IV. A more recent statement is in *The Physicist's Conception of Nature*, 1958. Heisenberg says, commenting on Aristotle's list of four causes, "Only the *causa efficiens* corresponds to what is meant by the word 'cause' today." p. 33. That the application of statistical laws in itself does not challenge this cause is recognized by Heisenberg when he says, "This application of the concept of statistical laws was finally formulated in the second half of the last century as the so-called *statistical mechanics*. In this theory, which is based on Newton's mechanics, the consequences that spring from an incomplete knowledge of a complicated mechanical system are investigated. Thus in principle it is not a renunciation of determinism." p. 37. After referring to development of quantum theory beginning with Planck at the turn of this century he says, "However, it took two and a half decades before it became clear that *quantum theory actually forces us to formulate these laws precisely as statistical laws* and to depart radically from determinism." p. 39. The italics are Heisenberg's.

[5] An interesting expression of this idea is given by Bohm: "We have thus come to an interesting inversion. For deterministic mechanists regard chance as reducible completely and perfectly to an approximate and purely passive reflection of determinate law. On the other hand, indeterministic mechanists such as von Mises and the proponents of the usual interpretation of the quantum theory, regard determinate law as reducible completely and perfectly to an approximate and purely passive reflection of the probabilistic relationships associated with the laws of chance." David Bohm, *Causality and Chance in Modern Physics*, 1957, p. 64.

as a critique of cause and effect makes use of these concepts and involves calling into question the ontological reality that is necessary in order to think of cause and effect in any other than an idealistic manner. Since the ontological interpretation of cause and effect does not apply in quantum theory, and since interpretations involving probability do, therefore the contention is that cause and effect is an unnecessary concept having its origin in a prescientific state of man's development.

My own understanding is that it is the old problem associated with the question, "What is real?" In anything scientific—whether it be knowledge or its ordering—this is always subjective and carried to an extreme by the idealist. The mind can never get away from this. It cannot think anything but thoughts. Cause and effect is just one of these thoughts. And it is these thoughts which we bring to any explanation which gives understanding. Must we always side with Berkley?

Perhaps the extreme operationalist [6] would feel freed from the apparent restriction, because he claims not to bring what is subjective. An electron is that which is represented by the totality of all experiments done by man with the electron—and it is nothing more. This indeed is an extreme effort to gain objectivity—but what is left? Only apparatus and sense perception arranged as data. What is its meaning? What indeed is the meaning of meaning itself without the subjective mind to play its part?

All of this is vicious. And there is only one way for me to gain relief and some peace that I may make sense out of the sensible data, and this is to believe in the reality of electrons and other forms of matter in nature, and to bring to the understanding of the data by which it is manifest to our senses such developed subjectivity of the mind as is possible. This is all I have. No one has suggested any third element. It is either mind or matter—but why should it be mutually exclusive? This I could never understand. Cause and effect belong to matter, or better to substance, in its several degrees. This is the way I prefer to talk about cause and effect, and not as originating in thought. It is perhaps true that the electron was invented to explain some ideas that J. J. Thomson had or Millikan had, and it is also possible that its positive counterpart the positron was invented in a higher stage of mathematical sophisti-

[6] See P. W. Bridgman, *The Logic of Modern Physics*, 1938, for the leading exposition of the meaning of operationalism.

cation to account for a singularity in mathematics. These ideas of Thomson and the mathematics of Dirac exist—but their existence as ideas or singularities is something quite different from the existence of matter, in which I also believe; and it is the effects in matter from which I think of cause. That is, there is something in nature which is the grounds for accepting the existence of the ideas or the singularities in mathematics as something other than mathematics,[7] namely certain ideas among all possible ideas. Why ask the physicist about the electron? Why not ask the poet? The poet's answer might be more interesting because it might exhilarate the mind to appreciate the possible. But the physicist's idea is closer to the real—because with him something more than mind has restricted the full flight of the possible. For him it is *this* electron with *these* properties as distinct from all possible electrons with all kinds of properties.

