Mathematical Reviews

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Rising tensions and unrest prior to World War II affected the world mathematical community. The reviewing journal *Zentralblatt für Mathematik und ihre Grenzgebiete* (*Zbl*) had been established in 1931 by the publishing house of Julius Springer, with an editorial committee of distinguished mathematicians from Europe and America. The editor was Otto Neugebauer, a professor at the University of Göttingen. His field is the history of mathematics and astronomy. He left Göttingen for a professorship at the University of Copenhagen in 1934, where he was in 1938 as events unfolded.

The Italian differential geometer T. Levi-Civita was one of the members of the original editorial committee. Although Mussolini initially distrusted the racism of Hitler's National Socialism, he later accepted anti-Semitism. As a consequence, Levi-Civita lost his professorship of rational mechanics at the University of Rome. His name was dropped from the Editorial Committee of *Zbl*. At about the same time, Russian reviewers were barred from *Zbl*. Springer, presumably under duress, required that no refugee Jews be allowed to act as reviewers and sought a written and binding guarantee of this policy from Neugebauer. At this point, Neugebauer resigned as editor. A number of the members of the Editorial Committee, including all of those from the United States, namely Richard Courant, J. D. Tamarkin, and Oswald Veblen, and others outside of Germany, also resigned. Between the persons not allowed to review and those who chose not to review in the face of the intrusion of political considerations into a scientific enterprise, the coverage of the journal weakened for lack of competent reviewers.

Before the end of 1938, informal consultations took place among mathematicians in the United States about how to save *Zbl* in such an emergency. At the Society meeting of December 1938 in Williamsburg, there was a meeting of the Council attended by about seventy-five additional persons by invitation. The issue of an abstracting journal in the United States was introduced by Secretary Richardson and was discussed by Thornton C. Fry and Warren Weaver prior to a general discussion. The outcome was the following resolution:

> It is the opinion of this informal meeting that the American Mathematical Society should undertake the sponsorship of a new abstracting journal in mathematics for an initial period of five years, provided that a suitable mode of cooperation with foreign mathematicians, especially in Great Britain, can be effectively arranged and that adequate financial backing can be obtained.

In closed session, the Council, on a motion by Warren Weaver, requested the president "to appoint a committee, not to exceed seven in number, with power to carry out the preliminary studies and negotiations and, in case it is deemed wise, to proceed with the inauguration of a mathematical abstracting journal." The initial five year period, the necessity for adequate financial backing, and the appropriate cooperative arrangements were all imposed on the committee.

President R. L. Moore subsequently appointed the Committee, consisting of C. R. Adams, chairman, G. D. Birkhoff, A. B. Coble, T. C. Fry, Marston Morse, and G. T. Whyburn. Correspondence from the period shows that Tamarkin and Veblen were not considered "for diplomatic reasons," i.e., because they had so recently been on the *Zbl* editorial committee.

Initial funding for the committee was budgeted at $500 for travel and clerical expenses.

The report of the Committee on the Establishing in America of an Abstracting Journal in Mathematics at the Council meeting of 25 February 1939 included the news that the President of the Carnegie Corporation was recommending an appropriation of $60,000 "for the support of 'an international mathematical journal' over a preliminary period, 'to be sponsored by and *eventually supported by various mathematical societies*.' " Further, it is noted that Springer stated its intent to continue the *Zbl* "as an impartial abstract journal on the present high level" and its plan to send a representative to the United States to discuss questions related to the possible founding of another abstracting journal.

The Council approved a recommendation of an appropriation of $1000 annually for five years to support a mathematical abstracting journal sponsored by the Society, provided such a journal were inaugurated.

In April 1939, it was announced that O. Neugebauer and J. D. Tamarkin had been approached with a view toward their joint editorship. Neugebauer had already been offered an appointment at Brown University that he had accepted, was in the United States for about ten weeks beginning on 16 February 1939, and was available to advise the committee.

The name *Mathematical Reviews* (*MR*) for the proposed journal was in use by the end of May, at which time, the committee, having been authorized to decide whether to proceed with the journal did in fact so decide. The journal was to begin publication in January 1940 with coverage from 1 July 1939. The initial list price was $13 for one year, with a price of $6.50 to members of sponsoring societies. The objection of Professor W. C. Graustein that the price was too low was recorded.

