An Interview with

JOHN R. LEHMANN

OH 219

Conducted by Frederik Nebeker

on

26 September 1990

Washington, D.C.

Charles Babbage Institute
Center for the History of Information Processing
University of Minnesota, Minneapolis

John R. Lehmann Interview
26 September 1990

Abstract

Lehmann discusses the changes in management style at the National Science Foundation with respect to its support for computer science research. He describes the move toward greater accountability in the 1980s, the routine of a program director, and the proposal review process.

DATE: 26 September 1990   INTERVIEWER: Frederik Nebeker

LOCATION: Washington, D.C.

NEBEKER: Am I correct in saying that you came to NSF in 1963?

LEHMANN: That's correct, November 20th.

NEBEKER: You were assistant program director for a couple of years, and an associate program director, and then a staff associate and program director for many years, and deputy division director? Can you tell me, before going into details, what have the main changes been in the way NSF functions, or the way a program director functions at the time you have been here?

LEHMANN: There have been changes, and they probably have more to do with accountability than anything else. In the early days, as a program director, I would get external review on a proposal, evaluate the proposal, make a recommendation to fund or not to fund. The NSF would rely on my professional expertise and only a minimal amount of written justification would be required. A great deal more of written justification is now required and I am not sure that it is all bad.

NEBEKER: Do you have to produce documents?

LEHMANN: Yes, you have to produce more paperwork. Accountability is a major issue, that is one major change.

NEBEKER: Why do you think that is? Had there been complaints about the way NSF has made decisions?

LEHMANN: There are always complaints but they are not the major reason. I think that a major part of reason is that the NSF budget has gotten bigger. When I came to the Foundation the budget was about $200 million. Now, the budget is over $2 billion. A small agency doesn't draw as much attention, from the public or from the Congress. A larger agency requires more written justification of decisions.

NEBEKER: And is this mainly for internal use within NSF, these justifications?

LEHMANN: Yes, in the past, they have been. More recently there's some changes--requirements that NSF provide to a person who's declined a more specific set of reasons for the declination, not just the standard letter that has been used in the declination. We have spent a fair amount of time in the last month defining what needs to be sent to the declined investigator. In the MIPS division, for example, we went back to the original National Science Board (NSB) criteria for the total evaluation of a proposal. We also considered program priorities and funding limitations. We have developed an approach that could help each of the program directors in writing a paragraph to go back to the investigator discussing the NSB criteria: research competence, intrinsic merit, utility or relevance, and infrastructure. In addition, there are program considerations, program priorities, funds available, and program balance. All of these factors are a part of a decision. The NSB criteria, of course, focus primarily on competence, merit, and capability. There are some proposals which are quite supportable but can't be supported with the resources available. And so, in trying to tell a person who was declined why it was declined, I think we need to include the things that really were significant. The declined investigator receives the reviews. In addition, we are planning to send 2 additional pages, one describing the general context of the review including information on number of reviews solicited, success ratios, etc. The second will contain a statement from the Program Director with more detailed reasons for the declination. There's a question of how much detail you want to include.

NEBEKER: Is this increase in the accountability-is that a fairly recent thing or has it been sort of a steady increase?

LEHMANN: This increase has been a steady change. There wasn't much concern through the early 1970s, but from then on it's been steadily increasing. Every three or four years somebody calls into question the whole review system, and we go through another analysis and we find out that, while the review system is not perfect, it is the best system we have been able to develop. There is some extra documentation and effort to inform the submitting investigator. It's partly the result of some studies showing some weaknesses of the system and how it can be improved.

NEBEKER: So there's been both an increase in the sort of documentation of the review and the decision processes for internal purposes and for communication with the proposee.

LEHMANN: Yes, I think so.

NEBEKER: Are there other long range, long term changes that you have seen?

LEHMANN: There has been some frustrating things that have happened in that period of time. I know that some Program Directors get frustrated with the rearrangement of priorities by the Congress. They do not see the program support for individual projects increasing as fast at that for large projects such as technology centers. I think that some people don't understand that these highlighted items often pull along the support for individual investigators. Without these highlighted items, I think that support for individual investigators would not increase as fast as it has.

