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A COURSE IN "NATURAL PHILOSOPHY"

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VI. Experience and Illustrations

Swedenborg says: "Can you tell me by synthesis, or *a priori*, before seeing the viscera or examining the interior parts, what is contained within the animal body?" The function of experience in the search for knowledge is self-evident to most people when it comes to enumeration, geometrical form, and identification of color in the vast array of the parts of nature that meets the senses most immediately. Even the use of scientific instruments is obvious in some cases, for example the microscope or the telescope. They merely extend the range of the senses. Objects are enlarged or brought nearer, but form appears as form.

However, instrumentation often does more than merely to extend the natural limit of the senses by making use of measurements in an indirect manner. Suppose, for example, that we desire to obtain some idea of molecular dimensions. No ordinary measuring tool would be of use to us in this case in a direct manner. In 1922 Hertzfeld collected a long list of indirect methods by which molecular dimensions may be obtained. (See Loeb, *Kinetic Theory of Gases*.)

The indirectness of measuring the diameter of the molecule is such that, without a detailed description of the instruments used and the theory of their operation, it is impossible to give a very good idea of the experiences which lead observers to assign numbers like 10^{-8} centimeter to the diameter of a molecule, or to say that about 300,000,000 of them laid side by side would make one inch. One who wishes to point up the nature of such a number

* Continued from the January issue.

might well ask, "Who will do the laying, and with what?" What sort of sense impression can justify a number so enormous as the latter or so minute as the former? Neither of these numbers can be assigned in any direct manner from experience as it is customarily meant.

A method of approximately measuring the diameter of a molecule will be described. It can be seen that a thin layer of any material must be at least one molecule thick. Thus by measuring the thickness of various thin layers one can obtain an idea of what is called "an upper limit" to molecular dimensions. (See Sutton, *Demonstration Experiments in Physics* p. 465 for some details.)

But how to make these measurements? Surely a meter stick or any of the usual measuring devices such as micrometer calipers is of no use for this purpose. The methods all call for indirect measurements, and thus the term "experience" must be extended in meaning.

Oil and soap films are commonly used as examples of thin layers. And while optical methods setting the upper limits of molecular dimensions to be not greater than the wave length of visible light are not difficult to perform, the technical "know how" required might leave some of our readers unaffected. Nevertheless the following experimental approach will be appreciated.

Almost everyone at some time has seen gold leaf. The area of a sheet of gold leaf is fairly easy to measure. Gold leaf is sold in booklets each of whose "pages" is about four inches by four inches. If ten or so gold leaves are weighed on a balance and the resulting weight is divided by the product of the total area and the density of gold, an "upper limit" of the diameter of a gold molecule is found. This gives a value of the order of 10^{-8} inches. The experimental fact is recorded (see Loomis, *Field Book of Common Rocks and Minerals*, p. 30) that one grain of gold can be beaten into a thin leaf covering an area of fifty-six square inches. An arithmetical calculation shows that such a thin layer is about $1/250,000$ of an inch in thickness.

Molecular diameters are smaller than those given above because the actual films are ten to a hundred molecules thick, nevertheless these experiments afford an idea gained from immediate experience of how numbers can be assigned to molecular dimensions.

Another experiment, closer to the experience of most people,

has to do with mixing colors. The common belief, and the common experience, is that there are three "primary colors" which when properly mixed will produce a color that will "match" any given fourth color. The experiment is performed by adding the three primaries by projecting three colors on the same area of a screen from three different projection sources. When red, green, and blue are chosen as the "primary" colors, the widest range of colors can be matched—but not all. However there is a sense in which additive color mixtures will produce *any* color if the concept of negative quantities is admitted. (See Sears, *Principles of Physics*, Vol. III, for a detailed discussion.) This last can be explained in the following manner. Take any three colors *A*, *B*, and *C*. By adding these three colors with proper intensities, a great variety of given colors can be matched. In the case of a color *X* which cannot be matched by this process, the color mixture *A* plus *B* can be made to match the color mixture *C* plus *X*. Certainly the results given above are known by experience alone; reason could not predict them.

Experiments, if they perform their assigned task, give us new knowledge. The choice of the above two experiments was made in the hope that, to many of our readers, they would convey new knowledge based upon experience with a certain degree of reasonableness, although actual demonstrations through writing are impossible. If they do not convey new knowledge to other readers, then this section is probably unnecessary for them.

