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A STUDENT APPRAISAL OF THE PROPOSED GUIDELINES FOR OPERATIONS RESEARCH

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FOREWORD

A number of my students have had their hackles up ever since the Guidelines appeared. They have been frustrated by their inability to do anything about them. Therefore, when an invitation to contribute to this discussion came to me, I asked them to substitute for me. What they have written is much more provocative and useful than anything I could have done.

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The "Guidelines for the Practice of Operations Research," as formulated by the ORSA Ad Hoc Committee on Professional Standards [1], appear to us to have a number of serious flaws. We cannot hope to provide an exhaustive critique of these Guidelines in this limited space. We also cannot address fully and systematically the question of what should replace these Guidelines, if only because we ourselves disagree as to the best approach. Instead, we have tried to present a range of criticisms, covering the major areas in which we found the Guidelines to be inadequate. Where possible, we have tried to suggest either viable alternatives to the Guidelines or reasons why no

fixed alternatives are likely to be found. We have grouped our criticisms under the following four headings:

- (1) The Nature of Operations Research,
- (2) The Nature of Guidelines and Scientific Ideals,
- (3) Ambiguities and Contradictions within the Guidelines,
- (4) The Nature of the Client-Analyst Relationship.

We note that some of our criticisms may appear to have been addressed by the Guidelines in the qualifications they attach to their recommendations. We believe, however, that such hedging does not dispel the inadequacies of the report. It only masks the fundamental problems under a cloak of ambiguity while lending an appearance of comprehensiveness. Nevertheless, the thrust of the Guidelines is clear, and it is this thrust which we wish to address.

The Nature of Operations Research

A restrictive conception of operations research can seriously impede the evolution of the profession and its ability to contribute to the solution of current and future problems. As newcomers, whose stakes lie with the future of OR, we are opposed to any premature hardening of the professional arteries. Yet the Guidelines treat several current modelling limitations as if they were rules of research. Moreover, they perpetuate a number of myths about the practice of OR.

For example, data collection is treated as the natural starting point of a project.¹ But this presupposes the existence of criteria of relevance for the data. These criteria should not be limited to measures of what information is currently available. They should also reflect the client's objectives. These objectives, and the analyst's perception of them, are challenged and redefined in continuing discussions between the client and the researcher. OR is not a linear process from given data to rational solution. It is basically an iterative process with no natural starting point. First solutions suggest new information needs and reformulated objectives, while new data suggest new solutions and so on.

As another example, there is an emphasis on quantitative methods in the Guidelines which is not accompanied by an adequate concern for the biases inherent in confining analysis to those parts of a problem which can be quantified.² There are few important problems of interest to operations researchers that can be addressed by current quantitative methods without serious distortion. For example, we have no accepted measures of educational quality, of personal health, of national security, and so forth. Instead, we are frequently forced to use surrogate measures—such as expected additions to GNP (for education and health) or assured kill levels (for defense). These surrogates can take on a life of their own if we place too much emphasis on the quantitative side of science. Analysis must include a reasoned consideration of the interface between the quantified and unquantified parts of the problem. Only in this way can the surrogate measures be kept in their proper context.

These and other inadequacies indicate the need for a more evolutionary concept of operations research than that contained in the Guidelines. We feel that OR professionals should avoid seizing upon any part of the research process as more fundamental than the other parts. In particular, we believe that the mission of OR does not primarily

¹ [1, p. 1129], first guideline on the page.

² See [1, p. 1129], tenth guideline on the page. In a later section, it is emphasized that a major role of operations analysts is "to provide their clients with quantitative insights into the possible consequences of alternative courses of action" [1, p. 1133].

involve the prediction of system behavior, as stressed in the Guidelines. Emphasis must also be placed on the prescription of actions needed to improve system performance. Finally, we believe that operations researchers should recognize that their solutions will generate new problems and that the process of research and implementation will often serve as a catalyst for other changes. The operations researcher should be fully aware of the extent of his impact and should seek to control it.