As far as workload is concerned, there are more proposals. If you have seen the reviewer report, one of the things noted is the increase in the number of proposals and the number of instances of more than one proposal from an individual. As funding is tight, and each grant is kept to a small size, an investigator may feel that he/she needs to have multiple support.

NEBEKER: Is that a recent trend?

LEHMANN: Yes within the last 10 years. There have been multiple proposals from a single investigator for as long as I can remember. It is a concern. The Foundation's staff has not increased over the last 5 years. Yet the number of proposals has gone up significantly.

As the NSF staff has grown, it has become more difficult to meet and get to know program directors in other parts of the Foundation including rotators who have good ideas. The former NSF director had established, for example, a lunchroom upstairs, where Program Directors, Division Directors, and Assistant Directors could meet over lunch and get to know each other. There was soup and a simple salad and sandwich bar. We each paid for the lunch. There

was a certain amount of cross-fertilization that I personally think is very valuable.

NEBEKER: There's less of that now?

LEHMANN: When Mr. Block became Director, this lunch activity got terminated. In its place, Mr. Block established a Friday afternoon get-together every once in a while. In my opinion, this did not accomplish the cross-fertilization. It's amazing how much business was conducted, how much coordination was done, how many arguments there were over NSF policies and issues, and how many different people one met over lunch. That's, I think, something that's been missing.

NEBEKER: I would like then to turn to the day-to-day activities of the program director. I understand the process in general, but let me see if my picture is accurate. You receive unsolicited proposals. You review them and name an advisory panel to look at [the proposal?]

LEHMANN: In the MIPS Division, we don't use an advisory panel very much. We use mostly independent, ad hoc reviewers. There is one thing that has changed. For many, many years, the first thing one would look for in a new proposal was the technical content with the view of selecting reviewers who could do the best job of helping me make a decision. In the last several years, the program director has had to focus first on whether there is any possible conflict of interest between the program director and the principal investigator, the submitting institution, or any sub-contractors identified in the proposal. This has been a real extra burden.

NEBEKER: And that's fairly recent, then, that concern?

LEHMANN: Yes! And it's been building.

There's a number of things that the program director does: the management of the review and decision process within the confines of available resources, the continual review and re-definition of the program to keep it up to date, the definition of new programmatic thrusts and the preparation of program announcements for areas deemed highly

important ant timely. The MIPS Division has been interested in stimulating experimental research. The study of computer architecture is accomplished at several levels. Early studies often are paper studies. These may be followed by simulation. Some of these ideas are promising enough that a prototype needs to be build which includes hardware, software and users with the goal of exploring performance, scalability and useability. We have an announcement of our interest in this sort of project. It includes some of the information that is needed since this sort of project is different from the more standard individual investigator proposal and requires more focus on institutional capabilities, relations with industry, and more management focus.

We have been trying to stimulate the undergraduate microelectronics education. We have done a number of things to stimulate work in this area although proposals do come in from the outside.

NEBEKER: Is that fairly new, this trying to stimulate education.

LEHMANN: The MIPS Division has been interested in stimulating VLSI education almost since the Division was formed. In the past, most support for education came from the Education Directorate. In the last several years, a partnership between the Research Directorates and the Education and Human Resources (EHR) Directorate has developed. The Research Directorates are taking more responsibility for undergraduate education.

One aspect of a Program Director's work is keeping abreast of research supported. Visiting researchers at their home institution is a good way of finding out just what research is being accomplished. Limited resources have reduced a Program Director's ability to do these site visits.

NEBEKER: How many of the proposals get a site visit?

LEHMANN: Let's distinguish between two different types of projects. For the regular, normal, small project type of support, there is usually no site visit prior to a funding decision. It would be very helpful to a Program Director if he/she could visit a grantee at least once. The congratulatory letter sent to a PI notifying him/her of the award includes a phrase to the effect that we hope to visit the project at least once during the term of the award. Resources

are not sufficient to carry out this intent.

