

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 conjugal 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

new effect to be looked for. Previously known effects were that X-rays could penetrate deeply through solid matter which was opaque to light of longer wave length—visible light for example—and the effect that X-rays could be diffracted as in the case of Laue patterns, and finally that the frequency of the scattered X-rays is changed in the Compton effect itself. Now it was suggested, in addition to the above effects, that electrons would under certain circumstances be dislodged. This effect was discovered. The Compton effect was announced in 1922; the discovery of the “recoil electrons” as they are called was announced in 1923. (For a description and also for a bibliography of experiments growing out of the discovery of the Compton effect see *X-rays in Theory and Experiment*, 1934, Compton and Allison.)

There is a further value to the hypothesis, however. The fact that a hypothesis does lead to new effects strengthens the possibility that the assumed model has some aspects closely related to reality. This means we have a deeper view of nature than that given by effects alone. We see here a confirmation in science of something taught in the Writings.

A knowledge of degrees is like a key to lay open the causes of things, and to give entrance into them. Without this knowledge, scarcely anything of cause can be known; for without it, the objects and subjects of both worlds seem to have but a single meaning, as if there were nothing in them beyond that which meets the eye; when yet compared to the things which lie hidden within, what is thus seen is as one to thousands, yea, to tens of thousands. DLW 184.

The confirmation lies in the fact that in the imagined model a photon striking an electron in a nucleus causes the electron to be dislodged and also causes the photon to lose some of its energy. The scattered photon and the recoil electron are studied by their respective effects.

Some of these effects would be not only unknown but also completely unrelated to each other if it were not for some sort of a model assumed in the microscopic world which we relate to these effects as their cause.

Cause and Effect Related. It ought to be noted, however, that there is a severe limitation upon the model as representing the “truth.” It is a model, in a degree higher, constructed by the mind on the basis of effects in a lower degree. We also read in the Writings:

Yet from effects nothing but effects can be learned; when effects alone are considered no cause is brought to light; but causes reveal effects. To know effects from causes is to be wise; but to search for causes from effects is not to be wise, because fallacies then present themselves, which the investigator calls causes, and this is to turn wisdom into foolishness. DLW 119.

It appears then that our "model" not only deepens our knowledge about the nature of creation itself but also advises us about further effects that might make themselves known to our sensations. Our "model" suffers all of the limitations of any deeper construct based upon effects alone as taught in DLW 119. The attitude of science which regards these hypotheses as "tentative" is consistent with New Church philosophy.

The Nature of the Microscopic World. It might irritate the mind that it cannot picture the nature of the microscopic world. But if one admits the existence of discrete degrees, is it not to be expected that if the microscopic world is a discrete degree different from the world of human sensation then models of the parts of that world can never be constructed in terms of the effects in the natural world? Indeed, granting discrete degrees, why should we expect our models of a world removed from human sensation to have any element of truth at all in them? The evidence for such an element of truth consists solely in the ability of such models to account for effects.

Many scientists admit of this reality in the microscopic world—whether or not they accept discrete degrees. Not only is the reality accepted but also that such a world cannot be described in terms of pictures obtained in the world of human sensation. For example, But it does not follow that it will always be possible to construct a picture of the physical reality that causes these experiences, in the same way in which we picture everyday objects. In classical theory, an electromagnetic field was assumed to have a certain character at every point in space and at every instant of time, as represented by certain values of the electric and magnetic vectors. According to the new view, such a conception of the electromagnetic field is valid at best as an approximation, and only in certain cases. *Introduction to Modern Physics*, 1955, F. K. Richtmyer *et al.*

Time Is not an Essential of Cause and Effect. Why do so many people who write of cause involve the time sequence as essential in its definition? There are two possible reasons. First, it may have originated in the language used by Hume. Second, it may be because of the way in which cause has in recent years been identified

with a special form of determination originating in Newton's laws of mechanics. In these laws expressed in differential equation form, time is usually involved implicitly.

It must be acknowledged that Hume repeatedly discusses that situation wherein from experience we observe that "A" always follows "B" and from this assign "A" as the effect and "B" as the cause. Now it is easy to think of examples of such a relation where "follows" means "follows in time." But must Hume be read this way?

There are three different ways of looking at cause and effect relations in which one can dispense with time. First of all, there are those instrumental forces of nature that obey Newton's action and reaction law. The table supports the book, for example, by pushing with a force equal to the weight of the book. To be sure this takes place in time but it is not a time sequence cause and effect. It is a simultaneous relation.

Second, we consider Swedenborg's association of cause and effect with discrete degrees. It is evident that sooner or later on some level we leave the world of time and space. Beyond this point time no longer has any relation to cause and effect.

Third, there is in nature a manifestation of influx from the Creator. Our very language in many respects implies this idea when we say such things as the climate or the conditions are right. If we ascribe to these conditions the cause, then the effect does not follow the cause in time, but is conjoined to the cause—within time to be sure, but not according to a time sequence. The conditions of spring provide the climate for which things happen in the spring, and these things happen so long as that climate persists.

"Existence is perpetual creation" incorporates the idea of time, but not of time sequence—only of simultaneity of time.

Thus because there appear to be cause and effect relations that occur simultaneously and also because the doctrine of discrete degrees leads us eventually away from the world of time, the temporal succession of cause and effect is not a necessary property of cause and effect in New Church philosophy.

This conclusion is in addition to and seems to agree with some of the authors who do not identify cause with determination. For it seems to be this identification that is responsible for interpreting the Humean "follows" as "follows in time."

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