There were alternatives and counter currents during the course of making the decision. One possibility that was considered was to buy *Zbl*. The representative from Springer, whose visit had been promised, was F. K. Schmidt. He indicated that the prestige of the German government required that *Zbl* continue.

Another potential problem was that a new journal in the United States would involve a break with German and Italian mathematicians, which might retard international good will in mathematics. This question was complicated by the fact that plans for the International Congress of 1940 were in progress and could be disrupted by such a break.

G. D. Birkhoff had a suggestion for a monthly classified listing of papers, with name and subject index, to be carried out at a clerical level. This would be accompanied by reviews of selected papers. A photocopying service of papers on request would be a substantial part of the venture. The whole was to be self-supporting. He was concerned with the facts that the proposed abstracting journal might not be funded, that it was unfriendly to undertake a journal similar to *Zbl*, and that reviewing would take a heavy toll of energy of young American mathematicians. His proposal did not prevail.

On the other hand, Richardson expressed the opinion that an abstracting journal would almost inevitably be undertaken in the United States. He asked what the Council would think if a Council committee, having been given power to proceed, decided not to do so and then an abstracting journal was started under other auspices. He took the position that the Society "must avoid any reference to political, religious or racial questions. We must under no circumstances put ourselves in a position of appearing to kill the *Zentralblatt*. We must study the question objectively and make up our minds as to what is best for mathematics as a whole and then proceed as cheerfully and efficiently as we can."

In June, the Council recommended acceptance of the gift from the Carnegie Corporation. The Trustees concurred. The Council further authorized the expenditure of at most $5000 by 1 September 1939 in furtherance of the founding of the journal. The Carnegie grant in fact became endowment for the journal.

The Rockefeller Foundation made a gift of $12,000, which was used for equipment, promotion, and to replace income that would later be derived from subscriptions. The expenditure of $5000 recommended by the Council was to be charged here.

The scale of the financial operation at the beginning is seen in the initial draft of an annual budget of $20,000. In fact, the expenditure for the fiscal year 1 December 1939 to 30 November 1940, which included the first eleven issues of *MR*, was $14,356.77.

In seeking support from other organizations, the Society naturally turned to the Mathematical Association of America. There was a difference of opinion within the leadership of the MAA over whether an expenditure for a venture primarily in support of research was appropriate. The issue arose just at the point that the MAA was conducting a general survey of the direction of its future activities. The chairman of the committee, R. E. Langer, appeared to be opposed both to the idea and to making a decision on it before the work of his committee was completed. The MAA noted that initial support seemed assured between the Carnegie Corporation gift and the proposed Society subvention and wondered whether spreading its support over an interval longer than five years might be helpful.

The Executive Committee for Mathematical Reviews, consisting of Oswald Veblen, chairman, T. C. Fry, and Warren Weaver, appointed Dr. Willy Feller to be technical assistant to the editors for a three year term effective 1 July 1939 and appointed Miss Evelyn Spencer to be a secretary for the editorial staff. Both salaries were charged to the Rockefeller subvention.

By deliberate decision of the committee, the names of the editors and the editorial assistant did not appear in the front matter of the new journal. The day to day work was done initially by Neugebauer and Tamarkin but then devolved on Feller. The name of Feller first appears, with the title Executive Editor in vol. 5 (1944). By this time, Oswald Veblen had joined Neugebauer and Tamarkin on the Editorial Committee, which was also listed for the first time.

Before the first issue of *MR* appeared, there were about 700 subscribers and 350 reviewers, with about 220 of these from the United States and Canada. The staff of reviewers was then regarded as almost complete. By 1943 there were 1332 subscribers.

As a promotional measure, the Society gave a premium consisting of a microfilm reading machine with initial three year subscriptions to the journal up until the middle of February 1942. This offer was subsidized by the Committee on Scientific Aids to Learning (itself supported by the Carnegie Foundation), which supplied machines of a simple design from the Spencer Lens Company. The machine had a retail value of $32.00. The initial annual subscription price of the journal to members was $13.00 but it was half that to members of sponsoring organizations. The initial stock of 400 machines was exhausted and more were made available.

The Society initially sold both microfilm copies and photocopies of the papers that it reviewed, except for books and copyrighted material. The price was two cents for an exposure (usually two pages) and fifteen cents for a photocopy (also two pages). This service ceased after 1947. The last five microfilm readers were offered for sale at a nominal price in 1956.

