Aristotle - Posterior Analytics

[Translated by G. R. G. Mure]

Book I

1

All instruction given or received by way of argument proceeds

from pre-existent knowledge. This becomes evident upon a

survey of all the species of such instruction. The mathematical

sciences and all other speculative disciplines are acquired in

this way, and so are the two forms of dialectical reasoning,

syllogistic and inductive; for each of these latter make use of

old knowledge to impart new, the syllogism assuming an

audience that accepts its premisses, induction exhibiting the

universal as implicit in the clearly known particular. Again, the

persuasion exerted by rhetorical arguments is in principle the

same, since they use either example, a kind of induction, or

enthymeme, a form of syllogism.

The pre-existent knowledge required is of two kinds. In some

cases admission of the fact must be assumed, in others

comprehension of the meaning of the term used, and

sometimes both assumptions are essential. Thus, we assume

that every predicate can be either truly affirmed or truly denied

of any subject, and that ‘triangle’ means so and so; as regards

‘unit’ we have to make the double assumption of the meaning

of the word and the existence of the thing. The reason is that

these several objects are not equally obvious to us. Recognition

of a truth may in some cases contain as factors both previous

knowledge and also knowledge acquired simultaneously with

that recognition – knowledge, this latter, of the particulars

actually falling under the universal and therein already virtually

known. For example, the student knew beforehand that the

angles of every triangle are equal to two right angles; but it was

only at the actual moment at which he was being led on to

recognize this as true in the instance before him that he came

to know ‘this figure inscribed in the semicircle’ to be a triangle.

For some things (viz. the singulars finally reached which are not

predicable of anything else as subject) are only learnt in this

way, i.e. there is here no recognition through a middle of a

minor term as subject to a major. Before he was led on to

recognition or before he actually drew a conclusion, we should

perhaps say that in a manner he knew, in a manner not.

If he did not in an unqualified sense of the term know the

existence of this triangle, how could he know without

qualification that its angles were equal to two right angles? No:

clearly he knows not without qualification but only in the sense

that he knows universally. If this distinction is not drawn, we

are faced with the dilemma in the Meno: either a man will learn

nothing or what he already knows; for we cannot accept the

solution which some people offer. A man is asked, ‘Do you, or do

you not, know that every pair is even?’ He says he does know it.

The questioner then produces a particular pair, of the existence,

and so a fortiori of the evenness, of which he was unaware. The

solution which some people offer is to assert that they do not

know that every pair is even, but only that everything which

they know to be a pair is even: yet what they know to be even is

that of which they have demonstrated evenness, i.e. what they

made the subject of their premiss, viz. not merely every triangle

or number which they know to be such, but any and every

number or triangle without reservation. For no premiss is ever

couched in the form ‘every number which you know to be such’,

or ‘every rectilinear figure which you know to be such’: the

predicate is always construed as applicable to any and every

instance of the thing. On the other hand, I imagine there is

nothing to prevent a man in one sense knowing what he is

learning, in another not knowing it. The strange thing would be,

not if in some sense he knew what he was learning, but if he

were to know it in that precise sense and manner in which he

was learning it.

2

We suppose ourselves to possess unqualified scientific

knowledge of a thing, as opposed to knowing it in the accidental

way in which the sophist knows, when we think that we know

the cause on which the fact depends, as the cause of that fact

and of no other, and, further, that the fact could not be other

than it is. Now that scientific knowing is something of this sort

is evident – witness both those who falsely claim it and those

who actually possess it, since the former merely imagine

themselves to be, while the latter are also actually, in the

condition described. Consequently the proper object of

unqualified scientific knowledge is something which cannot be

other than it is.

There may be another manner of knowing as well – that will be

discussed later. What I now assert is that at all events we do

know by demonstration. By demonstration I mean a syllogism

productive of scientific knowledge, a syllogism, that is, the grasp

of which is eo ipso such knowledge. Assuming then that my

thesis as to the nature of scientific knowing is correct, the

premisses of demonstrated knowledge must be true, primary,

immediate, better known than and prior to the conclusion,

which is further related to them as effect to cause. Unless these

conditions are satisfied, the basic truths will not be

‘appropriate’ to the conclusion. Syllogism there may indeed be

without these conditions, but such syllogism, not being

productive of scientific knowledge, will not be demonstration.