The Guidelines, however, dismiss these concerns as necessary but peripheral,³ thereby fostering a narrow view of the profession. Emphasis is placed on the role of the operations researcher as a technician who provides a logical solution to a portion of a (given) problem. The importance of expanding the technician's perspective by questioning that problem and by attempting to comprehend the larger problem context is implicitly rejected by the Guidelines. Instead, the analyst is counseled to accept a limited role, to merely "*be aware* of the fact that in many complex situations the study may illuminate only a portion (albeit a significant one) of the total problem" (emphasis added).⁴ We feel the analyst should strive to transcend these limits and, with the cooperation of the client, should press for the broadest feasible problem definition.

We feel that the literature and recent practice of operations research contain a solid scientific base for the broader role described in the preceding paragraphs.⁵ By asserting a narrower mission, the Guidelines sharply reduce the usefulness of the profession to potential clients.

The Nature of Guidelines and Scientific Ideals

In general, the report fails to distinguish between ideals and standards for research performance. An *ideal* is a goal that can be approached but never attained; a *standard* is a goal that must be attained to qualify the work as legitimate. An ideal often cannot be stated in precise terms. In fact, the task of moving closer to an ideal can be intimately bound up with the process of refining the definition of the ideal. A standard, however, can and should be stated precisely and operationally, so that all of those bound by the standard can be fully aware of what is expected of them. A binding standard requires measures for determining whether the standard has been met.

Most of the research criteria laid out by the Guidelines—objectivity, disinterest, flexibility, thoroughness, etc.—are described in terms suitable only for ideals but are treated as if they could be used as standards. A translation of these criteria into viable standards of performance does not appear to be possible at present (and the report is noticeably lacking in operational definitions). Therefore, any application of the Guidelines will, of necessity, tend to be supplemented and molded by second-guessing of the motives and personality quirks of the researcher. There will rarely be sufficient evidence in the research itself to support a charge of unprofessional practice on the basis of the Guidelines.

Indeed, some of the ideals contained in the Guidelines lack any discriminatory value. Many are empty platitudes whose triviality is concealed behind a fog of professional pomp and circumstance. They do not provide a guide to any real choices an analyst might face. We can see this by considering rules created by negating some of the Guidelines: keep your client out of all decision-making, use as much technical jargon as possible, and so forth. If these negations appeared plausible, then the origi-

³ E.g. [1, p. 1130], seventh guideline on the page.

⁴ [1, p. 1128].

⁵ For instance, see the recent publications of R. L. Ackoff, S. Beer, and C. W. Churchman, among others.

nal Guidelines *would* be valuable as guides to action, but they would also clearly require substantiation to be accepted. However, the absurdity of admonitions such as those given above reveals the platitudinal nature of the corresponding original Guidelines. At best, a platitude serves to jog the analyst's memory regarding something he has already tacitly accepted.

If we concentrate on the scientific ideals implicit in the Guidelines, it still is not clear that these ideals are appropriate or feasible for the operations research process. For instance, the Guidelines exhibit a passionate attachment to dispassion. Dualities are established between reason and emotion, objectivity and subjectivity, disinterest and prejudice, impersonal and personal approaches. Acceptance of these dichotomies amounts to an acceptance of the "story-book" image of science. The Guidelines thereby foster the notion that expertise is essentially neutral and that there is one best way to model a given situation. Such a notion is naïve in light of decades of research into the philosophy, psychology, and sociology of science. There is more than enough evidence to prove that scientific effort does not, cannot, and should not conform to the picture painted by the Guidelines.⁶

The most pervasive myth of scientific procedure found in the Guidelines is the exhortation to be "objective." There are two common definitions of the term *objectivity*. The first characterizes it as a property of the individual scientist—the absence of subjectivity. Objectivity is achieved when the problem formulation and treatment are completely independent of the emotions and values of the analyst. It is this definition which leads to the assertion that there can be only one "objective" treatment of a problem. Presumably, if values and emotions are factored out, what remains is logic and reason, which are assumed to operate identically in all individuals. Objectivity of this kind is never attainable. An attempt to be objective in this first sense merely ensures that the impact of individual subjectivity will go unrecognized. Values and emotions can be suppressed, but they cannot be put aside. It is far better that they be exposed and treated explicitly so that objectivity in the second sense will be possible.

