PHILOSOPHICAL NOTES

Concerning Purpose and the Teaching of Science. In another place in this issue there is a letter to the editor from the Rev. Martin Pryke. In a second and personal letter to me Mr. Pryke very kindly referred to some oral remarks I had made in a meeting of teachers who were considering science teaching problems. He said in this letter,

> Your contrasting of the view of the New Church scientist who looks for a purpose in all things and the average scientist who denies (or at least ignores) such a purpose was useful. I would have liked a lot more people to have heard it.

A considered attack upon purposeful explanations is rampant at the present time in literature for science teachers on an elementary level. However, there are a few who hold the opposite view as expressed by Mr. Pryke, these "look for a purpose in all things." The NEW PHILOSOPHY has taken note of published statements both for and against purposeful explanations. As an example of the former see the Review of "Science for the Non-Scientist" by A. R. Patton in the NEW PHILOSOPHY for April of 1963. In the April issue of 1961 Morna Hyatt discussed an article attacking purposeful explanations. Kenneth Rose carried the discussion further in the 1961 October issue.

Partly encouraged by Mr. Pryke's remarks and also by many things heard recently for and against purposeful explanations in education, I add a further note on purpose.

Looking for Purpose. One cannot deny that the mathematical theory of relativity, of mechanics, of quantum mechanics, or of any of the theories of modern physics can be given without purposeful explanations. And so it may be with the other sciences. And yet even on the advanced level of investigation questions are asked in science originating in a purposeful manner or demanding purposeful explanations.

The fact that such explanations can be avoided in formal developments in no manner justifies the denial of the importance of such explanations. In particular, on the elementary level it is questionable whether there is anything at all to be gained by the avoidance. For the formal development is more often than not too advanced for the elementary level. What remains then except a mere recitation or cataloguing of the facts? What connects these facts? Whether one is at work on the advanced level penetrating beyond the formal mechanics of his discipline or at work on the elementary level striving to explain—in either case it seems one must eventually come to ask the questions, "How?" and "Why?" Of course one does not come to see purposeful explanations unless—as Mr. Pryke suggests—he looks for them. As an analogy it can be pointed out with equal force that the energy levels of the atom in quantum mechanics are not observed either unless they are looked for, and the same is true for a thousand other things in nature. The millions and millions of dollars spent for all the paraphernalia from microscopes and telescopes to spectroscopes and atom smashers testify to this deliberate looking for something.

As an example of a book which asks questions that seem to demand some sort of purposeful explanations let me call your attention to a recently published volume of the well-known Science Study Series entitled *Mathematical Aspects of Physics: An Introduction* by Francis Bitter (a recognized authority on magnetism and professor at the Massachusetts Institute of Technology).

Its opening chapter, called "Patterns Beyond Life," is in striking contrast to the antiteleological attitude referred to above. Bitter says,

> Physics is boring only if one doesn't understand what it is all about—like listening to a speech in a language that one does not know. But in fact physics is a most exciting activity. It has to do with understanding, and it is most remarkable in that such great depth of understanding seems to be possible.

Then in less than twenty-two short pages Bitter carries one along quite easily from a picture of a village into a church building where he asks some questions about a figure kneeling there. Where did it come from, and in particular how did its skeleton come to be formed? From thence he carries one's mind along a beam of light penetrating the church window back to the sun whence the beam originates.

What causes this ray? It originates within the atoms of the sun. With proper equipment the ray can be analyzed—that is, separated into the colors of the spectrum. It was by this means that the Fraunhofer lines were discovered. From here Bitter traces the history of spectral analysis through simple mathematical formulae from the primitive beginning by George Stoney in 1871 to the more accurate and complete one of Rydberg of 1890. It is explained that at each stage in the history of physics a high degree of agreement is achieved between the mathematical formulae and the experimental facts. Yet as the matter was pursued further it was found that the formulae actually gave false results!

Further studies result in a revised theory, and the same sort of thing is repeated. Physics is filled with such examples. Bitter concludes this chapter with the following:

> We have come a long way in our train of thought—from the village, to the church, to the skeleton, to the light, to the atom, and on. It is not fashionable to speak of scientific matters in a philosophical or religious context. But I am continually struck by trains of thought like the one I have sketched out. The world we live in is clearly not a random jumble of objects, forces, and motions. There is a design. There is every indication of a creation, of complex ordering tendencies. Are not the patterns which lie beyond what men or beasts or insects have made, the patterns that we can usually see only with our inner eye, are they not real clues to the nature of creation, and the Creator? And is it not conceivable that you who read this, and your children, and your children's children, will find new and deeper meanings in these clues?

