

The AMS — Then, Now, and Soon

William J. LeVeque

The text of this article originally appeared in *Notices of the AMS*, Volume 35, Number 6, pages 785–789.

A talk presented at the 842nd meeting of the Society in Las Cruces, 8 April 1988.

How I Got Here

As I started thinking about this talk and how the Society used to be, I got to thinking about how *I* used to be—and how I came to be talking about the AMS instead of mathematics tonight. It occurred to me that there were one or two anecdotes that would shed some light on the Society's development, and at the same time provide some clues to those of you who would prefer to stay clear of the kind of thing I have been engaged in these past eleven years, or, equally, to those of you who might be interested in getting into this kind of work.

My first serious brush with the AMS came almost 30 years ago. During a two-year stay in Europe a few years earlier, while on a Sloan Fellowship, Harold Davenport and I had begun to talk about a rather grandiose plan to prepare a sequel to Dickson's *History of the Theory of Numbers*. This was a monumental book which covered the subject from antiquity to about 1910; it was known and used by every number theorist in the world, I suppose. When I returned to Michigan, Don Lewis and I developed the plan further. It was to be a splendid book, with chapters by about a dozen number theorists of the caliber of Erdős, Turán, Linnik, and Mahler, tracing the development of their specialties, and with lists of open problems as well as complete bibliographic listings for the period involved. But it turned out to be too expensive and the NSF didn't fund the proposal. At that point Gordon Walker, then executive director of the AMS, invited me to work for *Mathematical Reviews* instead, and I went to Providence for three months in the summer of 1961.

MR was then near death. The executive editor's attention had been diverted to the problem of translating Chinese mathematics, another editor was bogged down in the problem of producing a 1959 subject index, already two years overdue, and a third was temporarily on leave. Walter Hayman, then of Imperial College, London, had finished a speaking tour in this country a few months early, and he came to Providence too. We were put to work assigning journal articles to the various reviewers, from what seemed to be an enormous backlog. As we finished assigning the articles in each issue we put the latter on a pile in the corner of the room—until the top of that pile rose to eight feet and we had to start a new one. Of course we soon lost track of what we had assigned and to whom, and probably some reviewers got hundreds of articles eventually. I don't know just when 'eventually' was, as not a single issue was removed from the stack and processed further during our stay there! There was a new executive editor a few months later (Jack Lohwater) who was capable of working 18–20 hours a day, and within about three years he had the journal back on schedule.

The summer of '61 didn't seem especially significant in my life at the time, as I was otherwise busy teaching and doing research in number theory at Michigan. But in fact it strongly influenced much of what happened to me after that. By 1964 the Board of Trustees had decided that the *MR* editorial office had to be moved to a large university with an abundant supply of consulting specialists. When the decision was made to move it to Ann Arbor, I agreed to take over from Lohwater, who was by then ready to retire from the job, and to set up the new office. I had never hired or fired anyone, nor kept regular hours, nor made or attempted to abide by a budget, and I didn't really know much about how *MR* worked, so it was a plunge into unknown waters. I hired a secretary, a Slavic expert,

a proofreader, and a librarian, and we all went to Providence for six weeks to learn our jobs. Only two staff members moved back with us in June of 1965, but somehow all our issues went off to the printer at most two weeks late, and we had hired a nearly complete staff of about 20 by the end of the summer.

A little over a year later Sterling Berberian took over as editor and I went off to the Moscow Congress, and again it seemed that I was finished with AMS jobs. But by 1968 I found myself chairman of the newly formed Committee to Monitor Problems in Communication, or Comm.-Comm., as it came to be known. This must have been one of the most active committees in the annals of the Society; we met quarterly for a day or two for the better part of my three-year term, at least. This level of activity was probably due primarily to Gordon Walker, who helped enormously through his awareness of new developments in scientific communication and technology; this was his first opportunity to make practising mathematicians realize what was going on in these areas in the other sciences.

Not everything we tried was successful, of course, but some things lasted:

- We organized a conference at which an entirely new classification scheme was developed for modern mathematics; a slight variant of it is still used by *MR* and *Zentralblatt für Mathematik*. (By the way, if you are unhappy with either the Dewey Decimal or the Library of Congress classification system, don't think they have gone unnoticed; Society representatives have tried many times to get them improved, without success.)

- The Mathematical Offprint Service, or MOS, was a precursor of the online bibliographic databases common today, and I think it was the first full-blown service of its kind in any scholarly discipline. Each subscriber provided a profile of his or her interests, using the classification system just mentioned, and each article from hundreds of journals was similarly classified as to its contents. Then the computer matched articles with subscribers, and appropriate offprints, which had been obtained from the publishers, were sent out. There were about 1100 subscribers, but the price had been set too low, and the service was finally killed for lack of sufficient income.