The premisses must be true: for that which is non-existent

cannot be known – we cannot know, e.g. that the diagonal of a

square is commensurate with its side. The premisses must be

primary and indemonstrable; otherwise they will require

demonstration in order to be known, since to have knowledge, if

it be not accidental knowledge, of things which are

demonstrable, means precisely to have a demonstration of

them. The premisses must be the causes of the conclusion,

better known than it, and prior to it; its causes, since we possess

scientific knowledge of a thing only when we know its cause;

prior, in order to be causes; antecedently known, this

antecedent knowledge being not our mere understanding of the

meaning, but knowledge of the fact as well. Now ‘prior’ and

‘better known’ are ambiguous terms, for there is a difference

between what is prior and better known in the order of being

and what is prior and better known to man. I mean that objects

nearer to sense are prior and better known to man; objects

without qualification prior and better known are those further

from sense. Now the most universal causes are furthest from

sense and particular causes are nearest to sense, and they are

thus exactly opposed to one another. In saying that the

premisses of demonstrated knowledge must be primary, I mean

that they must be the ‘appropriate’ basic truths, for I identify

primary premiss and basic truth. A ‘basic truth’ in a

demonstration is an immediate proposition. An immediate

proposition is one which has no other proposition prior to it. A

proposition is either part of an enunciation, i.e. it predicates a

single attribute of a single subject. If a proposition is dialectical,

it assumes either part indifferently; if it is demonstrative, it lays

down one part to the definite exclusion of the other because

that part is true. The term ‘enunciation’ denotes either part of a

contradiction indifferently. A contradiction is an opposition

which of its own nature excludes a middle. The part of a

contradiction which conjoins a predicate with a subject is an

affirmation; the part disjoining them is a negation. I call an

immediate basic truth of syllogism a ‘thesis’ when, though it is

not susceptible of proof by the teacher, yet ignorance of it does

not constitute a total bar to progress on the part of the pupil:

one which the pupil must know if he is to learn anything

whatever is an axiom. I call it an axiom because there are such

truths and we give them the name of axioms par excellence. If a

thesis assumes one part or the other of an enunciation, i.e.

asserts either the existence or the non-existence of a subject, it

is a hypothesis; if it does not so assert, it is a definition.

Definition is a ‘thesis’ or a ‘laying something down’, since the

arithmetician lays it down that to be a unit is to be

quantitatively indivisible; but it is not a hypothesis, for to define

what a unit is is not the same as to affirm its existence.

Now since the required ground of our knowledge – i.e. of our

conviction – of a fact is the possession of such a syllogism as we

call demonstration, and the ground of the syllogism is the facts

constituting its premisses, we must not only know the primary

premisses – some if not all of them – beforehand, but know

them better than the conclusion: for the cause of an attribute’s

inherence in a subject always itself inheres in the subject more

firmly than that attribute; e.g. the cause of our loving anything

is dearer to us than the object of our love. So since the primary

premisses are the cause of our knowledge – i.e. of our conviction

– it follows that we know them better – that is, are more

convinced of them – than their consequences, precisely because

of our knowledge of the latter is the effect of our knowledge of

the premisses. Now a man cannot believe in anything more

than in the things he knows, unless he has either actual

knowledge of it or something better than actual knowledge. But

we are faced with this paradox if a student whose belief rests

on demonstration has not prior knowledge; a man must believe

in some, if not in all, of the basic truths more than in the

conclusion. Moreover, if a man sets out to acquire the scientific

knowledge that comes through demonstration, he must not

only have a better knowledge of the basic truths and a firmer

conviction of them than of the connexion which is being

demonstrated: more than this, nothing must be more certain or

better known to him than these basic truths in their character

as contradicting the fundamental premisses which lead to the

opposed and erroneous conclusion. For indeed the conviction of

pure science must be unshakable.

3

Some hold that, owing to the necessity of knowing the primary

premisses, there is no scientific knowledge. Others think there

is, but that all truths are demonstrable. Neither doctrine is

either true or a necessary deduction from the premisses. The

first school, assuming that there is no way of knowing other

than by demonstration, maintain that an infinite regress is

involved, on the ground that if behind the prior stands no

primary, we could not know the posterior through the prior

(wherein they are right, for one cannot traverse an infinite

series): if on the other hand – they say – the series terminates

and there are primary premisses, yet these are unknowable

because incapable of demonstration, which according to them

is the only form of knowledge. And since thus one cannot know

the primary premisses, knowledge of the conclusions which

follow from them is not pure scientific knowledge nor properly

knowing at all, but rests on the mere supposition that the

premisses are true. The other party agree with them as regards

knowing, holding that it is only possible by demonstration, but

they see no difficulty in holding that all truths are

demonstrated, on the ground that demonstration may be

circular and reciprocal.