The Compton Effect

There is abundant evidence in physics of a microscopic level (better a submicroscopic level) in the world— a discrete degree separate from the world of human sensation. I select a work on physics from my book shelf. Its index lists at least fourteen "effects," such as Compton effect, photoelectric effect, Doppler effect, etc., etc.—in short, all the way from A where we note the Auger effect to Z where we note the Zeeman effect. Do these

[7] Although the belief in a physical substratum *and* of ideas is not strange to the average worker in science as well as others this is not regarded as a respectable view by many philosophers. Nevertheless, I believe it to be consistent with philosophy based upon Swedenborg. That causality has to do with objective being, rather than idealistic concepts, is held to by many who have given careful consideration to the problem. For example we read, "Causality, it appears, deals with the fundamental workings of nature and should not be affected by accidental circumstances such as the extent of scientific knowledge or human ability." Lindsay and Margenau, *Foundations of Physics*, 1936, p. 521. Bohm speaks of what he calls "autonomy." For example he says, "Now, thus far, we have always found that such autonomy exists. Indeed, if it did not exist, then we would not be able to apply the concept of a 'thing' and there would then be no way to formulate any laws of nature. For how can there be an object, entity, process, quality, property, system, level, or whatever other thing one cares to mention, unless such a thing has some degree of stability and autonomy in its mode of existence. . . ?" David Bohm, *Causality and Chance in Modern Physics*, 1957. p. 140.

effects stand alone without any relation to anything else? I think they do not.

Let us single out one of these effects—the Compton effect, for example. What can we learn from it? It was discovered in the early 20's by Arthur Compton, whose field of research was X-rays. He died only recently, and as late as January 1961 I heard him explain to an audience of several hundred the experiences of those days. These alone comprised the address. To explain the apparatus used would take another address, and how data was read and arranged another—and how this data was related to other data in other fields of physics still other addresses. Compton himself has written a large book on the subject. So you can see, I could hardly tell you all about it even if I knew.

However, let us take a partial look at the Compton effect.[8] X-rays were shot into the face of a crystal. They were reflected and photographed. Where there should have been the image of one ray on the film there were two. Crudely it was as if one looked at the reflection of a match stick in a plane mirror and saw two matches instead of one.

Now, Compton and his coworkers considered and checked all the obvious explanations; they were all found to be not pertinent. Something fundamentally new had been discovered. It was a problem not only to find out what this something new was in a qualitative sense, but to explain its details. When one looked at one of the lines he asked not just, Why is it there at all?—but: Why is it in that particular place on the film and not some other place? Why is it as bright or as dim as it is? Why is it as broad as it is? And then he would look at the other line and ask all the same questions; and then at both of them and ask, Why are they

[8] For complete treatment see Compton, Allison, *X-Rays in Theory and Experiment*. A briefer treatment but adequate for our purpose is in Richtmyer et al., *Introduction to Modern Physics*, p. 386 et seq. The temptation was strong to include an explanation of the experiment and conclusions but this is unnecessary because such explanations are easily found in many other places as well as the two cited. For our immediate purpose it is necessary only to see the great wealth of questions the mind brings to bear in its efforts to explain the effects, and to appreciate that causal explanations depend upon a model imagined in a microscopic world one discrete degree removed from the world of human sensation. Naturally anyone who wishes to understand things fully will wish to read a good treatment of the Compton effect.

separated by just the amount they are? And then he would ask, What would happen if the reflecting crystal was made of something different? Only experiment could tell. What would happen if the surface was rotated in space with respect to the direction of the X-ray beam? What would happen if the nature of the beam itself was changed by using different wave lengths? What would be the relation of the effects made by substances chosen from various places in the periodic table, and do these different effects in any way relate to other properties known about these substances because of their locations in that table?