The second definition of objectivity characterizes it as a systemic property—the condition of being perceptible or verifiable by persons other than the original analyst. Objectivity in this sense emerges from subjecting one's research procedures and results to intelligent public discussion. It does require certain attitudes on the part of the analyst—ruthless honesty, openness to informed criticism, unwillingness to arbitrarily exclude a fact or argument from consideration. But it does not presuppose that the analyst himself is or can be "objective." Thus, this type of objectivity is not a standard. It is an ideal, one best sought in a group setting, where individual biases can be brought to consciousness by public debate. Even then, the resulting objectivity will be relative to the particular group context (for instance, group members may possess a common bias). Hence, there is no such thing as a unique objective treatment of a problem. Rather, there can be an ideal of objectivity for the discussion of alternate treatments of a problem.

Similarly, "expertise" in operations research is not a sufficient guarantee of the analyst's ability to treat a potential OR problem. "Expertise" may be nothing more than a history of (successfully) approaching problems by the same method. Reliance upon expertise as a guide for choosing the best model can easily ensure the very prior prejudice condemned by the Guidelines.

⁶ See the publications of T. Kuhn, I. Mitroff, and A. Maslow, for example.

A good example of the impossibility of attaining complete objectivity and of the vulnerability of a methodology based on expertise is contained in the following suggestion, stated in the appendix of the report, as to how the Safeguard debate *should* have been conducted:

The proponents of the ABM should show that there exists a reasonable set of future circumstances for which the ABM is desirable. The opponents must show that for *all* reasonable sets of future conditions the ABM is undesirable. Desirability in both cases should be represented in terms of cost-effectiveness or cost-benefits. The postulation of a particular set of future conditions for which the ABM is undesirable cannot show that the program should not be pursued.⁷

This formulation of the problem is replete with implicit assumptions and value judgments of questionable stature. For instance, it reflects the implicit assumptions of a minimax strategy in defending against ICBM threats and the independence (or extreme priority) of defense issues with respect to other national needs. Moreover, plausible alternate formulations are readily available. To see this, we need only consider the opposite of the cited formulation:

The opponents of the ABM should show that there exists a reasonable set of future circumstances for which the ABM is undesirable. The proponents must show that for *all* reasonable sets of future conditions the ABM is desirable.

Neither of these formulations is logically superior to the other, contrary to the assertion in Appendix III of the ORSA Report. The fact that the first formulation was seen as the only logical approach says more about the values of the analysts than it does about the nature of the problem.

Ambiguities and Contradictions Within the Guidelines

Even if we acknowledge the role of operations research defined by the Guidelines and accept the Guidelines themselves as a set of ideals, we find critical ambiguities and contradictions among the Guidelines. Space permits only a few of these problems to be raised here.

Ideals that appear consistent in the long run may generate incompatible judgments in the short run. This occurs several times in the Guidelines, but there is no attempt to face the hard choices that these short-term conflicts require. For example, there is often a direct conflict between a client's wish for confidentiality and the scientific spirit of open debate, but the Guidelines say very little about it. The Safeguard debate provides a prime example of the distortions which confidentiality creates in the scientific dialogue, but the report pays no serious attention to the problem, preferring to deal exclusively with the arguments as they emerged under this handicap.

To cite another example, conflicts frequently exist between the client's perceived interest and the public interest, but the analyst is exhorted to scrupulously observe both, with no serious discussion of the choices and priorities required when these interests are not compatible. There is, in addition, no serious consideration of the possibility that serving the public interest and providing analysis for a public organization may not always be equivalent.