VII. Epistemology and Illustration

Even as the studies in our course in reason are self-conscious studies, and our considerations of experience self-conscious ones, so also our philosophical questions are self-conscious. The self-conscious questioning, 'How do I know what I know?' leads to epistemology. For a more general idea of epistemology, going beyond self-conscious criteria as it may be used in New Church philosophy, see *The Principles of the New Philosophy*, Hugo Lj. Odhner, NEW PHILOSOPHY reprint, July 1941. Descartes was an epistemologist when, in an effort to avoid error, he doubted all until he became convinced of the single certainty that he was a doubter and from this certainty concluded that necessarily he existed. From this as a starting point for valid grounds of

knowledge, Descartes then went on to establish the other knowledges he already possessed even to the proposition that "God exists." Descartes was not a skeptic. He was a geometer. As a geometer he valued the method of Euclid. He regarded this method as providing the grounds upon which he could arrive at "clear and distinct" knowledges. That is, geometrical proof was for him an example of what is clear and distinct, and thus he sought to be able to regard other knowledge with the same clearness and distinctness. He says, for example:

"I was especially delighted with the Mathematics on account of the certitude and evidence of their reasonings: but I had not as yet a precise knowledge of their true use; and thinking that they but contributed to the advancement of the mechanical arts, I was astonished that foundations, so strong and solid, should have no loftier superstructure reared on them." Method I.

The advantage of the "method," as Descartes calls this application of mathematical reasoning to a loftier superstructure, is illustrated when he says:

"In the same way I thought that the sciences contained in books (such of them at least as are made up of probable reasonings, without demonstrations), composed as they are of the opinions of many different individuals massed together, are farther removed from truth than the simple inferences which a man of good sense using his natural and unprejudiced judgment draws respecting the matters of his experience." Method II.

In this is seen the regard with which Descartes holds the individual man as to his personal worth and dignity. These come about from what is proper to man himself, that is, what is most intimate to him and what is his sole possession.

But all epistemologists have not attached the same certainty to the same things. Still less have the results of the special method of Descartes led to indisputable conclusions. To illustrate: the *Ethics* of Spinoza stands as a wonderful example of carrying the method into practice. In this work Spinoza tries to establish the morality of Christian ethics as necessary conclusions based upon certain axioms.

Some idea of the nature of these necessary conclusions may be seen in the following sample propositions taken from Part II.

Prop. XLI. Opinion is the only source of falsity; reason and intuition are necessarily true.

Prop. XLII. Reason and intuition, not opinion, teach us to distinguish the true from the false.

Prop. XLIV. It is not in the nature of reason to regard things as contingent, but as necessary.

Prop. XLVII. The human mind has an adequate knowledge of the eternal and infinite essence of God.

Prop. XLVIII. In the mind there is no absolute or free will; but the mind is determined to wish this or that by a cause, which has also been determined by another cause, and this last by another cause, and so on to infinity.

(*Ethics*, Elwes edition)

The power of reason (and intuition) with the follower of Spinoza's *Ethics* is evident from propositions XLI and XLII. The inflexibility and certainty of necessary conclusions are manifest in XLIV. The self-sufficiency of reason, that is, the implication that revelation and experience are unnecessary, is seen in XLVII. Finally, determinism, which is predestination follows as a necessity in XLVIII. While the above conclusions might agree in some respects with Christian religion, it can *in no manner* be said to be based upon the same grounds.

Spinoza's *Ethics* is again at variance with Christian religion, however, as is evident when particular attention is paid to his words. After the definitions of what he calls emotions, i.e., ambition, luxury, intemperance, avarice, and lust, he says: "These last five emotions (as I have shown in III lvi) have no contraries."

It is evident that this is quite a different view from that which regards these passions as perversions. Yet Spinoza's conclusions through the application of the "method" are to be regarded as "necessary" because he has proved that the emotions are passions, and furthermore, he has shown that passions are dispelled with the development of the reason. Once reason has developed how can it conceive of a contrary to a passion?