What Are the Problems of Philosophy? We read a philosophy book and we adopt the idea that philosophical problems have to do with scholasticism, rationalism, materialism, *etc.* And yet these are but names for the self-conscious efforts of men, called philosophers, to solve deeper problems. What are these deeper problems? Typical examples are: What is virtue? What is good? Truth? What is the source of truth? What are the forms of thought? What are the forms of communication? What is purpose? What is the evidence for or against purpose? How do things happen? Why do things happen as they do? *etc.*

How can any self-reflecting person live any sort of life at all without coming to some decision on at least some of these questions? And furthermore, without a self-conscious realization of the bases upon which such decisions rest? In what do these bases consist? Simple faith? Obedience to authority? Faithfulness to one's ancestors? Or because of self-consciously directed investigation and acceptance of or denial of . . . ? A multitude of such questions can be asked. Do we but try to answer them in a consciously directed thoughtful process, then we are for the time of that process a philosopher. Surely it is possible that we might gain in that process from knowing something of the successes and the failures of those who with skill and learning have applied themselves to these same problems.

An Important Problem of New Church Philosophy? If we grant the contents of the previous note, if we grant that creation is a connected whole, if we grant a statement of Swedenborg's that there are two sources of truth: revelation and nature, then perhaps our self-conscious thought applied to all this poses for us a very important task, the careful scholarly performance of which by some would produce lives of use. This task is to come to understand the nature of our understanding of revelation and of nature and the connection between these two understandings.

This turning of the mind upon its own thought—the origin of that thought in revelation or nature; the organization of that thought, either by logic, by poetry, by history, or by some other form of creative imagination; the reference of the results of that thought to some standard of virtue, the good, the true, the beautiful, the useful; all this seems to be philosophy.

For us in the New Church that part of Revelation known as the Writings is the prime revelation. For us in the New Church who are living now at a time when knowledge about nature seems to have no bounds as to quantity, we have no small problem to relate knowledges in the many fields not only to each other but to the truth that is from revelation.

Swedenborg had no less a problem in his day, as we see when we try to measure his problems relative to the conditions under which he lived. He presented his effort toward a solution in his philosophical works. If we have some appreciation of the historical climate and background in which he lived, we will appreciate his successes the more. And while seeing the limitations of the rational and scientific application of his thinking we can see the effect upon the special philosophy that was his of his acceptance of God the Creator and the existence of purpose and of use, and especially of his belief in the existence of truth.

Formal Arguments. A criticism of these notes in the past is that they sometimes make use of technical concepts that ought to be explained. Perhaps so, but then notes are notes, and consequently they must assume certain knowledges. Nevertheless, here is an effort to introduce in a brief way an explanation of concepts that are required in dealing with thought. The concepts considered are "formal argument" and "content." Examples will be drawn from mathematics, where already the logical form is possessed of content. I shall try by illustration to separate formal argument from the content. Strictly this is a task in logic, not in mathematics. A pleasant introduction to the subject is given in *Elements of Logic and Formal Science* by C. West Churchman. Example: If a is greater than b and b is greater than c, then a is greater than c. This is a well-known example of an axiom in geometry. It is a particular representative of what in logic is known as the transitive relation. As an axiom in geometry it is accepted without proof.

As a formal statement, it is neither true nor false. Its truth or falsity can be seen only by giving it "content," that is by giving its words and symbols some kind of physical meaning. If for example a, b, and c are numerical magnitudes and "is greater than" assumes its usual meaning when comparing numerical magnitudes, then the axiom is true. All applications of such formal statements are however not true. To illustrate: If a, b, and c stand, respectively, for three football teams, and "is greater than" is read "defeats," then the number of exceptions is overwhelming. It does not follow that because a defeats b, and b defeats c, that if a and c play, a will defeat c.

Another example of a formal argument used in mathematics is known as the "associative law." Applied to addition it is written

$$(a + b) + c = a + (b + c).$$

That is in the addition process we can bring together a and b first and then add c to their sum. Or we can add a to the sum of b and c. The result will be the same in each case. So says the formal law, and indeed it applies to arithmetic. Is the associative law a universal law?