I spent the greater part of an hour one time going over the details of this experiment with a group, and the reaction of one person was that "it is confusing." I asked a friend what he thought of that; he said, "Well, in the sense that Spring is confusing?" My own reaction was that if one is in love with the phonetics of "confuse" then change the meaning entirely but keep the sounds by saying "Spring is profuse!" Or dispensing with phonetics maybe it is as one author put it with reference to a set of data: "It is like a jungle to be explored." Unless one starts with "confusion" as an *a priori* concept of science, confusion is not the word. Nor did Compton think so.

The natures of all possible kinds of waves were considered. Finally they were assumed to be corpuscular in nature. Also the nature of the crystal surface was considered—if it be of atoms with electrons going around nuclei—some going in this sense in their orbits, others in that. Some electrons were considered to make head-on collisions with the light corpuscles, some to make glancing blows. Sometimes the light corpuscles struck atomic nuclei instead of electrons. What were the energies of the light corpuscles, and the changes in energy of parts of the atom which were struck in the collision? How could a calculation using these energies give the paths of the scattered parts? Did the results of such thinking explain the lines on the photographic plates qualitatively *and* quantitatively? They did. Is this confusing? Is this just a play among effects? Are these all the questions that can be asked? Not at all. What happened to the light corpuscles which were scattered? Had they changed their properties? Indeed the assumed model required that they would. Then experiment measured these properties and verified their change. What happened to the parts in the original crystal which were struck? If some

of them were in the right state and were struck hard enough, would they not be dislodged? In what direction? And with what energy? Compton said to look for these things—and they were found.[9]

This is not confusing nor is it even just profuse, nor is it a jungle. It is wonderful! Creation is wonderful, and all the effects which are in the world of human sensation—in this case two blurred lines[10] on a photographic plate—give evidence of a world, a submicroscopic world, that we can never sense with our senses. Yet by just such indirect evidence as is sensed through the Compton effect, we can construct some kind of a picture of that world.

The evidence is overwhelming that the laws operating there are not as we understood them previously in an apparently satisfactory way with respect to the world of human sensation. The models we picture are inadequate; they are like analogies that are good as far as they go. That world is not the same as the world we sense immediately. Yet it exists, and what happens there is the cause of what happens in the world which we do sensate.

There are many such examples as this in physics.[11] I would guess there are thousands in the whole of science.

[9] The reader of the Writings will be interested in the relation of these questions that arise from effects to possible causes in the "model" imagined wherein a corpuscle-like photon strikes an electron moving in its orbit and is deflected and also changes its properties as a result. See, *e.g.*, DLW. 184. A brief discussion with some suggestions is included in the Philosophical Notes in this issue.

[10] Actually the lines were only apparently blurred, as their very structure, going from light grey on one edge to darker grey in the center and thence again to light grey on the other edge, was interpreted as having meaning in terms of the model.

[11] As a starter by way of gaining a realization of what is involved here one should understand that the study of X-rays in the Compton effect is but one aspect of X-rays. For example there are Laue patterns and powder-X-ray techniques which also use X-rays to probe the structure of the microscopic world. Then also X-rays form only a part of the electromagnetic spectrum available for various types of spectroscopic techniques which go by such names as atomic spectra, resulting from ultra violet, visible light, and infrared spectroscopy, not to mention gamma ray and radio frequency techniques. Then aside from spectroscopy which makes use of electromagnetic waves there is particle spectroscopy, as for example in the case of the mass spectrograph. Moreover there is what may be called field-absorption spectroscopy as with nuclear magnetic resonance and of electron spin resonance. Each of these spectroscopic techniques represents a method by which

Cause in the Writings

Up to now little has been said about what would be brought to a study of cause from the Writings. We pass now to some general remarks about the subject which depend upon interpretation from the Writings.