There are a number of larger projects - S&T Centers, Infrastructure projects, experimental research projects - which are often site visited prior to an award and then again at several times during the period of the award. For example, the Institution Infrastructure Program in Office of Cross-Disciplinary Activities site visits a project before the grant is made and again at the end of the third year to see how the project is progressing. In the Experimental Systems Program of this Division we expect to do something similar.

Given the resources for travel, many program directors elect to go to technical meetings rather than visit individual research projects. A Program Director can talk to a number of your grantees at one meeting. From my experience, this is not a good substitute for a visit to an investigator at his/her home institution where the Program Director can sit down with an investigator and the graduate students and learn much more about the research being pursued.

NEBEKER: Well, there is a big difference, I imagine, between the infrastructure program where they're giving four or five grants a year and your program, the design program, how many grants a year would [you give]?

LEHMANN: We are in the process of producing a Summary of Awards (SOA) for the MIPS Division for this past year. I don't know if you have seen one from a past year. (Reference: SOA, FY 1989, MIPS DIVISION) It describes all the grants awarded. In addition, there is a summary of awards made and dollars committed. The summary on page xii shows about 200 grants for the MIPS Division. This number includes continuing grant increments, Research Initiation grants, single investigator grants, etc. Harry Hedges in CDA will evaluate on the order of 10 to 15 new infrastructure proposals - large scale, small scale, minority - per year. In addition, he will manage a number of continuing grant increments on past infrastructure awards.

NEBEKER: And some of that is where you might solicit research of a certain type.

LEHMANN: You have to be careful. We don't really solicit proposals. The mechanism is to develop a program announcement which describes interest in specific types of proposals with a specific focus. This provides additional

information to researchers who might be interested in the area of the announcement. In addition, Program Directors are in constant communication with the research community and the community senses interests in the Program.

Another aspect of a program director's job is to interact with the budget process. The level of involvement of a Program Director varies considerably between Divisions. It also varies depending on how many Program Directors are rotators. It is hard for a rotator who comes to NSF for a year to have a major impact on the budget preparation. In the MIPS Division,4 of the 5 Program Directors are rotators. This helps to insure new ideas and enthusiasm for the program. On the other hand, the MIPS budget development needs to be handled more centrally.

Some Division Directors use a bottom-up approach where initial ideas are proposed by Program Directors and the Division Director melds these and his/her own ideas into a proposed Division plan and budget. In other divisions the Division Director generates a Division plan and budget with much more limited input from Program Directors. Program Directors might be asked to illustrate a particular thrust being included in the Division budget.

A proposed Division budget is then incorporated into the Directorate budget, the NSF budget and finally the President's budget which is submitted to the Congress. There is interaction between all of these levels and each level budget is often modified to fit within the overall budget.

NEBEKER: How has the number, or percentage of rotators changed over the last [few years]?

LEHMANN: I don't know what it is for the Foundation. In my experience, there are probably more rotators now than in the past. Many people have come as a rotator and stayed. When I first came to NSF, only the section head position was a rotator in the engineering section. The section head, Sam Seeley, was leaving and Ed Lear became the new section head. In the CISE Directorate, the ratio is about 40% rotators.

NEBEKER: And you said that this was a deliberate policy of this division?

LEHMANN: Yes. This is not an easy task for a number of reasons including: salaries, the cost of living in

Washington, interruptions in research projects, the two worker family problem, etc.

NEBEKER: Is it increasingly difficult, do you think in the last ten years?

LEHMANN: Yes! Investigators find it difficult to leave their research project for a year or two. We have had some very good luck. We have had a couple of Program Directors in the MIPS Division, for example, who have been able to carry on a full research program at the home institution as well as manage a Program at NSF. They return to their home institution every couple of weeks to work with their graduate students. This requires a hugh amount of effort.

NEBEKER: Yes, it's beginning to sound like these high energy physicists who are just constantly going to the National Lab.