Hume, who followed Descartes and Spinoza, also sought certain knowledge. But for his source he looked elsewhere than into reason. For him certainty begins in impressions. Hume regards the Cartesian method as one of the forms of skepticism. He cannot see how the doubting, once begun, can ever be stopped. He says:

The Cartesian doubt, therefore, were it ever possible to be attained by any human creature (as it plainly is not) would be entirely incurable; and no reasoning could ever bring us to a state of assurance and conviction upon any subject. (*Concerning Human Understanding* XII—1.)

Kant, the epistemologist, sought still other grounds for certainty of knowledge than those set forth either by Descartes in reason or by Hume in experience. For him the *a priori* knowledge of space and time constituted the starting point. Kant opposed the conclusion of the Cartesian school that logical necessity leads to reality.

The basis for his criticism is contained in his famous *theses* and *antitheses*. For one of these theses was the proof that God exists using the Cartesian "method." The corresponding antithesis proves that God does not exist by the same "method."

The example set by Descartes, Hume, and Kant is valuable in our studies. Each of them in his own words shuns skepticism and strives toward establishing the certainty of his knowledge. As noted above, however, Hume referred to Descartes' objective as skepticism. Kant in his turn levelled the same accusation at Hume when he said:

"Yet even he . . . ran his ship ashore for safety's sake, landing on skepticism . . ."
(*Prolegomena*)

We in turn, reflecting upon Kant's conclusions concerning metaphysics, can call him a skeptic.

It would seem that this demand for certain knowledge is too severe; and it would also appear that each of the great philosophers in his turn became so convinced of this that he sought other grounds upon which man may live than upon the dictates of *certain* knowledge.

Even while enduring the process of doubting, Descartes felt bound to set up for himself practical principles by which to live. He says:

"So that I might not remain irresolute in my actions, while my Reason compelled me to suspend my judgment. . . . I found a provisory code of morals, composed of three or four maxims. . . . *First*—to obey the laws and customs of my country, adhering firmly to the Faith in which by the grace of God, I had been educated. . . . *Second*—to be as firm and resolute in my actions as I was able. . . . *Third* . . . to endeavor always to conquer myself rather than fortune, and change my desires rather than the order of the world. . . ." *Method III.*

If Hume was accused of skepticism, it was because of what his arguments led to, unknown to himself. At least he did not think that in his own life he was misled by skeptical results. For him skeptical results "admit of no answer and produce no conviction."

"The great subverter of Pyrrhonism or the excessive principle of skepticism is action, and employment, and the occupations of common life."
(*Human Understanding* XII—2.)

It almost sounds as if he were saying: "to confound your misbelief, perform uses!"

Kant, after the foundation of reason on the *a priori* concept of space and time leads him to the difficulties inherent in the equal necessity of thesis and antithesis, nevertheless sees that man must live, and live in a purposeful world, and that this living must be moral. Reason becomes a regulator and defines, not knowledge, but its limit. ". . . we have ground for assuming as a principle in the investigation of nature that nothing in nature is without a purpose; but the final purpose of nature we seek there in vain." He proceeds to show the misfortune of one who manages by some device to be persuaded of the proposition that there is no God, even though he lives the moral law, that is:

". . . (he) . . . would always be contemptible while having such a disposition, although he should fulfill his duty as regards its (external) effect as punctiliously as could be desired, for (he would be acting) from fear or from the aim at recompense, without the sentiment of reverence for duty." (*Kritik of Judgment* II para. 87.)

VIII. Truth

It will be noted that the term "knowledge" and not "truth" has been used throughout in the above. In philosophy "truth" has always been a term to give pause. The prominence of the term "knowledge" in the literature testifies to this, not to mention the large list of terms that hint at but never stand for or pretend to take the place of truth; for example, "science," "valid statements," "axioms," "principles," "laws," etc.

"Truth" carries with it an authority beyond any considered in our course, which is directed at the introspective means available to man. This direction toward reason and experience is carried out in a self-conscious manner and we seek to understand something of its intimate nature. This nature, which is indeed not always conscious with man, is essential to his very existence as a thinking being, but it is limited. On the other hand, "truth" is not so limited. It is not relative to the intimate nature of man. Those who have seen this, but deny the possibility of absolute truth outside the individual man, have come to say that "truth" is a meaningless expression."