Our own doctrine is that not all knowledge is demonstrative: on

the contrary, knowledge of the immediate premisses is

independent of demonstration. (The necessity of this is obvious;

for since we must know the prior premisses from which the

demonstration is drawn, and since the regress must end in

immediate truths, those truths must be indemonstrable.) Such,

then, is our doctrine, and in addition we maintain that besides

scientific knowledge there is its originative source which

enables us to recognize the definitions.

Now demonstration must be based on premisses prior to and

better known than the conclusion; and the same things cannot

simultaneously be both prior and posterior to one another: so

circular demonstration is clearly not possible in the unqualified

sense of ‘demonstration’, but only possible if ‘demonstration’ be

extended to include that other method of argument which rests

on a distinction between truths prior to us and truths without

qualification prior, i.e. the method by which induction produces

knowledge. But if we accept this extension of its meaning, our

definition of unqualified knowledge will prove faulty; for there

seem to be two kinds of it. Perhaps, however, the second form of

demonstration, that which proceeds from truths better known

to us, is not demonstration in the unqualified sense of the term.

The advocates of circular demonstration are not only faced with

the difficulty we have just stated: in addition their theory

reduces to the mere statement that if a thing exists, then it does

exist – an easy way of proving anything. That this is so can be

clearly shown by taking three terms, for to constitute the circle

it makes no difference whether many terms or few or even only

two are taken. Thus by direct proof, if A is, B must be; if B is, C

must be; therefore if A is, C must be. Since then – by the circular

proof – if A is, B must be, and if B is, A must be, A may be

substituted for C above. Then ‘if B is, A must be’=‘if B is, C must

be’, which above gave the conclusion ‘if A is, C must be’: but C

and A have been identified. Consequently the upholders of

circular demonstration are in the position of saying that if A is,

A must be – a simple way of proving anything. Moreover, even

such circular demonstration is impossible except in the case of

attributes that imply one another, viz. ‘peculiar’ properties.

Now, it has been shown that the positing of one thing – be it one

term or one premiss – never involves a necessary consequent:

two premisses constitute the first and smallest foundation for

drawing a conclusion at all and therefore a fortiori for the

demonstrative syllogism of science. If, then, A is implied in B

and C, and B and C are reciprocally implied in one another and

in A, it is possible, as has been shown in my writings on the

syllogism, to prove all the assumptions on which the original

conclusion rested, by circular demonstration in the first figure.

But it has also been shown that in the other figures either no

conclusion is possible, or at least none which proves both the

original premisses. Propositions the terms of which are not

convertible cannot be circularly demonstrated at all, and since

convertible terms occur rarely in actual demonstrations, it is

clearly frivolous and impossible to say that demonstration is

reciprocal and that therefore everything can be demonstrated.

6

Demonstrative knowledge must rest on necessary basic truths;

for the object of scientific knowledge cannot be other than it is.

Now attributes attaching essentially to their subjects attach

necessarily to them: for essential attributes are either elements

in the essential nature of their subjects, or contain their

subjects as elements in their own essential nature. (The pairs of

opposites which the latter class includes are necessary because

one member or the other necessarily inheres.) It follows from

this that premisses of the demonstrative syllogism must be

connexions essential in the sense explained: for all attributes

must inhere essentially or else be accidental, and accidental

attributes are not necessary to their subjects.

We must either state the case thus, or else premise that the

conclusion of demonstration is necessary and that a

demonstrated conclusion cannot be other than it is, and then

infer that the conclusion must be developed from necessary

premisses. For though you may reason from true premisses

without demonstrating, yet if your premisses are necessary you

will assuredly demonstrate – in such necessity you have at once

a distinctive character of demonstration. That demonstration

proceeds from necessary premisses is also indicated by the fact

that the objection we raise against a professed demonstration is

that a premiss of it is not a necessary truth – whether we think

it altogether devoid of necessity, or at any rate so far as our

opponent’s previous argument goes. This shows how naive it is

to suppose one’s basic truths rightly chosen if one starts with a

proposition which is (1) popularly accepted and (2) true, such as

the sophists’ assumption that to know is the same as to possess

knowledge. For (1) popular acceptance or rejection is no

criterion of a basic truth, which can only be the primary law of

the genus constituting the subject matter of the demonstration;

and (2) not all truth is ‘appropriate’.