The first volume of *MR* in 1940 consisted of 400 pages with 2120 reviews. The size remained almost constant through 1945 but jumped abruptly to 621 pages in 1946. The size increased gradually through 1960 when it had reached 1600 pages. In 1961 there was a marked increase to 2548 pages. With the year 1962 came the change to two volumes per year and the number of pages per year continued to increase, passing 3000 in 1966 and 5000 in 1975. In 1977 and 1978 the number was a bit below 5000. In 1979 there were 7460 pages with 52809 reviews, corresponding to the fact that a backlog in reviewing had developed and was cleared. The journal then stabilized with more than 5000 pages and 34000–38000 reviews per year, numbers that gradually increased to keep pace with the volume of published research. In 1987 there were 7419 pages with 51848 reviews, as well as more than 3100 pages of indexes.

It was decided as early as 1943 not to copyright the journal. This policy was not reversed until the issue of September 1960.

The gathering of published mathematics during World War II presented difficulties and there was a decrease in publication. However, in November 1943 the Secretary noted that material from Russia was being obtained regularly and that material from Germany up to the beginning of 1943 had been secured. Some material was made available by the alien property custodian.

The gradual increase in journal size over almost fifty years represents chiefly the increase in the volume of published mathematics. The policy for selecting material for review has been nearly constant. The most serious issue may have been over applied mathematics. The policy set by Neugebauer was that a paper dealing with an application of mathematics should be reviewed on the basis of the new mathematics (if any) contained in it, without regard to the importance of the paper on other grounds.

The subscription price of the journal has increased with both the size of the journal and the general inflation. The size of the journal between 1940 and 1988 has increased by a factor of about 25. It is not completely clear what index of prices to use but it appears that a factor of about 8.4 between 1940 and 1988 is reasonable. A calculation yields a list price of $2730, compared with the existing list of $3275. On the other hand, the member's price calculated in the same way is $1365 whereas the actual price to members is $393.

The journal is supervised by an editorial committee of three persons (to be four after 1988), who are elected in an uncontested election to three year terms with the convention that one serve no more than two terms. The first elected editorial committee, chosen in 1941 for terms to begin in 1942 by virtue of a revision of the bylaws in 1941, consisted of O. Neugebauer, J. D. Tamarkin, and O. Veblen. . . .

The editorial committee sets editorial policy for the journal, being concerned with such problems as breadth of coverage, the policy on cover-to-cover reviewing versus selective reviewing, critical versus factual reviews, the status of author abstracts as reviews, and matters of bibliographic style. One very important task of the committee is the selection of the executive editor, who on recommendation of the committee is employed by the Trustees.

The operation of *MR* devolves on an executive editor and a professional staff. More recently, the staff has included a managing editor and an increasing number of associate editors. When the journal was started in 1939, with initial issue in January 1940, O. Neugebauer doubled as a member of the editorial committee and as editor. W. Feller was "technical assistant" from 1939 and appears to have been editor by the time the second volume appeared in 1941. The passage of authority from Neugebauer to Feller however is not clear. Feller signed himself managing editor in 1943 but this may have represented his capacity on the editorial committee. There are references to Feller as executive editor and, as already noted, he was so called in 1944 but the recommendation of Boas essentially names Boas as the first executive editor. . . .

Among the executive editors, Boas, Wehausen, Berberian, and Selfridge had their first substantial contact with the journal in that position. On the other hand, Lohwater was managing editor under Gould in 1961–1962 before becoming executive editor. LeVeque, Crittenden, and Burlak had all served as associate editors. Bartle moved from the editorial committee to the editorship twice during his terms on the committee . . . .

The annual report from the editorial committee of *Mathematical Reviews*, then consisting of J. V. Wehausen, chairman, E. Hille, and W. S. Massey, for 1961 contains a passage that exhibits some changes in operation of the journal from the early days of close supervision by the Editorial Committee:

> In October A. J. Lohwater was appointed to the *MR* editorial staff as 'Managing Editor.' He is responsible 'for matters concerning day-to-day operations of the office,' according to the Report of the Executive Director [Walker] and the Executive Editor [Gould], dated Nov. 16, 1961. 'Matters concerning the general policy of the journal, and the relationship of Mathematical Reviews with the outside mathematical world, continue to be the responsibility of the Executive Editor.' Essentially, what used to be the function of the Executive Editor has now become that of the Managing Editor, and what used to be the function of the Editorial Board has become that of the Executive Editor. There is now some question as to whether an Editorial Board is any longer necessary, or at least what its function should be. It had, for example, no prior knowledge of the above appointment or reassignment of duties. . . . The Board *did* meet together with the Providence

staff on November 25th to discuss several questions of reviewing policy, coverage and indexing.