The intimate nature of philosophy grows and dwells in the individual mind. Philosophers of all ages have seen that it is only the ideas that are in the mind that can be perceived by the mind. The belief that these ideas are the sole source of science has been the basis of idealism, whether of the less strict variety of Locke or the more formalistic brand of Berkeley. We cannot deny the individualistic nature of reason and also of experience, yet for this very reason it is necessary that the philosopher take care that one or the other of these, namely, reason alone or evidence of the senses alone, does not master him in the search for knowledge. Each has in its turn led to philosophic excesses that have eventually resolved in a sterility of knowledge which is just as effective in bringing an intellectual age to an end as is faith alone.

It is important to realize that there is an immense possibility for the growth of New Church philosophy through the investigation of Swedenborg's teachings regarding other guiding sources than experience alone and reason alone! The doctrine of connected wholeness, for example, means something more than mere integration of knowledge. It would seem that the doctrine of order would imply other series than those implied by logical reason and systematic observations. It would also seem that the doctrine of series would lead to something more than a faithful recording of natural history, or mere enumeration, or orientations geometric or aesthetic. Swedenborg says: ". . . the truths in the rational mind do not deserve to be called truths, but principles only, as indeed it is usual to call them" (AK 4). This indicates how remote are truths from sense impressions, imaginations, thoughts, necessary conclusions, facts, ideas, yes, of principles themselves. Truths are beyond all these and do not stand isolated but are in agreement with *all* other truths.

This is in marked contrast to the results of philosophy which depend on reason and experience only. The results of reason alone have led to Euclidean geometry *and* non-Euclidean geometry. Each of these is a necessary conclusion under its respective hypothesis. The results of experience have led on the one hand to the corpuscular concept of the electron *and* on the other hand to the wave concept of the electron. Of the same electron? Well, yes and no. If we regard the electron as a limited volume, either corpuscular or wavelike, then in its travels from one place to another it has a *velocity*. In these same travels at any instant it

is some *place*. Now it is the task of the experimental physicist to assign a number to velocity and a number or series of numbers to locations. According to the present views these assignments cannot both be determined at the same time with an arbitrary high degree of accuracy. This is known correctly as the *principle* of indeterminacy. We have never heard it called a *truth* yet it is the only guiding means by which *sensible* experiments may be set up to investigate the electron.

Swedenborg said :

“. . . we are bound to admit, that *particular experience*, or that which strictly comprehends or immediately refers to one and the same object, however rich in detail such experience may be, and however enlarged by the accumulated observations of ages, can never be sufficiently ample for the exploration of nature in the sphere of causes. . . . Particular experience, or that which concerns but one object, can never be so luxuriantly productive of phenomena as to exhaust and exhibit thoroughly all the hidden qualities of that object" (EAK 12, 13).

Whether it be reason alone or experience alone that is regarded as the source of knowledge, their very intimate nature in each case carried implications on a practical level for Swedenborg.

With regard to reason he says :

"It is also pleasing and wonderfully accommodated, and in a manner akin to human minds ; it enables each mind to indulge its own tastes, to favor its own state, and to assent to an order, whose laws are proclaimed as truths" (n. 4). "And we are easily impelled and carried away into ideal games of this kind, inasmuch as they are races of our thoughts from assumed starting places to the very goals we desire to reach. This also pimps to self-love and self-glory, for as nothing properly belongs to us but the produce of our own minds, when these have conceived anything, and supported it by plausibilities, we suppose we have divined the pure reality . . ." (AK 8).

Concerning experiment he says :

"Besides, I found, when intently occupied in exploring the secrets of the human body, that as soon as I discovered anything that had not been observed before, I began (seduced probably by self-love) to grow blind to the most acute lucubrations and researches of others, and to originate the whole series of inductive arguments from my particular discovery alone . . ." (EAK 18).

It is unnecessary, however, to repeat the demands that Swedenborg made upon the use of reason and experience in all of his writings.

As distinct from the particular problems of the scientist the philosopher must face general problems. It is he who must recognize the worth and respect, the dignity of the intimate sources of human knowledge. Yet it is also he who must be aware of the dangers expressed immediately above. This presents to him a problem which is truly a philosophical one. It is up to him to regard it as a problem, not as a dilemma. This last goes beyond knowledge itself, which is properly beyond the subject of our course. Yet it implies an attitude, and this attitude depends upon a frame of mind which is constructed around a hope or a faith. And while a hope and a faith are not our subjects of inquiry, they are important to the manner in which we conduct that inquiry. We cannot ignore them. This faith, which is the faith of New Church philosophy, is that truth exists. There is also a hope proper to that same philosophy, and it is that we can approach the truth. It is of immediate practical importance that we search for particular experiences and particular series of reasonings that are consistent with truth.