However deeply we enter into a study of cause, while on this earth we do so only by means of the natural mind. And if we consider an essential characteristic of cause as related to effect to be explained by discrete degrees, then there seem to be in the nature of things at least two limitations on this penetration in depth.

1. Our immediate knowledge of discrete degrees is limited to those degrees which are in outmost, for these are the only ones we can come to know immediately through sense perception. It is from these that we can think and not from those which are on a higher or a more interior level. However, in the Writings this limitation is modified because, we are taught, we can think *about* the higher degrees. What is involved in this is outside the scope of our present topic. I recite it because it ought to be included in any consideration of New Church philosophy.[12]

2. Every philosophy sooner or later becomes introspective. And the thought which may first have been directed outward becomes directed inwards. This is illustrated in the philosophy of Descartes, of Berkley, of Hume, and of Kant in an explicit way in their writings. If in New Church philosophy we direct our thoughts introspectively into our minds we see there a limitation in the light of the Writings. Because while limited to the conscious use of the natural mind we are limited to the way in which that mind develops. This is not by discrete degrees but by continuous degrees.

Our minds, it is true, can benefit by a temporary raising up. But

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physicists probe the submicroscopic world. Each of the effects gained should be explained in terms of a model of that world. There is a wonderful variety of effects that require a consistent explanation in terms of cause and effect.

[12] This ought to be developed from the Writings. In DLW 256, for example, it says," . . . enlightenment of the natural mind does not ascend by discrete degrees; but increases in a continuous degree. . . ." Nevertheless because we are taught about causes it says later, ". . . for effects present causes in themselves in clear light, and thus illustrate them, when there is some previous knowledge of causes."

even with the Writings themselves, which constitute the internal sense, this internal sense must flow into the natural language—the same language as the Old and New Testaments. So it is with such temporary raising up—its results must flow into thought which thinks from effects.

It could hardly be expected to be otherwise than that those who cannot make use of the Writings or in some way come into a knowledge of causes could only think from and about effects.

3. We come to a fundamental position that permeates all of our education and all of our studies, which stands out as a distinctly New Church contribution to education. This distinctive New Church doctrine is that the natural mind which is developed while on this earth serves as a basis for what a higher mind may be able to do in the next world. And the particular contribution on the subject of cause is that the natural may come to know that it does think from effects, but in its growth it can come to think about causes.

If its knowledges include those of discrete degrees, it can then come to have some realization of what might be possible if it could but think from causes. And if, to go one step further, it can come into this realization then the way might be clear for it to think from ends.

Some Unanswered Questions

These remarks were begun by listing some of the difficulties of giving a complete treatment. As we got into the subject the list of recognized unfinished tasks grew. Some questions which arose are:

1. The remarks shunned throughout any use of a modifier of cause, as "final," "essential," or "instrumental." A careful study would distinguish between these kinds of causes.

2. In our remarks we used the idea of the cause and effect relation associated with discrete degrees. The importance of this can be gauged by the frequency with which this idea is mentioned in the Writings. It needs development.

3. A clear distinction needs to be drawn between determination and cause.

4. A very important consideration of causes would come out of a treatment of the idealistic position—*i.e.* what the mind brings to knowledge. In our remarks we dogmatically asserted that the cause which we were talking about was ontological—as having to do with the reality of being. Thus when applied to science we would agree with Lindsay and Margenau when they say.

> Causality, it appears, deals with the fundamental workings of nature and should not be affected by accidental circumstances such as the extent of scientific knowledge or human ability. *Foundations of Physics.* p. 521.

Even so, what does the mind bring? This is to consider formal causes—a very important subject which was completely by-passed.

5. The quotation just stated points up another omission—what is the difference between "causality" as a principle and "cause and effect" as objects of study?

6. The Humean concept of cause as it is presently interpreted by many involves time sequence. Eventually as we progress through discrete degrees in nature we would leave behind the world of time—yet the cause and effect relation is still important. That existence is perpetual creation points up the simultaneity that exists between cause and effect—in time but not according to temporal sequence. This needs development.

