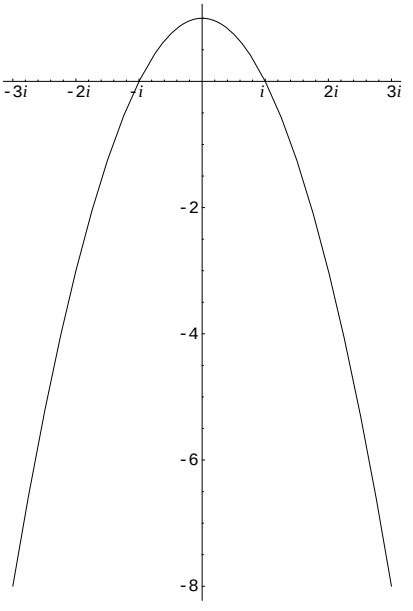
significance of Leibniz's discoveries, was kept among the active pursuits of science during the Eighteenth Century by, chiefly, a scientist who became a crucial promoter of the cause of American freedom, Franklin's one-time host Abraham Kästner. Kästner was also one of the two most significant teachers of the young Carl F. Gauss. Kästner was the first to prove in modern times, that a valid physical geometry must be not merely non-Euclidean, but must be recognized as anti-Euclidean, since the rectilinear kernel of assumptions of the Euclidean system, the rectilinear axiomatics, was provably

FIGURE 7



Equation $X = x^2 + 1$:

x	$-3i$	$-2i$	$-i$	0	i	$2i$	$3i$
X	-8	-3	0	1	0	-3	-8

progresses, and he only progresses when he applies his uniquely human power of cognition to those paradoxes which the universe communicates to us. Constructive geometry, in the complex domain, of the tradition of Archytus, through Gauss and Riemann, is the embodiment of those creative acts, which not only express, but also strengthen, that relationship between man and the universe. Any attempt to formalize and to degrade such universal problems of physical geometry to the level of the analytic, is nothing short of a crime against humanity, performed on behalf of those whom Dick Cheney calls master.

—Cody Jones and Chase Jordan

Box 5

Fermat's Principle

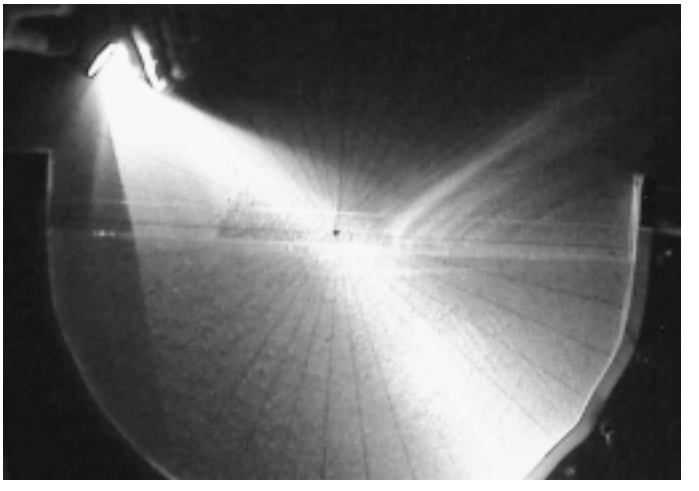
What the reason was for the change in light's direction when passing from one medium to another was a major fight in the 17th Century, and it must become so, again, today. Fermat's principle that light's action is determined by the principle of quickest time, was a political statement, a clear attack on the prevalent empiricist thinking, and a call back to the method of Greek knowledge. It demanded a conception of physical science that places man in his proper place—as in the image of, and participating in a single Creation, overthrowing the oligarchical view that placed man infinitely below the incomprehensible caprice of the Olympian gods and human feudal lords.

The refractive behavior of light had been a source of study and consternation for centuries, since no simple relationship between the angles of incidence and refraction could be determined (**Figure 1**). It was in 1621, that the Dutch investigator Willebrord Snell determined that it is the sines of the angles of incidence and refraction that maintain a constant ratio for a given pair of media, an experiment that is worth carrying out yourself (**Figure 2**).

Although Snell is correct, this observation of effects does not address itself to cause. Descartes, insisting that light had to be understood as ballistic particles (in opposition to da Vinci, and to keep his purely mechanical outlook) was forced to conclude, erroneously, that light actually sped up upon entering water. He also claimed Snell's discovery as his own! Fermat found this speeding up to be absurd, and sought to determine the *cause* for

Box 5 continues on next page

FIGURE 1

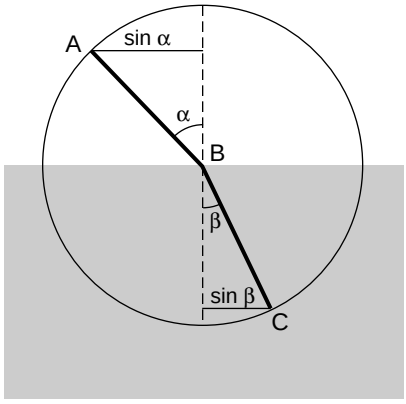


In an experiment conducted by the LYM, the path of light is seen to change direction when it passes from air to water.

absurd.[3] (See **Box 6.**)

3. As Gauss implicitly emphasized for the case of János Bolyai, neither of the famous so-called "non-Euclidean" geometries of Lobatchevsky or Bolyai are equivalent to the anti-Euclidean geometry of Kästner and Riemann. Both Lobatchevsky and Bolyai go only part-way in grasping the argument exposing the falseness of Euclidean geometry as shown earlier by Kästner. It was

FIGURE 2



Snell determined that the ratio sin/α:sin/β is maintained for two media, no matter at what angle the light hits the boundary.

light's behavior.