Swedenborg says :

“Thus a truth, to be such, must not be true in itself simply, or in the conclusion alone, but in those things and their connection from which the conclusion is derived: whence every circumstance and every different modification varies the thing itself. Howbeit, I admit the existence of absolutely constant and immutable truths, both natural and moral, and pre-eminently, of spiritual truths; indeed, of all those that are in harmony with the perfect order of the universe” (AK 4).

IX. Conclusion

As indicated at the beginning, our course consists in trying to understand in some measure three things; namely, man's self-conscious application of reason and of experience, and the effect of this on philosophy, through the study of the criteria of knowledge.

It has been the main task of this paper to describe briefly reason, experience, and epistemology, and to give illustrations of them. Our purpose is to study reason, experience, and the criteria of knowledge affirmatively, and thus to derive a realization that they are indeed useful and necessary tools in the pursuit of knowledge—not merely by acknowledging this to be so but by seeing how it is so.

The illustrations were chosen with the hope that in spite of space limitations for our remarks, the reader might see the development of new knowledge in his own mind. In the case of reason, the illustration should show that the numerical results that go with "all that goes up must come down" follow as *necessary* conclusions from the laws of kinematics. In the case of one of the illustrations in experience, one should gain some idea "how does it come about that one feels it useful to assign such a number as one three hundred-thousandth's of an inch in the world he experiences?" This is quite a different thing from trying to picture the meaning of such a small measurement, which is the usual task assumed by popular treatments in science. And finally, the illustration in epistemology should lead to some idea of the practical use to knowledge of Descartes' *dubito ergo sum* and also a partial answer to the question, does this end the story? and if not, what does it lead to?

While to some the limitations of reason and experience may appear to be more important than their use, and the excesses arising from their unregulated application may have given cause for many of the commentaries on them, it is nevertheless the conviction of the instructor that an experienced self-conscious contact with each of them is a vital part of a liberal arts education. It is also his conviction that, however much we deride their importance, the man of action in the search of knowledge uses each of them—reason, experience, and the search for criteria of knowledge itself—constantly.

It might be the case that the more recent moderns who would reduce philosophy to logic or to epistemology have forgotten the lesson taught by the epistemological efforts of such great philosophers as Descartes, Hume, and Kant, that reason alone, experience alone, or the mere search for criteria, is barren. Perhaps Durant is right when he says: "The author believes that epistemology has kidnapped modern philosophy, and well nigh ruined it"; although it is highly questionable whether his remedy is very good, when he says "he hopes for the time when the study of the knowledge-process will be recognized as the business of the science of psychology." (*The Story of Philosophy.*)

X. Outline of Course in "Natural Philosophy"

As indicated in Section I (NEW PHILOSOPHY Jan., 1955), it was proposed to give in two installments an outline of a course offered in the College of the Academy of the New Church entitled "Natural Philosophy." Within the limitations of the space allowed, some idea of the nature of the course has been offered through sampling the manner in which our subject is treated. It must be obvious that what takes three periods a week for over thirty weeks to cover must have been very condensed to be treated in about thirty printed pages. Many of our readers must depend upon these few pages to obtain some idea, not only of the subject matter treated, but also of the spirit and attitude with which this subject matter is approached. The course itself fits into a more complete outline than these pages can indicate; and while its subject matter is not drawn from a textbook it nevertheless has certain definite reference material for the use of the students. Therefore for those interested, this second and final installment concludes with an outline of the course with references inserted.

1. GENERAL ORIENTATION. Before considering our subject proper we ask: How is it in a general way related to other intellectual disciplines? The answer involves a consideration of the terms "philosophy" and "natural philosophy," also an example of a "form" of thought.
2. INTRODUCTION. The purpose of the course is to introduce the ideas concerning the question "How do we know?" from three points of view. a) From reason alone, with an introduction to the methods of logic and mathematics. b) From experience (i.e., of the senses). c) From application to philosophy with emphasis upon Epistemology.
3. NATURAL SCIENCE IN THE NEW CHURCH. The use of the subjects considered in this course to the New Church scholar. Reference: "Science and Philosophy in the Light of the New Church" *Words for the New Church*.
4. REASON ALONE. Experience, Imagination and Thought compared. Reference: Swedenborg, *Rational Psychology*.
5. LOGIC; ARISTOTLE. An introduction into the beginning of a systematic study of the forms of thought other than purely