After the move to Ann Arbor noted below, closer supervision by the Editorial Committee returned. This was facilitated by a policy that one member of the committee was from the Michigan faculty.

After Lohwater, no managing editor appeared until W. B. Woolf was appointed in 1979 early in the tenure of Selfridge. Woolf served as acting executive editor during 1984–1985 while Selfridge was on study leave.

The first associate editor, and the only one in 1956, was G. Y. Rainich, who served only that year. From that time forward there were several associate editors at one time, the number reaching a maximum of fourteen in 1981. The staff of associate editors does not completely represent the intellectual support at that level inasmuch as consultants are also used for special languages and fields and sometimes simply for manpower.

The initial staff under Neugebauer and Feller consisted of two additional persons. By 1988, the staff had grown to more than 70.

Initially *MR* was a file-card office. Reviewers, assignment of papers to reviewers, the load carried by reviewers, and the progress of papers from receipt to publication was recorded on cards. A great deal of repetitive typing and proofreading was characteristic. The advent of the computer and of hardware and programs to handle large files was welcomed. The change was made over a period of several years until the entire operation was computerized by 1980. The locus changed in 1981 from a computer mainframe at the University of Michigan to the DEC in Providence, soon augmented by a second, accessed by a dedicated telephone line. The operation was then divided, with the clerical work of maintaining and updating the MR database done on computer terminals in Ann Arbor connected to the Providence DEC, the issue preparation done on a network of smaller machines in Ann Arbor, and only the keyboarding of review texts done in Providence, again on the DEC.

The first location of the editorial offices was Brown University. There is mention in December 1939 of a letter of thanks to Brown for furnishing housing and personnel, the latter presumably being Tamarkin and Neugebauer. The editorial office stayed at Brown University until 1951. At that time the general offices of the Society moved from New York to Providence to settle at 80 Waterman Street and *MR* moved to the same location. The two offices stayed together when the move to 190 Hope Street in 1956 and the move to Butler Health Center in 1962 took place. . . . *MR* was moved to Ann Arbor on 7 June 1965. It was W. J. LeVeque to whom fell the task of executing the move. The University of Michigan was one of several places with the required qualifications of a good library, a large diversified staff (so that consultants would be available), and a receptive attitude.

On June 7, 1965 *MR* moved to Ann Arbor to space in a building at 416 Fourth Street, formerly a brewery, rented from the University of Michigan. In 1970 *MR* moved to space at 1315 Hill Street and in 1975 to an office building at 6II Church Street. In the spring of 1984, the Society bought the building at 416 Fourth Street and remodeled it to suit the needs of *MR*. The move from Church

Street to Fourth Street was made on 9 November 1984.

From the beginning of the time of *MR* in Ann Arbor, the Society had a signated local representative in Michigan. So far as one could see this was a purely formal response to Michigan law. However, when the Society bought the property in Ann Arbor it became desirable that *MR* be a subsidiary corporation in Michigan so that favorable tax treatment could be obtained. Mathematical Reviews, Inc. was established on November 8, 1983.

The first executive editor beyond the nucleus of Tamarkin, Neugebauer, and Feller was Ralph Boas. I quote from his reminiscences:

> When I was invited to be a reviewer, I hesitated, but finally accepted. What I found was that by being a reviewer I learned many interesting things that I probably would not have seen otherwise. Since I generally wrote my reviews promptly, I soon began to receive a lot to review, especially after I began to review Russian papers. Feller was half-time editor and in 1945 he resigned from *MR* to be full time at Brown. I was at Harvard as a temporary replacement for faculty who were away doing war work; I was making $4000 at Harvard and asked AMS to pay me that much. The AMS thought this excessive, but since there was no other candidate, they gave in; but I got the reputation of being "grasping" with J. R. Kline. I spent several months in 1945 learning the job.
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> At that time, Neugebauer and Tamarkin were not spending much time at *MR*; Feller was half-time editor, the secretary was Janet Sachs; the manuscripts were sent out to a nonresident copy editor. When I arrived I discovered (to my surprise) that I was expected to take over the copy-editing as well as all the editorial work, which included assigning papers to reviewers, editing the reviews, reading proof, making the subject index, and tending to the correspondence. For the first few months, Feller and I sat at the same desk and discussed everything in detail. We felt under pressure to keep everything concise; once we succeeded in cutting a ten page review down to five pages. (Feller struck out "partial" from "partial derivative," saying, "What other kind is there?"). Neugebauer handled most of the correspondence with foreigners, partly because many of them were old-time acquaintances. It was through his friendship with Heinz Hopf that *MR* was able to keep up with the German literature throughout the war, via Switzerland. We could not keep up with either the Italian or the Japanese journals; when they eventually came in, there were no real surprises from Japan, and only one (Cesari's work on surface area) from Italy. Neugebauer made a point of always writing in English. When van der Waerden reproached him with not using his "Muttersprache," he wrote back, "It's not a question of my mother's language, but of my secretary's."
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> For the first few years, *MR* published 280 pages of reviews a year, about 7 reviews a page, or about 2000 reviews. The procedures were simple: on Monday we distributed the papers to reviewers; records were made and the journals went downstairs to the Photo Lab to be microfilmed (and copied, if the journals were

borrowed from the library); on Friday the articles were mailed to the reviewers. The rest of the time I edited reviews, read proof, tended to correspondence, and went to the library to check references (in those days, every reference was verified from our files, or from the author index of the *Zentralblatt* (which Neugebauer brought with him on cards), or in the library).

Fortunately Lancaster Press was willing to work from legible handwritten copy, but some reviewers' hands were so bad that the reviews had to be copied. We never dared insist on reviewers' providing legible copy for fear of losing them, especially if they could read Russian or other, even stranger, languages. However, we did send uninformative reviews back to reviewers for clarification, not always successfully. Part of my job was to translate all titles that were not in English, French, German, or Italian.

One Monday after the war ended there were only three papers to distribute, until the mailman came with a large registered package of the war years' Roumanian journals. At that point the flood began. Presently Wehausen came back from Japan with the wartime issues of the Japanese journals, and we had to photocopy them, at a cost of, as I recall, $300, an expense about which the AMS was not enthusiastic. (It should be remembered that for a few years, *MR* had run at a modest profit.) It must have been about 1947 that Mark Kac walked into my apartment one evening, remarking "Say, Ralph, have you noticed how big the *Reviews* is getting?" Had I noticed, indeed. By 1950, *MR* was publishing 766 pages of reviews in a year, and of course it has accelerated ever since.

I calculated once that I read every review nine times; I doubt that there is such close supervision now. The selection of reviewers was a difficult part of the job, because although we had them indexed by field and languages, there were often no reviewers who had specified the field of a given paper and admitted to a knowledge of the relevant language. We had to be persuasive. Some reviewers were incredibly cooperative; some were the opposite.

We went, under Neugebauer's influence, to great lengths to achieve completeness and accuracy. However, we took a firmer line than is followed today about what should not be reviewed. Neugebauer's principle was that papers were to be reviewed for their mathematical content, no matter how significant they might be otherwise.

The relaxed atmosphere and the small staff described by Boas are a far cry from the journal of today, where there are an executive editor, a managing editor, an associate executive editor, about ten associate editors, and a total staff of about 75, not counting consultants who supplement the work of associate editors in exotic languages or out-of-the-way subject matter. Instead of the initial 2000 reviews per year, the number is now up to 51,000. One year of the journal, unbound, occupies one foot of shelf space and the index alone comes to another five inches. . . .

During its early years *Mathematical Reviews* operated at a surplus. Its subscriptions for the first five years were:

1940	1225
1941	1350
1942	1400
1943	1239
1944	1332

The income through 30 November 1944 (end of fiscal year) was $83,047.12 in contributions (including $60,000 from the Carnegie Corporation) and $61,473.35 from subscriptions and other sources while the expenditures were $67,584.38. The receipts and expenditures for 1944 were $15,453.59 and $12,770.02 respectively.

The rejuvenation of the *Zentralblatt* following World War II was a competitive influence that was closely watched. The report of the Editorial Committee of *Mathematical Reviews* in December 1949 notes that speed in reviewing was one of its aims, that it is ahead of the *Zentralblatt* on most papers, and that this is particularly true of Russian papers.

Mathematical Reviews has long offered a service for mathematicians of providing copies of papers from journals that are difficult to obtain. When this service was formalized in 1971 it was noted that no list of such journals would be established because the relatively inaccessible was different in different places but that the service did not apply to journals in nearby libraries.

