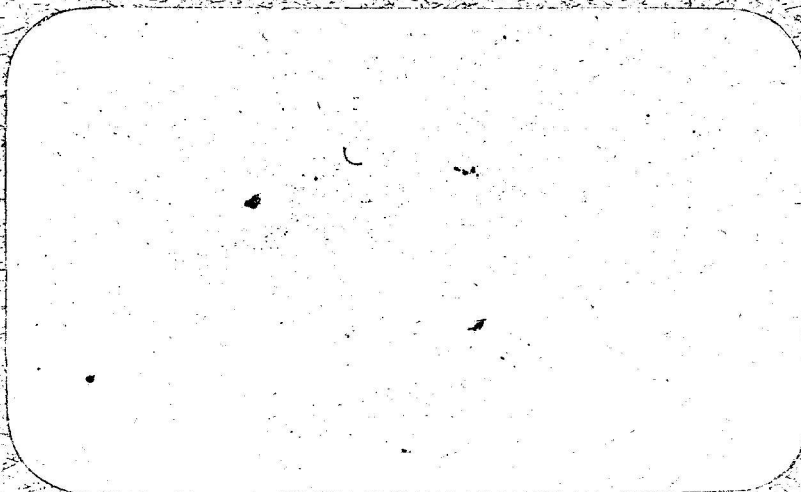


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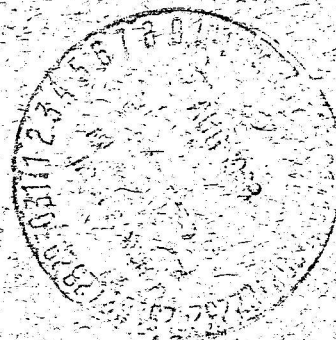
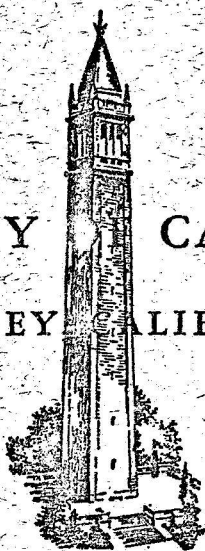
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SYSTEMS ANALYSIS AND THE TECHNICAL
WRITER'S GROWING RESPONSIBILITY *

by

Ida R. Hoos

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SYSTEMS ANALYSIS AND THE TECHNICAL
WRITER'S GROWING RESPONSIBILITY

by Ida R. Hoos**

The final third of the twentieth century finds the United States moving into what has been called a "post industrial phase". This is defined as a period in which the economy has moved from preoccupation with the production process to greater concentration on services, research, education, and amenities.¹ Economic historians point out that during the past fifty years, Gross National Product has shown a consistent tendency to increase faster than the labor force and capital goods investment, and they attribute this to a special growth factor, new technology. As the weight of the economy shifts from a product base, scientific and technological innovation becomes increasingly the force expected to maintain and spur prosperity. The current year, 1968, will show an investment in research and development in the United States of \$ 25 billion; and, as the old industrial order wanes, we may reasonably expect that more and more interest will be shown in the "software" of ideas and methods than in the hardware of machines and merchandise.

It should surprise no one, therefore, that the post industrial era provides an environment hospitable to the transplant of intellectual technology from the arena of the military and the vast expanses of interplanetary research to matters nearer the hearth and home of the American public. There appears to be widespread belief in the notion expressed by President Johnson in his 1968 State of the Union Message that a nation which can put a man on the moon can put its genius to work to solve social problems. During his governorship of California, Edmund G. Brown used almost precisely the same words in asking the aerospace industry to

**Associate Research Sociologist, Space Sciences Laboratory, University of California (Berkeley).

¹Daniel Bell, "Notes on the Post-Industrial Society II," The Public Interest, No. 7, Spring, 1967, p. 102.

conduct systems analyses of crime, transportation, waste management, and information handling for the State. "We can use the know-how that will get a man to the moon to get Dad to work on time," he said. The government, then, has issued an invitation for the application of systems techniques to civil matters; industry is not only receptive but eager; and there is certainly no limit to the growing complexity, perplexity, and urgency of problems besetting public administrators. Here then is an ideal concatenation of circumstances for the shift of systems engineering from defense and space activities to the civil sphere. The apparent tidiness and precision of mission management in these sectors have long been envied by decision-makers at every level of government from county highway men to federal foreign policy framers. They certainly subscribe to President Johnson's and Governor Brown's pronouncements and to the more recent version put forth in a Fortune article: "The systematic planning that built missiles and space (sic) can be used with telling effect to attack urban complexities."² Especially favorable to the bountiful growth of this form of technology utilization is the fact that it provides an activity in which government and industry can cooperate to mutual advantage; this new manifestation of graftage, i.e., of technological procedures onto the body politic, has been seen as solving the problems of the commonweal and also offering outlets for manpower and talent diversification and diversion in the event of retrenchment of defense and space spending.

