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4S *Society for Social Studies of Science*

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4S: PROGRESS AND PROSPECTS

Editors' Note

The publication of this issue brings us closer to the schedule for timely publication of the Newsletter. We appreciate the many efforts of all colleagues who contributed their talents and time to completing this issue.

We realized that not all members of 4S would be able to attend the annual meeting in Bloomington so we included the program for the meetings that will be distributed at the conference. We believed this would enable you to see quickly what an excellent program was arranged and the variety of topics represented by colleagues in the social studies of science.

The next issue will attempt to print abstracts of most papers from the meeting plus commentary on the sessions by various individuals. Hopefully that issue will be mailed sufficiently before the rush of the holiday season, or if that is not possible, shortly thereafter in the early days of 1979.

Because the author of this page is J. Gaston, Chair of the Publications Committee, he can take this opportunity to thank publicly Henry Small whose continued devotion and hard work on the Newsletter has resulted in its success over the recent past. Ms. Beverly Morber continues to provide the necessary talent and effort that puts the Newsletter into print. I thank them for their extraordinary contributions way beyond the call of duty.

THOUGHT AND OPINION

An Assessment of Studies on Interdisciplinary Research

Philip H. Birnbaum
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Cross-disciplinary collaborative team research has become an increasingly popular form of social enterprise yet it is still poorly understood. The literature is generally atheoretical consisting primarily of claims with few findings. The exceptions to this general situation have tended to be empirical studies which have reflected the values of the disciplines from which the researchers on interdisciplinary activity have come. Thus, for example, social scientists have studied social networks across disciplines¹ while management scientists have studied managerial activities.² Only a few cross-disciplinary studies of interdisciplinary research have appeared.³ The reasons for this situation are many and reflect not only academic inattention but also the difficulties in studying the phenomenon.

The nature of the interdisciplinary research activity itself has constrained its study. It is difficult to operationally define precisely, its activities do not lend themselves to study by citation analysis, and it is difficult to find. In the paragraphs below the major difficulties will be described and suggestions for overcoming them made.

The concept of interdisciplinary activity is rather straightforward with general consensus over its meaning. However, as with many seemingly simple ideas, they become ambiguous with use. Writers on interdisciplinary activity⁴ generally agree that the following indicators characterize the construct: (1) different bodies of knowledge are represented in a research group, (2) group members use different problem solving approaches in attempting to solve problems, (3) members of the group perform different roles in solving problems, (4) the group shares common facilities, (5) members of the group work on a common problem, (6) there is group responsibility for the final product, (7) the nature of the problem determines the selection of research group personnel, and (8) members are influenced by how others perform their tasks. The first four indicators are generally viewed as characteristic of both multidisciplinary and interdisciplinary research while the last four, with their emphasis on integrated effort, characterize interdisciplinary research activity alone. The confusion in use of the concept has come from the social desirability of terming any cross-disciplinary effort, no matter how loosely-coupled, as interdisciplinary.

Interdisciplinary research does not lend itself to study by conventional social study of science means such as citation analysis. The primary reason is that many of the results tend to not be published. Discipline specific journals tend not to publish material of tangential interest to their readership and the editorial review boards are usually not made up of interdisciplinary individuals even among most journals claiming to be interdisciplinary. In addition, the results of the research are frequently not submitted for journal review but are reported to a client as solutions to specific problems. My own research has shown that the lack of professional visibility from publications has been associated with very few untenured but tenure tracked individuals working in interdisciplinary research; tenured or non-tenure track researchers tend to predominate.

Not only is interdisciplinary activity difficult to operationally define and study using conventional citation analysis but it is also difficult to find. Constructing a sampling frame, for example, is most readily done with lists such as contained in American Men of Science or The Research Center Directory. However, no lists exist for what are known as shadow or transient institutes² or for even less formal associations between scholars across different disciplines that are independent of centers or institutes.

Although challenging, the problems briefly described above are not insurmountable. Improved measuring instruments built upon the generally agreed to construct of interdisciplinary activity are helping to identify variability in the phenomenon. Snowball procedures and the use of informants to provide judgmental strata in a stratified sampling plan show promise of improving our ability to identify samples of individuals engaged in the activity representative of the population who can then be measured through the familiar survey or ethno-methodological methods.

Footnotes

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Noah E. Friedkin, "University Social Structure and Social Networks Among Scientists," American Journal of Sociology, 83 (May, 1978), 1444-65.
2. Philip H. Birnbaum, "Assessment of Alternative Management Forms in Academic Interdisciplinary Research Projects," Management Science, 24 (November, 1977), 272-84.
Philip H. Birnbaum, "Academic Contexts of Interdisciplinary Research," Educational Administration Quarterly, 14 (Spring, 1978), 80-97.
3. David F. Gillespie and Brian Mar, "Interdisciplinary Team Preproposal Management," Journal of the Society of Research Administrators, IX (Fall, 1977).
Philip H. Birnbaum and David F. Gillespie, "Status and Performance in Interdisciplinary Research Projects," paper presented at the 38th Annual National Meeting, Academy of Management, San Francisco, California, August 9-13, 1978.
4. W. Caudill and B.H. Roberts, "Pitfalls in the Organization of Interdisciplinary Research," Human Organization, 10 (1951), 12-15.
Margaret B. Luszki, "Team Research in Social Science: Major Consequence of a Growing Trend," Human Organization, 16 (1957), 21-24.
Margaret B. Luszki, Interdisciplinary Team Research: Methods and Problems (New York: New York University Press, 1958).
G.W. Blackwell, "Multidisciplinary Team Research," Social Forces, 33 (1955), 367-74.
Daniel Alpert, The Role and Structure of Interdisciplinary and Multidisciplinary Research Centers (Washington, D.C.: Council of Graduate Schools of the U.S., 1969).
G. Michaud, Note on the Interdisciplinary Concept (Paris, France: Organization for Economic Cooperation and Development, 1969).
5. S.O. Ikenberry and B.C. Friedman, Beyond Academic Departments (San Francisco, California: Jossey-Bass, 1972).

Recent Meetings

American Sociological Association

San Francisco, 4-8 September 1978

Session 35: Theory: The Sociology of Knowledge

Organizer and Presider: Sherry Turkle, Massachusetts Institute of Technology

- (1) "Two Developments in the Rise of the Modern Intellectual"
George Becker, Vanderbilt University

This paper argues that two linked intellectual developments--the "Quarrel of the Ancients and the Moderns" and the evolution of the genius concept--played an important yet often ignored role in the rise of the modern intellectual. It is suggested that these two developments led ultimately to a climate of opinion receptive to the view of the critical intellectual as one who feels himself compelled to act as a "conscience" of society--a view inextricably linked with the very definition of the terms "genius" and, to a degree, "intellectual." The failure to appreciate the contributions of the genius concept to the making of the modern intellectual, so it is argued, will lead to a less than thorough and comprehensive understanding of the struggles and complexities involved in the development of the modern man of intellect.

- (2) "From Scenes to Scripts: On the Relationship Between Laboratory Research and Published Papers in Science"
Karin D. Knorr, Institute for Advanced Studies, Vienna

Recent studies of the rhetoric of science have generally analyzed writings in the social sciences and in philosophy and they have restricted their inquiry to the published text. Based upon a one year observation study done in a major research institution, in the present paper the attempt is made to change the perspective (a) by looking at a scientific paper in a technological science specialty; and (b) by analyzing the relationship between the research process as observed in the laboratory and the scientific text which originated from this research. In addition, the origin and dynamics of a research effort in the laboratory are specified and the strategies of persuasion and accounting as applied in the text are presented by using discourse analysis techniques. A discussion of the transformation-function between the written text and the research process shows that the link between the paper and the laboratory is provided by measurement traces, and that a conception of the scientific paper as a "relevant summary description" of what happened in the laboratory is not substantiated by the present data.

- (3) "Scientists' Selection of New Areas for Investigation: UFOs or ETI?
David W. Swift, University of Hawaii, Manoa

This paper is concerned with scientists' decision to search for extraterrestrial intelligence while rejecting the analysis of unidentified flying objects. The two topics seem similar: both imply knowledge and power superior to our own, and origins outside our familiar world. Thirty years ago neither was a reputable field of study; today ETI is while UFOs are not. Yet there are thousands of UFO reports, including many by reliable observers, but none of ETI.

Discussions with scientists and reviews of books and other printed materials indicate several factors present in one field and absent in the other. Intense public interest, government manipulation of public opinion, and ridicule were prominent in the history of UFOs.

In contrast, several positive aspects of the search for ETI made it attractive to physical scientists: compatibility with established theories, ease of measurement, use of existing methods and equipment, and control over decisions as to when, where, and how to examine the phenomenon.

- (4) "Social Science Attitudes Towards Women Workers"
Dorothy C. Wertz, Westport Point, Massachusetts

Social science investigations of controversial subjects tend to be value-laden in hypotheses and methods, especially in areas of value-conflict. Women's work outside the home, which has traditionally been considered in conflict with motherhood, represents such an area of value-conflict. From its beginnings in about 1870, social science research on women workers has reflected certain dominant values of the middle classes concerning the place of women and women's physical, mental, and moral capacities. Early research was based on Victorian medical ideas about women's physical and mental weakness. Concern for the protection of morals and motherhood was a major reason for investigating blue-collar women, who were believed to supply the ranks of prostitutes. Between 1870 and 1925, research focussed on blue-collar women and reported little about professional women; between 1950 and 1970, researchers focussed on professional and white-collar women, to the virtual exclusion of blue-collar women. This paper contrasts these two periods and explains how cultural values contributed to the exclusion of the blue-collar women. The researchers and their values remained middle-class throughout the entire one hundred years, but images of women changed. Apparent improvements in women's health and in industrial conditions, and a relaxation of middle-class sexual standards, removed what researchers saw as the major reasons for studying blue-collar women. The increasing social acceptability of combining professional work and motherhood led researchers, both women and men, to focus on the problems of their own group. The exclusion of blue-collar women in the recent past has led to an absence of research on day care, occupational health, and the meaning of work to blue-collar women. Some cultural values have continued to influence research for the entire 100 years; these include the belief that women's work was deviant behavior and that motherhood was women's primary task.

(5) "The Social Construction of Assumptions of Human Nature in Formal Organizations"

John A. Busch, University of Louisville

The existence is suggested (at least in industrial societies), in both scientific and implicit theories of social psychology, of an emphasis on the morphostatic and anamorphic assumptions of human nature as opposed to the morphogenic assumption. To the degree that this emphasis has a basis in social organization there is, therefore, an interface between the subdisciplines of social psychology and social organization. It is the task of this paper to build an argument suggestive of one aspect of this interface. We will look at complex formal organizations subject to norms or rationality which apply their core technologies to human objects as potential spawning grounds and sources of evidence (non-scientific) for views of human nature based upon these assumptions. Specifically then, we are concerned with an aspect of the sociology of knowledge which we shall pursue from a perspective largely compatible with the work of Berger and Luckmann.

Session 87: Theory: Theoretical Issues in the Sociology of Science

Organizer and Presider: Harriet Zuckerman, Columbia University

(1) "Fraud in Science"

Deena Weinstein, DePaul University

The numerous cases of fraud in science that have been reported in scientific and general publications generate suspicion that the institution of science is not self-policing. According to the functionalists, particularly Merton, the scientific community regulates itself through observance of the norms of universalism, communism, organized skepticism, and disinterestedness. The growing specialization of science, competition for research grants, the interpenetration of science and government and business, rewards for original research rather than replications, acceptance of authority, and unquestioning commitment to paradigms and ideologies, however, are barriers to self-policing. Although the extent of fraud in science is unknown, there are few barriers to its perpetration and many temptations for it. The results of fraud in science are not only loss of the truth, but, where science is relevant to technology and policy, loss of economic resources and even of life.

(2) "Obliteration by Incorporation: Toward a Problematic, Theory and Metric of the Use of Scientific Literature"

Peter Messeri, Columbia University

Contributions to the advance of knowledge, reported in scientific papers, are treated as basic units of cognitive structure. It is proposed that a contribution's cognitive development is recorded in the way subsequent papers draw upon the source paper. It is often difficult, however, to establish the true extent of use of the most important of scientific contributions due to what Merton has referred to as the obliteration (of the source of a contribution)

by incorporation (into later work). In particular, as a consequence of obliteration by incorporation, reliance on explicit citations as indicators of use may greatly underreport the actual usage of older but widely used papers. It is argued that obliteration by incorporation is an inherent feature of the growth of scientific knowledge. A procedure is presented to "measure" OBI and trace out the changing use of a paper. This technique is applied to two papers that independently advanced the idea of sea-floor spreading, a seminal contribution to the development of plate tectonics theory in geology.

- (3) "Some Observations on Science and Rationality: The Greeks and the Puritans"

Charles Camic, University of Chicago

It is well known that, despite the vast scientific achievements of the Greeks, the role of the scientist was not institutionalized in Greek society, but rather in the Puritan society of seventeenth century England. This paper first observes that the customary sociological explanation of this Greek "failure"--that Greek society was a traditional society--must be rejected in light of much research on the thoroughly anti-traditional and rational character of Greek society. This research demands a new explanation of the Greeks' failure to institutionalize the role of the scientist, one which recognizes that rationality is of various kinds and that variations in types of rationality systematically produce very different consequences for the development of the scientist's role. To demonstrate this, this paper employs Weber's distinction between zweckrational and wertrational orientations to action to characterize the difference between Greek and Puritan rationality and it then explores the consequences of these types for the emergence of the scientist's role in the respective societies. It indicates that, while the wertrationality of the Puritans was conducive to this development, the zweckrationality of the Greeks--rather than their supposed traditionalism--was, at many levels, deeply subversive of it. This conclusion implies, following Weber, that attempts to link science with "rationality" must recognize the complex nature of the latter and its variegated consequences.