7. A common inclusion in definitions of cause and effect involves the necessity that the effect always follow its cause. Yet New Church philosophy must acknowledge that the container does not always accept the influx. There is need to introduce here the doctrine of order. This needs development.

And so you see our treatment is quite incomplete as such illustrative questions as the above clearly show.

REVIEW

RELIGION AND LIFE. A translation of the section on good works and the Ten Commandments included in the exposition of the fifteenth and sixteenth chapters of the Book of Revelation in the work entitled *The Apocalypse Explained* by Emanuel Swendenborg. Translated from the Latin by John Chadwick with Erik Sandstrom as Consultant. The Swedenborg Society, London, 1961. 92 pages including title. Price 2/6d.

The translation is based principally on the Latin text edited by S. H. Worcester, published at New York in 1885; but reference has been made to the manuscripts and other editions and translations. (From Translator's Preface.)

Religion and Life is another of the several New Church publications now coming out which has an attractive cover, an easy to read style, and pocket book size. The contents include, besides the explanation of the Ten Commandments, a chapter on the good of charity, the two requisites for works to be good, evils which are to be shunned, refraining from evils, life according to the commandments, and the Ten Commandments in general.

The style of *Religion and Life* is one of simplicity, clarity, and brevity. The translator has gathered direct statements of doctrine from nos. 932 to 1028 of the *Apocalypse Explained*. The method of sentence structure seems to indicate that the translator anticipated questions about relationships and tried to answer them and explain the doctrine at the same time. This method is an interesting one and should prove successful. *Religion and Life* lends itself quite favorably to missionary purposes as well as to useful study in New Church homes. This is the kind of book that one can pick up, read a paragraph, get right to the point, and immediately apply the teaching directly to life.

We would note that one third of *Religion and Life* is devoted to the sixth commandment. A somewhat different way of expressing the term 'conjugial love' is used in the following paragraph from *Religion and Life*: 44.

The best way to see that marriage is heaven and adultery is hell is from their origin. The origin of truly conjugial love is the Lord's love towards the church. Hence the Lord is called in the Word Bridegroom and Husband, and the church is called bride and wife. It is this marriage which makes the church a church in general and in particular. The church

in particular is the man in whom the church is. It is clear from this that the Lord's conjunction with the man of the church is the very origin of truly conjugial love. But it must also be explained how that conjunction can be its origin. (*AE* 983).

Considered in its entirety *Religion and Life* appears to be an excellent treatment of a very vital section of the Writings, addressed to the adult rational mind. Perhaps the most interesting aspect of the book is the way in which the first three commandments, having to do with the Lord, are shown to be connected by the fourth commandment to the last six, having to do with the neighbor. The fourth commandment deals with both the Lord and the neighbor. Another related aspect concerns the fact that eight commandments have to do with what is not to be contemplated or done, and two commandments have to do with what is to be thought about and done if man is to inherit eternal life.

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PHILOSOPHICAL NOTES

Discrete Degrees. In the third section of the paper on *Cause* in this issue of THE NEW PHILOSOPHY there is illustrated the great variety of questions that may be asked concerning the cause of two lines on the photographic plate in the Compton Effect. The answer to each of these many questions seems to involve a cause which is in a part of creation one discrete degree removed from the world of human sensations.

If we limit ourselves to the world of human sensations all we can do is to describe the apparatus used and show the film with its images. If, however, one assumes that these images have a cause then one endeavors to imagine a model of something in nature that causes these images as effects. Indeed this is "to create a hypothesis."

What is the value of such a hypothesis? The value for practical matters is that the hypothesis may lead to certain conclusions not previously suspected and from such conclusions new experiments are suggested and new effects are observed.

For example, in the case of the Compton effect, it was suggested that the X-ray photons under certain conditions would dislodge electrons from a crystal struck by X-rays. This was an entirely