Peer Review: Software for Hard Choices

Some agencies in the U.K. are experimenting with an electronic system that helps make funding decisions

ARE YOU FACED WITH A HUNDRED INNOVATIVE grant proposals, of which you can fund only a couple? Two hundred marvelous applicants for a single tenure-track position? Help could be at hand—literally—in the form of a new electronic gizmo that is already being used to assist tough scientific decision-making in Britain. Called Teamworker, the Agricultural and Food Research Council (AFRC) has been using this novel combination of software and hardware for more than a year to assess funding proposals. The Ministry of Defense finds it concentrates the minds of committee members assessing new strategies or firepower. And some universitities are even toying with it as an aid to the staff promotion process.

"It's a room-based communication system for groups," says Tony Gear, one of the two people who devised Teamworker. Each member of the group holds a handset resembling a TV remote. They send messages to a master unit via radio transmission. From there the messages pass into a personal computer, which uses its software to analyze them, then displays the results for all to see. Cost presently is between $6,000 and $20,000, depending on the number of handsets, each of which carries a numerical keypad and a small display screen.

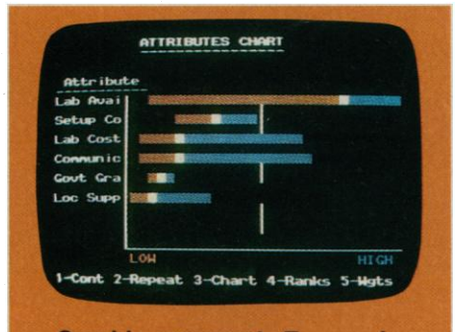
The process can be applied to any sort of choice among a set of options. Consider, as an example, a committee awarding grants to proposals by scoring them on criteria such as timeliness, importance, feasibility, and so on. That seemingly simple procedure hides a plethora of problems. Do all committee members agree on the meaning of the criteria? Do they attach equal importance to each criterion? How do they know when they disagree and how do they cope with disagreement?

All these problems can be dealt with by a good chair—and a set of mathematical procedures. But mathematics takes time and skill, and good chairpersons are hard to find. The electronic system does these things automatically. Take the probelm of weighting the criteria. The computer asks each member to decide whether timeliness, say, is more important than feasibility and to value the difference on a suitable scale. Each person presses a numbered button on their handset and the computer stores the answers. Similar pairwise comparisons are made among all criteria, and the system calculates the relative importance that the group attaches to each criterion.

The next task is to score all proposals. The computer prompts members to respond via their handsets and calculates the average on each criterion; projects are then ranked according to their total, weighted, and scored.

That's useful stuff. But the real strength of the system, according to everyone who has used it, lies in its output: a display of histograms of the scores each proposal obtained. The display shows the pattern of votes (preserving as much anonymity as the group wants). Specifically, it reveals what the disagreements in the group are and where they are centered: about a proposal's feasibility, for example. That information will help the chairperson call on those who have divergent opinions and encourage them to speak before the proposal is reevaluated.

"One outlier in 20 might be insignificant in statistical terms," says Teamworker designer Gear, "but could be important in technical input terms. If you let that person speak, he may have a point of view that's important and could sway all the other 19 people."



Graphic argument. *Teamworker software displays differences of opinion—quantitatively.*

Isn't this what happens in a committee anyway? Well, no. The reason is that at a typical meeting, a few people do most of the talking, and many members come away with a feeling of frustration because they failed to make their point or were not given the opportunity to do so. Teamworker, says Gear, with its on-line display of divergent views, "offers [the chair] a natural way in."

Gear and his partner, Martin Read (who wrote the Teamworker software), arrived at this solution to the problem of committees from quite different starting points. Read was a specialist in battlefield simulations for Britain's Ministry of Defense. Gear is a physicist who has also specialized in operations research. They found themselves sharing an office at Royal Ordnance, Britain's state arms manufacturer, and discovered that they felt the same way about decision-making groups: they do not communicate well.

That is hardly a novel conclusion. But Gear and Read's solution—a package that formalizes scoring procedures and instantly indicates areas of disagreement—is innovative. Nevertheless, the two have discovered that their better mousetrap was not an easy sell even though they quit their jobs to form Decision Dynamics, Ltd., the company (based in Wigan in the north of England) that produces and markets Teamworker.

But they got some help from John Lake. Lake is now director of the newly established European Environmental Research Organization (EERO), but he was formerly head of policy at the AFRC. He was one of a half dozen people invited to a demonstration of Teamworker organized by a friend of Gear's in the Cabinet Office.

"I went with heavy-hearted cynicism," Lake told *Science*, "but I couldn't turn the invitation down." Gear and Read set up a group assessment of five daily newspapers. "My cynicism quickly vanished," Lake admitted. The rapid analysis swiftly revealed illogicality and inconsistency and fostered debate where it mattered. "I liked the way it forced you to think and be consistent, whereas normally you just waffle."

Introducing the system to the AFRC, he met with varying responses, "from real enthusiasm to outright aggression." One grant- committee chairperson went through the whole procedure before announcing that they put all that nonsense to one side and agree to his rankings.

"The committee members were pretty upset," says Lake. But after one more session, the hostile chair had embraced the system and was referring to it as "the usual method." Lake believes that, using Teamworker, the AFRC "gets more information than before, with significantly more precision." He plans to use it at EERO.