- (4) "The World-Economy and the Rise of Science in Seventeenth Century Europe"

Robert Wuthnow, Princeton University

Efforts to explain the institutionalization of modern science have come under increasing criticism in light of recent historical evidence. The traditional Mertonian and Marxian explanations provide important insights, but leave much to be explained. This paper explores the possibilities of examining the institutionalization of science from a new perspective. If, following Wallerstein, early modern Europe is viewed as a single world-economy, new social properties become highlighted that may prove useful in accounting for the rise of science. In particular, the international communication network that developed among scientists seems to have been facilitated by the pre-existence and intensification of commercial and diplomatic

relations throughout the European world-economy. The political decentralization of this system may have contributed significantly to the autonomy of scientists. Competition among states in the European system may also have helped to motivate patronage to the sciences.

Session 146: Social Change: Technology: Innovation and Accumulation

Organizer and Presider: Jerry Gaston, Southern Illinois University, Carbondale
Substitute Presider: Charles Lemert, Southern Illinois University, Carbondale

(1) "Experimental Technology Assessment: Explorations in Processes of Multidisciplinary Team Research"

Daryl E. Chubin, Frederick A. Rossini, and Alan L. Porter,
Georgia Institute of Technology

Technology assessment (TA) is multidisciplinary team research which involves more than scientific study of a topical problem; it involves the values, experiences, styles, and perceptions of team members. In an effort to relate these characteristics to group process and problem-solving, experimental TA sessions were conducted with three groups of scientists. Communication and interaction patterns resulting from three modes of operation imposed on the assessment of biological, physical, and social technologies were observed. These patterns were then compared with the findings from the authors' comprehensive survey of 24 NSF-supported TA projects. The experimental data not only simulated many of the processes which occur in natural settings, but yield valuable insights into the integration of multidisciplinary projects and the organization of modern research teams.

(2) "The Politics of Science and Technology: Nuclear and Solar Alternatives"
Henry Etzkowitz, State University of New York, Purchase

A comparative case study in the politics of science and technology is presented utilizing historical data on the development of nuclear energy and the underdevelopment of solar energy. Differential funding of nuclear and solar R&D is related to United States government policy and military and corporate interests. The potential of photovoltaic solar cells, as detailed by researchers and government panels, is presented in the context of an analysis of the suppression of this technology. The possibility for mobilizing political support for the development of solar energy technology is suggested.

(3) "Defining Technology: Political Implications of Hardware, Software, Power and Information"

Jon Wagner, University of California, Berkeley

This article examines the difficulties encountered by professional and lay persons in conceptualizing technology within the contemporary context of a "technological crisis." Four dominant models (i.e., hardware, software, power and information) are reviewed and assessed in terms of the kinds of research they typically inspire.

In addition to this assessment and review, specific revisions of the information system are proposed which allow that model to

incorporate many of the best features of the other three. An argument, based on the potential for productive research, is made in favor of their adoption; and this revised model is applied to the analysis of schooling, housing and urban design.

In conclusion, the resistance to "information system" models of technology is tied to policy making practice and a political climate of terrestrial domination. The case of technology suggests that social science might serve a more useful function in refining the questions to be asked than it has done in providing--or failing to provide--answers to questions already raised by policy makers.

- (4) "Technology in Agriculture: Labor and the Rate of Accumulation"
William H. Friedland, University of California, Santa Cruz

Technological change in agriculture is not always a function of the availability of technology. Technological capacity establishes the preconditions for change: adoption and implementation are a function of several factors including, particularly in the case of mechanization, the supply and control of the labor force.

Two case studies are used to examine this argument. In processing tomatoes in California, the impetus to develop a mechanically harvestable tomato and a harvesting machine came from a continuous threat to the labor supply, e.g., the bracero program. Significant adoption did not develop, despite the availability of the new system, until after the bracero program ended after which complete mechanization was accomplished within 5 years. Subsequent threats of union organization led to adoption of an optical sorting system to further reduce dependence on the labor supply.

While research on mechanized harvesting of iceberg lettuce also began under threat of the end of the bracero program, growers were able to develop a productive and self-reproducing labor supply and therefore lost interest in mechanization. Two research groups have since developed prototype harvesters in which growers continue to manifest little interest. While availability of mechanized options is useful to growers in their relations with workers and unions, until supply or control is threatened, little likelihood exists of adoption. Alternative conditions for machine adoption are also considered.

These two cases buttress the experience in cotton harvest mechanization where adoption was delayed by a variety of factors exogenous to the availability of technology

Summary and Discussion of Session 35, 87 and 146 of 1978 The American Sociological Association

Susan E. Cozzens, Institute for Scientific Information

"Let a hundred flowers bloom, and let a thousand schools of thought contend" could have been the overall theme of the three sessions dealing with science and technology at the American Sociological Association meetings.

Session 35:

Sherry Turkle, of MIT, chaired this session, which encompassed a wide range of work. The dominant theme was the social bases for the choice not to research certain topics; and as such the session represented a case-study approach to the "sociology of non-knowledge," a paradigm introduced at these meetings in 1975 by Deena and Michael Weinstein. In her comments on the papers, Turkle chose to stress the constraints on knowledge and the relationship between "permitted and forbidden" subjects. She criticized Becker's essay for its acceptance of the "fiction of autonomous action and objectivity," and suggested that "invisible, repressed, and hidden knowledge" play a crucial role in knowledge itself.

Audience reaction was much more prosaic, with a number of questions addressed to Knorr, whose paper presented the only primary research of the session and dealt most directly with scientists at work. Knorr's work was a maverick at the convention, related to all three sessions reported here, but fitting neatly into none. Her analysis of the rhetorical structure of the literature-production process represents a fresh empirical approach to science as an institution, one which will perhaps eventually bridge structural and phenomenological theoretical camps.

Session 87:

As discussant for this session, Tom Gieryn began by noting that none of the papers dealt with a scientific specialty. The tendency to leave the past behind was evident in all four papers, which approached old topics from new directions.

Weinstein's paper sparked the most response. She extrapolated from Summerlin and Burt to the conclusion that fraud in science is extensive, giving the explanation that pressures toward deviance have grown disproportionately to the power of "policing" mechanisms which detect and punish it. Without tackling the question of whether "policing mechanisms" and "institutional enforcement of norms" are equivalents, Gieryn countered that the pressures toward deviance were met with the most forceful resistance in precisely those areas where they were strongest, where work of great scientific or practical import was being done. Other comments from the floor attempted to confirm or deny Weinstein's conclusions on the extent of fraud in science, although in the end there was general agreement that hard data on the phenomenon were unavailable. Given this situation and the long history of controversy over the normative theory of science, a useful discussion of this issue could have been expected either to produce greater theoretical clarity or to suggest, if not implement, a critical empirical test of competing hypotheses. Unfortunately, neither purpose was accomplished either by Weinstein's paper or the discussion which followed it.

A member of the audience asked Peter Messeri if his research on the disparity between use of a scientific paper and explicit citations to it could be translated into an equation "to clean up citation-counts." Messeri did not advocate this application, since the rank ordering of papers by either "use" as he defined it or by citations would be identical. Instead, he proposed that his work could be applied to the interpretation or co-citation clusters, and accepted a suggestion from the floor that hypotheses for future work on

his topic could be drawn from this literature. Gieryn similarly pointed out that Messeri's work provided an antidote to the "false sense of confidence that we know what citations mean."

The two final papers, on historical subjects, occasioned much less audience response, with a significant exception. Given the chance for a "last word" in the session, Merton chose to use it in praise of Camic and Wuthnow, for producing new insights into well-known materials.

Session 146:

The session on the place of technology in social change highlighted several distinctively sociological ways of examining technological questions. Wagner proposed a definition of the phenomenon which would allow the inclusion of social technologies (the American Sociological Association being offered most frequently as an example). Etzkowitz and Friedland both presented class analyses of rates of technological development, while Chubin, et. al., explored the implications of the nature of technology for the social organization of science and engineering, which must learn to cope with problems that cut across disciplinary boundaries.

The audience reaction to the papers, however, centered mainly on their political and hardware themes. Etzkowitz received by far the most questions, on topics ranging from the implications of solar versus nuclear energy for local political units to his own participation in the "power" struggle. There was virtually no overlap between the audience for this session and the audiences for the other two sessions described here, and this perhaps accounts for the apparent lack of interest in the Georgia Tech paper, which dealt most specifically with issues in scientific organization.

Science and Technology as Objects of Social Science Research

Review of Part 1, I. Spiegel-Rösing and D. Price's Science, Technology and Society: A Cross-Disciplinary Perspective (Beverly Hills: SAGE, 1977).

In 1965, Brewster Denny published a review article on books by Don Price, Etzioni, and Mesthene entitled: "Science and Public Policy: A Literature in Search of a Field." Denny felt that the books he had chosen for review differed from other works dealing with the political implications of contemporary science and technology: they were written by social scientists, and social scientists, for some reason, had largely ignored issues of science policy. Whatever literature existed was the work of participant observers, many of them natural scientists or engineers who reflected upon their personal involvement in building new relations between science, technology, and the state. Exceptions to this rule were rare. This state of affairs, in Denny's view, was dangerous for two reasons: important public policy issues remained without systematic analysis; the social sciences, at the same time, lost touch with reality by ignoring significant new developments in the policy process. What was needed, in Denny's term, was a "substantial body of analysis of the field itself which gives it the kind of shape and direction in which priorities for study and action can be identified" (Denny 1965:240). Other authors arrived at similar indictments. Harold Wilensky devoted an entire book to the role of knowledge and policy in government and industry, trying to fill a gap in social science research: "It is strange that social scientists, who are by profession devoted to the application of reason to man's affairs, have been more impressed by the use and misuse of power than by the use and misuse of knowledge" (Wilensky 1967:7).

In 1977, Science, Technology and Society was published--a massive work of over six hundred pages, divided in fifteen chapters, each reviewing a substantial body of social science research on the organization of science and technology and their functions in modern society. How is it possible, we must ask, that a field of scholarship has grown in just a dozen years from virtual nonexistence to the point where a handbook-type volume is needed to synthesize what is known? Or, alternatively, was the assessment wrong which Denny and Wilensky, and others, arrived at in the sixties?

Science, Technology and Society is written from the viewpoint that indeed considerable changes occurred over the course of the last ten or fifteen years in the degree of attention given by the various social science disciplines to science and technology as social forces. On the institutional level this can hardly be disputed: ". . . The massive institutional development of the field did not begin in most countries until the mid-1960's. Today (the study of science, technology, and society) exhibits all the signs of an institutional field, such as specialized research institutions and teaching programs, organization at a national and international level, and specialized media of communication" (9). The same impression of significantly scaled up research activity in recent years results from even a cursory look at the bibliographical section following each chapter in the volume: most of the articles and books cited show relatively recent publication dates. However, an immediate qualification is in order. Dominance of recent publications is pronounced in the area of "science policy studies," but much less visible in "social studies of science." This division into two subfields is suggested by Spiegel-Rösing, writing as one of the editors of the volume, and is used to structure the various contributions to the enterprise: articles in

Part II (following the introductory materials in Part I) deal with "The Social Studies of Science: The Disciplinary Perspectives"; Part III is devoted to "Science Policy Studies: The Policy Perspective." I will try to show that the intellectual history of science and technology studies is richer and somewhat older than the book under review assumes. But a general comment should be made first.

Science, Technology and Society is more than an important addition to the literature on science and technology. Publication of the book represents a milestone in the process of growth and maturation of a field of study. We now have, for the first time, an overview and assessment of the field. It is unlikely that an equally ambitious undertaking will be tried again for many years to come. The book will serve as a guide to the field even after many of the studies discussed in the different chapters will have been superseded by new research. The book deserves this standing because it serves well the different functions which, taken together, add up to a successful summa: it synthesizes a large body of research from different areas, disciplines, and countries; it suggests a structure for the organization of the field into areas of concentration and specialization; it identifies deficiencies and gaps in the current state of knowledge; and it presents a research agenda which can guide future work. Science, Technology and Society goes a long way toward giving us what Denny had called for in 1965: a "substantial body of analysis of the field itself which gives it the kind of shape and direction in which priorities for study and action can be identified." Much of the following discussion will show where the book, in my opinion, falls short of this goal. But this critique is presented against the background of genuine appreciation for the difficulty of the task at hand and the invaluable service rendered by Science, Technology and Society in helping the field of science and technology studies to gain identity and cohesiveness.

Part I, which I was assigned to review, consists of three programmatic articles. Spiegel-Roesing sets herself a double task. She first gives the reader an overview of the volume: How was it prepared? What are the main themes dealt with? What are the principal conclusions reached by the authors? She then attempts a general assessment of the field of science and technology studies: what are its major characteristics and constituent parts? What has been achieved and what needs to be done? What are the major weaknesses and deficiencies of scholarly work in the field? Salomon traces the development of science policy and of science policy studies over the course of the last four decades. He asks: as science policy emerged, grew, and changed as a distinct policy responsibility of national governments, what happened with regard to science policy studies? Did they mainly reflect science policy developments or contribute to shaping science policy itself? Ravitz, in a brief paper, reviews historical stages of critical attitudes toward science: antiquity, the Romantics, the period of industrialization, our own time. My review is focused on general issues concerning the field of science and technology studies: what is the field? how did it develop over time? what is its current condition? I will develop my points by commenting on Spiegel-Roesing's and Salomon's papers.

