

## PREFACE TO THE GENERAL SCIENCE [1677]

G. Leibniz

Source: P. Wiener (ed.), *Leibniz Selections*, Macmillan Press Ltd, 1951, pp. 12-17.

Since happiness consists in peace of mind, and since durable peace of mind depends on the confidence we have in the future, and since that confidence is based on the science we should have of the nature of God and the soul, it follows that science is necessary for true happiness.

But science depends on demonstration, and the discovery of demonstrations by a *certain Method* is not known to everybody. For while every man is able to judge a demonstration (it would not deserve this name if all those who consider it attentively were not convinced and persuaded by it), nevertheless not every man is able to discover demonstrations on his own initiative, nor to present them distinctly once they are discovered, if he lacks leisure or method.

The *true Method* taken in all of its scope is to my mind a thing hitherto quite unknown, and has not been practised except in mathematics. It is even very imperfect in regard to mathematics itself, as I have had the good fortune to reveal by means of surprising proofs to some of those considered to be among the best mathematicians of the century. And I expect to offer some samples of it, which perhaps will not be considered unworthy of posterity.

However, if the Method of Mathematicians has not sufficed to discover everything that might be expected from them, it has remained at least able to save them from mistakes, and if they have not said everything they were supposed to say, they have also not said anything they were not expected to say.

If those who have cultivated the other sciences had imitated the mathematicians at least on this point, we should be quite content, and we should have long since had a secure Metaphysics, as well as an ethics depending on Metaphysics since the latter includes the sort of knowledge of God and the soul which should rule our life.

In addition, we should have the science of motion which is the key to physics, and consequently, to medicine. True, I believe we are ready now to aspire to it, and some of my first thoughts have been received with such applause by the most learned men of our time on account of the wonderful simplicity introduced, that I believe that all we have to do now is perform certain experiments on a deliberate plan and scale (rather than by the haphazard fumbling which is so common) in order to build thereupon the stronghold of a sure and demonstrative physics.

Now the reason why the art of demonstrating has been until now found only in mathematics has not been well fathomed by the average person, for if the cause of the trouble had been known, the remedy would have long since been found out. The reason is this: Mathematics carries its own test with it. For when I am presented with a false theorem, I do not need to examine or even to know the demonstration, since I shall discover its falsity *a posteriori* by means of an easy experiment, that is, by a calculation, costing no more than paper and ink, which will show the error no matter how small it is. If it were as easy in other matters to verify reasonings by experiments, there would not be such differing opinions. But the trouble is that experiments in physics are difficult and cost a great deal; and in metaphysics they are impossible, unless God out of love for us perform a miracle in order to acquaint us with remote immaterial things.

This difficulty is not insurmountable though at first it may seem so. But those who will take the trouble to consider what I am going to say about it will soon change their mind. We must then notice that the tests or experiments made in mathematics to guard against mistakes in reasoning (as, for example, the test of casting out nines, the calculation of Ludolph of Cologne concerning the magnitude of circles, tables of sines, etc.), these tests are not made on a thing itself, but on the characters which we have substituted in place of the thing. Take for example a numerical calculation: if 1677 times 365 are 612,105, we should hardly ever have reached this result were it necessary to make 365 piles of 1677 pebbles each and then to count them all finally in order to know whether the aforementioned number is found. That is why we are satisfied to do it with characters on paper, by means of the test of nines, etc. Similarly, when we propose an approximately exact value of  $\pi$  in the quadrature of a circle, we do not need to make a big material circle and tie a string around it in order to see whether the ratio of the length of this string or the circumference to the diameter has the value proposed; that would be troublesome, for if the error is one-thousandth or less part of the diameter, we should need a large circle constructed with a great deal of accuracy. Yet we still refute the false value of  $\pi$  by the experiment and use of the calculus or numerical test. But this test is performed only on paper, and consequently, on the characters which represent the thing, and not on the thing itself.

