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COVER: The heavy fog that shrouds a solitary visitor to a Washington, D.C., park was caused by a sudden warming trend. The past winter, though—and especially the month of January—was a time of bitter cold and high winds. For a look back see p. 298. (Photo courtesy of Wide World)

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ADVERTISING: **Scherago Associates, 1515 Broadway, New York, N.Y. 10036, Fred Dieffenbach, Sales Director**

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Editorial and Business Offices
1719 N Street, N.W.
Washington, D.C. 20036

Subscription Department
231 West Center Street
Marion, Ohio 43302

Subscription rate: 1 yr., \$27.50; 2 yrs., \$47.50; 3 yrs., \$67.00. (Foreign postage \$5.00 additional per year.) Change of address: Four to six weeks' notice is required. Please state exactly how magazine is to be addressed. Include zip code. For new subscriptions only Call (1) 800-247-2160. Printed in U.S.A. Second class postage paid at Washington, D.C. Title registered as trademark U.S. and Canadian Patent Offices. Published every Saturday by SCIENCE SERVICE, Inc. 1719 N St., N.W., Washington, D.C. 20036. (202-785-2255)

ISSN 0036-8423

MAY 1, 1982

COMMENTARY

Le proton de ma tante est dans le cyclotron de mon oncle

Science education may not be as widespread a topic of conversation as the weather, but it's equally perennial. Where people do discuss it, they never stop. Certainly here at SCIENCE NEWS we see a good bit about it in our correspondence both in direct comments and indirectly in how people's comments and questions illustrate their understanding of science and their attitudes toward it.

I would like to enter this never-ending discussion by drawing some parallels to instruction in languages, also a favorite conversational football. In language teaching there is a spectrum of methods from the formal contrivances of the *plume de ma tante* school to the freewheeling naturalism of the aural-oral people. I once had to tutor a young man who had been to school with the latter faction. He had had four years of French with them. He could have peddled grass on the Boul' Mich': He had the Parisian street argot of those days down pat, but he had hardly ever seen a printed French text, and he didn't know a nominative from an accusative. Our mutual German professor, for whom I was tutoring him, took a dim view of such lacunae in one's background.

The thing about the *plume de ma tante* school was that they taught you some grammar. Grammar is taught by paradigms. Paradigms are condensations of what an infant learns of language structure by trial and error in, say, eight or ten years. For anyone over ten who wishes to learn a new language, paradigms are necessary. Adults don't have the time that infants do. Hence, ever since Cato learned Greek at 80, paradigms.

A fellow student of mine once demonstrated the purpose of paradigms when he told our Latin teacher that he put himself to sleep repeating the declension of the demonstrative adjective: *hic, haec, hoc, huius, huius, huius...* You're supposed to know your grammar in your sleep, and then you can read Goethe or Sartre or Dostoevsky, you can understand precisely a conversation with your Zurich banker or you can peddle souvenirs to Japanese tourists in Banff. You are not stuck with set pieces like *Je ne veux pas de cire aux bouts de mes moustaches.*

Language instruction becomes deadly for many people because paradigms are treated as the end rather than the means. The German professor mentioned above demonstrated a more balanced attitude when he took his beginners' course in about 10 weeks from such sentences as: "*Herr und Frau Schmidt haben ein Haus in der Stadt,*" to novellas by Arthur Schnitzler and Thomas Mann. If you are going somewhere, why not get there as soon as you can?

Science is taught paradigmatically, too, and for the same reasons. But in courses for science majors it often seems as if the paradigms, the derivations and formulas in red boxes, are the end of instruction. (Or maybe it's the manipulation that the paradigms give you the power to do.) The "physics for poets" type of course, if well done, can give a sense of the meaning of science, the esthetics of science, the intellectual strengths and limitations of the scientific method and the mysteries of science, but the material often floats in the air ungrounded by an appreciation of what can be accomplished by manipulating differential equations, an essential that the paradigmatic instruction does give.

I have met physics professors who advise their physics majors to take the physics for poets course so that they will understand what they are being taught in the physics major courses. Perhaps a combination of the two aspects is good for everybody.

In this situation it is often the science majors who get the best of both sides if they stop to philosophize or if they take the physics for poets course. The nonspecialists may come out with a good acquaintance with contemporary scientific doctrine (which may change next week although many of our correspondents seem to have the notion that such things are graven on Sinai), philosophy of science and scientific method. What they often don't have is a feeling for the possibilities and limitations inherent in the doing of science itself. This kind of feeling comes mostly from mucking about with the paradigms by which science is done.

The schools generally suppose that every citizen should have a working facility in the grammar of at least his or her native language. (Whether that is accomplished or not is another question.) Why not also aim at a basic understanding of the grammar of science and mathematics? The courses that might do this are already in most curricula, but nonspecialists almost never take them. One reason may be that these courses are often taught in the deadliest cut-and-dried fashion. Science majors will swallow this because they know they need the material for ulterior purposes, but for arts majors it can't compete with Mozart or Proust or Mondrian. Perhaps the courses need a little restructuring, too. English professors do not assume that everyone who takes Expository Writing I is likely to become another H. L. Mencken or another Mary McGrory, and the courses are designed accordingly. Why should science and math professors assume that everyone who walks into their ordinary offerings (not specially prepared and pickled versions) intends to be the next generation's Riemann or Schrödinger or Delbrück. Maybe science and math departments ought to conclude that the basics and workings of their subjects (not just the certified conclusions) are part of the general culture and offer them as such.

—D. E. Thomsen

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