What is the field? Definitional debate can be quite sterile--and the field we are dealing with has had its share of empty discourse about boundaries and definitions. Little of this is going to burden the reader of Science, Technology and Society. Spiegel-Roesing defines the field in a straightforward manner as the "study of science, technology and society (SSTS)." No attempt is made to shorten this sequential listing of terms to a single name or concept. Spiegel-Roesing holds a chair for Wissenschaftsforschung in one of the new German universities, and similar terms--science of science, research on research--have emerged in different languages. Spiegel-Roesing was well-advised in not using any of these terms or coining a new one. Thus, she cannot be accused of glossing over two perennial problems with the boundaries of the field that all those close to it are familiar with. At the present time, there is simply no unifying concept which would adequately identify the scope of the field and the range of activities under study. There is first the science and technology issue. We all agree that science and technology have become dependent upon each other and, therefore, must be studied in conjunction. But we also maintain that significant differences remain between both activities, not just of scale, but also of methods and goals. Each, therefore, requires attention in its own right, and questions and findings cannot be automatically transferred from one to the other. Much of the research done in the field can be faulted for not adequately dealing with the science-and-technology connection--a point made repeatedly by Spiegel-Roesing in her assessment of current research efforts.

The second complication arises because science and technology can be studied from within, treating them as relatively self-contained social systems with their internal structures, relations, and procedures making up the research agenda. They must also be studied as subsystems of a larger social and political environment of which they are a part and which they help in shaping. Both viewpoints are partial. While we all know about this limitation and the need for combining internal and external analysis, most research undertaken does not span the entire range of orientations and issues. Such breadth of scope cannot reasonably be expected to become the norm. One must insist, however, on recognition and acknowledgement of the partial focus of any particular piece of research and of its findings. Any of the shorthand terms which could be used to identify the field encourage disregard for this rule. Spiegel-Roesing's descriptive definition serves as a constant reminder of the three constituent elements which research in the field has to deal with. To be sure, there is little elegance to "science, technology and society." Nor is there the force of logical unification which a single term might help along. Some day, perhaps, a term will emerge and gain acceptance both as an accurate and a compelling name which would help in conferring substantive identity to the field.--I note in passing that the proposed acronym, "SSTS," does not strike me as a happy choice, partly because it triggers associations with the ill-fated SST, partly because use of acronyms encourages the development of an insider's lingo which I find objectionable.

Social Studies of Science. The internal-external focus is identical, by and large, with Spiegel-Roesing's subdivision of the field in "social studies of science and technology" and "science policy studies." Work in both subfields is seen as having progressed in two parallel streams with few bridges ever built between them. The two areas differ with respect to " (1) their disciplinary origin, (2) their major sources of research questions, (3) the

consequent emphasis on cognitive or operational problems and (4) their focus on science or technology" (17). Social studies of science represent the "well-articulated subfields of different mother disciplines"--sociology, psychology, history, philosophy, and others. Work is characterized by almost total neglect of the wider socio-political context of science, and dominance of intra-scientific issues and of cognitive and methodological questions. There is also consistent neglect of operational and managerial aspects of scientific development. With the obvious exception of the history of technology and the economics of science, "they all focus primarily on science; the social studies of science have greatly neglected technology" (17).

Unfortunately, Spiegel-Roesing does little to help the reader in identifying the principal stages of development which the social studies of science went through over time. The same is true of most of the articles in Part II, which review work in the areas of sociology and psychology of science: a lot is said about the trees and little about the forest. Thus, the reader is left with repeated comments about the fragmentation of work in the social studies of science, but little analysis of what is being criticized. Unless this is done, the plea for integrating social studies of science with science policy studies remains rather general. The discussion of the historical development of research in the social studies of science lacks historical perspective.

To illustrate the point, I quote from a recent characterization of work in the single subdiscipline of the sociology of science: "In the 1940s . . . sociology laid heavy emphasis on the organizational matrix of the scientific and technological communities. . . . This in turn was followed by the 1950s period, during which great attention was given to attitudes of scientists: attitudes ranging from feelings about their profession to sentiments about career mobility The decade of the 1960s tended to emphasize career patterns of the scientific 'greats.' The problem became that of the nature of scientific discovery, the presumed stewardship of scientific results, jealousies and competitiveness among the talented. . ." (Horowitz 1978:vi). It is this kind of broad synthesis which is missing in the treatment given to research in the social studies of science, for one in Spiegel-Roesing's overview, and equally in some (but not all) of the articles in Part II of the volume. Unless there is first some understanding about dominant themes and orientations in the subfield over time, the call for change in the direction of a broadening of agendas and approaches--a call repeatedly made by Spiegel-Roesing--is not totally convincing.

Science Policy Studies. A clearer picture is drawn for the development of science policy studies. These are described as being more homogeneous in terms of the disciplinary background of the scholars involved. Most of them were trained as political scientists. They lack focus, however, in terms of issues dealt with and how the various topics are discussed. Problems studied are related to science and technology, but are played out in a much wider social and political context and in different organizational settings. The range of topics covered is large and rapidly increasing, reflecting the fact that many social problems have roots in or can be remedied by, at least partially, science and technology. Additional weaknesses of science policy studies result from fragmentation of effort due to national and regional specialization, reflecting differences in political organization, philosophical

orientation, and stages of economic development. Since technology, at least on the face of it, tends to raise more policy issues than science, science policy studies deal more often than social studies of science with this range of activities. A serious shortcoming is the lack of historical perspective which is characteristic of much science policy work. Science policy scholars tend to be ignorant, in addition, of the internal social and cognitive functioning of science and technology--again evidence for the gulf separating science policy studies from social studies of science, and additional reason for arguing the case for a new alliance between both approaches.

The emergence and growth of science policy studies is traced by Salomon. Work done prior to 1940 is characterized as belonging to the prehistoric phase of science policy studies. Much early work was utopian in character or, as in the case of Bernal's sweeping analysis, far ahead of real world conditions. The years of the Second World War and the Cold War brought the breakthrough which made mandatory the growth of new relations between science and state. The familiar chain of events is recalled: the development of science-based weapon systems which had an immediate impact on the outcome of war and its conduct, the massive mobilization of scientific and technological resources for the war effort, the entry of scientists and engineers in the corridors of power, the development of government machinery for the implementation of national science policies, the rapid rise of budgetary allocations to research and development, the change to stationary or declining support levels over the course of the last decade, and the emergence of new science policy goals to reflect changed national priorities. Salomon attempts to show for each phase in the development of science policy, the parallel development and changing focus and priorities of science policy studies. This is an interesting approach, since it might reveal the existence of a dialectic movement between science policy and science policy studies. Specifically, to what extent and for which problems did science policy studies help in shaping science policy? However, the author does not pursue the question systematically. His occasional comments suggest a view of science policy studies as largely reflecting events once they had occurred--"events precede reflection" (43).

As the case of Bernal's work shows symptomatically, policy research needs a real world frame of reference in order to be meaningful. This did not exist with regard to the government's science policy function when Bernal's book was published in 1939. But once the real world context changes to the point where essential features of the new reality become visible, the policy research function must be both reflective and prospective, historical and normative. Salomon and Spiegel-Roesing seem to suggest that the normative contribution of science policy studies came into being only during the late sixties when new critical attitudes about science and technology as social change agents emerged. Repeatedly, the new social consciousness and the establishment of the field of science and technology studies are presented as related events. I question the accuracy and adequacy of this interpretation.

To be sure, the institutional build-up of the field, through chairs, institutes, degree programs, journals, and professional associations is of recent origin. It should be noted, however, that this process of institutionalization began in England and in the United States, while other countries followed the movement with a time lag of about five to seven years. This time difference suggests that the process of institutionalization was well underway, at least in the

Anglo-Saxon countries when the anger of Vietnam and the distrust of power, size, and rationality changed the social climate in the Western nations.

A similar point can be made about the emergence of science policy studies in East and West. In general, the book deals only with research done in the Western countries (called "bourgeois" by Spiegel-Roesing--a reminder for readers on this side of the Atlantic that Marxist and neo-Marxist terminology continues to be fashionable in Europe). In the preface, the editors report that they had originally planned to cover research from both East and West, with each subject matter treated in a chapter and counter-chapter fashion. This would have reflected the international nature of work in the field as well as the international membership of the sponsoring body for the book, the International Council for Science Policy Studies. As it turned out, the whole idea had to be dropped. But Spiegel-Roesing herself, in previous work, has studied science policy in Eastern nations. Her article, therefore, contains occasional references to the development of science and technology studies in Communist countries. Her comments suggest that rapid institutional growth of the field occurred at about the same time as in the West. Given Marxist views about the social roles of science and technology, one would have expected earlier institutionalization and diversification of research in the field. This did not happen. On the other hand, the emergence of anti-science and anti-technology attitudes during the sixties was restricted to the West and, obviously, can hardly be seen as a factor in promoting science and technology studies in the East at exactly this point in time.

I wonder whether the simultaneous growth, in both East and West, of a concentrated, long overdue research effort into the social effects of science and technology does not require a different explanation. With the gradual thaw in East-West relations we notice a surprising speed with which research questions and research results travelled between the competing political systems, notwithstanding basic differences of view about the social roles of science and technology. This was true, in my limited experience, with regard to the relationship between research and development investments and economic productivity, the criteria for allocation of R&D funds, the issue of research management, and the development of national science policy structures.

Returning to the West, it would be entirely wrong to credit social science research for the transition from uncritical "can do" optimism to a more balanced, or simply negative view of the social powers of science and technology. Salomon does not make this claim, which would also contradict his basic belief in the post facto function of research in the social sciences. But he does come close to suggesting that high quality science policy studies only began to be published during the late sixties, simultaneous with the growth of new social attitudes about science and technology. One may wish that this had been the case, but the historical record of what happened when, at least in the case of the United States and England, does not justify this interpretation. Much more detailed scrutiny of the action-knowledge connection is needed to identify the critical stages in the development of science policy studies. A few observations along this line must suffice to make the point.

In the early sixties there was much concern in the United States about the impact of computers and other forms of high technology on employment and work. This phase in the debate about possible negative effects of technology clearly preceded the Vietnam era. At the time, fairly basic research had first become

available which quantified the effects of science and technology, and more broadly of education and training, on productivity and economic growth. But little was known about numbers and types of jobs which would be affected by the automation of production functions which was expected to be imminent and to occur on a massive scale. Extensive research, some of it under the auspices of a Presidential Commission, showed where the real problems loomed: in the level of aggregate demand for goods and services and in the degree of training required for the jobs for which openings existed. Research also revealed that automation technology generally, and computers specifically, would have impacts different from those which had been widely expected. Research on automation technology and the economy had a direct impact on shaping economic and manpower policies during the remainder of the sixties.

A similar, perhaps even more fundamental example of real world impact of policy studies in the field of science and technology, takes us back to the fifties. A number of major studies appeared at this time attempting to assess the impact of nuclear weapons on the nature of war and on relations among nations. Given the nature of the new nuclear age, relations among the United States and the Soviet Union were central to this research. The role of Europe in the new international environment was covered, but mostly as a subissue to the global competition of the new superpowers. These studies, some done in universities, others at the RAND corporation and in government-funded institutions, had a major impact on thinking about military strategy, disarmament and international relations. It is here, if anywhere, where I see the beginning of serious science policy studies.

It is true that the kind of studies mentioned is not generally claimed as being part of the scholarly work in science policy. This indicates, in my view, that the science policy community--actors as well as scholars--tends to define its area of work in narrow and technical terms. Such a view is further supported by the following observation: science policy studies on automation and on relations among nuclear powers had their most important impact on defense and disarmament or economic and manpower policies, not on science policy narrowly defined. The same can be shown for other policy issues which, gradually, became the object of science policy studies: environmental pollution, critical shortages of natural resources and energy, the interdependence between food, population growth and economic development, and others. Analysis of broad and critical policy issues, examined from the standpoint of their connection with science and technology, is at the heart of science policy studies.

Relatively little is said about these kinds of studies by Salomon, Spiegel-Roesing--or the volume on Science, Technology and Society in general. The science policy problems they deal with are important, such as the political roles of scientists, participatory controls in making decisions on new technological systems, allocation decisions for research and development funding. But compared to the critical social issues referred to above, they seem to be second-order problems. Science and technology have entered the policy process in a much more fundamental way: many, if not most, of today's social and economic problems have significant science and technology aspects either because these factors are part of the problem genesis, or because they contain elements towards a problem solution.

Science, Technology and Society does not cast the net as far as I think is required by the nature of the issues. Occasionally, the great issues of our

times are referred to--in some chapters more than in others. But the critical issues do not occupy center stage. There is little evidence in the book, outside the areas of military and foreign policy, for the high degree of penetration by science and technology into virtually all major policy functions--agriculture, communications, transportation, health care, nutrition. The book suffers, in my view, from too narrow a view of science and technology studies.

Narrowness is evident, for example, in the constant concern with the societal uses of science and technology developed in the defense and space contexts. Much effort is spent on criticising the policies, procedures and attitudes which were developed for these purposes. But notwithstanding all the criticism, only the military and industrial models are recognized as the norm for science-technology-policy linkages. Little attention is given to studies looking at alternative policy uses of science and technology. There exists a century-old tradition of agricultural science and technology which uses different institutional networks and procedural approaches for linking policy purpose to innovation. Similarly, biomedical research and technology have developed specific approaches in structuring their place in the modern health care system. Neither of these alternatives is dealt with in the book. If science and technology were treated less as known entities and more as factors with different functions, values, and procedures depending on the broader economic and social environment in which they are used, a substantially different and richer view of the field of science and technology studies would emerge. Instead, science and technology studies, as discussed by Salomon and Spiegel-Roesing, seem restricted to a relatively narrow range of policy concerns. It may well be that this accurately reflects the perception of the field held by those associated with it. However, a larger research and issues context exists which needs to be considered in defining the boundaries of the field and in assessing the social impacts of science and technology.