This consideration is fundamental in this matter, and although many

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persons of great ability, especially in our century, may have claimed to offer us demonstrations in questions of physics, metaphysics, ethics, and even in politics, jurisprudence, and medicine, nevertheless they have either been mistaken (because every step is on slippery ground and it is difficult not to fall unless guided by some tangible directions), or even when they succeed, they have been unable to convince everyone with their reasoning (because there has not yet been a way to examine arguments by means of some easy tests available to everyone).

Whence it is manifest that if we could find characters or signs appropriate for expressing all our thoughts as definitely and as exactly as arithmetic expresses numbers or geometric analysis expresses lines, we could in all subjects *in so far as they are amenable to reasoning* accomplish what is done in Arithmetic and Geometry.

For all inquiries which depend on reasoning would be performed by the transposition of characters and by a kind of calculus, which would immediately facilitate the discovery of beautiful results. For we should not have to break our heads as much as is necessary today, and yet we should be sure of accomplishing everything the given facts allow.

Moreover, we should be able to convince the world what we should have found or concluded, since it would be easy to verify the calculation either by doing it over or by trying tests similar to that of casting out nines in arithmetic. And if someone would doubt my results, I should say to him: "Let us calculate, Sir," and thus by taking to pen and ink, we should soon settle the question.

I still add: *in so far as the reasoning allows on the given facts*. For although certain experiments are always necessary to serve as a basis for reasoning, nevertheless, once these experiments are given, we should derive from them everything which anyone at all could possibly derive; and we should even discover what experiments remain to be done for the clarification of all further doubts. That would be an admirable help, even in political science and medicine, to steady and perfect reasoning concerning given symptoms and circumstances. For even while there will not be enough given circumstances to form an infallible judgment, we shall always be able to determine what is most probable on the data given. And that is all that reason can do.

Now the characters which express all our thoughts will constitute a new language which can be written and spoken; this language will be very difficult to construct, but very easy to learn. It will be quickly accepted by everybody on account of its great utility and its surprising facility, and it will serve wonderfully in communication among various peoples, which will help get it accepted. Those who will write in this language will not make mistakes provided they avoid the errors of calculation, barbarisms, solecisms, and other errors of grammar and construction. In addition, this language will possess the wonderful property of silencing ignorant people. For people will be unable to speak or write about anything except what they understand, or if

they try to do so, one of two things will happen: either the vanity of what they advance will be apparent to everybody, or they will learn by writing or speaking. As indeed those who calculate learn by writing and those who speak sometimes meet with a success they did not imagine, the tongue running ahead of the mind. This will happen especially with our language on account of its exactness. So much so, that there will be no equivocations or amphibolies, and everything which will be said intelligibly in that language will be said with propriety. This language will be the greatest instrument of reason.

I dare say that this is the highest effort of the human mind, and when the project will be accomplished it will simply be up to men to be happy since they will have an instrument which will exalt reason no less than what the Telescope does to perfect our vision.

It is one of my ambitions to accomplish this project if God gives me enough time. I owe it to nobody but myself, and I had the first thought about it when I was 18 years old, as I have a little later evidenced in a published treatise (*De Arte Combinatoria*, 1666). And as I am confident that there is no discovery which approaches this one, I believe there is nothing so capable of immortalizing the name of the inventor. But I have much stronger reasons for thinking so, since the religion I follow closely assures me that the love of God consists in an ardent desire to procure the general welfare, and reason teaches me that there is nothing which contributes more to the general welfare of mankind than the perfection of reason.

Source: S. M. Cahn (ed.), *Ch*  
pp. 604-13.

1. The *monad*, which substance that enters in
2. And there must b the composite is nothing
3. But where there a bility is possible. These the elements of things.
4. There is also no d which a simple substanc
5. For the same reasc begin naturally, since it
6. Thus, one can say they can only begin by c begin or end through th
7. There is also no changed internally by s thing in it, nor can one directed, augmented, or where there can be cha through which somethi nor can they go about Scholastics once did. monad from without.
8. However, monads even be beings. And if si there would be no way c in a composite can only had no qualities, they