Unlike the traditional industry-government transaction, which involves specific, material items, contractual arrangements for civil systems studies deal entirely with concepts and symbols. Throughout every phase of the relationship, from formulation of the proposal to final report,

²Lawrence Lessing, "Systems Engineering Invades the City," Fortune, January, 1968, p. 155.

nothing but words and paper are exchanged. Not only is the end result intangible, but it eludes all customary evaluation criteria and quality controls. What is crucial during the entire process is the company's ability to get its message across. And in this, to a considerable extent, the medium is the technical writer. Now, I could yield to temptation in the form of a McLuhanesque syllogism by saying that the medium is the message. But if you get as much out of Mr. McLuhan as I do, neither of us would be much the wiser. What I am saying--clearly, I hope--is that the substitution of information techniques for "hard" technology poses special problems for the writer. In his role as proposal writer, he would be well advised to try to understand them, for they are a conceptual tangle aggravated by the nature of the product he is supposed to be getting across and the question as to its ultimate effects on society at large. This, I realize, may be burdening him with a responsibility far beyond what is set forth on his company's organizational chart. But it is not beyond reason. For the technical writer to take them to heart is, if you will, a matter of professional commitment, rather than a perfunctory sales approach, to the vital transplant underway.

Within his accustomed confines, the technical writer could have been regarded as a sort of intellectual middle man, conveying an interpretation of scientific events and developments to a community imbued to a greater or lesser degree with specialized interest or knowledge. Even if his primary responsibility was proposal writing, this description, with an element of persuasion added, essentially characterized his role. He was dealing with clearly identified and generally understood objects and entities. If he was an aerospace man, his stock in trade were guidance and flight control systems, submarine-launched missile systems, or, perhaps, world-wide

satellite-tracking systems. The government's request for proposal was, for him, fairly comprehensible. If what was asked for was a Titan 3D space booster, specifications for design, fabrication, and testing were articulated and mutually understood by all parties to the transaction. In setting forth his firm's superiority in a bid for a contract, the writer could produce evidence of similar missions successfully accomplished, capability palpably demonstrated.

When, by contrast, the request for proposal is in the social area, the writer finds himself caught in the semantic web spun out of hazy conceptions of the word system. These appear to originate in the request for proposal but actually reflect the lack of conceptualization at still earlier stages. The request for proposal should at the very least convey a notion of the need, the problem to be addressed. Requests in the realm of social affairs rarely do so. Modification of the oleo assembly system on the CH-46 helicopter to permit it to sustain stated touchdown velocities without damage may not inspire great innovativeness, but it is explicit. In underscoring the contrast, as exemplified in the State of California's requests for systems studies of crime, welfare, and the like, one cannot in all fairness criticize. They were intentionally loose, vague, and general so as "to draw upon the imagination of the contractor in approaching the optimal solution to the problem at hand".³ But, unfortunately, this procedure placed the responsibility of defining the problem in the hands of persons inexperienced with the substantive essentials, naive politically, and insensitive to the social dimensions of their tasks. Requests that simply ask that systems analysis be applied to the study

³State of California, Department of Finance, The Four Aerospace Contracts: Review of the California Experience, December 1, 1965, p. 6.

areas dump all of the responsibility into the lap of the prospective bidders. Merely because the word system is used in conjunction with nuclear weaponry and elementary education, the writer has had to live with the apriority that systems design, engineering, and analysis as found in the first can be meaningfully and appropriately applied in the second, that they are equally relevant because both are systems.

Moreover, the writer must treat as articles of faith, whether or not he is a believer, the assumptions that social problems can ever be solved, that acquiring and "managing" the information in and around them is all that is necessary for their solution, that anyone can presume to encompass all their troublesome and tricky human, social and political ramifications in a mathematical, malleable framework, that society's ills, subjected to this costly treatment, will be cured. As a matter of fact one of the most important, and never publicized, results of the now-legendary California aerospace studies was the discovery that, in the final analysis, most of mankind's problems, even those which superficially appear to fall into the engineering category today, turn out to be social. Transportation is not mere networks of roads; it is people's reasons for living and working and playing where they do. It is why the hard core unemployed have given up the job hunt; it is why the sick babies of migrant workers do not receive treatment at free clinics. Air pollution is the one-man, one-car life style of Americans; it is our national reverence for big business which can with impunity load the limited pure air at our disposal with poisonous emissions; it is an international determination to build and test instruments of destruction at all costs.