Perhaps I have presented my case with insufficient recognition of Salomon's attempt, in the final section of his paper, to develop a broadened view of science policy studies which may come close to what I have in mind. Writing about "The Death and Resurrection of Science Policy" he points to the need for science policy studies to be less concerned with the technical level of issues and controversies, and more with the broader political, economic and ethical dimensions. "All this suggests that a new form of exchange will have to be set up between society and technology, one that will take into consideration the aspirations of man in a complex society rather than the 'autonomous' tendencies of science and technology" (65). But I still maintain that significant work of this type has been going on for some time, much of it outside the artificially narrow limits of organized science policy studies. A need for synthesis exists between broad policy studies and work in science policy.

Symptoms of Disease and Health. A few other characterizations of the field in its present state of development should be mentioned briefly. On the negative side, Spiegel-Roesing criticizes fragmentation by discipline, and even more so between the two constituent parts of the field. She sees a tendency to ask the right questions, but to do so mostly in a rhetorical mode and without the demonstrated capability to really incorporate the new questions into the research design. The concept of a new social responsibility of science and scientists is a good example for this tendency. Fragmentation is also a

problem with regard to work done in different nations and on different social and economic conditions. Lastly she criticizes a bigness and hardness bias which she sees at work, for example, in concentration of research on top governmental structures, on big nations, on heroic inventions, on scientific elites.

The catalogue of hopeful signs for the development of work in the field consists of five recent changes which point in the direction of more humanistic, more relativistic, more reflexive, more de-simplifying, and more normative work. These various tendencies reinforce each other. In general, they indicate movement away from a view of science as a totally objective force, or from technology as a force for social betterment toward more balanced views: recognition of particular socio-economic conditions which do make a difference and must be taken into account as part of the research design. In other words, a tendency to move away from treating science and technology as known entities with well-understood characteristics. In its place an attitude is gaining acceptance which subjects science as well as technology to critical scrutiny both with regard to their internal qualities and their external impacts.

The discussion aimed at assessing the state of the field is well informed and helpful. It adds up to a repeated plea, for breaking down the dividing lines between social studies of science and science policy studies. The entire volume is designed to make this point and to show that both approaches need each other. What is at stake, is "the intellectual integration of the field" (2f). Spiegel-Roesing points to scientometrics--the quantitative mathematical study of science and technology--as one significant research effort which "can be said to mediate between the social studies of science and science policy studies" (19). But she immediately adds that the work of Derek de Solla Price (with whom she edited this volume) and others is still in an early stage: "Whether scientometrics . . . is apt to integrate these subdivisions of the field at the fundamental theoretical level is still a debated question" (19).

I have pointed out that I see the immediate need somewhat differently: rather than integration of two subfields, each of which seems to have well-known boundaries and characteristics, a broadening of the entire concept of science and technology studies. I have indicated what this means in terms of substantive focus, a movement from technical to broad policy issues. It also means a broadening of our theoretical understanding of the knowledge-action interface. Neither Science, Technology and Society, nor this review, address the second task which may well be the most important one the field needs to deal with, and a task which might provide the intellectual unity which is still lacking.

Notes

Denny, Brewster C., 1965. "Science and Public Policy: A Literature in Search of a Field." Public Administration Review, 25, pp. 239-248.

Horowitz, Irving L., 1978. Foreword to James Everett Katz, Presidential Politics and Science Policy, New York: Praeger.

Wilensky, Harold L., 1967. Organizational Intelligence: Knowledge and Policy in Government and Industry, New York: Basic Books.

Stuart S. Blume (ed.), Perspectives in the Sociology of Science. Chichester: John Wiley & Sons, 1977, vii + 237 pages, \$24.50.

- Published on the heels of the Spiegel-Rösing and Price-edited opus, Science, Technology and Society: A Cross-Disciplinary Perspective, Perspectives in the Sociology of Science immediately invites comparison. Resist the temptation; this is a modest collection. Of the seven essays plus the editor's introduction, five are country-specific case studies and one (by Orzack) examines the "supra-national tendency" to regulate the production and administration of pharmaceuticals in the European Economic Community. Thus the voluminous details supplied, for example, on a research center in Thailand (Hill), agrarian impediments to the development of indigenous science and technology in India (Ramasubban), and nationalisms (e.g., francophone versus anglophone) within Quebecois science and society (Fournier and Maheu), fall far short of Blume's expectation of a "theoretical rapprochement" of the "cognitive" and "externalist" perspectives in the sociology of science.

Blume's emphasis, however, is laudable. His introduction takes cognizance of the differing research programs in North America and Europe rather than ignoring or dismissing the former's literature as has been the Europeans' wont of late. Nevertheless, while Blume's head is in the right place, his pen is not. In essay after essay trenchant questions about policy, authority, organization, and culture are raised, but the ensuing analyses devolve into disjointed discussions which border on priggishness. Some exercise of editorial prerogatives would have condensed the chapters and sharpened their impact.

What Perspectives does provide is a consistent repudiation of the functional (Mertonian) approach to understanding the performance of intellectual work and the production of scientific knowledge within various organizational, institutional, and cultural settings, and an endorsement of economic, political, and "interpretive" theories that are sensitive to the perception, reception, and transformation of scientific and technological innovations. To my mind, the gems of the collection are those authored by familiar names in the "science studies" community--Whitley, Weingart, and Neyman. Richard Whitley argues convincingly that scientific organization constrains both the form and content of intellectual work, and therefore, what constitutes change within "restricted" and "unrestricted" fields. This theme is nudged in a related direction by Elzbieta Neyman who conceptualizes the scientific labor market and the scientific career as mediated by a series of mechanisms which can be analyzed in various "generational" forms, e.g., as a measure of social time. Though bibliographically incomplete, this essay exhibits an empirical orientation to future studies that is otherwise lacking throughout the volume. Finally, sandwiched between Whitley and Neyman is Peter Weingart's attempt to systematize the relationship between science policy and science development. Using the "technocratic" and "Marxist" theses as rhetorical guideposts, Weingart describes the history of the environmental protection issue in West Germany. He suggests that the key role the scientific community--or a part of it--would seem to play in initiating the process of issue formation is as much a vulnerability "to a bandwagon effect as the issue crystallizes in the public and political sectors" (p. 61).

Clearly emerging from this volume is that Stuart Blume is well-connected in the international network of scholars who research the science-society conundrum (as distinct from the internal dynamics of science). Thus, he is strategically located to monitor this research activity and report on it periodically. To identify the pertinent questions and countries, however, is not enough; codification of case study data is needed--indeed, it is essential. If one cannot be comprehensive (as the aforementioned Spiegel-Rösing and Price collection achieved in large measure), then one must be integrative (which Blume sought to be but failed to deliver). In the end, Perspectives in the Sociology of Science is merely a collection overshadowed by its introduction, whereas it could have been much more. I look for better, for that is what Blume has to offer.

Daryl E. Chubin
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Stuart S. Blume (ed.), Perspectives in the Sociology of Science

Whether or not one wishes to view the erosion of the functionalist consensus within sociology as due to the discovery of anomalies, it is clear that several reasonably well-developed paradigms exist today. They are competing not only for intellectual respectability but also for control of the discipline through determining the kinds of phenomena the discipline ought to be trying to explain. This situation is reflected in the sociology of science.

The anomie that accompanies scientific revolution (if indeed we may dignify our current disarray with this term) can be fought in two ways. One is to seek complete victory for a particular paradigm. The other is to rise above the battle and erect a broader scheme that can encompass the competing paradigms and perhaps legitimate their separate existences within the discipline in terms of an advance in its division of labor.

Blume's introduction to this valuable volume elects the second strategy and succeeds about as well as seems possible these days, although for the most part the other six papers represent (some more explicitly than others) specific paradigms. Blume does an admirable job of setting forth the broad outlines of what he views as the three major perspectives that characterize the sociology of science today. These are the "internalist" (essentially Mertonian), the "externalist" (the political science-in-society approach), and the "cognitive" (sociology of knowledge) perspectives. Each is clearly elucidated, its major proponents identified, and the relations among them are discussed quite usefully.

Although duly respectful of each, albeit with some snide remarks about the Mertonian perspective, Blume cannot avoid raising the question, "What is it that the sociology of science should be trying to explain?"--and is led finally to tentative agreement with Bourdieu that the only solution to our present confusion seems to lie in the development of "a sociology of . . . 'the complete system of strategies,' 'the game as such'." Unhappily, though, the ideal of an ultimate system of systems (which sounds to me like a super-positivistic sociology of knowledge) appears not only beyond our grasp but logically impossible as well, if we accept Godel's Theorem.

We shall have to settle, I fear, for Kipling's dictum: "There are nine and sixty ways / of constructing tribal lays / And every single one of them is right!" Perhaps in response to continuing competition for the specialty's title, there will emerge a new paradigm--the sociology of academic warfare--and then it too can join in the fun.

But perhaps this is more editorializing than is appropriate in a book review. The six papers Blume has collected, all of substantial length and quality, deserve brief summary here. Limits on space (and on the reviewer's time) preclude extensive evaluation of each.

Richard D. Whitley, in "The Sociology of Scientific Work and the History of Scientific Developments," makes a persuasive effort to establish some relationships between the characteristics of a field's subject-matter and the nature of the division of research labor that develops in that field. He begins with Pantin's distinction between "restricted" and "unrestricted" sciences (one that in many ways parallels the "hard/soft" and "degree-of-codification" distinction developed earlier within the Mertonian paradigm) and argues that there is a strong connection between the intrinsic qualities of the phenomena addressed, the character of the body of knowledge that develops about those phenomena, and the organizational characteristics of the discipline itself (including the character of its scientific elite). I find his conclusions extremely persuasive, perhaps because I came to many of them myself in "The Hard Sciences and the Soft" (Bulletin of the Medical Library Association, January 1967).

Peter Weingart devotes his "Science Policy and the Development of Science" to modeling the process through which public opinion comes to focus on a problem that has scientific aspects and then leads to policies that affect science. He rejects both the "technocratic" approach to the topic (which would view science and technology as having the upper hand in determining governmental science policies) and the "Marxist" (in which the political system determines the development of science through policies it forms for reasons stemming from political exigencies). In place of these views, Weingart proposes a more diffuse process that seems actually a special case of public opinion formation and reminds me of Smelser's model of collective behavior.

In her "Scientific Career, Scientific Generation, Scientific Labour Market," Elzbieta Neyman provides first a discussion of the concept of "generation" as it is used in the sociology of science, emphasizing the difference between the ahistorical approach (e.g., any individual at age 30 is the equivalent of any other, regardless of specific era), and the historical approach in which the concatenation of world events, socioeconomic conditions, etc., clearly distinguishes one generation from another. She opts for the latter, placing her clearly in Blume's "externalist" perspective, and offers an insightful discussion of how to tie historical generations in with the development of paradigms. The remainder of the chapter is essentially a checklist of all the variables that should be taken into account when analyzing scientific careers.

Louis H. Orzack presents a case study of an international attempt in the early 1970s to develop common definitions of scientific specialties in order to enact policies delegating responsibility for the safety of drugs manufactured

and sold within the European Economic Community. "Competing Professions and the Public Interest in the E.E.C.: Drugs and Their Quality Control" does little in the way of drawing generalizations from the case but gives considerable detail on the actions of governments and scientific associations in forging acceptable correspondence among differing national licensing practices under the need to standardize the supervision of pharmaceutical production.

Marcel Fournier and Louis Maheu offer, in "Nationalism and Nationalization of the Scientific Field in Quebec," a detailed analysis of the forces which have shaped the development of francophone science in Quebec. They highlight the relationship between this development and competition for cultural authority within the francophone community, and then relate this to the community's changing relations with the enviroing anglephone society. Although there are obviously certain peculiarities involved when the group within which science is developing is an enclaved minority within a single society, the broad outlines of this development seem to be generally in accord with the Ben-Davidian model.

The sixth chapter, "Towards a Relevant Sociology of Science for India," by Radhika Ramasubban, is the most partisan (in terms of paradigms) in the book. She presents a stout critique of the Mertonian position and proposes that only a Marxist perspective can provide an adequate understanding of Indian science. I disagree with her quite thoroughly but am pleased to have the Marxist perspective set forth so clearly. Unfortunately, her concentration on the reasons for what she evidently considers the failure of agricultural research to bring a genuine "green revolution" to India does not, in my estimation, provide sufficient support for her case. But then, I inhabit a different paradigm. . . .

Finally, Stephen C. Hill describes, in "Contrary Meanings of Science--Interaction Between Cultural and Personal Meanings of Research in a Developing Country Scientific Research Institution," the ways that cultural forces in Thailand worked to undermine the effectiveness of a national research organization. His case-study suggests that when personal interests and organizational survival predominate, "research" can come to mean mere busywork, particularly in a society in which bureaucracy is quite patrimonial. The many slips 'twixt cup (research) and lip (economic development), exacerbated by poor leadership, faulty communication, changes in funding, etc., are analyzed in discouraging detail. I am not certain, however, that this case so much contradicts the "structural" literature (which assumes that social and economic progress will follow a nation's development of a self-sustaining scientific community) as it illustrates the difficulties that a developing nation may encounter in trying to develop such a community.

There is obviously much more in this book than I have been able to touch on here. I believe it is an important contribution to the literature and can assure prospective readers that they will find it both provocative and useful.