- Comm.-Comm. also did smaller things, such as instituting abstracts and key words in AMS journals, getting the zero-backlog policy adopted for all Society journals, and starting a new periodical, *Contents of Contemporary Mathematical Journals*. The latter was an inexpensive journal consisting simply of copies of tables of contents of about 300 major journals. Later, its format was changed and it was renamed as *Contents of Mathematical Publications*. It is still thriving.

- We also tried something much more ambitious, to create a so-called National Information

System for the Mathematical Sciences. We worked at this for over a year with representatives from about ten other mathematical organizations, but it never got off the ground.

I left Ann Arbor in 1970 after three stormy years during the Viet Nam War as chairman of the department at Michigan. During the seven years I taught in California, I finally accomplished part of one of my earlier goals by publishing a six-volume collection of *Reviews in the Theory of Numbers*. But it covered only the period after 1940; the subject had simply grown too large for me to have the courage or resources to push back past the date at which *MR* had started.

The point in recounting these activities is to show you how I was naturally and gradually led away from my career in teaching, and research in number theory, to a stronger interest in the dissemination of information in mathematics. When I was invited to succeed Gordon Walker as director I really couldn't resist, and I went to Providence again in 1977.

How The Society Was Then

The Society was then doing many of the things it does now, of course. In the thirty years since the headquarters had been moved from New York City it had outgrown four successive sites, including a portion of a mental hospital, and the Society had finally built its own building two years before I came. The hundred or so employees were busy producing our various books and journals, running meetings, maintaining membership records, fulfilling orders, and keeping the books, just as today. The Society's computer, a Univac Spectra, was used for all of these functions. Its use in publishing, along with some other exotic equipment, was quite unusual for that time, as most publishers still sent paper copy to commercial typesetting houses where hot type was cast on a Linotype machine. Again, Gordon Walker must be credited with envisaging the effect that modern technology could have on publishing.

Let me tell you about some of this avant garde work. The least exotic, perhaps, but to me the most impressive technique involved the use of typewriters. A number of the journals were then prepared on typewriters, in the interests of economy, and of course it's not easy to type decent-looking mathematics. The solution to that problem still astounds me. The machines were IBM Selectrics, which used type balls instead of keys. In front of each of the typists were thirteen balls, with italic, Cyrillic, Greek, and Roman alphabets in various sizes, as well as balls with special mathematical symbols. The typists appeared to use all thirteen balls with equal fluency, interchanging them rapidly and sometimes frequently, and typing with no discernable diminution in speed, and usually

without special keyboard templates. Like Chinese acrobatics, it had to be seen to be believed.

An experiment using more technology was still under way when I came. By that time the Society already owned its second, improved, model of the Photon, a pioneering optical typesetter. On this machine, when the typist struck a key it caused an opaque disk to rotate so as to position an aperture having the shape of the desired character in front of a beam of light. Lenses focused the beam on light-sensitive film so that the image of the character was recorded in the right place on the film, and then the operation was repeated. Code names in ordinary ASCII letters could be used to call up nonstandard characters, so the potential number of characters was very large. But the Photon had far too many moving parts and mechanical components, of course, and it was soon displaced by a typesetting program run on a computer; the code was input in Providence and shipped on tape to a firm on Long Island, where it was processed and the material was set on a phototypesetter.

Equipment was also in the office for scanning material into the computer from manuscripts prepared with special typewriters having bar codes beneath the various letters. It was thought that the bar codes could be more reliably read than the special fonts then in use with scanning equipment. But the equipment could never be made sufficiently robust, and the experiment was abandoned soon after I came. Another unsuccessful experiment was with the Flexowriter, a machine that turned keystrokes into punched tape, which in turn was fed into a computer. Its use had been pretty well discontinued by the time I came, but I still heard stories of mountains of tangled and torn paper tape, and of millions of little round dots of paper that had been punched out and were floating around the building.

What Has Happened Since

So that's how it was in 1977. Since then, change has permeated every facet of the AMS operation, and I might mention some of the major events and movements.

The Univac wasn't in great health when I came, and we soon installed a DEC 20-20 and began re-writing almost all the hundreds of production programs then in use. We thought the new computer would suffice for several years, but this was the first time-sharing machine in the office, accessible to persons who were not computer experts. The operators couldn't install terminals fast enough to get everyone on who wanted to use it, so in fact the machine lasted only about six months, when we had to replace it with the bigger model 20-60. Then *MR* was tied in from Ann Arbor, and usage continued to grow, so we bought a second 20-60, thinking we would soon replace one of the two with the still larger 20-80. But then DEC announced

it was discontinuing the entire line. Even though the machines might have lasted indefinitely, there would be no new software for them and programmers would not be interested in working on them, so after a thorough study of the options we purchased a VAX 8600 two or three years ago and again started rewriting the programs. Now we also have a VAX 8700, and with the 20s still in place for another year or so, we temporarily have plenty of computing power.