The journal for many years was sold also in a one-sided printing for those who wished to clip it. The number of subscribers was always small (15 in 1948, 29 in 1949). More recently, as the bulk and price of the journal increased and the classification of papers was refined, subscriptions to sections of the classification were available.

Mathematical Reviews has spawned a variety of closely related services. There are cumulative author indexes for 1940–1959, 1960–1964, and 1965–1972. There are cumulative subject indexes for 1940–1958 and 1959–1972. Finally, there are combined author and subject indexes for 1973–1979 and 1980–1984. Earlier versions were produced by physical handling of file cards and transcription. With the increased computerization of the production of the initial reviews, the information for indexes is all in a data bank for almost automatic production of the indexes.

The database of *Mathematical Reviews* is an asset that has been exploited and made available through online vendors. Initially under the name Mathfile, the bibliographic information since 1973 and the full texts of reviews since July 1979 were made accessible. The material is distributed on the basis of royalties to the Society through three commercial services, Dialog Information Services, BRS (Bibliographic Retrieval Services) and ESA-IRS. The file of bibliographic information was later extended back to 1959. Data from *Current Mathematical Publications* was incorporated and replaced as the reviews appear. Other files, notably the current Index to Statistics and the Index to Statistics and Probability, 1902–1968, compiled by J. W. Tukey were added. The name was changed to MathSci in 1986 as an indication of the broader scope. On an ordinary screen or printer, the mathematical content is coded and takes some experience to read. The language of entries since 1985 is TEX, so that with appropriate graphic display equipment or printer the coded mathematics

can be made to appear in conventional form. There is an extensive user's guide to MathSci.

Computerization of *MR*

Over a period of fifty years, the production of *Mathematical Reviews* changed. Whereas it was once a cardfile and coldtype operation it has gradually become completely computerized from the initial handling of papers to the preparation of camera copy. The following account has been slightly edited from a draft prepared for this volume by William B. Woolf.

At its inception in 1940, *MR* was produced following procedures developed at *Zbl* and brought to the USA by Otto Neugebauer. Information was typed and retyped, first onto several 3×5 cards for maintenance of several record chains, including the basic control sequence and the reviewer records, then onto reviewer forms, and again by the typesetter for the printed journal. It was typed yet again for the issue and for the volume indexes and, from 1973 on, for the annual indexes. When cumulative indexes were issued, the information was typed yet one more time. These repeated keyboardings, each with its potential for error independent of the others, made it extraordinarily difficult to maintain the reputation for accuracy which *Mathematical Reviews* had always sought. Over the years, efforts were made to find methods to reduce this multiple keyboarding. Sometime in the late 50s, the "Ditto" machine was introduced into the process: a Ditto master was typed of each reviewable item, and both 3×5 cards and review forms were printed from the Ditto master. This eliminated several keyboardings at the front end of the production pipeline, but left the process prone to independent error at the issue, issue index, annual index and cumulative index stage. In fact, as late as 1978 it was estimated that bibliographic information about reviewed items was being keyboarded as many as 10 times.

The first major effort by the Society to computerize (the word then was "mechanize") the handling of bibliographic information appears to have been initiated in the late 1960s. Under an NSF grant, concerted efforts were undertaken to utilize punched tape input to Photon type-setting machines for the production of indexes. Photon machines in another version were used in the Providence office for the production of the annual *Indexes to Mathematical Publications* (IMP), Volumes 1–4, which covered the literature in the Mathematical Offprint Service, already described, for the periods July–December 1970, 1971, 1972, and 1973, respectively. When the NSF ended funding of MOS, it was replaced by the less elaborate Mathematical Title Service and the Indexes to Mathematical Publications. That service ended in 1973, and Volumes 5–9 of IMP were annual indexes of *Mathematical Reviews*. The first four of these indexes were prepared using IBM Selectric typewriters with many different typing elements providing both font selection (Roman, italic, bold, Greek, Cyrillic) and mathematical symbols. Finally, the index for the 1977 issue year of *MR* was typeset using the STI typesetting system (see below) but still requiring a complete re-keyboarding of the information.