To judge from the numerous proposals and studies I have analyzed, there is also the universal tendency to treat the systems approach as

though it were, indeed, a concrete entity, a commodity for exchange or sale. Not, of course, that we do not all know better: We know that systems analysis is a method, a philosophy, a way of approaching a problem. We know, moreover, that neither historically, operationally, nor necessarily is systems analysis the private preserve of the "hard" scientific and technical community, nor exclusively the province of aerospace and defense managers. How diffuse and variegated is the array of resources and disciplines mobilized for this business can be seen by examining the contenders for contracts: aviation and aerospace firms, computer manufacturers, electronics companies, management consultants, nonprofiteering think tanks teeming with talent, and their dizzying, spinning-off satellites with unpronounceable acronymic titles and post office box addresses in Santa Monica, San Mateo, and Silver Spring, Maryland. All are competing for the opportunity to bring what have been journalistically called "the powerful tools of technology" to bear on such problems as crime, education, public health, and welfare. Viewed with high hope on this continent,⁴ systems analysis is also regarded as a promising item for export, especially as the European business community casts a jealous eye toward sustained economic growth and prosperity in the United States.⁵

Thus, in responding to the government's requests for proposal to deal

⁴Some two-thirds of \$ 1 billion worth of nondefense contracts is listed in Defense Systems Resources in the Civil Sector: An Evolving Approach, An Uncertain Market, by John S. Gilmore, John J. Ryan, and William S. Gould, Washington, D.C., Superintendent of Documents, U.S. Government Printing Office, 1967, Table C-1, pp. 148-155. These include several carried out in Canada and Lockheed Missiles & Space Co.'s projects in Greece and Pakistan. The authors of the report note that coverage is not comprehensive or all-inclusive. It is, however, a valuable indicator.

⁵Organization for Economic Cooperation and Development, Reviews of National Science Policies--United States, Paris, 1968.

with malfunctioning social systems, the writer finds himself in the position of having to set forth convincingly his company's superior ability over that of contenders from an unprecedented gallimaufry of backgrounds. Where previously a certain category of requests called for a rather specific type of qualification and attracted a homogeneous circle of bidders, the situation here is confusingly wide-open, probably as confounding to the public officials who must select as to many of the aspiring contractors. If you can imagine aerodynamics people competing for the same task as a group of ornithologists on the ground of experience with flying objects, you can appreciate the condition which prevails!

The proposal, therefore, must carry forcefully the message that the organization submitting it is unrivalled in its prowess to perform systems analysis. And here the state of art of proposal- and all other writing in this field reflects the state of the art in systems analysis. Firm definitions are lacking; the operational definitions used are often simplistic descriptions. There is a strong inclination to use technical language, not to clarify the problem but, rather, to impress the reader. If this comes across only to the extent of getting the contract, then it matters not whether the real-life problem has been grasped, let alone a solution devised. Most contractors have the unfortunate habit of swamping the agency with inconsequential details and starving it for the policy and management guidelines it sought. I wonder how many of my readers recognize that the following, which resembles embarrassingly the stuff out of which proposals and analyses are made, is really a spoof: "This rather optimistic estimate was derived by plotting a three-dimensional distribution of three arbitrarily defined variables; the macro-structural, relating to the extension of knowledge beyond the capacity of conscious experience; the

organic, dealing with the manifestations of terrestrial life as inherently comprehensible; and the infra-particular, covering the subconceptual requirements of natural phenomena. Values were assigned to the known and unknown in each parameter, tested against data from earlier chronologies, and modified heuristically until predictable correlations reached a useful level of accuracy."⁶

The mixture of jargon and salesmanship employed in proposals and reports renders almost impossible the task of distinguishing the merchandise from the merchandising. Scientific and technical terminology is used to describe the commonplace, and obvious relationships are "discovered" with a latter-day Columbusism that stems from unfamiliarity with the subject matter. But, in the hands of the astute bidder, even the lack can be made to look like a virtue: Touting the team's ignorance as objectivity, he stresses the values of the new approach, free from doctrinaire restraint! There are always facile allusions to "parameters", "interfaces", and the like, but they serve no useful purpose when, as is often the case, they obscure or avoid the issue. The heavy reliance on the status symbols of science without concomitant application of its rigors in the way of control, replication, independent testing, and verification of results, is obviously an appeal to the public's pervasive propensity to revere whatever is "scientific", the more so the less comprehensible it is!

