the latter, for all practical purposes, unsolvable. For many years linear programing seemed to hover in between: Although the simplex algorithm usually worked in polynomial time, sometimes it did not. Theorists were able to prove that linear programing was not as bad as the terrible NP complete problems, so they thought that it represented a new class of problems that was in between the easy (polynomial) and hard (NP complete) problems.

Now, suddenly, all that has changed. Several months ago the Russian mathematician L. G. Khachian published in DOKLADY, the Proceedings of the Academy of Science of the USSR, the outline of a totally new algorithm for linear programing that is guaranteed to finish in polynomial time. Just last month Khachian's algorithm was confirmed and elaborated by Peter Gacs and Laszlo Lovasz, two Hungarian mathematicians currently visiting in the United States.

As might be expected, Khachian's algorithm is totally different from any heretofore proposed. Instead of following the edges of the simplex or tracing the branches of a large decision tree — as many other combinatorial algorithms do — Khachian exploited classical Euclidean geometry inflated into high dimensions.

The key idea is to construct a sequence of high dimensional ellipsoids that slide sideways, under the influence of the constraining surfaces, so their centers gradually converge on the solution. The volumes of the ellipsoids gradually decrease, thus ensuring that the solution will be located within a reasonable number of steps. When written in formulas, Khachian's algorithm is sufficiently simple that it can be programed on a hand calculator. It is certainly no harder to use than is the simplex algorithm, and may, when fully understood, be much simpler.

So despite a quarter-century of successful use of the simplex algorithm, it turns out that it is really not the only way, nor even perhaps the best way to solve linear programing problems. Moreover, Khachian's scheme raised the tantalizing possibility that if linear programing, which was nearly NP complete, could be reduced to polynomial time, then perhaps a similar stroke of genius could break through the NP barrier with a polynomial time solution to these problems as well.

What matters most is that it is a totally new idea, a refreshing dream that reveals how geometry and algebra can interact to their mutual benefit. Khachian's method appears to exhibit greater "intelligence" than Dantzig's simplex method, because it is able to sacrifice in order to assure greater future gains. Nobody yet fully understands how it is able to do this: As we are unable to explain the origins of dreams or ideas, so we are yet unable to comprehend the way in which Khachian's moving ellipsoids can behave as if they were intelligent. □

OFF THE BEAT

Pardon me, does anyone here speak English?

Mathematics is a kind of language. To really get into it you have to be able to think in those funny symbols and the ideas they relate to, nonverbally if possible. That is one of the reasons it is often difficult to interpret mathematical sciences for a general public. American schools have seldom equipped people to think like that. Mostly people have learned it for themselves.

Similarly, American schools have rarely equipped people to think in any of the natural verbal languages of humankind except the English native to the country's majority. Great Britain and the Queen's other dominions are largely in similar case, and together that makes a large reason why English is the accepted language of international science. Accepted by a kind of default.

Some years ago Charles de Gaulle, who always gave the impression that he was refighting the battle of Bouvines, ordered French scientists to deliver their communications in French. For a while they complied. But they wanted audiences, and so gradually they drifted back to English. I once attended an international conference where simultaneous translation was provided à la United Nations. People found the earphones uncomfortable, and waiting for the interpreters inhibited the spontaneity of the question-and-answer portions. Those who could, began to speak English without waiting for the translators.

This situation has been accepted quite smugly for a long time, but recently a couple of letters in scientific publications have asked how much of these "international" proceedings are really understood by people whose native language is not English. As I sat through international meetings this summer — all proceedings of which were in English — I wondered too. On the one hand there were speeches with reference to baseball or American football or wisecracks based on English idioms and proverbs. It's all right to say that these were not the scientific parts of the talk (sometimes they were), but the foreigner whose English is imperfect doesn't know that. On the other hand, there were extremely painful attempts to communicate in an English that was obviously a very foreign language.

Montreal is a good place to watch these things. An international conference in Montreal is certain to be dominated numerically by English-speaking North Americans, yet in Montreal they are slightly off their base. One should not exaggerate the exotic quality of Montreal. As the man in the *brasserie* said, it's a North American city. In the corridors of the University of Montreal were posters advertising a *Ligue de Balle-Molle* (softball league). A Frenchman would have required an explanation of that phrase.

Yet the city looks and sounds more French all the time. If you can't read French, you won't know where you're not allowed to park, nor where they tow it if you do. The atmosphere seemed to inhibit some people. There is a small bank branch in the University building where the sessions were held. Few of the 3,000 astronomers present seemed to use it, although they made long lines at a currency exchange near the registration desk. Was it that they could not speak French to the tellers? Did they not know that this, like all Montreal banks, would gladly buy U.S. currency? Were they reluctant to ask?

Finally, a story about some Germans in a restaurant in the West End of Montreal. One of them spoke a little French and got from the waitress descriptions of the dishes on the menu, which she then related to her companions in German. Later they were wondering if they would get what they thought they had ordered. One of them said plaintively, "But I speak English." I seldom interfere at tables not my own, but I wanted to go over to him and say, "Then talk to her in English, man." The waitress's better language was obviously French, but her English was adequate.

Linguistic inhibitions are thus not solely an anglophone problem, but it is the anglophones who are the loudest group in international science today, and it is they who will have to do some reaching out. English is likely to remain the most widely used language because of the number of scientists whose native language is English and because those from Asia, Africa and South America are often educated in English. But perhaps anglophone scientists could learn foreign languages more — if only to be familiar with the difficulties of a foreigner listening to English or to be able to ask and answer questions in languages more comfortable for non-English colleagues. Provision for delivery of papers in non-English languages could be made again, with translators on duty if needed. It might improve communications.

But it won't be perfection. Even when everybody understands the information conveyed, there can be problems. I was standing in a bar in Montreal one night when I heard a voice beside me say, *"As-tu l'heure?"* (Have you the time?)

I looked at my watch and replied, *"Midi trente."* (Half past noon.)

When the giggling started, I realized what I had said and corrected it: *"Minuit trente."* (Half past midnight.)

The mind has to be in gear as well as the vocabulary.

—Dietrick E. Thomsen