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PROGRAM

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4S *Society for Social Studies of Science*

Former President: Robert K. Merton

President-Elect: Dorothy Nelkin

President:

Warren O. Hagstrom

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Jerry Gaston
Michael Moravcsik
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Dorothy Nelkin
Eugene Skolnikoff
Patricia Woolf
Dorothy Zinberg

Editor of the 4S Newsletter:

Henry Small

FRIDAY, 3 NOVEMBER

Noon - 3 PM

REGISTRATION - *Wittenberger Auditorium*

2:30 - 5 PM

KEYNOTE SESSION - *Wittenberger Auditorium*

Welcome: Warren Hagstrom, 4S President
University of Wisconsin

"Epistemological Consequences of a Social Model of
Science"

John Ziman, University of Bristol

"Comments on the Fragmented History of the Psychology
of Science"

Donald Campbell, Northwestern University

5 - 6:30 PM

COCKTAIL PARTY - *University Club*

FRIDAY, 3 NOVEMBER

7:30 - 10 PM

SESSION II

SOCIAL PSYCHOLOGICAL PERSPECTIVES
ON RESEARCH STYLE AND CAREER
DEVELOPMENT - *Georgian Room*

Chairman: John Wilkes, Worcester Polytechnic
Institute

"The Social Process of Scientific Investigation"
Roger Krohn, McGill University

"The State of University Scientists in West
German Universities: The Case of Psychologists"
Rudolf Fisch, University of Konstanz

"Personality Styles and Degree of Involvement in
the Scientific Research Enterprise"
Kalman J. Kaplan, Wayne State University
Moriah Markus-Kaplan, Boston University

"Styles of Research and Scientific Audience Self-
Images in Four Socio-behavioral Fields"
Gabriel Haim, University of Minnesota

"The Application of Advances in Cognitive
Psychology to the Study of Scientific Processes"
David Faust, University of Minnesota
Craig Alexander, Ohio University
Joe Ipacs, Ohio University

Discussant: Ian Mitroff, University of Pittsburgh

SESSION III

METHODOLOGICAL PROBLEMS AND
POTENTIALS IN SCIENCE STUDIES
State Room East

Chairman: Belver Griffith, Drexel
University

"The Impact of Changing Research
Technologies on the Sociology of
Science"
Lowell Hargens, Indiana University

"An Anthropological Visit to a
Scientific Laboratory"
Steve Woolgar, Brunel University

"The Mapping of Science"
Henry Small, Institute for Scientific
Information
Belver Griffith, Drexel University

"Multivariate Citation Analysis and
the Changing Cognitive Organization
in a Discipline of Physics"
Edward Nadel, New York City

Discussant: Warren Hagstrom,
University of Wisconsin

SATURDAY, 4 NOVEMBER
9:15 - 11:30 AM

SESSION IV

PUBLIC PARTICIPATION IN SCIENCE:
RESEARCH APPROACHES - *Georgian Room*

Chairman: Alexander Morin, National
Science Foundation

"Citizen Participation in State Weather
Modification Policy"

W. Henry Lambright, Syracuse University

"Public Involvement in the DNA Controversy"
Rae Goodell, Massachusetts Institute of
Technology

"Can the Science Court Work? The Minnesota
Experience"

Barry M. Casper, Carleton College

"Institutional Review Boards and Medical
Research"

Bradford Gray, Institute of Medicine

"Science Shops in the Netherlands: An
Experiment in the Distribution of Scientific
Expertise"

Dorothy Nelkin, Cornell University

Arie Rip, University of Leiden

SESSION V

INDICATORS AND MODELS OF SCIENCE
State Room East

Chairman: Arnold Thackray, University
of Pennsylvania

"Indicators of Scientific Activity in
Lesser Developed Countries"

J. Davidson Frame, Computer
Horizons, Inc.

"Bibliometric Characterization of
Research Papers from U.S. Medical
Schools"

Paul McAllister, Computer Horizons,
Inc.

Francis Narin, Computer Horizons, Inc.

"A User Perspective on Science Indicators"
John Holmfeld, House Committee on
Science and Technology

Discussants: Don Buzzelli, National
Science Foundation
Alex Michalos, University
of Guelph

11:30 AM - 1 PM

LUNCH

SATURDAY, 4 NOVEMBER

1 - 3:15 PM

SESSION VI

THE SOCIAL ASSESSMENT OF SCIENTIFIC
RISK - *Georgian Room*

Chairman: William Blanpied, National
Science Foundation

"Regulation and Risk Management in Federal
Science-Related Agencies"

Michael S. Baram, Franklin Pierce Law
Center

"The New Zealand Accident Compensation Act:
An Innovative Response to Technology-Related
Risk"

Richard Gaskins, Bryn Mawr College

"Equity Issues in Radioactive Waste
Management"

Roger Kasperson, Clark University

"Case Studies of Scientific Research on
Aggression"

Ronald Bayer, Institute of Society, Ethics
and Life Sciences

ROUNDTABLE SESSIONS VIII - *State Room West*

A. "Notes from the Cancer Underground: The
Laetrile Controversy"

Gerald Markle, Western Michigan
University

B. "Possibility and Limitation of Participation
According to Function in German Big Science
Institutions"

Ingrid Deich, University of Missouri, Rolla

C. "The Scientific Conquest of Western Culture:
The Case for the Intrinsic Value of Science"

John Sevier, Indiana University, South Bend

SESSION VII

CASE STUDIES OF SCIENTIFIC
INNOVATION - *State Room East*

Chairman: Diana Crane, University
of Pennsylvania

"A Durkheimian Analysis of Scientific
Knowledge: J.A. Udden and Particle
Size Analysis"

John Law, University of Keele

"Sociological Aspects of the Solar
Neutrino Controversy"

Trevor Pinch, University of Bath

"The Role of Inter-specialty Migrants
in Scientific Innovation: The Case of
Research on the Stellar-Energy
Problem, 1919-1938"

Karl Hufbauer, University of California,
Irvine

"Philosophy and the Development of
Scientific Psychology in Nineteenth-
Century Germany"

David E. Leary, University of New
Hampshire

"Scientific Theory as a Weapon of
Social Combat: The Rise of the
Unilinear Theory of Human Evolution
in French Paleontology"

Michael Hammond, University of
Toronto

Discussant: Daniel Sullivan, Carleton
College

SATURDAY, 4 NOVEMBER

3:30 - 5 PM

SESSION IX

PUBLIC UNDERSTANDING OF SCIENCE

Georgian Room

Chairman: Robert Wright, National Science
Foundation

"Selective Attentiveness: A Conceptual Frame-
work for Understanding Public Attitudes toward
Organized Science"

Jon D. Miller, Northern Illinois University

"The Development of Attentiveness to Organized
Science among Young Adults"

Robert Suchner, Northern Illinois University

Allan Voelker, Northern Illinois University

"The Mobilized Public for Science Politics"

Kenneth Prewitt, National Opinion Research
Center

Robert Pearson, National Opinion Research
Center

Discussant: to be announced

SESSION X

HISTORICAL AND PHILOSOPHICAL
PERSPECTIVES IN SCIENCE

STUDIES - State Room East

Chairman: Thomas F. Gieryn,
Indiana University

"The Natural-Selection Model in the
Historiography of Science"

Robert J. Richards, University of
Chicago

"Sociology of Knowledge as Theory
of Rationality"

Michael J. Zenzen, Rensselaer
Polytechnic Institute

"Physics, Mysticism, and Society:
A Sociological Perspective on Distin-
guishing and Relating Alternate Realities"

Sal P. Restivo, Rensselaer
Polytechnic Institute

"Social Determinants of the Comparative
Development of Mathematics: A
Theoretical Orientation"

Randall Collins, University of Virginia

Discussant: Roger Krohn, McGill
University

SATURDAY, 4 NOVEMBER

3:30 - 5 PM

ROUNDTABLE SESSIONS XI - *State Room West*

- A. "Editing Ludwik Fleck's The Genesis and Development of a Scientific Fact:
A Progress Report"
Thaddeus J. Trenn, University of Regensburg
 - B. "The Future of Engineering Communication"
Hedvah L. Shuchman, The Futures Group
 - C. "Disaster Thrillers: A Literary Mode of Technology Assessment"
John Woodcock, Indiana University
-

5 - 7 PM COCKTAIL PARTY - *University Club*

7 - 10 PM BANQUET - *Frangipani Room*

Remarks: Warren Hagstrom, University of Wisconsin
Dorothy Nelkin, Cornell University

SUNDAY, 5 NOVEMBER

9:30 - 11:45 AM

SESSION XII

ENERGY, TECHNOLOGY, AND SOCIETY

Georgian Room

Chairman: Jerry Gaston, Southern Illinois
University

"Nuclear Technology in India's Science Policy"
Dhirendra Sharma, Nehru University

"Formation of Attitudes toward Nuclear
Power"

John Wilkes, Worcester Polytechnic
Institute

"Solar Energy and the Technology of
Liberation"

Henry Etzkowitz, State University of
New York, Purchase

"The West German Fast Breeder Program:
Why Early Economic Assessments Went
Wrong"

Otto Keck, University of Ulm

Discussant: Dan Willard, Indiana University

SESSION XIII

SCIENCE POLICY, ORGANIZATION,
AND PRACTICE - *State Room East*

Chairman: Daryl Chubin, Georgia
Institute of Technology

"Science and Public Policy"
Harrison Shull, Indiana University

"The Concept of the R&D Bargain as a
Tool of Policy Analysis"

Kathryn S. Arnow, University of Sussex

"Policy and Practice of Entomology in
China"

Susan E. Cozzens, Institute for Scientific
Information

"Governing the 'Republic of Science': An
Analysis of National Science Foundation
Officials' Attitudes about Managed Science"

Barry Bozeman, Syracuse University
Dong Kim, University of Missouri, Columbia

Discussant: Dorothy Zinberg, Harvard
University

SUNDAY, 5 NOVEMBER

11:45 - 1:15 PM

LUNCH

1:15 - 3 PM

RAPPORTEUR SESSION. ASSESSMENTS OF THE WEEKEND'S
PROCEEDINGS - *Wittenberger Auditorium*

Chairman: Warren Hagstrom, University of Wisconsin

Rapporteurs: Nicholas Mullins, Indiana University
Linda Lubrano, American University
Others to be announced

ANNUAL BUSINESS MEETING of 4S will begin immediately after Rapporteur Session.

PROGRAM NOTES

Gerard Lemaine, Roy MacLeod, Michael Mulkay, and Peter Weingart (eds.), Perspectives on the Emergence of Scientific Disciplines. Paris: Mouton-Adline, 1976.

This volume is part of the European barrage of collections--this one courtesy of Project PAREX--devoted to scientific innovation, the legitimization of new specialties, and the institutionalization of disciplines. The focus here ranges from agricultural chemistry to tropical medicine and radar meteor research. In all, the collection contains thirteen essays (two in French), four of which were published in 1973-75 in Social Studies of Science or Social Science Information, and some of which have since been superseded by the authors' own longer article or monographic treatments (notably the Mulkay and Edge, and the Mulkay essays incorporated into Astronomy Transformed).

What is still "new" here and worthy of serious attention two years after publication is first, the editors' introduction which suggests that studying the emergence of new disciplines is minimally a tripartite problem of measuring the rate, direction, and intellectual content of scientific development; second, Woolgar's methodological caveat plus demonstration that there is indeed a significant difference between identifying and defining a scientific collectivity because "a research network is defined in terms of a relative concentration of interest ties, [and] . . . has no inherent boundary" (p. 234). This is a data source problem: what one uses as a baseline (comprehensive bibliographies, review articles, abstracting services' keywords, panel of participants-informants) yields a particular slice of the network, area, or specialty that one seeks to characterize--a mundane message perhaps, but a nagging issue for specialty analysts nonetheless;¹ and third, Van Den Daele and Weingart's "Resistance and Receptivity of Science to External Direction . . ." in which research in policy areas such as space, cancer, and environmental studies is conceptualized on three levels:

on the policy level, in which the objectives of science policy must be classified; on the cognitive level, in which the structures of science are defined as a cultural or intellectual enterprise; and on the institutional level, in which science is defined in terms of a system of social action (p. 248).

The authors advocate science policies built upon evaluation that will render a "finalization" of science, "that is, strategic theory development, according to externally set goals" (p. 268). Of course, resistance to strategic planning--theoretical or otherwise--is notorious in an enterprise fraught with uncertainty, anomaly, and serendipity.

Above all, this collection is a reminder that "science studies," and especially "specialty studies," is a surging literature that may be cumulating without obsolescing. Recent additions to the case study load include Mendelsohn et al.'s The Social Production of Scientific Knowledge (1977, and the first of an annual series), and Blume's Perspectives in the Sociology of Science (1977). The redundancy of contributors to these volumes indicates that, like the specialties we study, identifying core members is far simpler than defining the boundaries of coherent groups in science.

A final note: we North Americans could emulate the strategy of our European counterparts by establishing a PAREX-like axis (Bloomington and an east coast center) for the purpose of periodic (quarterly or semi-annual) meetings and presentations as preliminary to publishing our own collections. No ethnocentrism implied, merely a desire to fulfill the need so often expressed for comparative studies. It's difficult to really compare when we seldom convene.

Daryl E. Chubin
Georgia Institute of Technology

¹See the exchange between Griffith et al. and Edge which appeared in the Summer 1977 issue of this newsletter.

Robert K. Merton and Jerry Gaston (eds.), The Sociology of Science in Europe. Carbondale: Southern Illinois University Press, 1977, 383 pp., \$19.

Robert Merton and Jerry Gaston have assembled a valuable collection of papers designed to increase the familiarity of North American sociologists of science with the efforts of our colleagues in major European nations and with the work of our precursors, both American and European, who wrote primarily between the two World Wars. The volume is divided into two parts. The first is a long "episodic memoir" by Merton which concentrates primarily on the development of science studies in the U.S. The second consists of seven shorter reviews of the sociology of science in various European nations.

Merton's essay is nearly 140 pages long and constitutes roughly forty percent of the book. It is his first extended assessment of the state of the field since his foreword to Bernard Barber's Science and the Social Order (1952), and will attract interest for this reason alone. But it is much more than a review of the field. It adds to past analyses of the sociology of science as an example of specialty development; attempts to demonstrate, through example, the utility of the conceptual framework he has developed over the last two or three decades; and serves as a forum for response to critics. The "episodic memoir" structure is well suited to such a multipurpose essay, and readers will find it to be a contentious and provocative paper.