The Ministry of Defense has also used the system for some committees and called in an outside consultant, the Centre for Operations Research and Defense Analysis Ltd. (CORDA), to report on Teamworker. Stewart Kempster, a senior manager at CORDA, judged the system very favorably:

"It provides the structure you should have anyway," he said, and "modifies the impact of the vociferous person."

Academic institutions are interested too. Mike Beveridge, professor of education at Bristol University, would like to see it available throughout the university, wherever groups meet to decide between options. He arranged a demonstration at which "the response was favorable."

But the innovation hasn't yet taken the world by storm. Other research councils have been slow to follow the AFRC's lead. John Lake expresses himself "surprised and disappointed that other public sector bodies making assessments of science feel that they can do without this, or something like it."

Perhaps the problem lies precisely in the system's strength: that it formalizes and democratizes decision-making. There are always those who use the informal, imprecise atmosphere of a committee to get their own way. And, says Beveridge, the electronic system "works against those people who regard themselves as good in working committees to their own advantage."

■ JEREMY CHERFAS

Which Patient Did Gallo's Virus Come From?

Having proclaimed that it has all but cleared National Cancer Institute virologist Robert C. Gallo of allegations that he stole the AIDS virus from a group of researchers at the Pasteur Institute (*Science*, 12 October, p. 202), the National Institutes of Health has decided to try to nail down once and for all which particular patient the virus came from.

This foray into viral archeology is the latest twist in a 6-year saga that began in early 1984 when Gallo announced that his lab had pinned down the viral cause of AIDS and developed a blood test for the virus. Almost immediately, questions were raised about the origin of Gallo's virus, which he called IIIB. It is remarkably similar in nucleotide sequence to an HIV isolate from the Institut Pasteur in Paris which was called LAV-BRU, BRU being the letters identifying the patient from whom the French virus came.

Allegations in the *Chicago Tribune* that Gallo stole the French virus prompted a 10-month inquiry, leading to what NIH acting director William Raub has called a verdict of not guilty "on the basis of the evidence." (NIH is, however, investigating alleged discrepancies in a key research paper Gallo published in 1984.)

Gamma Liaison

Leftovers. *NIH probers will examine early viral samples from Robert Gallo's freezer.*

Still, for historical and scientific reasons, NIH wants to track down IIIB. To this end, Raub has asked Gallo for original samples of cells from his lab in the months in 1983 and 1984 that the work was going on. "We have given him what we have and will cooperate however we can," Gallo told *Science*. In addition, he has asked the Institut Pasteur whether they would be willing to cooperate in this virologic dig by supplying an original sample of BRU. "As of now, they say they have not been able to locate one," Raub reports. Montagnier was not available when *Science* called him for comment.

The Gallo lab's success in confirming that HIV causes AIDS depended on the fact that Mikulas Popovic, a Czech cell biologist on the Gallo team, was able to get an AIDS virus to grow in large quantities. He did it by pooling ten different candidate viruses in an admittedly unusual—one leading scientist sympathetic to the Gallo cause called it "crazy"—attempt to see if he could culture one virus from a viral soup. He succeeded.

Today, original frozen cells from nine of the pooled viruses are known to exist and the tenth is being sought. In addition, NIH has secured original samples of other isolates that were growing in Gallo's lab. According to Suzanne Hadley, deputy director of the NIH Office of Scientific Integrity, the plan is to send all this material to an independent laboratory where "blind" tests, including PCR (polymerase chain reaction) analysis of the viral DNA, will produce a profile of every virus.

If these studies show that IIIB was one of the patients in the ten-patient pool, researchers will then know not only the origin of IIIB, which is of historical interest, but also have new information about the genetic closeness of certain AIDS viral isolates.

Virologist and Nobel laureate Howard Temin of the University of Wisconsin says the archeology is of interest because "if we can verify the origins [of IIIB and BRU], we could perhaps learn whether they came from patients who had close contact, or were exposed to AIDS from the same source, or, maybe, whether they each came from the same person." Data show that even though IIIB and BRU are so much alike, the 1% difference between them seems to translate into clear biological differences. BRU is, for example, reported to be a more potent cell killer.

One possible route to unraveling the source of IIIB would be to find out whether Gallo and his French competitor, Luc Montagnier, happened to receive blood samples from the same physicians. Gallo's records show that in addition to numerous blood samples from U.S. patients, he got AIDS blood from physicians in France and Switzerland, but NIH officials do not yet know whether Montagnier received blood from the same people or whether his records still exist.

Scientists on Gallo's team have told *Science* that they have complete records of every AIDS blood sample that the lab received for testing. If IIIB is for some reason not among them, Hadley says, the NIH will go back to some of the physicians who sent early AIDS blood samples to see whether they might have kept the primary samples after all this time. "On the other hand, we may be lucky and find IIIB right off."

Although the outcome of all this investigating may tell us who IIIB came from, there is, Hadley says, another possibility. "It may be that we just won't be able to find the source." If so, what would it say about alleged misconduct in the Gallo lab? "Nothing," Hadley told *Science*. "You certainly couldn't conclude that there was misconduct."

Hadley speculates that the analysis of original samples will be complete within 6 to 8 months, "at the outside."

■ BARBARA J. CULLITON