The Nature of the Client-Analyst Relationship

The failings noted in the preceding paragraph bear upon the general problem which arises when the "buyer" and the "consumer" of analysis are not the same. The buyer

⁷ [1, Appendix III, p. 1237].

of analysis in the public domain is a government decision-maker, but the consumer is the general public. The researcher has a dual responsibility in such cases which he cannot avoid by assuming that the buyer's values are always an acceptable surrogate for those of the consumer (the emergence of public lobbyists at all phases of the decision-making process testifies to the gaps between citizens and their agents). The analyst cannot appoint himself sole guardian of the public interest nor can he delegate his responsibility to official public agents. There is a moral dilemma here which the Guidelines completely sidestep.

The Guidelines also understate or ignore the researcher's responsibilities in choosing a client. In our opinion, a researcher's moral responsibility extends not only to *how* the research is done but also to *whether* it should be done at all. A responsible professional should not agree to a contract if he lacks the capability to address his client's needs. He should also refuse a contract if his prospective client is (1) engaged in unethical practices in his own field, (2) interested only in the showcase value of the research, (3) immovably committed to a particular course of action before the research begins, (4) unwilling to investigate the real problem, or (5) unwilling to provide sufficient information and cooperation to make the study successful. Of course, the conscientious researcher should refrain from contributing his skills to studies with whose objectives or utilization he disagrees.

The most conspicuous oversimplification in the Guidelines occurs in its treatment of the analyst's role as advocate. Here, all the conflicts between private and public interest, secrecy and the scientific spirit, objectivity and effectiveness for one's client come together. Yet the Guidelines assume that the present mode of interaction between the adversary process and the research process is adequate. We question whether the present method for combining research and advocacy necessarily provides better social decisions than those produced individually by either the research process or the adversary process. To substantiate this assertion, we must explain our understanding of the adversary process.

If the adversary process is seen as a mechanism for problem solution, its function is to take a set of individual preferences over various options and to combine them into a social choice. The Guidelines assume that operations research will frequently be involved in refining some or all of the individual preferences but that OR may not be involved in selecting or characterizing the overall social choice based on these individual contributions.⁸ It is not at all clear that the final social choice will be improved by this use of OR exclusively at the lower levels, particularly if there is a gross imbalance in the protagonists' power to affect the social choice. Operations research may exacerbate this imbalance or it may reduce it; there is no way of knowing which will occur without further study of the specific situation. Certainly, when one side has more resources to purchase research, better organization to focus research, or more easily quantified interests to facilitate research, that side will benefit from the introduction of OR in a disproportionate way.

More generally, the Guidelines ignore the problems faced by the analyst as advocate when the adversary process is either nonexistent or critically compromised by gross asymmetries in access to funding, information, and communication facilities (the Safeguard debate provides a case study of the decay of the adversary process and the resulting distortions in scientific dialogue). These problems often occur in proceed-

⁸ The Guidelines assume that the analyst will be serving as a consultant or spokesman for one of the protagonists [1, pp. 1133, 1135]. Indeed, the report laments the absence of operations researchers at the highest decision levels [1, p. 1134].

ings involving private interests and the interests of an unorganized public. Public goals are rarely explicit enough or well enough organized to be forcefully asserted against private goals. Moreover, the public has no pooled funds to obtain the research needed to sharpen these goals. Spokesmen for the public help to remedy some of these problems, but there is a continuing question as to whether the public spokesmen reflect the public interest (assuming that the term has a meaning) or whether they have become spokesmen for smaller interest groups.

There are a number of ways that these problems might be addressed by the operations research profession. We might stress the importance of furnishing analysis to *all* participants in the adversary process; we might emphasize the responsibility of all analysts to seek global solutions rather than analysis tailored only to the objectives of their clients; we might stress the importance of creating analytical, organizational, or institutional instruments which could be used to replace or restructure the adversary process. But none of these approaches clearly resolves the tension between the scientific approach and the adversary process.

For the foreseeable future, the operations research profession will have to face the fact that analyses fed into the adversary process may not be used in the scientific spirit. This situation presents moral and methodological dilemmas. The methodological dilemma is how to design a structure such that the operations research process and the adversary process are effectively combined. The moral dilemma is how and when to provide analysis to participants in an existing adversary process that is far from perfect.