A further proof that the conclusion must be the development of

necessary premisses is as follows. Where demonstration is

possible, one who can give no account which includes the cause

has no scientific knowledge. If, then, we suppose a syllogism in

which, though A necessarily inheres in C, yet B, the middle term

of the demonstration, is not necessarily connected with A and

C, then the man who argues thus has no reasoned knowledge of

the conclusion, since this conclusion does not owe its necessity

to the middle term; for though the conclusion is necessary, the

mediating link is a contingent fact. Or again, if a man is without

knowledge now, though he still retains the steps of the

argument, though there is no change in himself or in the fact

and no lapse of memory on his part; then neither had he

knowledge previously. But the mediating link, not being

necessary, may have perished in the interval; and if so, though

there be no change in him nor in the fact, and though he will

still retain the steps of the argument, yet he has not knowledge,

and therefore had not knowledge before. Even if the link has not

actually perished but is liable to perish, this situation is possible

and might occur. But such a condition cannot be knowledge.

When the conclusion is necessary, the middle through which it

was proved may yet quite easily be non-necessary. You can in

fact infer the necessary even from a non-necessary premiss,

just as you can infer the true from the not true. On the other

hand, when the middle is necessary the conclusion must be

necessary; just as true premisses always give a true conclusion.

Thus, if A is necessarily predicated of B and B of C, then A is

necessarily predicated of C. But when the conclusion is

nonnecessary the middle cannot be necessary either. Thus: let A

be predicated non-necessarily of C but necessarily of B, and let B

be a necessary predicate of C; then A too will be a necessary

predicate of C, which by hypothesis it is not.

To sum up, then: demonstrative knowledge must be knowledge

of a necessary nexus, and therefore must clearly be obtained

through a necessary middle term; otherwise its possessor will

know neither the cause nor the fact that his conclusion is a

necessary connexion. Either he will mistake the non-necessary

for the necessary and believe the necessity of the conclusion

without knowing it, or else he will not even believe it – in which

case he will be equally ignorant, whether he actually infers the

mere fact through middle terms or the reasoned fact and from

immediate premisses.

Of accidents that are not essential according to our definition of

essential there is no demonstrative knowledge; for since an

accident, in the sense in which I here speak of it, may also not

inhere, it is impossible to prove its inherence as a necessary

conclusion. A difficulty, however, might be raised as to why in

dialectic, if the conclusion is not a necessary connexion, such

and such determinate premisses should be proposed in order to

deal with such and such determinate problems. Would not the

result be the same if one asked any questions whatever and

then merely stated one’s conclusion? The solution is that

determinate questions have to be put, not because the replies to

them affirm facts which necessitate facts affirmed by the

conclusion, but because these answers are propositions which if

the answerer affirm, he must affirm the conclusion and affirm

it with truth if they are true.

Since it is just those attributes within every genus which are

essential and possessed by their respective subjects as such

that are necessary it is clear that both the conclusions and the

premisses of demonstrations which produce scientific

knowledge are essential. For accidents are not necessary: and,

further, since accidents are not necessary one does not

necessarily have reasoned knowledge of a conclusion drawn

from them (this is so even if the accidental premisses are

invariable but not essential, as in proofs through signs; for

though the conclusion be actually essential, one will not know

it as essential nor know its reason); but to have reasoned

knowledge of a conclusion is to know it through its cause. We

may conclude that the middle must be consequentially

connected with the minor, and the major with the middle.

7

It follows that we cannot in demonstrating pass from one genus

to another. We cannot, for instance, prove geometrical truths by

arithmetic. For there are three elements in demonstration: (1)

what is proved, the conclusion – an attribute inhering

essentially in a genus; (2) the axioms, i.e. axioms which are

premisses of demonstration; (3) the subject – genus whose

attributes, i.e. essential properties, are revealed by the

demonstration. The axioms which are premisses of

demonstration may be identical in two or more sciences: but in

the case of two different genera such as arithmetic and

geometry you cannot apply arithmetical demonstration to the

properties of magnitudes unless the magnitudes in question are

numbers. How in certain cases transference is possible I will

explain later.

Arithmetical demonstration and the other sciences likewise

possess, each of them, their own genera; so that if the

demonstration is to pass from one sphere to another, the genus

must be either absolutely or to some extent the same. If this is

not so, transference is clearly impossible, because the extreme

and the middle terms must be drawn from the same genus:

otherwise, as predicated, they will not be essential and will thus

be accidents. That is why it cannot be proved by geometry that

opposites fall under one science, nor even that the product of

two cubes is a cube. Nor can the theorem of any one science be

demonstrated by means of another science, unless these

theorems are related as subordinate to superior (e.g. as optical

theorems to geometry or harmonic theorems to arithmetic).

Geometry again cannot prove of lines any property which they

do not possess qua lines, i.e. in virtue of the fundamental truths

of their peculiar genus: it cannot show, for example, that the

straight line is the most beautiful of lines or the contrary of the

circle; for these qualities do not belong to lines in virtue of their

peculiar genus, but through some property which it shares with

other genera.

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