Finally, in the late 1970s, the production procedures at *MR* were effectively computerized. The first step succeeded in computerizing the reviewer files, including procedures for keeping track of the papers assigned to reviewers and producing reminder letters intended to encourage prompt return of reviews from sometimes laggard reviewers. Immediately on the heels of this project came

the effort to computerize completely the management of bibliographic information concerning items covered in *Mathematical Reviews* and *Current Mathematical Publications*. The goal was to ensure that one initial keyboarding would suffice for all production steps, from the initial record keeping, through the reviewing stage, and finally including the typesetting of issues, issue indexes, volume indexes, annual indexes, cumulative indexes, and specialized review volumes.

The project was carried out in 1978–1979 under the leadership of Executive Editor J. L. Selfridge using a program called SPIRES developed at Stanford University for the management of bibliographic information. SPIRES (Stanford Public Information Retrieval System) was available on the University of Michigan computer system.

During the same period the British typesetting house William Clowes & Sons Ltd., which had typeset *MR* for years, reorganized and, in the process, raised the price for setting *MR* to such heights that alternatives were sought. The decision was made to typeset *MR* in the STI (Science Typographers, Inc.) system, with the review text being input in the Providence office of the Society while the bibliographic information would be input and maintained in the *MR* database created in Ann Arbor. Thus when a galley or an issue was to be printed, a program on the Providence computer took a bibliographic file from the *MR* database and a file of review texts input in the Providence office, merged them, and ran them through the STI program to create a file which drove a Harris typesetting machine (first in Washington, D.C., and later at the STI headquarters on Long Island). [The result was a system which provided typeset output for *CMP*, *MR* and the several indexes, but output of proof-quality for internal record-keeping or for galleys was in coded form, requiring staff and reviewers to learn (or at least tolerate) the special typesetting codes imbedded in the bibliographic files; in fact, galleys were printed by the Harris typesetting machine in order to provide editors with a final-quality version of the output for proofreading.]

In Spring, 1981, work began on the migration of the *MR* database created in Ann Arbor. Thus, when a galley or an issue was to be printed, a program on the Providence computer took a bibliographic file from the *MR* database from the SPIRES system on the University of Michigan Amdahl computer to the SEED database management system on the DEC 2060 machine in the Providence office. That project continued over the next two years, involving the efforts of staff members of the Providence Computer Services Division (CSD) as well as staff members of *MR* in a detailed analysis of the production of *MR* and the design of the database system. The latter, with enhancements has persisted.

Over the first half of the decade of the 1980s, staff members of both offices grew increasingly familiar with TEX, the typesetting language especially designed by Donald E. Knuth of Stanford University for the setting of mathematics. During 1984, the staff at *MR* undertook the necessary programming steps to move *MR* from the STI typesetting system to TEX. Effective with the January, 1985, issues of both *MR* and *CMP* were typeset in TEX. This meant that the initial keyboarding of bibliographic information could be used without emendation to provide both proof quality output for all pre-publication uses (internal record-keeping documents, reviewer forms, galleys, etc., using either dot-matrix impact printers or, later, laser printers) and final camera-ready output for the several printed versions of the information (*CMP*, *MR*, *MR Sections*, review volumes, is-

sue indexes, annual indexes, specialized indexes), using phototypesetting machines such as those of Alphatype or Autologic.

In 1983, the Digital Equipment Corporation (DEC) announced that it would cease development of the DECsystem 20 (the Society owned two DEC 2060s, and had been expecting to be able to migrate to the rumored 2080 system). Plans were immediately laid in each office to examine alternative hardware choices and to lay out development programs leading to independence from the DEC 20s sometime in 1990.

MR examined the microcomputer work-station environment as well as the VAX family of super-minicomputers (which CSD had selected as the environment in which to develop the AMS database, AMSDB, used for all membership and business activities of the Society). A decision was made to move the typesetting (TEXing) aspect of *MR*'s computing from the DEC 2065 (the improved version of the DEC 2060 then in use) to Apollo work stations, and to develop the new version of the *MR* database on the Providence VAX machines, utilizing the database management system INGRES which had been chosen by CSD for the AMSDB. Work began in earnest in the Spring of 1987, and is expected to be complete late in 1989 or in 1990. It is being carried out in a way to make it relatively straightforward to migrate to the work station environment when machine power and software developments are far enough along. There is the possibility that the system will be developed in such a way as to allow on-line editing of manuscripts by editors and proofreaders, utilizing an interactive TEX program developed by a small Ann Arbor Company, ArborText, whose founders were all active in the first successful computerization of *MR* in the late 1970s. . . .