Ars Representatoria

Representational Art

G. W. Leibniz, 1691

Tr. David Jekel, Matthew McMillan

It is difficult to make something completely new in kind. Nonetheless, it cannot be denied that this art is such. It is as much superior to algebra as it is greater to render figures and motions in the mind faithfully and in their original aspect, than to do so only by numbers, i.e. by magnitudes.

Guided by this art, therefore, and with the help of the simplest signs, every figure, motion, machine, and in short the whole of nature (to the extent it is considered to be explained mechanically) we will be able to depict in the mind without figures and models, and just as precisely as could be done with figures and models. In fact, much more precisely and usefully. For we could thus represent with a few tiny lines what otherwise would need to be represented by large figures, and many of them. And whereas figures and (when it comes to solid bodies) models require such a lot of time, not to mention the expense, and motions are the most difficult things to represent by figures alone without models, with this art more figures and their transmutations (i.e. motions) could be described in a few hours than figures could be drawn in a week, or models built in a year. Particularly because most of the many figures and models described or built at the beginning of the investigation turn out to be useless, and the time and cost are lost forever; but by this mental (i.e. representational) drawing and building, many figures and many motions are easily produced in a short time at no cost.

But you will say that I can do the same thing with the imagination. Yes of course, in part. But this art was invented for that very thing, namely to relieve and perfect the imagination. To *relieve* it lest it becomes excessively fatigued by close attention to figures, which of course is very great when pursuing complex figures and motions; and to *perfect* it, because our imagination cannot contemplate many things simulta-

neously, especially when things which cannot be simultaneously viewed are to be simultaneously thought, when the mental images [*phantasmata*] desert the mind. Hence it happens that before arriving at the last things, the first ones have slipped away. Certainly to contemplate many things distinctly, and to pass through many transmutations and neglect or skip over nothing, is quite difficult, and it cannot be done except by great artisans of these things who already have a lot of practice, although they themselves also slip up frequently and become entangled in difficulties.

But the best thing is that this art supplies something beyond imagining, for not only does it exhibit figures, but also it unfolds and expresses their inmost natures, or causes, and thus reduces the matter to a perfect analysis, and to a synthesis resulting from that in turn.

And it happens that by this method we could enumerate in order all the ways of making proposed figures and motions, and choose the most suitable for present purposes, and determine what is impossible, indeed just as algebra does with numbers. Algebra has of course the distinction that with its help we can also solve problems of figures and motions, but this is because everything is brought from situation over to magnitudes and their relationships, i.e. to calculation of numbers; hence, once we have brought the matter over from figure to algebra, the mind now completely deserts the imagination and it wanders as if through the metaphysical, that is, through higher dimensions than are given in figures; from here it reaches the way out, but by remarkable convolutions, removed far from contemplation of the thing itself, and with all thought being converted into symbols.

But in this new kind of representational calculus, the imagination perpetually accompanies the mind or pen, so that whatever the pen sets down can be imagined by continual mental imagery [*continue phantasia*]. And the mind never so clings to the symbols that it is forced to abandon contemplation of the thing itself, and accordingly every tiny line is some theorem or property of the figure or motion itself, yet so that it is not necessary to actively follow the calculation in the imagination (unless we want to). Hence also, by employing and establishing

this calculus, there will follow a wonderful confirmation and revitalization of the imagination. In the end, then, we will be able to follow even the most difficult and complicated things, and that without pen and paper or figures, once we have this Ariadnean thread of the mind in imagining that the calculus will show to us.

And I already showed, in an essay in this art, how a spherical and a planar surface, and likewise the circumference of a circle and a straight line, are represented exactly through marks so that something like an image of them is subjected to the mind (the expression, though, not helping only the imagination [*phantasiam*] but also supplying definitions to the mind). Hence it follows that all other curves and surfaces can be exhibited in the same way, since they can be determined by these.

The final analysis of everything will be into situations, i.e. regarding points. One must see how we can know that a point we seek has multiple possible values. We need not always go to the final analysis, but where possible we should remain in the middle, i.e. in the representations themselves of the generations of motions. As in the calculus, so also here, the points are always to be determined through intersections of loci. Since the trigonometric calculus is of great utility, the thing should be set up such that any problems are conveniently referred to it, for it is more convenient than the algebraic one in practice.