After briefly reviewing the major social and intellectual forces which shaped the early development of the sociology of science, Merton examines some of the social and theoretical backgrounds of two research techniques--content analysis and prosopography--which have recently found favor again among those who study science, and of three techniques--citation analysis, the search for basic parameters of scientific development, and science indicators--in whose development sociologists of science have played a more active role.

The general question of the interrelations of social and cognitive factors in scientific development is also a central focus of an extended discussion of relations between the sociology, philosophy, and history of science, especially their manifestations in and about Harvard University over the last half century. This discussion culminates in a sketchy social and intellectual biography of T. S. Kuhn, which Merton uses to argue that fine-grained analyses of the cognitive and social contexts of those who have made fundamental contributions to their fields hold great promise for the study of determinants of scientific development. The resulting picture of Kuhn's early career (up to the publication of The Structure of Scientific Revolutions) is one of active cultivation and sponsorship of a young scholar who everyone agreed was destined for greatness and who, as a result, did not have to be distracted by the career difficulties and disappointments with which less able scholars must contend. Merton identifies himself as one of Kuhn's active sponsors, and those who believe the "Mertonian" and "Kuhnian" perspectives to be antithetical will see this section of the essay as an unsubtle attempt at irony. (Readers who haven't already made up their minds on whether there are fundamental differences between "Mertonianism" and "Kuhnianism" will find an opportunity for direct comparison in Merton's account of Kuhn's development and Kuhn's autobiographical comments in the preface to his collection of papers, The Essential Tension, recently published by the University of Chicago Press. In it, Kuhn rejects some previous claims

about such differences between his perspective and Merton's.) Merton also uses his analysis of Kuhn's early career to defend sponsorship as a beneficial mechanism in scientific stratification systems, and to argue that most quantitative studies of achievement and ascription in science are seriously flawed because they, unlike sponsors, do not take scholarly potential into account.

The authors of the papers in Part Two of the book were asked to chronicle the beginnings of the sociology of science in their respective countries and to outline the major lines of research followed during the recent past. The resulting essays are more or less informative as a function of both the vigor of the field in the nations being discussed and the felicity of the authors' portrayals. Especially good papers include Klima and Viehoff's discussion of West Germany and Austria, and Krauze, Kowalewski and Podgorecki's discussion of Poland. Papers on France, Italy and Scandinavia seem less stimulating, probably because work in the field is less developed in these countries. Dobrov's paper on the Soviet Union focuses only on science policy studies; readers who want a more complete discussion of the sociology of science there are better served by Lubrano's Soviet Sociology of Science and Mirsky's "Science Studies in the U.S.S.R." (*Science Studies* 3(1972):281-94). Finally, Mulkey's paper on the sociology of science in Britain ignores extensive work on the role of specialties and research areas and the interaction of cognitive and social factors in scientific change. As a result, it fails to convey the vigorous and distinctive tradition that has been established there over the last decade.

Organization of Part Two in terms of nation states may obscure international efforts--such as those between Poland and the Soviet Union, and Britain and France--and future work should probably give them explicit attention. But on the whole, the papers in Part Two provide an excellent introduction to the European work and therefore constitute a valuable source for North American sociologists of science.

Lowell Hargens
Indiana University

Williams Sims Bainbridge, The Spaceflight Revolution, A Sociological Study. New York: John Wiley, 1976, x + 294 pages.

There is much that is worthwhile and interesting in this book: (1) a combined sociological and technical analysis of an important but yet virtually unanalyzed technological movement; (2) a critical and often penetrating behind the scenes analysis of the fringe personalities and social groups which preceded and made possible the success of the American space program; (3) an interesting attempt at constructing a simple actor-process model for analyzing the success and failure of various critical incidents in the history of the spaceflight movement, and (4) an often interesting social psychological analysis of offbeat social groups such as science fiction fans (clubs) which have existed on the fringe of the space movement but in their own way also helped it along.

The strength of the book clearly lies in the fact that the author is knowledgeable both in the areas of social science and technology. Thus the author is continually able to show the impact between technological ideas, particular individuals, and social history (social structure). Unlike so many with an engineering background, the author is able to convey clearly, sensibly, and understandably difficult technical ideas to the lay reader. Also unlike so many with an engineering background, the author is not enamored of technology for its own sake. Indeed, the book as a whole calls for a critical and realistic analysis and appraisal of our motives for going to the moon.

However much I admire the author's worthwhile objectives and his long overdue analysis of an important event, I found myself too often exhibiting frustration with the book. The book drones on and on with way too much factual detail and not enough, in this reviewer's opinion, penetrating social analysis. Where often a couple of examples would suffice, too many are given. I think the reader could tolerate the seemingly endless examples, for the data presented is important as historical evidence, if the analysis which followed it were as extensive. I found myself too many times reading on for pages to find only a few paragraphs just touching on the interesting psycho-social themes begging for detailed analysis.

To give the reader a better feeling for what I mean, let me use two examples. As mentioned in the opening lines of this review, the author develops a simple actor-process model for analyzing certain critical events in the history of the space-flight movement. Example after example is given showing how they fit to greater or lesser degree the author's actor-process model. I was more than just surprised given the critical nature of this model not to find it compared with more sophisticated models of knowledge diffusion developed by social scientists such as Coleman, Rogers, and Zaltman. Too much of this book is concerned with reporting too much detail (they become tedious and boring after a while) and not enough to theory building, at the very least conceptual theorizing.

In the same way, I believe the book could have profited by making use of the now growing work in the area of cognitive styles in science. Many of the examples call for an analysis in terms of conflicting styles of perceiving social reality, let alone constructing it.

In sum, I regard this as an interesting attempt at sociological and technological explanation. However, in this reviewer's opinion we are still far from having an integrated theory of socio-technological explanation.

Ian I. Mitroff
University of Pittsburgh

Yehuda Elkana, Joshua Lederberg, Robert K. Merton, Arnold Thackray and Harriet Zuckerman (eds.), Toward a Metric of Science. New York: Wiley, 1977, ca 333 pp.

In 1973, the National Science Board--the official overseer of the National Science Foundation--published the first in a projected biennial series of reports of quantitative measures of the state of science in the U.S. In contrast to the development of most national economic indicators, Science Indicators 1972 was apparently constructed with little input from the academic community. In an effort to remedy that oversight, the Social Science Research Council sponsored a 1974 conference to critically review the work in SI-72 and to lay the groundwork for improving indicators of science. Toward a Metric of Science gives us 12 papers presented at that conference.

Four of the papers are primarily reports of empirical research of various quantitative features of science. Using a variety of approaches, Cole, Cole and Dietrich have attempted to define and measure the level of intellectual consensus in scientific disciplines. This is a difficult problem, however, and their admirable efforts still leave much to be desired. In brief, they find that disciplinary differences in consensus are small, and not consistent across different measures. They persuasively argue that there is more variation in consensus among specialties within disciplines, but have little data to support this claim. Garfield, Malin and Small, after a general introduction to the uses of citation data, report results of co-citation analyses to map the cognitive structure of science. While interesting, much of this material has been more thoroughly presented in a series of articles by Small and Griffith (principally in Social Studies of Science). Derek Price begins with some autobiographical reflections on science indicators and proceeds to discuss some criteria for differentiating basic and applied science. The remainder of the paper is a summary of his previous research on transience and continuance in publication patterns. In a too brief paper, Zvi Griliches summarizes his work on the effect of research on economic growth. His cautionary conclusion is that much of the impact of research is "lost" in the GNP accounting system which fails to include contributions to the public sector and many product improvements.

The remaining papers respond more directly to SI-72 and the general problems of constructing science indicators. Arnold Thackray surveys earlier work relating history, science and quantification, and suggests that only recently have these three interests been brought together. O.D. Duncan makes some brief and not especially enlightening remarks on the relationship between science indicators and social indicators generally. Perhaps the most immediately useful paper is William Kruskal's "Taking Data Seriously." Kruskal takes SI-72 to task for its lack of attention to data quality: documentation is weak, the arbitrariness of categories is not considered, and there is virtually no effort to check on the error structure of the data. He argues that diverting only a small fraction of the cost of primary data collection to error studies would have a very salutary effect.

Four of the papers consider the development of science indicators at a more abstract level. The most successful of these is the balanced, insightful view of Gerald Holton, who presses the need for greater disaggregation of

the data--even to the point of "identification of one or a few crucial events. . . in a mass of noisy data." In a logical decomposition of the process of indicator construction, John Ziman makes a critical distinction between information and knowledge. Since the latter cannot be algebraically manipulated, Ziman is pessimistic about our ability to quantify the important products of science. Manfred Kochen discusses five theoretical models of science and the implications of each for the development of indicators. I found little in this paper that went beyond conventional wisdom, and much of it seemed to deal with difficult issues in a too casual manner.

Perhaps the most ambitious (and probably controversial) paper is Yaron Ezrahi's "Political Contexts of Science Indicators." There is insufficient space to do justice to Ezrahi's arguments, but I will attempt to summarize a few major points: Since the making of science policy is fundamentally a political process, the introduction of science indicators is unlikely to rationalize that policy. Indeed, additional information may only further clarify differences between opposing groups. On the other hand, ambiguous and imprecise descriptions of the state of science may serve administrators by reassuring conflicting audiences. Ezrahi distinguishes between the symbolic and instrumental functions of science indicators, and uses this distinction to analyze the reception of different indicators. But even though he convincingly undermines an optimistic view of science indicators, he lacks data to support his own pessimistic view.

If I were a science policy administrator, I would be rather disappointed in this volume. With the exception of the Holton and Kruskal papers, there is little that is immediately applicable to the development and improvement of science indicators. While the more theoretical papers offer some stimulating thoughts on the enterprise of indicator construction, these ideas appear to be still at an early stage of development. The empirical papers, on the other hand, concentrate on indicators that have only limited relevance to questions of science policy, and may well be too costly to implement in any long-term accounting system. In retrospect, then, it does not appear that the National Science Board greatly erred in failing to seek more academic advice. Sociologists and political scientists of science will find the book more valuable, especially the papers by Holton, Ezrahi, and Cole et al. Even so, much of the material has been better presented elsewhere, and what is new often has the flavor of ad hoc reflections on a topic that is peripheral to the authors' interests.

Paul D. Allison
Cornell University

IN THE LITERATURE
Recent Publications

Gerald Holton, THE SCIENTIFIC IMAGINATION: CASE STUDIES (Cambridge University Press)

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PHILOSOPHY OF SCIENCE ASSOCIATION 1976, Volume One

Proceedings of the 1976 Biennial Meeting of the Philosophy of Science Association
Contributed Papers & Special Sessions

Edited by: Frederick Suppe and Peter D. Asquith

Contents:

1. James H. Moor, "Rationality and the Social Sciences"
2. Thomas Nickles, "On Autonomy Arguments in Social Science"
3. Morton Winston, "Did a (Kuhnian) Scientific Revolution Occur in Linguistics?"
4. Mary B. Williams, "The Logical Structure of Functional Explanations in Biology"
5. T.R. Girill, "The Problem of Micro-Explanation"
6. Thomas W. Simon, "A Cybernetic Analysis of Goal-Directedness"
7. Peter A. Bowman, "Einstein's Second Treatment of Simultaneity"

8. Gary M. Hardegree, "The Modal Interpretation of Quantum Mechanics"
9. Michael R. Gardner, "The Unintelligibility of 'Observational Equivalence'"
10. Nancy L. Maull, "Reconstructed Science as Philosophical Evidence"
11. Maurice A. Finocchiaro, "Galileo and the Philosophy of Science"
12. Arthur B. Millman, "The Plausibility of Research Programs"
13. Desmond M. Clarke, "The Ambiguous Role of Experience in Cartesian Science"
14. John Heffner, "Some Epistemological Aspects of Recent Work in Visual Perception"
15. Michael Bradie, "Ayer and Russell on Naive Realism"
16. Stephen Spielman, "Bayesian Inference with Indeterminate Probabilities"
17. John V. Strong, "The Infinite Ballot Box of Nature: DeMorgan, Boole, and Jevons on Probability and the Logic of Induction"
18. Jonathan E. Adler, "Evaluating Global and Local Theories of Induction"
19. Bernard P. Zeigler, "The Hierarchy of System Specifications and the Problem of Structural Inference"
20. John H. Holland, "New Perspectives in Nonlinearity or What to do When the Whole is More Than the Sum of its Parts"
21. Hector J. Sussmann, "Catastrophe Theory: A Preliminary Critical Study"
22. Robert J. Baum, "Can Governmental Support of Philosophy of Science Research be Justified?"

