

AN ILLUSTRATION.

A MATHEMATICAL curve sometimes serves to illustrate the results of investigation in other sciences. Here, for instance (Fig. 1), is a part of a plane curve of the second degree—an hyperbola—referred to its rectangular asymptotes.

May not this curve be used to illustrate the theory of the evolution of organic life upon our planet, from its lowest to its highest possible forms?

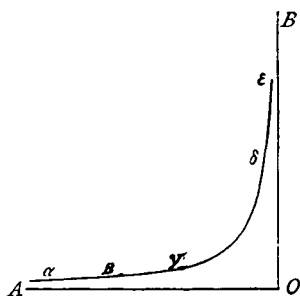


Fig. 1.

Suppose the direction AO to represent the duration of time, and the direction OB to measure the degrees of organic development through the possible range of organic life. Then the curve $\alpha\epsilon$, combining the two directions according to a certain law, may represent the successive development of organic life during the course of time.

Thus, organic life of the lowest possible form is supposed to have begun on the line OA at an unmeasurable distance to the left of O . From that point on, in the course of time, improvement has been continuous. In each successive age, higher forms of life have

appeared, as, in the curve, every point of it is above AO , and increasingly so as we proceed from left to right. But the development has been very slow,—the direction of the curve for ages seems to be almost parallel with the course of time itself. When we reach α , for instance, the highest form of organic life of the period is still very low.

Suppose now that the distance from the line AO to the point α represents the degree of development attained by a trilobite, and in like manner think of β as representing a fish, γ an anthropoid ape, δ the lowest known type of man, and ϵ the highest known type of man. Then it will be interesting to note the *direction* of the curve at each of these points. At α , and even at γ , it is almost horizontal, and if development were to continue at the same rate, im-

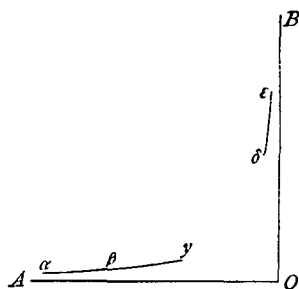


Fig. 2.

provement would be hardly perceptible in ages. How different at δ and at ϵ ! The greatly increased rapidity of the improvement results in giving the curve an entirely new direction. Heretofore, we may say, the development has been mainly physical; now it appears to be mainly psychical—intellectual, moral, spiritual—reaching heavenward, if we may think so. Yet the curve, from end to end, even in the beautiful deflection from *onward* to *upward*, is following its mathematical equation. Every point in it satisfies that law, and we are reminded that the theory of evolution also embodies a law.

But suppose, now, that instead of Fig. 1 with its continuous curve, we had only Fig. 2.

To one not familiar with mathematical curves, there is little to

suggest that these two bits of line, $\alpha\gamma$ and $\delta\epsilon$, have anything to do with one another. Their directions are quite different, and they *seem* to be straight rather than curved. A mathematician, however, might look at them in a different way. He might turn the page up edgeways and squint along the lines, and he would then find that $\alpha\gamma$, and even $\delta\epsilon$, show a perceptible, though slight, curvature. He would apply such micrometric tests as he could, and from the measurements obtained would carefully calculate the equation of each short curve, and the resulting equations would be found identical. One conclusion only is possible,—the two bits of seemingly straight line are parts of *one curve*, and he proceeds to reconstruct the missing parts as far as ever he will, with mathematical pre-

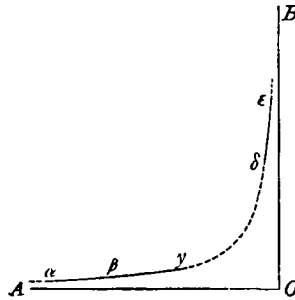


Fig. 3.

cision, by simply applying the law of the curve. This reconstruction may be seen in the dotted lines of Fig. 3.

But let us suppose, now, that some one had torn out a piece of the paper between γ and δ , and so had rendered it impossible to reconstruct the curve across that gap. Would our mathematical friend be any the less sure that the two bits of curve are in reality the same curve? No. He has already discovered that they have the same equation, involving the same variables in the second degree, the same constants. Proof does not depend upon ocular demonstration, nor does it consist in ability to mechanically reconstruct all the missing parts.

But how is it in the matter we are trying to illustrate? Another friend of ours, a theologian, has read Darwin and Wallace and Mivart and Romanes, and is informed and believes that organic life

in the lower forms of existence has been developing according to an ascertained law. So far, however, the direction of the development appears to be almost on the dead level of animalism, though some semblances of intelligence are found among the higher animals. He has found man also developing at a wonderful rate in a direction quite different from that other, that is, intellectually and spiritually. In other words, reverting to our illustration, he has discovered the two bits of curved line shown in Fig. 2 and he has noticed the hypothesis that they are parts of the same curve and have the same equation. He agrees with a recent writer that natural law extends into the spiritual world, but when brought face to face with the proposition that the development of man and the development of the lower animal forms have followed the same identical law, he hesitates, and then frankly expresses his opinion that the proposition is absurd and cannot possibly be true. Why? Oh, there is that marked difference in direction, almost the whole quadrant of difference between physical and psychical, or between material and spiritual. And besides, there is that great gap, with no missing link discovered or perhaps discoverable. He cannot reconstruct the curve across the hole in the paper. Ocular demonstration is not to be had, though it would seem so desirable, not to say essential to proof, in a proposition of this kind. And who knows, after all, whether the micrometric tests which Mr. Darwin and others applied were not so minutely *in*-accurate as to be practically worthless,—whether the calculations based on them have not been vitiated by some undiscovered error?

Moreover, our theological friend has followed some observations long since made on the bit of curve called $\delta\epsilon$, and has held a theory of man somewhat different from our more modern and crude scientific one. He believes that $\delta\epsilon$ is a curve, sure enough, but he has been taught and has been teaching that its nature is parabolic, or perhaps, even elliptical, rather than hyperbolic. He has an equation which seems to fit it excellently, and has himself done some reconstructing in accordance therewith, as in Fig 4, whereby it appears that his curve does not start with a point at an unmeasurable distance to the left, and lower down than a polyp,

but really began only a little lower than a certain Θ , at α' ,—Adam, the first man. Man had to fall before he could begin to rise. Paradise must first have been *lost* before Paradise can be regained. How else is it possible to account for the phenomena of *Sin*?

A simple illustration should not be pressed too far. Of course, it does not prove anything. But this one suggests a question or two. In Fig. 4 the dotted curve has been constructed from observations made on one small part of one leg of it. The hyperbolic curve in the preceding figure was constructed from observations made on parts of *both* legs. The data in one case may be said to

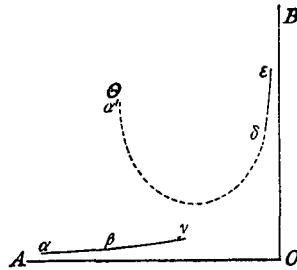


Fig. 4.

be all spiritual. In the other case, there are two sets of data. Which process would seem more likely to lead to a correct result? And again, it is not hard to believe that one of God's laws, in the form of a mathematical equation involving the squares of X and Y , represents the very nature of an interesting curve, of whose legs the one is almost horizontal, the other almost perpendicular. Is it really any harder to believe that under another of God's laws, involving variation and selection, the evolution of organic life has successively produced such forms as the longitudinal worm, the half-upright ape, and the upright man?

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CHICAGO.