LEHMANN: Yes, somewhat. We would like to get people who are more senior in the community. This is difficult at this point in time since a person who is an associate professor probably has a higher salary than the Foundation can pay. Program management involves a number of activities as I have noted. There is a fair amount of interaction with people that have been declined, for example. They will call and want to discuss the reasons for the declination. Or a potential investigator will call to discuss an idea and try to ascertain whether the NSF is interested and where in NSF would be the most appropriate home for a proposal. I fell strongly that our job is to help people. President Truman had a sign that said, "The buck stops here." I've always that was a good motto. If somebody calls me for information within NSF and I don't have the information, I will try to get it for the individual rather than pass the buck to somebody else. I don't like this telephone tag that we go through sometimes.

NEBEKER: That's a substantial fraction of your time?

LEHMANN: No, I wouldn't say substantial fraction. Most people don't call. On the other hand, I've had cases where I have spent three hours on the phone with somebody trying to get him/her to understand the context of the review and that the declination is not completely earth-shattering at all. However, a declination may really affect somebody's career.

NEBEKER: Can you tell me more about this program guidance direction?

LEHMANN: There are a couple of sources of advice which help us to identify promising research directions which can result in new program components. One is interaction with advisory committees. The MIPS Advisory Committee has produces several reports of promising research directions. The MIPS staff has worked closely with the MIPS Advisory Committee in defining Divisional and Program thrusts.

Workshops are another source of advice. A workshop often consists of a small number of experts in a particular field. They are brought together for a day or two. Some participants are asked to prepare a talk on some aspect of the field in order to stimulate discussion. By the end of the workshop, there is usually an outline of a report. For example, Dr. Grafton, Program Director for the Design, Tools, and Test Program had a workshop on integrated circuit theory. In this case, there were 6-7 participants. The question was what future directions in this area should be supported through the DTT program. Another question focused on the role of the DTT program and the role of the Computer and Computation Theory program in the Division of Computer and Computation Research. I think it's important that theoretical approaches to some of these problems be considered along with experimental approaches.

Another mechanism is accomplished through allocation of resources. The Program Director is usually allocated a certain amount of resources. The Program Director attempts to allocate this resource among competing programmatic areas. By letting it be known that the Program Director intends to reserve resources for a particular area, a Program Director can shape the program and stimulate research in that particular area.

NEBEKER: How does that information get out to the researchers at large?

LEHMANN: There are a number of ways such as;

1.   Personal communication

2.   MIPS Summary of Awards

       This gives a synopsis of the programs as well as summary of each projected supported

during the year.

3.   MIPS Program Descriptions

The MIPS Program Description provides a 2 page description of each Program in the Division.

4.   Conference participation

The two documents identified are sent to anyone who asks for them. In addition, the MIPS Summary of Awards is sent to all Computer Science and Computer Engineering Department Heads and to all who returned a proposal review to the Division during the past year. We often take many copies of each document for distribution at a conference.

NEBEKER: So if a certain type of research [is needed] you as a program director say you feel is very valuable then that can be mentioned in these applications?

LEHMANN: A special program announcement can be published as we did for the Experimental Systems Program. In addition, there are the avenues identified in the last answer.

NEBEKER: Certainly, to some extent direction comes from the community at large. They are sending in proposals. You judge these proposals individually. Ones that have promise get funded?

LEHMANN: Within funding limitations, proposals with real promise are supported.

NEBEKER: So it's kind of which research frontier happens to be fertile.

LEHMANN: That's the intention.

NEBEKER: What I am trying to get at is -and you have answered this certainly to some extent, maybe as much as can be answered-what direction is NSF giving and to what extent is this sort of spontaneous from this community of researchers?

LEHMANN: Well, I think of it in terms of derivatives. A new Program Director is not likely to change the direction of research funded in a specific area during a year at NSF. He/she is more likely to have a major effect on the second derivative of the direction research should progress in a specific area. The result of his/her actions will probably not have a major effect during a 1 year tenure at NSF.

We still have unsolicited proposals. There are more high quality proposals than can be funded with limited resources. A Program Director must set priorities in the Program and select proposals in one area over another.