- grammatical leading to logic. The nature of logic considered. References: *Organon*, Aristotle, especially the chapter entitled "Categories." For treatment of Aristotelian logic itself, Churchman, *Elements of Logic and Formal Science*, especially the chapters entitled Deductive Science, The Logic of Propositions, General Exposition of the Traditional Logic of Classes. For modern logic, Tarski, *Introduction to Logic*.
6. GEOMETRY; EUCLID. An introduction into mathematics as a systematic development. The nature of a mathematical system studied through the example of Book I, *The Elements*. Reference: Euclid's *Elements*, Heath edition.
 7. LOGIC AND GEOMETRY COMPARED. Aristotle and Euclid. A comparison between the logic and the mathematics from 3 and 4 above.
 8. THE USE OF LOGIC AND MATHEMATICS. Considered from the points of view introduced by 2 above, but now aided by illustrations from logic and geometry.
 9. SYMBOLS. The extension of symbols of communication and study of ideas beyond language. This is seen in literal symbols applied to logic, mathematics; also in geometrical symbols applied to logic and mathematics. For geometrical symbols applied to logic, see chapters on Boolean Algebra in Churchman with special regard to Euler's diagrams.
 10. GEOMETRY. Introduction to geometry based on different postulates than those of Euclid. An example of a mathematical science. An introduction to projective geometry. Reference: Veblen and Young, *Projective Geometry*.
 11. NUMBER. More examples showing the nature of mathematical systems but now applied to the theory of number. Examples of objects of study which arise from reason alone. References: *College Algebra*, A. A. Albert, "What is Mathematics?" Courant and Robbins.
 12. THOUGHT SYSTEMS. The above examples of Logic and Mathematics are more or less obvious examples. Treatment of what these thought systems have in common to be regarded as logical. Hence to other examples less known

but important to the history of thought. *Treatise on God*, Aquinas; *Two New Sciences*, Galileo; *Principia*, Newton; *Ethics*, Spinoza.

13. **FORMS OF THOUGHT.** To complete our perspective, considerable reference is made to the fact that a logical construct represents only one of many forms of thought which regulate man's thinking. To include other such forms we take note of what we term as "list making," whether of the classification type illustrated by Linnaeus' treatment of plants, to the method of exhaustion of Bacon, or encyclopedic methods which follow alphabetical or chronological dictates. Forms of thought may also be determined according to the nature of artistic expression as in art, music, poetry and prose. Again, the form of thought may follow a pattern dictated by professional convention as with legal briefs or engineering reports. Famous scholars have used prose in a great variety of ways to organize the expression of their developed ideas. Swedenborg's *Principia*, Descartes' *Meditations*. In every case the "form of thought" itself is an abstraction and of itself empty of content, as in the case of its most obvious example, logic; yet necessary to regulate the development of, the communication of, and the preservation of knowledge.
14. **EXPERIENCE.** Beginning with an elementary principle in mechanics, units of measurement are defined and a law is demonstrated by experiment, using "primitive" methods, i.e., all equipment and ideas conforming to the beginning of the subject of mechanics. An experiment such as Galileo did, then one as done by Newton. And finally one in modern atomic theory.
15. **EXPERIMENTAL SCIENCE.** Its meaning illustrated by showing the relation of atomic theory to spectroscopic information.
16. **EPISTEMOLOGY.** The branch of philosophy in which an effort is made to answer the question, How do I know what I know? Examples of serious effort are the philosophies of Descartes, Berkeley, Hume, Kant.

17. CONCLUSION. Consists usually in reviewing our earlier ideas, held at the outset of the course, of what philosophy is, what reason, experience. Reading the section from *Words for the New Church*, 3 above; and *Rational Psychology* 4 above.

The reader may recall from his school days that no school year is long enough to cover all the above, any more than one can cover all that is contained in the usual "table of contents" of the usual textbook. And to many it will be evident how incompletely our subject has been treated. Some will note the lack of distinctiveness in large portions of it. We are only trying to do in part what used to be included in every liberal arts program, but today can scarcely find a place in the curriculum.