To note the sine relationship is good, but to actually assert that this trend *is* a scientific principle would not be an honest blunder, it would be an admission by anyone who would make that statement, that that person believes principles are unknowable.[1]

Fermat sought not to describe the motion of the fish, but the shape of the aquarium in which they swam: He returned to the Greek discovery that light reflected off a mirror takes the path of minimal distance, an experiment worth performing on your own (**Figure 3**).

Fermat took up this approach, and hypothesized and demonstrated in 1662 that light follows a path of quickest *time*, rather than shortest distance: As far as the light is concerned, it is always propagating straight ahead by this principle. This hypothesis results in the sine ratio discovered by Snell, but Fermat *delivered* the child whose form Snell accurately reported.

Fermat politically dared to hypothesize a cause for action in the universe, and the attacks on this daring came quickly. Claims that knowable ideas and intentions direct the universe were not acceptable by the oligarchical faction. The Cartesian view insisted on a strict separation between ideas of human minds, and the purely mechanical operations of the physical universe. Claude Clerselier, a friend of the by-then-deceased Descartes, wrote, shortly after Fermat's hypothesis:

"The principle you take as a basis for your proof, to wit, that nature always acts by the shortest and simplest path, is only a moral principle, not a physical one: it *is not* and *cannot* be the cause of any effect in nature . . . cannot be the cause, for otherwise we would be attributing knowledge to nature: and here, by nature, we understand only that order and lawfulness in the world, such as it is, which acts without foreknowledge, without choice, but by a necessary determination."

Is Clerselier right? Why is he so insistent? What is he afraid could happen to the practice of science and society if Fermat's principle and approach were generally adopted?

Generalize Fermat's Concept

Find out: Generalize Fermat's concept. Although a relationship of sines is a geometric statement, the *intention* of quickest time is not, itself, geometric. If this is true for light, what can we say of other processes? Do their geometric effects cause themselves, or must we generalize least action? Must every material event be considered irreducibly as the effect of a non-material, *physical* intention?

Leibniz writes in his *Monadology:* "Our reasoning is based upon two great principles: first, that of Contradiction, by means of which we decide that to be false which involves contradiction and that to be true which contradicts or is opposed to the false. And second, the principle of

FIGURE 3

LYM members re-creating the Greek discovery of minimal distance for reflected light. The reflective path from eye to eye can be "felt" by a third person as minimizing the required string from one eye to the other.

LaRouche text continues on the next page

Riemann, following Gauss's own explorations of a physical hypergeometry, who threw the entire Euclidean and related baggage out of the window in 1854, and went on to develop a general physical hypergeometry. It is that notion of a physical hypergeometry which I absorbed for the generalization of my own discoveries in physical economy, from Riemann.

Sufficient Reason, in virtue of which we believe that no fact can be real or existing and no statement true unless it has a sufficient reason why it should be thus and not otherwise."

All understanding of the universe must be of the form of knowledge of generative principles, from whose curvature, all action appears to be "straight." The development of further principles changes our conception of the shape of what is shortest—as the example of the change from least-distance of reflection to least-time for refraction indicates.

Leibniz, the unique creator of a truly infinitesimal calculus, took up Fermat's position on this question in his first writing on the infinitesimal calculus, and in his *Discourse on Metaphysics:*

"But the way of final causes is easier, and is not infrequently of use in divining important and useful truths which one would be a long time in seeking by the other, more physical way; anatomy can provide significant examples of this. I also believe that Snell, who first discovered the rules for refraction, would have waited a long time before discovering them if he first had to find out how light is formed. But he apparently followed the method which the ancients used for catoptrics, which is, in fact, that of final causes. For, by seeking the easiest way to lead a ray from a given point to another point given by reflection, on a given plane (assuming that this is nature's design), they discovered the equality of angles of incidence and angles of reflection, as can be seen in a little treatise by Heliodorus of Larissa, and elsewhere.

"That is what, I believe, Snell and Fermat after him (though without knowing anything about Snell) have most ingeniously applied to refraction. For when, in the same media, rays observe the same proportion between sines (which is proportional to the resistances of the media), this happens to be the easiest or, at least, the most determinate way to pass from a given point in a medium to a given point in another. And the demonstration Descartes attempted to give of this same theorem by way of efficient causes is not nearly as good. At least there is room for suspicion that he would never have found the law in this way, if he had learned nothing in Holland of Snell's discovery."

There is no *scientific* controversy between Fermat and Leibniz and their adversaries Descartes and Clerselier: This is a *political* controversy of the nature of man. While political operatives like Descartes and his followers attempted to describe this change by a non-physical formula which would accurately match the observed path of light, Fermat's approach, and Leibniz's development upon it, was Promethean, and forced a conception of man as a knowledgeable co-creator, discovering principles and implementing them to create new states of nature. Knowledge is solely based on *power.*

—Jason Ross

1. One could just as well make the (admittedly, true) statement that middle schoolers with larger feet are better spellers. Larger feet do not confer orthographic proficiency; the education that comes with being older does. Retrospective musings on the results of completed action in the past are not hypotheses of motive powers.

For Further Reading

Christiaan Huygens, *Treatise on Light,* 1690.

Gottfried Leibniz, *Discourse on Metaphysics,* 1686.

Gottfried Leibniz, "Submission of Differential Calculus," in D.J. Struik, *A Source Book in Mathematics: 1200-1800* (Cambridge, Mass.: Harvard University Press, 1969).

Oevres de Fermat, V. II, pp. 354, 457, 454, as cited in Laurence Hecht, "Why You Don't Believe Fermat's Principle" (Editorial), *21st Century Science & Technology,* Fall 2001.