NEBEKER: To keep a balance?

LEHMANN: To get some sort of a balance.

NEBEKER: Is that often a consideration in making a decision?

LEHMANN: I think so, at least in the back of one's mind. You don't often have two proposals you can say are equal. I think there are other factors which I consider secondary to quality criteria such as geographical distribution, support for women and minorities, impact on undergraduate education, a balance between large and small institutions, etc.

NEBEKER: Okay, it's one of a number of secondary factors.

LEHMANN: Balance may be a major secondary factor. It depends on the Program and on the Program Director's style.

NEBEKER: You'd say these are the four main activities of the program director?

LEHMANN: Yes, I think so.

Depending on the program, a Program Director may spend a fair amount of time on the phone with investigators discussing new ideas. The Program Director might encourage an idea that sounds great. He/she would make it very clear that encouraging an idea does not necessarily mean that it would be funded. Encouraging an investigator means that the Program Director would be happy to run it through the review process.

NEBEKER: One of the ways a program director can guide research.

LEHMANN: Another way a Program Director can guide research in an area in which he/she is expert is to identify others working in the area and other publications during a discussion of an idea. This will often help the investigator to strengthen a proposal.

For new researchers, I often suggest that they send a preliminary proposal to someone in the field that the proposee knows, asking for a critical review. Based on this informal review, the investigator can often strengthen the proposal before submission to the NSF. This will often save 1 review cycle (on the order of 6 months) and increase chances for funding. I have noticed a couple of cases where that has been quite effective.

NEBEKER: Certainly it's not that a person makes a proposal, it's accepted or rejected, and that's the end of it, but that somebody not accept it the first time may revise a proposal. How much iteration is there in all of this?

LEHMANN: It depends on the individual entirely. In fact, a declined investigator should study carefully the reviews. It may be that the proposal can be strengthened and then should be resubmitted. On the other hand, the reviews might indicate that the area of research is really a dead area. A lot of the work's been done. Most of the major problems have been solved. The best that could result from the project would be incremental improvements. The proposal fails to make a strong case. In this case, the investigator should probably reevaluate his/her research plans.

We do get renewal requests. The success ratio for renewal proposals is significantly higher than for new investigators.

NEBEKER: Yes, is there an expressed policy to try to give an extra chance to people who haven't been funded before?

LEHMANN: I don't know that I would call it policy. We have the Research Initiation Award Program.

If you look at a set of proposals that have been reviewed, they fall into 3 categories: Must Fund, Do Not Fund, and Fund If Possible. This later category often includes a large fraction of the set of proposals. If there are 2 proposals of substantially equal merit, one from an experienced person and another from a new person, I would usually give a chance to the new person. This has in the last few years. We have encouraged new people to submit proposals through the Research Initiation Award Program whose aim is to fund new investigators. This is a special program open to researchers without previous support. This is a partnership between the institution and the NSF. The institution is interested in initiating the research program of a new faculty member. With a limit of 10% overhead, it is attractive from a Program Director's standpoint.

NEBEKER: You're saying in the last several years there has been a special program?

LEHMANN: Yes, it's probably been three years or so now. There was an earlier Engineering Research Initiation grant program with the same aim starting in 1964. That program was in existence for many, many years. It was terminated about four or five years ago.

NEBEKER: And that had the same intention?

LEHMANN: Yes. When this new Research Initiation Award program was initiated, the CISE directorate and the Engineering Directorate established a joint program because we had certain engineering components.

NEBEKER: Let me ask you finally this very general question. If you can think of issues that we ought to probe to illuminate the effect that NSF funding has had on computing.

LEHMANN: I am not sure how to respond. There are certain activities where the effect can very clearly be seen. For example:

      1.   the early support of the university computing centers

TAPE 1/SIDE 2

      2.   the support of supercomputer centers

              The supercomputer centers are used primarily by the physicists, the chemists, the biologists, not by computer scientists or engineers.