By the use of the vernacular to convey the notion of competence in systems analysis, the proposal reflects a fundamental source of confusion in the process itself. Paradoxical though this may seem in the realm of the scientific and technical and in an area in which millions of dollars

⁶Leonard C. Levin, Report from Iron Mountain: On the Possibility and Desirability of Peace, New York: Deal Press.

of public money have been expended, we still do not have agreement among the experts as to what systems analysis is, nor do we have criteria by which capability can be assessed and end products evaluated.

It is small wonder, therefore, that the proposal writer must resort to fancy language to convince the world that his employer is able to do better than anyone else whatever it is that has to be done. By way of proof positive, we are treated to a kind of post hoc, ergo propter hoc ("after this, and, therefore, because of it") exercise. Set forth in meticulous detail are the feats achieved in far out space, in the ocean's depths, as though designing a launch system for an ATLAS vehicle were an indication of ability to ascertain the factors which contribute to welfare loads and dependency.

All proposals contain many pages devoted to biographical materials relating both to the organization as a whole and the experts to be assigned to the project. But, as anyone who evaluates these documents must know, the first portion is probably irrelevant and the second unreliable as a clue to competence. The company or think tank or entrepreneur may have won an undisputed reputation in its field; it can truthfully count thousands of advanced degrees among its employees. All this is set forth in bold-faced type, in its advertisements as well as in its proposals. But if such panegyrics are accepted as substantiation of the claim to "systems capability", then we need only refer to an earlier paragraph to refresh our memory as to the state of that art!

As for the particular qualifications of the members of the team which will tackle the public problem, my observations and contacts lead me to suspect that the giant corporations do not necessarily assign their most talented scientists and engineers to these contracts. The curricula vitae

which help fill the pages between the plastic covers include the usual intelligence about schools attended, posts held, and papers published, but little of this serves as a useful clue to whether this is really a good man for the job at hand. The reason that he appears among those available for redeployment may be more his expendability than his ability, or he may be a relative newcomer to the firm: Likely as not a "graduate" of DOD or one of the think tanks, he is part of the restless, roving band of "information technologists" in search of new fields to conquer, as promised in the employer's institutional advertisements.

The perusal of personnel records uncovers the extraordinary payoff derived from an undergraduate minor in economics or a chance course in education. Very frequently, an individual's file contains evidence of no further exposure to social science. And yet, when the contract is won and the business cards printed, he turns up as "Manager of Socio-Economic Systems", "Specialist in Demography", or "Educational Systems Analyst". The widespread practice of ad hoc title bestowal raises some interesting questions about (1) the personnel practices in effect in the "hard" systems work that has been held up as the model; (2) the possibility that civil systems, which involve such a significant element of public trust, are being addressed in a cavalier fashion, without sufficient professional commitment; (3) the jeopardy into which analysis performed by inappropriate experts masquerading as specialists could place the entire endeavor!

Inhouse capability is, in most proposals, bolstered by outside consultants. We read in one document that the company "has long carried on a policy of drawing upon the keenest minds available." Another promises that "eminent consultants are also available from outside the . . . organization to act as contributors in research projects requiring specialized

capabilities." Some proposals list names and titles of their anticipated consultants. Their professional proficiency is unimpeachable, their reputations impeccable. But the extent to which their services are utilized and recommendations heeded is another matter. I am tempted to write a scenario and call it "The Case of the Captive Consultant", but that would be understating the total picture for alliterative effect, for there are various categories of consultants: (1) the outside experts who are hired to advise, guide, or evaluate the effort; (2) specialists from within some branch of the organization on loan to the analysts; (3) independent professionals, usually in the academic community, whose knowledge is available as a public service and without fee. In actual practice it is only the first two groups who are captive, the first because, once bought and paid for, their contribution can be put to use or on the shelf, whatever best suits the purposes of the enterprise; the second because, through operation of the pecking order and the natural phenomenon of trained incapacity, they cannot perform meaningfully. In the welfare study, a Ph.D. in psychology was borrowed from the company's personnel department to lend the study its social science orientation. Since his forte was personality testing and his status obviously less glamorous than that of the team's leader, he played just about the same role as the Dormouse at the Hatter's Mad Tea-Party! The third group is serviceable in the process popularly and tastelessly called "brain-picking". In this, professional research and faculty people are visited for quick orientation or at least useful language in the field under study. Having found myself included as a consultant or advisor after such encounters, I cannot but question the extent of participation of others whose names appear. I have also emerged in a progress report as a "contact" when all I did was

spend a day observing an information-gatherer in the field. Accorded similar status was the police official who handed us the visitors' register for signature!