Consider for example the human case of a, b, and c representing three crooks:—men that can be counted on to be consistently crooked in their actions. Let "addition" mean "coming together to make plans." Suppose these three crooks agree to meet to plan a bank robbery and also to plan the subsequent method of dividing the loot. Consder the difference in a and b planning things for a few days before c is taken in as compared with b and c planning things for a few days before a is taken in.

The above should serve to illustrate in a small way the distinction between formal arguments and formal arguments with content. Although in logic "truth" and "falsity" are used in a technical sense appropriate to that discipline, the question of truth or falsity in the ordinary meaning of those terms does not enter the consideration of logical arguments until the logical elements and operations are given physical meanings.

The examples given may appear to some as artificial. For it might be observed that mathematical statements cannot be applied outside mathematics. And so of course $a > b > c$ cannot be applied in the football example to predict with certainty that a will defeat c if a has defeated b and b has defeated c. This is so. But the point of the contrasting true and false examples given is that each used the same formal structure, that is the transitive relation, but with different contents. And as it turns out in the one case a true relation is obtained and in the other a false one. The fact that we went outside mathematics is not the crucial point because examples within mathematics can be given. However, even in very simple cases a certain technical knowledge will have to be assumed and this may detract from the illustration for some.

Here is an illustration: Consider the formal statement represented by the equation

$$ab = ba.$$

This is known as the commutative law of multiplication in algebra. Filling it with the content of numbers we see that it is "obviously" true. Thus by setting a equal to 2 and b equal to 3 we have that

$$2 \cdot 3 = 3 \cdot 2$$

This is obviously true—is it not? Yet the commutative law is not a universal law even within mathematics. In mathematics we can multiply elements other than numbers, for example matrices. As an example set a and b to mean the following:

$$A = \begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix} \qquad B = \begin{bmatrix} +1 & +1 \\ +1 & -1 \end{bmatrix}.$$

Then by the multiplication of matrices

$$AB = \begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} +1 & +1 \\ +1 & -1 \end{bmatrix} = \begin{bmatrix} -1 & -1 \\ +1 & -1 \end{bmatrix},$$

whereas

$$BA = \begin{bmatrix} +1 & +1 \\ +1 & -1 \end{bmatrix} \begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} -1 & +1 \\ -1 & -1 \end{bmatrix}.$$

Any book on the algebra of matrices will give the details on how to multiply matrices. Also matrix multiplication will be defined in the next note. All we are interested in here is the results. Two matrices by definition are equal if and only if every one of their corresponding elements is equal, just as two numbers as ordinarily represented are equal if and only if each of the corresponding digits is equal. That is, $132 = 132$ but 131 does not equal 132. Similarly in the resulting matrices above, the second numbers in the first row in the two cases are not the same and therefore the matrices are not equal. By this example it is seen that the commutative law of multiplication is not a universal law in mathematics. Thus also the formal property to which is assigned the term "commutative" is of itself neither true nor false but becomes true or false according to the mathematical content given it.

It is possible to give the noncommutative property thus illustrated very significant meanings by going outside pure mathematics. In fact an example that has had far-reaching consequence in physics was introduced by W. Heisenberg in 1926. The physical meaning is too complex to enter into here, and therefore I will give you only the formal display.

If p and q are two ordinary numbers, then because

$$pq = qp,$$
$$pq - qp = 0.$$

Nevertheless one of the most fundamental equations at the basis of modern quantum theory as introduced by Heisenberg is the equation

$$pq - qp = nh.$$

Where of course p, q, n, and h must be given their proper meanings in that discipline. The point is that the commutative law leads to true statements in mathematics and many applications, but the noncommutative law also leads to true statements. Here again is another example showing that laws of logic or formal arguments cannot be labeled true or false until content is assigned to them.

Matrix Multiplication. One can hardly appreciate the possibilities of the application of the ideas in the previous note without actually experiencing such applications in other than verbal terms. No amount of descriptive talk will explain fully that which is expressed in the implication of the formal structure of thought itself. To illustrate this let us extend the above note somewhat. In order to do so we must first learn something new. This is: How to multiply matrices.

Take as an example the two matrices

$$A = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}, \qquad B = \begin{bmatrix} b_{11} & b_{12} & b_{13} \\ b_{21} & b_{22} & b_{23} \\ b_{31} & b_{32} & b_{33} \end{bmatrix}.$$

Where the a's and b's stand for ordinary numbers and a_{ij} stands for that number in the i th row and the j th column.