PHILOSOPHY OF SCIENCE ASSOCIATION 1976, Volume Two

Proceedings of the 1976 Biennial Meeting of the Philosophy of Science Association
Symposia

Edited by: Frederick Suppe and Peter D. Asquith

Contents:

1. Richard D. Alexander, "Evolution, Human Behavior, and Determinism"
2. Richard C. Lewontin, "Sociobiology-A Caricature of Darwinism"
3. Stuart A. Kauffman, "Constraints on the Sociobiologists' Program"
4. Michael Ruse, "Sociobiology: Sound Science or Muddled Metaphysics?"
5. Marjorie Grene, "Philosophy of Medicine: Prolegomena to a Philosophy of Science"
6. Marx W. Wartofsky, "How to Begin Again: Medical Therapies for the Philosophy of Science"
7. H. Tristram Engelhardt, Jr., "Is There a Philosophy of Medicine?"
8. Caroline Whitbeck, "The Relevance of Philosophy of Medicine for the Philosophy of Science"
9. Paul T. Durbin, "Are There Interesting Philosophical Issues in Technology as Distinct from Science? An Overview of Philosophy of Technology"
10. Mario Bunge, "The Philosophical Richness of Technology"
11. Edwin T. Layton, Jr., "Technology and Science, or 'Vive La Petite Difference'"
12. Max Black, "Are There Any Philosophically Interesting Questions in Technology?"
13. Ronald N. Giere, "A Dilemma for Philosophers of Science and Technology"
14. J. Alberto Coffa, "Carnap's Sprachanschauung Circa 1932"
15. Lindley Darden, "The Heritage from Logical Positivism: A Reassessment"
16. Mary Hesse, "Truth and the Growth of Scientific Knowledge"
17. Dudley Shapere, "The Influence of Knowledge on the Description of Facts"
18. Fred I. Dretske, "Comments on Shapere and Hesse"
19. Wilfrid Sellars, "Is Scientific Realism Tenable?"
20. Bas C. van Fraassen, "On the Radical Incompleteness of the Manifest Image"
21. James W. Cornman, "Sellars on Scientific Realism and Perceiving"

22. Richard Jeffrey, "Savage's Omelet"
23. Mancur Olson, "Cost-Benefit Analysis, Statistical Decision Theory, and Environmental Policy"
24. Frederic Schick, "Rationality and Sociality"
25. Ilmar Waldner, "Decision Theory and the Rationality of Ends"
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27. Soshichi Uchii, "Induction and Causality in a Cellular Space"
28. William L. Harper, "Rational Conceptual Change"
29. Paul Teller, "Comments on Niiniluotto and Uchii"
30. Herbert Simon, "How Complex are Complex Systems?"
31. R.J. Nelson, "Structure of Complex Systems"
32. Patrick Suppes, "Some Remarks About Complexity"
33. Stephen G. Brush, "Statistical Mechanics and the Philosophy of Science: Some Historical Notes"
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35. Abner Shimony, "Comments on the Papers of Brush and Tisza"
36. Laszlo Tisza, "Response to Comments"

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2. Ernest W. Adams, "Measurement Theory"
3. Noretta Koertge, "The Problems of Appraising Scientific Theories"
4. Myles Brand, "Causality"
5. Bas C. van Fraassen, "Modality"
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10. Larry Laudan, "Historical Methodologies: An Overview and Manifesto"
11. Gary Gutting, "Continental Philosophy of Science"
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Philosophical Foundations of Various Scientific Disciplines

18. Nancy Cartwright, "Philosophy of Physics"
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20. Arthur W. Burks, "Computer Science and Philosophy"
21. David L. Hull, "Philosophy of Biology"
22. H. Tristram Engelhardt, Jr., "Philosophical Problems in Biomedicine:
Towards a Philosophy of Medicine"
23. Ned Block, "Philosophy of Psychology"
24. Alex C. Michalos, "Philosophy of Social Science"
25. Ronald N. Giere, "Foundations of Probability and Statistical Inference"

General Discussion of Methodological Issues

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28. Patrick Suppes, "The Role of Formal Methods in the Philosophy of Science"

PHILOSOPHY OF SCIENCE ASSOCIATION 1978, Volume One

Proceedings of the 1978 Biennial Meeting of the Philosophy of Science Association
Contributed Papers

Edited by: Peter D. Asquith and Ian Hacking

Contents:

1. Nancy Maull, "Perception and Primary Qualities"
2. Edward MacKinnon, "The Development of Kant's Conception of Scientific
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3. John V. Strong, "John Stuart Mill, John Herschel, and the 'Probability
of Causes'"
4. Jeffrey Bub & Vandana Shiva, "Non-local Hidden Variable Theories and
Bell's Inequality"
5. Nancy Cartwright, "The Only Real Probabilities in Quantum Mechanics"
6. Carlo Giannoni, "A Universal Axiomatization of Kinematical Theories"
7. Kathleen Okruhlik, "The Interplay Between Theory and Observation in the
Solar Model of Hipparchus and Ptolemy"
8. William B. Jones, "Theory-ladenness and Theory Comparison"
9. P. William Bechtel & Eric Stiffler, "Observationality: Quine and the
Epistemological Nihilists"
10. Mark G. Tamthai, "Analyticity Without an Observational-Theoretical
Distinction"
11. Barbara Klein, "The Role of Psychology in Functional Localization Research"
12. Thomas Nickels, "Scientific Problems and Constraints"
13. Lindley Darden, "Discoveries and the Emergence of New Fields in Science"
14. Robert Cummins, "Explanation and Subsumption"
15. J.K. Derden, "Reasons, Causes, and Empathetic Understanding"
16. T.R. Girill, "Approximative Explanation"
17. Sandra Harding, "Four Contributions Values Can Make to the Objectivity of
Social Science"
18. Caroline Whitbeck, "Four Basic Concepts of Medical Science"
19. Paul Thagard, "Why Astrology is a Pseudoscience"
20. Maurice Finocchiaro, "Rhetoric and Scientific Rationality"
21. Peter Mittelstaedt, "The Metalogic of Quantum Logic"

22. David Holdsworth, "A Role for Categories in the Foundations of Quantum Theory"
23. James McGrath, "Only if Quanta had Logic"
24. B. Loewer, B. Laddaga & R. Rosenkrantz, "On the Likelihood Principle and a Supposed Antinomy"
25. Andre Mirabelli, "Belief and Incremental Confirmation of One Hypothesis Relative to Another"
26. David Papineau, "Salmon, Statistics, and Backwards Causation"

NOTE: PHILOSOPHY OF SCIENCE ASSOCIATION 1978, Volume Two, Proceedings of the 1978 Biennial Meeting of the Philosophy of Science Association, Symposia, Special Sessions, and Invited Lectures, Edited by: Peter D. Asquith and Ian Hacking, to be published Summer 1979.

TOWARD A METRIC OF SCIENCE: THE ADVENT OF SCIENCE INDICATORS - Edited by Yehuda Elkana, Joshua Lederberg, Robert K. Merton, Arnold Thackray, Harriet Zuckerman [See review of this book on pages 33 to 34 of this Newsletter.]

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I ORIENTATIONS

- 1 Measurement in the Historiography of Science - Arnold Thackray
- 2 Science Indicators and Social Indicators - Otis Dudley Duncan
- 3 Can Science Be Measured? - Gerald Holton
- 4 Toward a Model for Science Indicators - Derek de Solla Price
- 5 Models of Scientific Output - Manfred Kochen

II PARTICULARS

- 6 Taking Data Seriously - William Kruskal
- 7 Economic Problems of Measuring Returns on Research - Zvi Griliches
- 8 Citation Data as Science Indicators - Eugene Garfield, Morton V. Malin and Henry Small
- 9 Measuring the Cognitive State of Scientific Disciplines - Stephen Cole, Jonathan R. Cole and Lorraine Dietrich
- 10 Difficulties in Indicator Construction: Notes and Queries - Hans Zeisel

Forthcoming Publications

ON THE MARGINS OF SCIENCE: THE SOCIAL CONSTRUCTION OF REJECTED KNOWLEDGE
Sociological Review Monograph 27 - Edited by Roy Wallis

1. Introduction
Roy Wallis
2. Reflections on Deviant Science
R.G.A. Dolby
3. On the Role of Interests in Scientific Change
Barry Barnes and Donald MacKenzie
4. Between Orthodoxy and Oblivion: The Normalization of Deviance in Science
Brian Wynne
5. A Study in the Legitimization of Knowledge: The "Success" of Medicine
and the "Failure" of Astrology
Peter W.G. Wright
6. Professional Deviants and the History of Medicine: Medical Mesmerists
in Victorian Britain
Terry Parssinen
7. Scientific Controversy and Socio-Cognitive Metonymy: The Case of
Acupuncture
Andrew J. Webster
8. The Politics of Observation: Cerebral Anatomy and Social Interests in
the Edinburgh Phrenology Debates
Steven Shapin
9. In the Beginning: The Battle of Creationist Science Against Evolutionism
Eileen Barker
10. Between Scepticism and Credulity: A Study of Victorian Scientific
Attitudes to Modern Spiritualism
Jon Palfreman
11. The Construction of the Paranormal: Nothing Unscientific is Happening
H.M. Collins and T.J. Pinch
12. Experimental Parapsychology as a Rejected Science
Paul D. Allison
13. Knowledge About Sea-Serpents
Ron Westrum

14. Ufology: The Intellectual Development and Social Context of the Study
of Unidentified Flying Objects
Joseph A. Blake

Available from November 1978 (\$12.00) onwards from:

Sociological Review Monographs
University of Keele
Keele
Staffordshire ST5 5BG
England

ISIS

September, 1978 - Articles

Robert E. Kohler, "Walter Fletcher, F.G. Hopkins, and the Dunn Institute of
Biochemistry: A Case Study in the Patronage of Science"

Frank M. Turner, "The Victorian Conflict between Science and Religion: A
Professional Dimension"

Peter K. Machamer, "Aristotle on Natural Place and Natural Motion"

Ian Campbell and David Hutchison, "New Studies of Glacier Movements: The
Forbes-Agassiz Controversy"

William A. Wallace, "Causes and Forces in Sixteenth-Century Physics"

Steve Pyne, "G.K. Gilbert and T.C. Chamberlin: The Emergence of Scientific
Methodology in Geology"

December, 1978 - Articles

Jacob Lorch, "The Discovery of Nectar and Nectaries and Its Relation to Views
on Flowers and Insects"

M.F. Burnyeat, "The Philosophical Sense of Theaetetus' Mathematics"

Joseph W. Dauben, "Georg Cantor: The Personal Matrix of His Mathematics"

Edward Grant, "The Impenetrability of Bodies and Its Fundamental Role in the
History of Concepts of Separate Space from the Middle Ages to the Seventeenth
Century"

William R. Woodward, "From Association to Gestalt: The Fate of Hermann
Lotze's Theory of Spatial Perception, 1846-1920"

Scientometrics

Vol. 1, No. 2 (Scheduled for January 1979)

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(Papers)

- D. deB. Beaver, R. Rosen (USA): Studies in Scientific Collaboration. Part II. Scientific Co-authorship, Research Productivity and Visibility in the French Scientific Elite, 1799-1830
- G. Boalt, U. Bergryd (Sweden): Differences in Research Orientation Reflected in the Allocation of Grants
- M.J. Moravcsik, P. Murugesan (USA): Citation Patterns in Scientific Revolutions
- D. Chubin, K.E. Studer (USA): Knowledge and Structures of Scientific Growth, Measurement of a Cancer Problem Domain

Book Reviews

Mobility in Science: A Bibliography of Scientific Career Migration, Field Mobility, International Academic Circulation and Brain Drain

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Contents
(Papers)

- D. deB. Beaver, R. Rosen (USA): Studies in Scientific Collaboration. Part III. Professionalization and the Natural History of Modern Scientific Co-authorship.
- A. Szalai (Hungary): Research on Research and Some Problems of Research Bureaucracy
- Y.M. Rabkin, H. Inhaber (Canada): Science on the Periphery: A Citation Study of Three Less Developed Countries
- M. Kunz (Czechoslovakia): Time Distribution of Patent Information

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Bibliography on Nobel Prizes

Social Studies of Science

Volume 8, Number 4

November, 1978

Papers:

The Interplay Between Socio-Economic Factors and Medical Science:
Yellow Fever Research, Cuba and the United States
Nancy Stepan

Strategy in American Cancer Research After World War II: A Case Study
R.F. Bud

Science and Social Intelligence about Anomalies: The Case of Meteorites
Ron Westrum

Discussion Paper:

The Rise and Fall of the Limits to Growth Debate
Francis Sandbach

Notes and Letters:

Independent Discovery in Science and Technology: A Closer Look at the
Poisson Distribution
Dean Keith Simonton

ANNOUNCEMENTS

NEW BIBLIOGRAPHY ON WOMEN IN SCIENCE. A bibliography entitled "Women and Mathematics, Science and Engineering," has just been published at Roskilde University Library, Denmark, by Else Høyrup. The bibliography was compiled to support endeavours to get more women to work in mathematics, science and engineering. Anyone interested in the bibliography can contact the author at the following address: Else Høyrup, Bøgevej 8, DK 3500 Værløse, Denmark.

WORKSHOP ON SCIENTOMETRICS AT UNIVERSITE DE MONTREAL. A workshop on scientometrics is being planned for Spring 1979. The workshop is to cover progress in quantitative methods in the history of science, science indicators, applications of scientometric data to science policy, bibliometrics and related subjects. The workshop is to cater to the needs of science policy specialists working in academic, governmental and industrial settings, of historians and sociologists of science, and of information and library scientists. The key note speaker, tentatively Dr. Derek De Solla Price, Avalon Professor of History of Science, Yale University, will review recent progress in scientometrics. After extensive discussion and question and answer period the workshop will adjourn for lunch. After this, two or three selected papers will be presented by other workshop participants. The proposed workshop will be the first of its kind to be held in Canada, where science policy debate has acquired considerable prominence over the last decade. All persons interested in taking part in the workshop and having comments and suggestions are requested to contact: Yakov M. Rabkin, Institut d'histoire et de sociopolitique des sciences, Universite de Montreal, Montreal 101, P.Q. Canada. (Telephones: 514-343-7924 or 514-343-7620)

EVALUATION INSTITUTE NEWSLETTER. The Evaluation News is interested in publishing information about evaluation related activities; meetings, conferences and so on. There are slightly over one thousand subscribers and perhaps four thousand to five thousand readers of the newsletter. The parent organization, Evaluation Network, was formed four years ago to bring together evaluators from various disciplines (education, human services, health delivery, etc.) to share common concerns and increase communication.

Its membership is quite diverse with interests covering all aspects of evaluation and related areas, e.g., cost analysis, policy analysis, change theory, etc. Evaluation News, among other functions, keeps readers informed about ongoing evaluation projects, meetings, conferences and activities. For further information contact Dr. Barbara Gross Davis, Editor, Evaluation News, University of San Francisco, Campion Hall, Room D-9, San Francisco, California 94117.