Outside resources set forth in proposals are not limited to the human. Reverent mention is made of the computer capacity, irrelevant though it may be. One also encounters a detailed listing of all available repositories of scientific and technical journals and papers as well as the libraries within reach. Not to deprecate the importance of reference materials but out of sheer admiration for perseverance am I impelled to mention one aspiring contractor who included among his sources the library of the Space Sciences Laboratory at the University of California. Modest as to size, confused as to state, served by a continuous flow of part-time clerical workers or students, each with her own private system of cataloguing, our library is far from a fount of ready knowledge to those of us who know it well!

The materials presented under "Participation in Conferences" probably do not, in the present analysis, deserve serious attention. Anyone who has traveled the conference circuit will probably agree that this is certainly not a matter for honorable mention! The papers are always available in preprint and other forms, and could probably have been circulated by mail. Attendance at local bars is higher than at some of the sessions listed for "credit". Moreover, if a presentation is made by the bidder, whether the conference topic be health, education, or welfare, it follows a monotonous pattern. There is the head-shaking and tongue-clucking introduction, in which the audience is informed, through charts and graphs, that things are in a terrible mess. Then, there are more charts, with perhaps, long lists of items that, supposedly, pertain to the post-1984,

pre-year 2000 world. From this in-depth analysis, professionals in education, for example, are exposed, as though for the first time, to the likelihood that urban schools will have different racial mixtures and community pressures! Then come slides about the brave new world of information technology and how its various magic works busily, to help teachers teach and administrators plan. Electronic data-processing, programmed instruction, cost/benefit measurements, and systems analysis are held up as the tools with which to clean up the terrible mess mentioned above. What is listed in proposals as "conference participation" is usually a thinly-disguised sales promotion, and small credit is due anyone--the expert who conducted the electronic brainwash or the professional organization so naive as to invite a fox into the henhouse!

Tremendous advantage, far out of proportion to service rendered or competence demonstrated, accrues to being able to refer in the proposal to civil systems analysis done under previous contract with some agency. In their ambitious quest for fame and fortune (especially the latter in its capitalized version!) analysts have been observed to refer proudly to their completed studies as though these were proof of quality performance. Having examined a number of these critically, I can find little substantiation for this pride. Those aspects of the civil problem amenable to quantification might have been addressed, and the results put forth in technical or professional language pleasing to the expert, the rules of his game were evidently satisfied. The terms of the contract were fulfilled. But the essence of the problem remained untouched, exacerbated, if anything. I have seen paraded in this fashion plastic-bound agglomerations of verbiage, figures, and printouts that not only left problems unsolved but the government agencies involved in a state of complete disarray. Only

the protective shroud of politics and pride has discouraged, if not prevented, critical analysis from being conducted so far.

Public agencies are, understandably, sensitive about their image. Criticism of the expensive study might make it appear that hundreds of thousands of dollars out of strained budgets have been squandered. The completed study, quite irrespective of its worth, is unassailable, and, coincidentally, useful to all parties to the contract. The astute administrator can use it for leverage in obtaining more grant money for follow-on purposes; the contractor parades it as evidence of capability, for he is secure in the knowledge that his claim will go unchallenged. One cannot but conjecture how the investment of public funds in systems studies will fare when Programing-Planning-Budgeting techniques really become operative in government. With this the current fiscal religion, and systems analysts its high priests, it should be only a matter of time until one of them conceives the bright idea of applying cost/benefit measures to this expenditure!

If the proposal writer views his role simply as that of salesman, then my message can have made little impact on him. It would be patently unrealistic to expect him to mount a crusade for clarity or to carry Diogenes' lantern in a quest for honest enlightenment. If he interprets his mission as to do or die, he will crank out proposals mechanically, in tune with the technique but insensitive to the problem. I am assuming that his interest goes beyond the mere acceptance of the proposal to what is eventually achieved by the contract. For this reason, I have considered it important to examine the deeper implications of this manifestation of technology transfer. Public administrators, faced with complex, intricately-calibrated, and far-reaching decisions, seek to recruit

experts from a variety of disciplines, especially those associated with "glamor" activities. This means that newcomers to the realm of public affairs must learn how to understand the full dimensions of the problems at hand and to forge linkages with professionals from other fields.

Perhaps the most significant lesson to be derived from the transplant of systems analysis to civil matters is that all problems facing government decision-makers and planners are multi-faceted, with the social causes and consequences probably the most crucial factors. This certainly indicates a clearcut need for the coordinated application of knowledge from many disciplines. Perhaps, properly understood and applied, systems analysis will be the vehicle through which a creative synthesis may be achieved. For the technical writer, this process means expanding measures of responsibility and a new order of professional commitment.