Matrix multiplication applied to A and B gives

$$\begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix} \begin{bmatrix} b_{11} & b_{12} & b_{13} \\ b_{21} & b_{22} & b_{23} \\ b_{31} & b_{32} & b_{33} \end{bmatrix}$$

$$= \begin{bmatrix} a_{11}b_{11}+a_{12}b_{21}+a_{13}b_{31} & a_{11}b_{12}+a_{12}b_{22}+a_{13}b_{32} & a_{11}b_{13}+a_{12}b_{23}+a_{13}b_{33} \\ a_{21}b_{11}+a_{22}b_{21}+a_{23}b_{31} & a_{21}b_{12}+a_{22}b_{22}+a_{23}b_{32} & a_{21}b_{13}+a_{22}b_{23}+a_{23}b_{33} \\ a_{31}b_{11}+a_{32}b_{21}+a_{33}b_{31} & a_{31}b_{12}+a_{32}b_{22}+a_{33}b_{32} & a_{31}b_{13}+a_{32}b_{23}+a_{33}b_{33} \end{bmatrix}.$$

Using this rule of multiplication the reader can now return to the previous note and check on the multiplication given there. It will be noted that the element in the i th row and j th column of the product is formed by adding the products of the corresponding terms of the i th row from A and the j th column from B respectively.

Now that the above foundation has been made concerning the formal concepts of commutative and noncommutative multiplication, the representation of a new kind of quantity, namely the matrix, and finally a law of operation defined for matrices, namely multiplication, we can now observe some very interesting things not otherwise possible. There will be three such things:

1. Further illustration of the noncommutative property
2. An extention of the meaning of roots in mathematics
3. A discussion of an application to a physical problem concerning the electron.

Dirac Matrices. We use as our examples a set of matrices given in *Quantum Mechanics* by Sherwin. They are

$$\beta = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & -1 \end{pmatrix} \qquad a_x = \begin{pmatrix} 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{pmatrix}$$

$$a_y = \begin{pmatrix} 0 & 0 & 0 & -i \\ 0 & 0 & i & 0 \\ 0 & -i & 0 & 0 \\ i & 0 & 0 & 0 \end{pmatrix} \qquad a_z = \begin{pmatrix} 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & -1 \\ 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \end{pmatrix}.$$

It is understood that $i^2 = -1$. These matrices are four examples of a large set of matrices known to mathematicians before they were used by Dirac. However, their use by Dirac in solving certain problems in connection with the electron has caused them to be known as "Dirac Matrices." For alternate forms and discussion to that given in Sherwin see *An Introduction to Quantum Mechanics* by Rojansky as well as Dirac's own book *The Principles of Quantum Mechanics.*

1. The reader can now satisfy for himself that these matrices have interesting properties using no other information than that given in the previous notes. For example he can see that these matrices do not give the same product when commutation is applied. In fact they have the very interesting property known as anticommutation. That is, the product obtained when they are multiplied in one order is the negative of that when multiplied in the opposite order. The reader should check this by substituting the matrices for the letters in the following equations and multiplying according to the rule for multiplication of matrices:

$$a_x a_y = - a_y a_x, \qquad a_y a_z = - a_z a_y$$

$$\beta a_x = - a_x \beta, \qquad etc.$$

2. These matrices are examples of a class that has another very interesting property. Before discussing this we must extend our knowledge a little. One may ask this question: If matrices are new kinds of numbers then what matrix corresponds to the number 1? (When the word "new" is used here it must be understood that it refers to the reader who is considering matrices for the first time. The algebra of matrices was developed in the nineteenth century.) The answer to our question is not a unique one for matrices. That is, there is no matrix which in the algebra of matrices performs all that the number one does in ordinary arithmetic. However, we can give the answer for the operation of multiplication of matrices. It is called the unit matrix and is written

$$I = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}.$$

That it is analogous to one in ordinary arithmetic for multiplication can be seen when we note that the product of any number by one gives that number. So also the product of I by any matrix will give that matrix. The reader can check this by multiplying any one of the matrices above by I or by multiplying any four-rowed square matrix of his own invention by I.

And now we can note the interesting property of the Dirac Matrices. It is this: Multiply any one of the Dirac Matrices by itself and the result is the matrix I. This is an amazing property when one relates it to other things—especially when one realizes that there are other four-rowed matrices as well as those above which when multiplied by themselves give the matrix I.

