common sense and that these corrections have all been made by airies. A short catalog of onetime common-sense beliefs easily settles the matter: The Earth is flat, the Earth is at the center of the universe, the stars revolve in crystalline spheres, species are immutable, mankind was specially created, magic works, everything in the Bible is literally true, and so on.

On the question of illusion, I pointed out that we discover illusion by means of contradictions within perception, and so Biederman's claim that illusions are discovered empirically in no way disagrees with my position. The contradiction that he did fail to appreciate was the one between the belief that what we perceive around us is real simply because it is external, and the fact that some of this is illusory and therefore unreal.

On the question of identifying empirical reality and theoretical reality, Biederman's defense that this belief has been held for millenia is no answer. This belief—common-sense realism—is, I contend, another step in the history of ideas, another falsehood of common sense needing to be corrected. To appeal to common sense against this is merely question-begging. It is reminiscent of the clergy who argued that scientific discoveries did not falsify the Bible because the Bible said so. If he wants to refute me on this point, Biederman should criticize my argument. That he dislikes what he calls my "redefinitions" is not germane; they are stipulative definitions, made for the purpose of exposing error in "our common-sense convention of word meanings." This applies to my distinction between the empirical and the theoretical in defining such things a reality, perception and heads. Biederman's assertion, that in each case the empirical and theoretical are one, is merely dogmatic; in each case he has failed to follow my argument and then asserted as true that which I am arguing against.

It is incorrect to suppose that my position comes from considering perception as one-eyed immobile vision, in which there is no three-dimensionality. The Leibniz–Russell theory has no difficulty in accounting for the three-dimensionality of empirical worlds—both visual and tactile. It is not this three-dimensionality that gives empirical worlds their reality, as Biederman seems to think, although it does, of course, contribute to it.

Finally, Biederman's concluding question poses no difficulty. If I run my head into a brick wall in the dark, what happens is that my theoretical head bangs into a theoretical wall and this is reproduced in my empirical world as an image: that is, my empirical head bangs into an empirical wall. And my theoretical head then develops a bump that is imaged on my empirical head. The difference between the two bumps is that the theoretical bump continues to exist when I am asleep and not perceiving it, while the empirical bump ceases to exist while unperceived.

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5/84

More on how to soar

In "The art and physics of soaring" (April, page 34), Lloyd Hunter seems to be unaware of the fact that physics reasoning provides an analytic expression for the shape of the sailplane polar curve.

This expression is

$$V_{\text{sink}} = A/V + BV^3$$

where A and B are constants.

The first term is caused by induced drag and the second by skin friction.

The induced drag is given by

$$F_I = \frac{C_L^{\,2}}{\pi A.R.}\,\frac{V^2}{V_0^{\,2}}$$

But since

$$C_L = \frac{V_0^{\,2}}{V^2}$$

Then

$$F_I = \frac{1}{\pi\, A.R.}\,\frac{V_0^{\,2}}{V^2}$$

The skin friction is given by

$$F_S = C_D\,\frac{V^2}{V_0^{\,2}}$$

I hope this may help the thoughtful reader understand what is going on.

JOHN V. KANE
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4/84

THE AUTHOR COMMENTS: I would like to thank John Kane for pointing out the analytical expression for the form of the polar curve. It is my experience that its use in calculating cross-country speed is unnecessarily cumbersome. The polar curve can be quite adequately approximated by a parabola over the range of speeds needed for such calculations. The results of such a calculation are good enough for effective flying.

LLOYD P. HUNTER
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6/84

Canadian nuke tips

"By early summer the NRC expects to propose a rule . . . mandating conversion from high enrichment uranium to low . . . at university research reactors" was an item in the Bulletin of The American Physical Society **29** May/June 1984 (page 873). From the viewpoint of a reactor physicist, it makes more sense simply to change the design concept to that of the SLOWPOKE reactor. This reactor is on Canadian university campuses and elsewhere because of the following qualities:

- Critical mass 0.80 kg U-235 (93%) as a U–Al alloy: a dilute solution. If the US campus reactors used this fuel, they would all have to be stolen and chemically processed to make one bomb.
- Small, and cheap to buy ($700 000) and cheap to operate ($50 000/year), for a thermal flux of $10^{12}/20$ kW_t.
- Licensed in Canada for unattended operation.

Maybe it would be a good idea to close down all US university reactors and send nuclear engineers to Canada for hands-on experience. The campus reactors here cost ten times as much to buy and ten times as much to operate—money that could be better spent elsewhere: for example, on work that would led US commercial reactors approach the power cost from CANDU reactors (the Canadian commercial reactors that use D_2O and natural U), which is one half of that from US plants.

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7/84

Corrections

January, page S-9—In the 21st line of text in "What is the Cosmic X-Ray Background Telling Us About the Quasars Missing at High Red Shifts?," "evaluation" should read "evolution."

April, pages 35, 37—In "The art and physics of soaring" by Lloyd Hunter, there are several errors. The discussion of part b of figure 1 on page 35 distinguishes the various lines by structure. The figure, as printed, distinguishes them by color. To follow the argument, one must know that the "solid line" is green, the "dashed line" is orange and the "short dashed line" is blue. The same thing occurs in connection with figure 3 on page 37, where the "dashed curves" are now solid green lines. Also, on page 35, the slope of the polar curve is not the reciprocal of the glide ratio, as stated. Rather, the slope of a line from the origin to any point of the polar curve is the reciprocal of the L/D of the sailplane when flying at the speed representing that point.

April, pages 40, 41—Several errors appear here in the equations. In the second equation on page 40 Q should be V. In the fourth equation $D - h/S$ should be $(D - h)/S$. In the fifth equation $D - h/c$ should be $(D - h)/c$. In the first equation on page 41, $c + S_0/B$ should be $(c + S_0)/B$, and in the second equation C should be c. □