Along with hardware came software advances. *MR* had already started to computerize its operations on the University of Michigan computer system, and moving the system to the Providence machine entailed constructing a rather large and intricate database. Now we are in the midst of converting both Providence's and Ann Arbor's major programs to large databases on the VAX. This will be about a five-year project in Providence, and rather less in Ann Arbor because much of the structure of the database has already been worked out.

Perhaps I will give you some data on the size of the various groups involved so that you can see the magnitude of the work the two offices engage in. Twenty-four people are now employed in the Computer Services division in Providence, including programmers, analysts, and computer operators, and there are eight more in Ann Arbor.

Two other technological developments are worth mentioning. In 1978 Don Knuth gave the Gibbs Lecture on mathematical typography and announced his new composition system for mathematical text, which he called $\text{T}_{\text{E}}\text{X}$. Even before that the Society had become involved with $\text{T}_{\text{E}}\text{X}$, and we have contributed strongly to its development ever since. We hired Michael Spivak to write an add-on package, which we call $\mathcal{A}\mathcal{M}\mathcal{S}\text{-T}_{\text{E}}\text{X}$, to simplify the use of $\text{T}_{\text{E}}\text{X}$ for mathematicians. We now use these systems for the composition of all our books and journals, and we publish papers from $\text{T}_{\text{E}}\text{X}$ input tape prepared by authors. We also provide the personnel to edit the $\text{T}_{\text{E}}\text{X}$ Users Group newsletter, TUGboat, and we make available to the public several collections of characters for $\text{T}_{\text{E}}\text{X}$ output, including Fraktur, Cyrillic, and our definitive collection of mathematical symbols.

About 30 people in Providence and five more in Ann Arbor are principally engaged in the key-boarding and composition of text for our books and journals.

Also on the publishing side, we decided a number of years ago to make *MR* available as an electronic database, which we call MathSci. You can dial in to one of the commercial vendors (Dialog or BRS) and search all of *MR* back to 1959. Recently, we have added other societies' databases on statistics and computer science, augmenting the coverage of these subjects in *MR*, and you can access all of this material through MathSci. In your search

you can use any boolean combination of words from the author's name, the title of the article or book, the classification code, the journal name, and the review itself. This enormously strengthens the access modes available in comparison with the traditional author and subject indexes. The mathematical symbols in the reviews are in T_EX input code, which is fairly readable as it stands, or you can run each record through T_EX and get a page that looks like the original *MR* review.

Speaking of *MR* indexes, it finally became possible, with the help of computers and T_EX, to produce that missing subject index from 1959 that I mentioned earlier, and all its brethren, so that there is finally a complete set of author and subject indexes from 1940 on. This grand project, which was guided by John Selfridge while he was *MR* editor, involved some hundreds of thousands of dollars in production costs.

The nearly complete computerization of Society operations, while in a way the largest effort of the past ten years, is certainly not as visible to outsiders as some of the other developments. The *Notices*, for example, has changed considerably. The *Abstracts* was split off as a separate journal some time ago. Several new kinds of articles were incorporated, such as short reports on recent important mathematical developments, Dick Palais' column on technical word processing, and the annual reports of the Secretary and myself. And there has been a gradual but steady improvement in the overall appearance of the *Notices*, culminating in a complete redesign this year.

One new book series, *Contemporary Mathematics*, was started and now contains about 70 volumes. Another, *Surveys and Monographs*, was successfully rejuvenated and usually several new books now appear in it each year. And 1988 saw Volume 1 Number 1 of the new *Journal of the AMS*. It will be followed this summer by *Sûgaku Expositions*, a journal of translations of Japanese expository articles.

The editorial function, of readying authors' manuscripts for keyboarding, engages the attention of about 35 employees in each of the Providence and Ann Arbor offices.

The steady-state meetings program is very similar to what it was eleven years ago, except that we now also run the ten Summer Research Conferences each year. Of course, the ICM in 1986 and the Centennial meeting coming up this summer are major perturbations in what was already a very demanding program for the staff involved. You can have no idea of the amount of detailed planning that goes into a national meeting! There is a check list of over 1,000 items to take care of, from the simple matter of learning the telephone number of the local FBI office to the preparation of the complete meeting schedule. The collection of instructions for everyone working at a meeting

runs to more than 200 pages. I doubt very much that any other society takes such pains as does the AMS to see to it that meetings are as pleasant and smooth as possible for the participants.

These meetings, the SRCs, and another 15 meetings and conferences are organized and run each year by a staff of ten.

Five or six years ago we decided we could do our own printing and warehousing more cheaply than we could pay someone else to handle these functions, so we put a rather large addition onto the Providence building to house them. About 20 employees are required to staff these operations. And three or four years ago we bought the building occupied by *MR* in Ann Arbor, so the Society now owns about five million dollars worth of real estate.