The amazing nature of this property will be appreciated by those who remember that there are *two* square roots of 1, namely $+1$ and -1, respectively. Also there are three cube roots of 1, namely 1,

$$-\frac{1}{2}+\frac{\sqrt{3}}{2}i, \qquad -\frac{1}{2}-\frac{\sqrt{3}}{2}i.$$

there are four fourth roots of 1, namely 1, -1, i, and $-i$; five fifth roots of 1, *etc.*

But already the reader has before him four "square roots" of I—and there are others! Truly matrices are strange "quantities" with very remarkable properties.

3. It is because of these properties that Heisenberg made use of them in his formulation of quantum mechanics in 1926; and in turn Dirac made use of them in his mathematics which established the theoretical basis of the "spin" of the electron and which further led to the prophecy of the existence of the positron.

It is hoped that this subject can be extended in the Journal while the series on Swedenborg's *Principia* is being published.

Form vs. Content. Logic is the best example of a formal means of connecting words. Poetry can be a way of connecting words. Music and mathematics are still other ways, but these latter do not connect words alone, but as often as not other symbols. But logic that connects words which themselves have no content is itself empty. Poetry that depends only on meter or rhyme is only sounds; so with music, which may be pure harmony or rhythm, however pleasing to the senses. And mathematics can be a mere game played with undefined elements satisfying an arbitrary set of axioms. Each of these forms has its use. And for the development of that form it is necessary that some people of genius have the love of that form for its own sake—perhaps not always to the exclusion of its content—but at least for enough time to reflect on the form itself abstracted from content. Thus we can imagine logicians whose loves are in logic itself, that is, in its very nature aside from its use; or of poets and musicians who likewise are in the love of the forms and the development of those forms that are proper to their arts. Of course we know of mathematicians whose loves were directed to "pure" mathematics.

But it seems that a great logician (*e.g.*, Aristotle) or a great poet (*e.g.*, Dante) or a great musician (*e.g.*, Beethoven) or a great mathematician (*e.g.*, Gauss) is great not alone because of a devotion to a form of expression, but for a content. Thus the form becomes a living receptacle and not just a series of formally connected symbols.

What is this content? Is it possible that this content receives its life from a belief in something?

What is the Nature of Belief? At its foundation, belief seems to depend upon a human faculty resting upon something that appears permanent. What is the term that is associated with the most permanent object of interest? Is this term not "truth"? How can we feel a sense of permanence in anything whatsoever, how can we have any belief at all, unless we have a sensation somehow of the existence of truth? Therefore the most primitive belief seems to be a sensation that truth exists, that is, a belief in the existence of truth.

Perhaps most of us do not cause our thought to turn on itself in this manner. Nevertheless, if asked what belief consists in, we will give as an example a thought which we ourselves hold to be a truth.

Thus Aristotle, although he was a logician, was not just a logician, as is well illustrated by the fact that however important Aristotelian logic has been for some two thousand years his treatment of logic was a very small portion of his voluminous work. Logic was not for him an end in itself. It is significant that Aristotle considered other forms of expression as well as logic; hence his books, *Rhetorica* and *Poetica.* Dante was almost incidentally a poet as we realize when we consider that his poetry is but a means of expressing the cosmological beliefs of his day. What of the musician Beethoven? Could he compose a symphony to a hero if he did not believe in heroism as a virtue? As for Gauss, his application of mathematics to magnetism and other physical things is too well known to historians of mathematics for them to be deluded that this great pure mathematician was only a pure mathematician.

Thus it seems that what is great is great not because it is perfect logic, or poetry that formally satisfies all the rules, or music that embodies pure harmony and measured rhythm, nor mathematics that is of the purest variety. It is great because that form not only approaches perfection but also contains that which is living—a belief—a belief in something held to be true.

The great creations of man seem to satisfy these requirements: they each have a perfect or beautiful form plus a living soul depending upon a belief in the truth of something.

Ever since George Boole's work in the middle of the nineteenth century, logicians have been creating "new" logics. Some have even suggested that Aristotelian logic is obsolete—"has served its purpose" as the saying goes. Yet these judgments and the introductions to the "new logics" must themselves be expressed in Aristotelian terms! The greatness that was in Aristotle thus remains with us today.

Dante's cosmology or "religion" may no longer be a belief—but that belief was honest enough in his day so that his work continues to be a great one for those who can penetrate its formal poetical covering to its soul.