EINSTEIN CENTENARY IN JERUSALEM. An international symposium to mark the 100th anniversary of the birth of Albert Einstein will be held in Jerusalem during March 14-23, 1979. The symposium is being organized by The Israel Academy of Sciences and Humanities, The Hebrew University of Jerusalem, The Van Leer Jerusalem Foundation, The Jerusalem Foundation, and The Aspen Institute for Humanistic Studies.

The first part of the ten-day conference will deal with broad scientific, historical, cultural and social perspectives of Einstein's work and influence,

while the second part will be devoted to developments in gauge and unification theories. Among the themes which the approximately fifty invited lecturers will discuss, are: Einstein's Scientific Contributions; Perspectives of the History of Science; The Impact of Einstein's Work on Scholarship and Science; Einstein and the Culture of Our Time; The Impact of Einstein's Ideas on Modern Thought; Einstein and Developments in the Jewish World; Einstein and the Nuclear Age; Working With Einstein: Reminiscences by Associates; Gauge Theories; Quantum Chromodynamics; Grand Unification Theories.

The Jerusalem Einstein Centennial Symposium is under the honorary sponsorship of ICSU, IUPAP, IUHPS, a number of prominent national academies, and the institutions of higher learning in Israel.

Further information is available from: Israel Academy of Sciences and Humanities, P.O.B. 4040, Jerusalem, Israel.

JERUSALEM EINSTEIN CENTENNIAL SYMPOSIUM

March 14-23, 1979

PROVISIONAL PROGRAM

(Lecturers in each session are listed in alphabetical order)

SESSION I - Wednesday, March 14 (Evening)

Festive opening under the auspices of the President of Israel

Address by Sir Isaiah Berlin

Concert by Isaac Stern

SESSION II - Thursday, March 15 (Morning)

EINSTEIN'S SCIENTIFIC CONTRIBUTIONS: PERSPECTIVES OF THE HISTORY OF SCIENCE

Peter G. Bergmann: The Quest for Unity: General Relativity and Unitary Field Theories

Max J. Jammer: Einstein and Quantum Physics

Martin J. Klein: Statistical Physics in Einstein's Work

Arthur I. Miller: The Special Relativity Theory: Einstein's Response to the Physics of 1905.

SESSION III - Thursday, March 15 (Afternoon)

RECEPTION OF EINSTEIN'S IDEAS BY SCIENTISTS: THEN AND NOW

Paul Forman: Einstein and Causality

Loren R. Graham: Reception of Einstein's Ideas: The Influence of Political Culture

Banesh Hoffmann: Some Einstein Anomalies

SESSION IV - Friday, March 16 (Morning)

THE IMPACT OF EINSTEIN'S WORK ON SCHOLARSHIP AND SCIENCE

Erik Erikson: To Be a Psychoanalyst in Einstein's Century

Roman Jakobson: Einstein and the Science of Language

Eugene P. Wigner:

SESSION V - Saturday, March 17 (Evening)

Lectures in Hebrew

Haim Harari: The Relativistic World of Particles and Fields

Shmuel Sambursky: Einstein, the Man and the Scientist

Jacob Shaham

SESSION VI - Sunday, March 18 (Afternoon)

OPENING OF EINSTEIN EXHIBIT IN JEWISH NATIONAL AND UNIVERSITY LIBRARY
IN JERUSALEM

Remarks by:

Avraham Harman

Harry Woolf

SESSION VII - Sunday, March 18 (Evening)

EINSTEIN AND DEVELOPMENTS IN THE JEWISH WORLD

Fritz Stern

Uriel Tal

SESSION VIII - Monday, March 19 (Morning)

THE IMPACT OF EINSTEIN'S WORK ON MODERN THOUGHT

Daniel Bell: From the Quest for Certainty to the Shock of
Uncertainty

Yehuda Elkana: The Myth of Simplicity

Nathan Rotenstreich: Relativity and Relativism

SESSION IX - Monday, March 19 (Afternoon)

EINSTEIN AND THE CULTURE OF OUR TIME

Kenneth J. Arrow: Physics as a Metaphor for Economics

Alan Bullock

Meyer Shapiro

SESSION X - Monday, March 19 (Evening)

PORTRAIT OF EINSTEIN

Readings from and on Einstein; documentary film

Presented by Gerald Holton

SESSION XI - Tuesday, March 20 (Morning)

EINSTEIN AND THE NUCLEAR AGE

Bernard Feld: Einstein and the Politics of Nuclear Weapons

Yehoshafat Harkabi: Theory and Doctrines in Strategic Thinking Before
and After the Nuclear Age

Paul Doty

SESSION XII - Tuesday, March 20 (Afternoon)

UNIFICATION: AIMS AND PRINCIPLES

Valentine Bargmann: Einstein's Search for a Unified Field Theory

Chen N. Yang: Geometry and Physics

SESSION XIII - Wednesday, March 21 (Morning)

GENERAL RELATIVITY AND COSMOLOGY

Jacob D. Beckenstein: Gravitation, The Quantum, and Statistical Physics

Nathan Rosen: Mach's Principle and General Relativity

Dennis Sciama: Einstein's Theory of Gravitation and Cosmology--
From Inception to Present Status

SESSION XIV - Wednesday, March 21 (Afternoon)

GAUGE THEORIES ON GRAVITY AND ITS ENLARGEMENTS

Daniel Z. Freedman: Aspects of Supergravity

Yuval Ne'eman: Affine Gauge Gravity and Strong Interactions

SESSION XV - Wednesday, March 21 (Evening)

WORKING WITH EINSTEIN: REMINISCENCES BY ASSOCIATES AND ASSISTANTS

Valentine Bargmann

Bruria Kaufman

Peter Bargmann

Nathan Rosen

Helen Dukas

G.E. Straus

Banesh Hoffmann

SESSION XVI - Thursday, March 22 (Morning)

QUANTUM CHROMODYNAMICS

Roger Dashen: Toward a Theory of Hadron Structure
Yoichiro Nambu: The Case For and Against Confinement
Gerald 't Hooft: Beyond Perturbation Expansion

SESSION XVII - Thursday, March 22 (Afternoon)

GAUGE THEORIES OF WEAK AND ELECTROMAGNETIC INTERACTIONS AND
FLAVOUR DYNAMICS

Sheldon L. Glashow: The Question of Fermion Flavour
Haim Harari: Quarks and Leptons

SESSION XVIII - Friday, March 23 (Morning)

GRAND UNIFICATION THEORIES

Feza Gursey
Steven Weinberg: Unified Elementary Particle Interactions

SESSION XIX - Friday, March 23 (Afternoon)

SUMMARY

Murray Gell-Mann

POSTDOCTORAL RESEARCH FELLOWSHIPS

POSITION #1: Postdoctoral research fellow, half-time, for one year.

DUTIES: In collaboration with principal investigator, develop and analyze mathematical models for scientific productivity, spread of information about important discoveries, processes of evaluating manuscripts and research proposals, formation of scientific specialties and similar problems in the science of science.

REQUIREMENTS: Experience with mathematical models in social sciences, good background in use of mathematics, sciences, computers. Talent and desire for creative scientific inquiry. Excellent opportunity for productive young scientist to develop research career in the expanding new field of information science.

POSITION #2: Postdoctoral research fellow, full-time, for one year.

DUTIES: In collaboration with principal investigator, design, conduct, and analyze experiments related to mathematical models for scientific productivity, spread of information about important discoveries, processes of evaluating manuscripts and research proposals, formation of scientific specialties and similar problems in the science of science.

REQUIREMENTS: Experience with complex social science experiments, familiarity with survey research, and expertise in constructing information systems. Background in experimental research methodologies including use of statistics, computers, test design and administration. Must have talent and desire for creative scientific inquiry. Excellent opportunity for productive young scientist to develop research career in the expanding new field of information science.

DEADLINE: Applications should be received by 1 December 1978.

CONTACT: Manfred Kochen, Mental Health Research Institute, University of Michigan, Ann Arbor, Michigan, 48104 (telephone: 313/764-2585).

IDUPOM

Information Dissemination to, and its Utilization by, Policy-Makers in Nigeria.



The National Library of Nigeria

Title and Sponsors

The Research Project is entitled: "Information Dissemination to, and its Utilization by, Policy-Makers in Nigeria". For short, it is referred to as the "IDUPOM Research Project". Information is defined generally as the knowledge item, any unit or portion of the collective memory of mankind. Specifically in this context information is data of value in decision-making. The Project is sponsored by the National Library of Nigeria.

Preamble

No nation can survive in the twentieth century which ignores the thorough and systematic utilization of the world's cumulative knowledge in order to achieve her national objectives. The advanced countries have long realised the crucial significance of exploiting knowledge for the purpose of consolidating and accelerating their already high rate of economic and social development. This is to say that increasing attention is being given by these advanced countries to the application of information generated by man's inquiries to national developmental issues. Indeed, industrialized countries are already referring to this era as the 'post-industrial' or 'information' age and are devoting an increasing proportion of their Gross National Products to the effective application of existing knowledge to achieving even more rapid development than ever before. In these countries, the 'information industry' is as complex, costly and competitive as any modern industry could be. For example, Japan in a recent "white paper" titled *The Plan for an Information Society—a National Goal Toward Year 2000* budgeted for a five-year investment of 3.2 billion American dollars in the provision and utilization of scientific and technological information.

Less developed countries (LDCs), including Nigeria, have neither the technological nor material resources to generate developmental information on a competitive basis with the developed countries since the LDCs must concentrate most of their scarce resources on the provision of vital infrastructures. Fortunately, however, a considerable proportion of such information is already available somewhere and can be effectively utilized to achieve rapid development in LDCs.

As it relates to Nigeria, the question is whether this fund of available information is utilized, and if not, why?

Objectives

The focus of the on-going Research Project concerns the effective and economical utilization by policy-makers in Nigeria of internationally-and locally-generated information. Typical questions to which the study will attempt to provide answers include:

1. How could the policy-maker in Nigeria know what information support to demand in order to make a specific policy decision?
2. How could the policy-maker be sure that his decisions are at all times based on the most relevant and up-to-date facts available?
3. In what respects are the information needs of the policy-maker in a developing economy like Nigeria's different from, or similar to, the information needs of policy-makers in developed economies? For example, in what packages does the policy-maker in Nigeria receive/prefer to receive his information?
4. What is the general level of the policy-maker's "information consciousness"?

maker in Nigeria place on information *before, during, and after* his processes of decision-making? How could he best evaluate the relevance of the information he receives in relation to these stages of decision-making?

5. What is the policy-maker's role expectations of human intermediary processors and interpreters of information, such as librarians, information officers, data analysts, etc, in the policy-making process?
6. To what extent could the overall performance of a policy-maker in Nigeria be the function of the quality and relevance of information available to, and used by, him? In particular, the study will
 - (a) isolate those factors that combine to make easy and effective flow of relevant information to, and its utilization by, the Nigerian policy-maker, assess such factors, and relate them operationally to the policy-maker's information needs;
 - (b) evaluate any institutional constraints to timely and effective use of relevant information by policy-makers. For example, the statutory functions of the Federal Ministry of Information and NISER in this regard will be closely examined;
 - (c) indicate which elements have led to the success or failure of a given relevant information being taken into account in policy-making, e.g., the quality, quantity, or format of the information, its timing, the method of disseminating it, and the professional training or disposition of the target audience, so that it will be possible ultimately:
 - (i) to discern the dimensions of vital information available and accessible to policy-makers;
 - (ii) to identify and evaluate the constraints to effective utilization of information; and
 - (iii) to evolve an information system that would maximize information input in policy decision-making processes for rapid development in Nigeria, with particular emphasis on cost effectiveness, timeliness,

Scope

The study is designed to cover all processes of decision-making that involve the use of information among top government officials at the Federal level. In other words, the study will try to achieve the objectives listed above by making a detailed analysis of the structure of information flow to, and its utilization by, policy-makers in Nigeria before, during and after specific policy decisions are taken.

Duration

The Research Project is planned to be completed within two years, that is, September 1, 1977 to August 31, 1979.

Research Team

The Research Project is being led by Dr Wilson O. Aiyepaku of the Department of Library Studies, University of Ibadan, Nigeria, to whom all enquiries about the Project should be directed. He is assisted by a Research Assistant, Miss R. Okiy, of the National Library of Nigeria, Lagos.

Three or four other social science experts in the Universities of Ibadan and Ife complete the membership of the research team.

An Appeal

Data for this study will be derived from questionnaire returns completed by government policy-makers, staff of related bodies such as NISER, and staff of other institutions generating and/or using developmental knowledge in Nigeria. I hereby appeal to all potential respondents to, please, cooperate with the Research Leader in this venture, and also with the Assistant(s) who will assist you to complete the questionnaires.

You will be making a most valuable contribution to the cause of planning effective information support for government policy-making in Nigeria by completing your questionnaire promptly and fully.

Correspondence

All enquiries and correspondence concerning the Research Project should be addressed to:

Dr Wilson O. Aiyepaku
IDUPOM Research Project
c/o Department of Library Studies
University of Ibadan
Ibadan, Nigeria
Tel. (032) 62550 Ext. 1807

Director
National Library of Nigeria

4S Society for Social Studies of Science

The 4S Newsletter is published four times each year, beginning with V.2:4 at the Department of Sociology, Southern Illinois University, Carbondale, Illinois 62901, and sent to all members of the Society for Social Studies of Science. Membership is on a calendar year basis. Membership dues (\$10 for professionals, \$5 for students) and institutional subscriptions (\$20) should be sent to: The Secretary/Treasurer, 4S, SASS, 323 Uris Hall, Cornell University, Ithaca, NY 14853. Renewals are handled by Neale Watson Academic Publications, Inc., 156 Fifth Avenue, New York, NY 10010.

Editorial Assistant: Beverly Morber

4S

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