There are no clear answers to either of these dilemmas. The Guidelines provide no compelling rationale for their own approach. They essentially accept the existing adversary process and the traditional views of both scientific objectivity and the client-analyst relationship and then dictate standards within these constraints. However, the traditional definition of a "client" is not applicable in the case of individual analysts who testify on behalf of themselves and the public. The analysis of the Safeguard debate provides sufficient evidence that the framework created by the Guidelines is not good enough. Its authors have treated the Safeguard proponents' greater access to information, time, and funding as a sufficient basis for endorsing their positions on matters of fact or judgment, rather than as a cause for concern. By so doing, they compromise their assessment of the debate from the outset.

Conclusions and Suggestions

In summary, the recent Guidelines for professional conduct consist largely of exhortations to all operations researchers to be virtuous. Yet it is also clear that individuals who cannot or will not define virtue in any meaningful way frequently show no hesitation in judging its presence or absence in others. As newcomers to the profession of operations research, we are the most vulnerable to judgments of virtuous conduct, for we do not have the leverage of established prestige to use in our own defense. We therefore have the greatest stake in seeing to it that inadequate professional standards are challenged.

All of us who have signed this article agree as to the nature of the deficiencies in the present Guidelines. We do not agree on the best way of responding to these deficiencies, although we consider that the response should consist of one or more of the following options:

1. Expose all operations researchers to the literature on the history, ethics, psychology, and sociology of research.

2. Establish a set of professional standards specifically prohibiting deliberate deception. A fair procedure for charging individuals under these standards would be required.

3. Prepare a list of professional ideals and provide for extensive discussions of the reasons for and implications of each ideal.

In our view, a broad, systematic discussion among the members of the operations research community is necessary to define the pros and cons of these options and to identify other possibilities. The formulation of professional guidelines is too important a task for it to proceed in an *ad hoc* fashion.

Reference

1. ORSA AD HOC COMMITTEE ON PROFESSIONAL STANDARDS, "Guidelines for the Practice of Operations Research," *Operations Research*, Vol. 19, No. 5 (September 1971).

REFLECTIONS ON THE ORSA GUIDELINES: A STORY, A POEM AND A COMMENTARY

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A story and a poem are presented as vehicles through which to express the authors' impressions of the Guidelines for the practice of operations research issued by the Operations Research Society of America. A commentary on the story and poem is included. This commentary makes the points that the language of the Guidelines is inappropriate to both the practitioner of operations research and his or her client, and that the Guidelines allow and approve of inhumane behavior on the part of a practitioner of operations research. The argument is made that the linguistic problem, if appreciated, can probably be easily rectified. An acceptance of the legitimacy of the second problem, however, is argued to imply a change of attitude.

A Story

The following is a status report on our continuing study of the "ORSA fragment" discovered on the third planet of the system Delta-0-84 during the transuniverse expeditions of the seventeenth astral cycle.

It will be recalled from previous reports that, as best as we can determine, "ORSA" is the name of a religion which flourished in one of the dominant social units of the planet shortly before that planet's catastrophe (which another team in our division has determined to have been due to a still unexplained release of thermonuclear energy).

Adopting this attitude toward the word "ORSA" as a working hypothesis, we have recently concluded that the letters "OR" refer to the name of the deity involved. This conclusion has led us to the opinion that the "ORSA" fragment constitutes a system of commandments for the members of the religion.

It seems apparent that the practitioners of ORSA believed that the god OR was manifested in "purposeful man-machine systems" (this is a direct quote from the fragment). The commandments, of which five appear to be major, were directions on how to pursue manifestations of OR.

The commandments have been deciphered to be the following:

1. Thou shalt be open, explicit, verifiable, and self-correcting.
2. Thou shalt be quantitative.
3. Thou shalt be considerate of alternative conceptualizations and solutions of problems.