By now I've accounted for about 110 Providence employees. The other big groups that I haven't mentioned include the department that handles membership records and order fulfillment, the fiscal department, and the management groups in the two offices. Altogether, there are now about 150 employees in Providence and about 70 in Ann Arbor.

And of course we also have had a small contingent in Washington for the past few years, in the person of Ken Hoffman and his staff, who are engaged in public awareness efforts. But that is really a joint activity with the MAA and SIAM.

Soon...

Now let me turn to the future activities of the Society. I can't fail to mention first that this centennial year is also the year of the changing of the guard. I will be replaced in September by William Jaco (or Bus, as he is commonly known), who is coming from Oklahoma State University. And Everett Pitcher, the very able Secretary of the Society for the past 21 years, retires at the end of 1988. He will be followed by Robert Fossum of the University of Illinois. These are much younger men and they will surely bring many new ideas with them. There are also a number of young and very active members of the Council who can be expected to influence Society policy. So I think you can look forward to a good number of changes that I can't possibly predict.

I can predict some new developments, however, simply because they are already in the works. One is that the Society will be concerning itself rather more than in the past with mathematics education. The first visible movement in this direction came just this spring, when we sent off to the NSF a joint proposal, with the MAA, for funding a newsletter concerned exclusively with collegiate mathematics education. This will be a bimonthly at the outset, in newspaper format, and it will be sent free during 1989 to all members of the AMS, MAA, and AMATYC, as well as to all teachers of advanced place-

ment mathematics in the country's high schools. Also, the Executive Committee of the Council is now developing a committee structure that will enable the Society to work effectively with the MAA, the MS2000 project, and the Mathematical Sciences Education Board on problems of common concern. The AMS has a parochial interest in these matters, of course, because of the predictable shortage of PhDs in mathematics to staff the nation's colleges and universities during the next decade or two. But there is also growing awareness among many research mathematicians that our participation is needed if the spectrum of problems in mathematics education from the elementary schools through graduate school is to be properly addressed.

In the publications area, I recently mentioned in my annual report in the *Notices* that several new books series have been authorized. These include books on the history of mathematics, reprints of important older books that have been allowed to go out of print by other publishers, and translations of books originally published in Chinese or Japanese.

Speaking of translations, we have a contract to publish a new Soviet journal, scheduled to commence in 1989. And it appears that *glasnost*' may enable the Society to establish more direct relationships with Soviet mathematicians who are writing books, so that we can copublish books in English more or less simultaneously with the Russian editions.

The big news about *MR* is that it will soon be published in an entirely new form, as a compact disc. The contents of about five years' worth of issues of *MR* can be digitally recorded on one CD-ROM, as this kind of disc is called. Using appropriate indexes and search software, also recorded on the disc, you will be able to search the disc just as you can MathSci, described earlier, and see the reviews on the monitor. With a printer attached to your microcomputer, you can search and read the reviews retrieved at your leisure. The price of a subscription, in which the discs will be updated semiannually or maybe even quarterly, will be only a few hundred dollars for individuals at institutions having subscriptions to the discs. This may sound expensive at first reading, but it is extremely low by the standards of the CD-ROM industry, and it will give you much more powerful access to the mathematical literature than does *MR* on paper.

Somewhat less exciting, perhaps, is that *Mathematical Reviews*, in collaboration with *Zentralblatt für Mathematik*, is preparing a revised version of the classification scheme, to be used in both journals starting in 1990.

I would guess that the Society will establish an electronic bulletin board in the near future. Anyone with a microcomputer and a modem can then dial in and keep in touch with any of various special interest groups, such as the people interested in

a certain mathematical specialty, a committee, an editorial board, or a collection of calculus teachers. This service may be free at first, if Federal funding can be obtained, and in any case it should be quite inexpensive.

Efforts are now being made to find ways to get mathematical publications to Third World libraries at costs they can afford. These may include gifts of, or large discounts on, AMS publications, as well as arrangements for donations of unwanted books and journals by American mathematicians.

As regards meetings, I think that it can be predicted that there will have to be serious reconsideration of Summer meetings. The AMS is one of the relatively few organizations that holds two national meetings a year, and the one in the summer regularly costs tens of thousands of dollars more than the income generated from registration fees. It may be that with the ten annual summer research conferences, and all the other conferences, symposia, and meetings that everyone can find to attend, the Summer meeting is an anachronism. I have no inside knowledge on the subject, but I do foresee a reexamination of the Society's meetings program.

So these are the principal things I can see coming. Both the new secretary and the next executive director are articulate and thoughtful mathematicians, and I am sure you will be hearing from both of them next year, with really interesting ideas for the future. I suggest you stay tuned.