      3.   the support of computer use in education

              It seems to me that the 1965-1968 time frame there was a fair infusion of computing into education. There were many computing activities including computer applications in research and education. I managed a program we called Development of Computer Uses. This program supported a number of projects to introduce the use of the computer in education, music, chemistry, art, physics, etc. There were some interesting projects involving the use of the computer in the undergraduate chemistry laboratory linking the computer to a spectrometer and other chemical instrumentation.

      4.   Computer aided instruction [CAI]

              There were a number of projects including PLATO at Illinois and a project involving Pat Suppes.

What about the effect of NSF supported research? I heard a talk by Justin Rattner from INTEL. He noted a new INTEL computer being developed was based on a half a dozen or so major research results. He noted that three or four of these results came from NSF supported research including a memory management project and a graphics system project (Fuchs, U NC). You might want to talk to Intel or other industrial groups in order to identify other NSF supported research that has a major impact.

NEBEKER: What about that issue of academic research connected to industrial R&D? What's NSF's role there then?

LEHMANN: Industrial R&D has become fairly short term in outlook in recent years. If you look at some of the major companies, for example, their central research activities have been decreasing. The divisional or departmental research activities have become more prominent, and these are focusing on more short-term goals. NSF-supported research, on the other hand has or should have longer term goals.

Coupling in with industry is a tough problem. We use industrial reviewers. Industrial people participate in the conferences where papers are presented. They also refer to the journals where research results are published.

NEBEKER: May I ask any rough percentages of industrial reviewers among the reviewers?

LEHMANN: This depends on the research area and the particular program. In the MIPS Division, I would guess 25% to 35%.

NEBEKER: That is obviously an important link between industry interests and research.

LEHMANN: Yes. There have been problems. For example, there was a period of time when IBM policy would not allow IBM personnel to review proposals because of a concern by their lawyers that IBM personnel might glean an idea out of a proposal, use it in a product and then IBM might be incur some sort of liability. It's gotten straightened out. They didn't prohibit reviewing, but they put some of the burden on employees in terms of conflict of interest and so forth. GM research had a similar policy for a while but that has been corrected.

The MIPS Division Advisory Committee has several industrial members. Last year there were industrial members from Sun Micro Systems, Silicon Compiler Systems, Digital Equipment Corporation, IBM Corporation, and Sutherland Sproull Associates. That is 5 out of 18 members from industry. In addition, there are representatives from DARPA, SRC, etc who regularly attend the MIPS Advisory Committee meetings.

NEBEKER: What about another issue-that is, the support of computer science as a discipline, and NSF's role in the early days was support activity for other types of research in computing?

LEHMANN: There has been support for the discipline of computer science in the traditional computer science departments and computer engineering through electrical engineering departments and computer engineering departments. There has also been support for research using computing in other disciplines where the focus was on the use of computing in the research. Support was provided through a number of departments such as electrical departments and mechanical engineering departments, and a couple others. There has been a certain focus on experimental computer science. The Coordinated Experimental Research (CER) program was started to stimulate experimental computer research, because it was felt back ten years ago that computer science departments were too theoretical. There were a few exceptions, of course, such as MIT, Carnegie Mellon, Stanford, and Illinois which had a tradition of experimental research. But the feeling was that there were not enough students being produced in those areas. This is one of the reasons why the CER program was started. The program has been very successful as evidenced by the large increase in Ph.D.'s with experimental training. Unfortunately, budgets have not increased as fast as the number of new PhD's and so funding is tighter. You could certainly look at the CER grants (now the Institutional Infrastructure grants). What effect have they had on individual schools?

The original intent of the CER program was to identify schools which planned to develop experimental computer research but could not invest large sums immediately. The idea was for NSF to invest a larger amount in the first few years of a 5 year plan with the institution assuming an increasing share over the period of the award. I have been involved in the review and site visit of several of the CER proposals. We spent significant time trying to understand what the plan of the university was. Does the university have a plan for assuming the support of permanent personnel in the future years, either later in the grant period or after the grant terminates? What effect has the site visits and the review had on either grantees or those that were declined?

NEBEKER: I think we have reached the end of my questions, so thank you very much.

END OF INTERVIEW