Perhaps the awesome nature of armaments today somewhat changes the nature of an army general as a hero in the mind of a common man today. But the belief in heroism that was so strong with Beethoven has its own virtue quite aside from being attached to a particular man. The *Eroica* is music that is great not only because of the great mastery of form that it represents but because of the great living spirit of the hero that fills that form.

And now finally to Gauss and his continuous variables and infinite series—important enough in themselves as beautiful and logical constructs of the human mind—yet as such they can appeal only to those who can appreciate such logic and such beauty. But to a much wider circle of humanity the application of these things to the physical universe gives life to such mathematical theory, because people believe that in some way the mathematical representation is related to truth concerning nature.

Perhaps our modern minds find it impossible—even if we knew how—to think like the ancient Greeks; we can no longer believe in the views of a thirteenth century Italian poet; or think of heroes as they were thought of a hundred or more years ago, or of natural philosophy as the great mathematicians who followed Gauss. But the great creations of Aristotle, Dante, Beethoven, and Gauss are still great not only for the reason that the form of their creations are great works of art—measured in terms of standards gauged by "art for art's sake"—but also for the additional reason that each form was filled with a content that rested upon a belief in truth.

What is Academic Freedom? Academic freedom is today as well as in times past closely related to belief. But with many, belief and freedom are related in a very different manner than in the past. At one time, academic freedom meant the freedom to believe something; today it seems that academic freedom means freedom from any belief—except perhaps the belief in non-belief.

This last belief is perhaps too restricting as it denies the basis of connected thought. Beliefs are not lacking in the universities, but principles upon which groups may rest their beliefs are missing.

Swedenborg says the following:

> Consequently, the science of natural things depends on a distinct notion of series and degrees, and of their subordination and coordination. The better a person knows how to arrange into order things which are to be determined into action, so that there may exist a series of effects flowing from their genuine causes, the more perfect is his genius. And inasmuch as an arrangement of this kind is prevalent throughout nature, so the faculty of arranging is perfected by observation and reflection on the objects of nature, by natural abilities, and by the assistance of those instructors whose minds are not too artificially moulded, or under the influence of prepossessions, but who claim to themselves a freedom in contemplating the objects of nature with a view to become instructed by things themselves, as they flow forth in their order (EAK, Vol. II, 587).

In this quotation there is a concept of freedom which in some respects agrees with the idea of science as expressed in the words "things . . . as they flow forth in their order."

But what is order? For some it is the laws of statistics or of probability. This sort of belief that consists in accepting the laws of nature themselves as being the same as the laws of probability is a belief very common today. Sometimes the answer is given, this is a belief in law, for by their very title the laws of probability *are* laws!

Academic freedom can also mean not "freedom" but "license."

The clamor for academic freedom can mean simply this: to teach as one pleases. This pleasure often manifests itself as a challenge to religion, to philosophy, to anything in the classical tradition because it is in that tradition. A facet of this view is manifest in the oft-expressed admonition attached to almost any idea, standard or principle that was a part of academic living more than a few years ago: "it is outmoded."

This particular manifestation of the substitution of license for freedom will perhaps have its period cut short. Good solid sense even without revelation or any idea of the internal workings of the mind will perhaps deal with this noisy symptom of a disturbed learned world.

The triumph of common sense will be possible only if true "freedom" is regarded as an objective in education, in learning. What is this "freedom"?

May I suggest that freedom has two essential properties. The first aspect of "freedom" is primitive because it involves no sophistication whatsoever; it involves choice. How can anyone enter a state of freedom without having choice? The good education, the good learning, provides the basis for choice. The regenerate man who is in freedom from evil, arrived at that happy state by a road of choices between good and evil. In this freedom of the regenerate man we see its second aspect, namely, the freedom from evil.

The artisan, for example, becomes free to create when he has mastered an art. This mastery of art comes through practice. And in what does practice consist? Does it not consist in repeatedly choosing between the right way and the wrong way of doing something? He who repeatedly chooses the right way masters his art and is thus free from error.

So with learning in general, and also with regeneration, the goal of freedom is arrived at through choices. Once arrived at, freedom then and only then is a freedom from something—a mistake, an error, an evil. Is it not true that people often speak and act as if the process were reversed, as if the freedom from something comes first, before choice?

Ought not academic freedom to consist in devotion to an education that leads one to know how best to make such choices, whether it be in the conduct of an art, or an intellectual discipline—even in the conduct of life itself?

E. F. A.