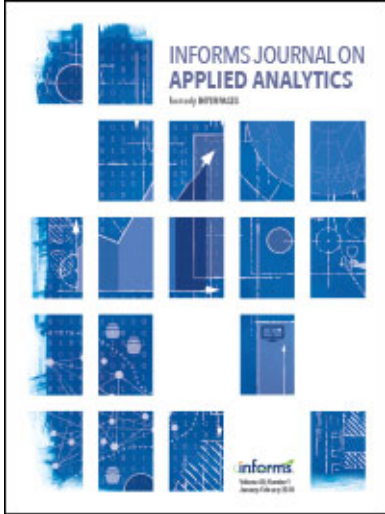




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Letters to the Editor

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LETTERS TO THE EDITOR

Letter To: The Editor

From: E. Veklerov, Lawrence Berkeley Laboratory

Subject: Another Response to "The Value of Queueing Theory"

As a new reader of *Interfaces*, I was surprised by a large number of articles in the journal devoted to a theme which I consider to be fruitless, namely, to the relation between theory and practice. What seems particularly strange to me is the almost unanimous condemnation of both theory and theoreticians. The latest of such articles was the one by Professor J. Byrd, entitled "The Value of Queueing Theory" (*Interfaces*, Vol. 8, No. 3). At the end of the article Professor Byrd, as well as the Editor, challenges readers to send any case studies proving the value of queueing theory. The purpose of this note is to express my belief that such an invitation itself makes little sense, as well as the whole above-mentioned issue.

Queueing theory traces its origin to the work of Erlang, who worked for a Copenhagen telephone company at the beginning of this century. Fortunately, the mathematical models used by Erlang for describing functioning of communications systems turned out to be so productive that both the models and their applications have been greatly extended. They have now penetrated into such areas as evaluation of computer systems performance, reliability, inventory problems, etc.

On the other hand, queueing theory is only a theory and analytic queueing models play about the same role in "real-life situations" as do elementary mathematical functions among "real-life functions" or solvable differential equations among "real-life differential equations." And just as concepts of classical mathematics and its insufficiency led to modern numerical methods, so concepts of queueing theory and its insufficiency led to modern simulation techniques. For example, everyone familiar with the capabilities of Q-GERT knows that the area of applications covered by it is a far cry from the cases presented by Professor Byrd. I claim that it would take just a few minutes to prepare programs simulating his cases in Q-GERT. And what is really sad is that there are OR and related university departments which do not include courses on simulation techniques in their programs. On the other hand, I believe that queueing theory is an excellent and necessary introduction to such techniques.

Queueing theory is a rather robust theory, but it is only a theory. By that I mean that practitioners should not expect to make a living just by using readily available formulae of the theory. But queueing theory, simulation, and mathematical programming are only quantitative techniques available to practitioners. There is no magic in their work. After all, an OR practitioner working, say, in the transportation area, probably knows less about the area than his clients. Although from time to time we hear about amazing contributions made by OR workers who utilize nothing but their intuition or imagination, it would be too naive to expect that the art will play an essential role in the normal workload of most of us. Unfortunately, most of us have to reconcile ourselves to rather

boring OR techniques, such as capturing data, maintaining the data base, and using one or another form of mathematical modelling, including queueing theory. As to the question of how to use the models, it is the OR practitioner's responsibility to find an answer, not anybody else's and certainly not queueing theory's.

Reply by the Editor:

For openers, I must respectfully disagree that the theme of the relation between theory and practice is "fruitless." I feel that it is precisely the viability of the theory-practice relation that guarantees continued growth and progress in our profession. I also must disagree that there exists here or among practitioners an "almost unanimous condemnation of both theory and theoreticians." As for myself, I wrote in *Operations Research* (Vol. 20, No. 3, p. 731) in 1972: "There is no question that, if the theologians of our profession don't do their work, we parish priests cannot do ours." Further, I wrote in *Interfaces* (Vol. 8, No. 3, p. 8, May, 1978): "God knows we need more good theory." Apparently, my position hasn't changed on this point for at least six years. I will cheerfully admit my dedication to the commercially practical side of OR/MS. However, it would be fatuous indeed to say that, without good conceptual training in *applications-oriented* theory, I could have done as well. The key element here is the presentation of theory *in relation to* practice. I would argue that a paper on queueing with no defined tie to practice is mathematics, and should appear in journals of mathematics. If the tie to practice is defined, it *becomes* OR/MS.

Next, I must disagree that the invitation by Professor Byrd and myself, at the end of the article, "makes little sense." The purpose of the invitation was to provoke submittals of queueing applications papers to *Interfaces*. This provocation quickly generated four submittals of queueing applications, all of which have, at this writing, been accepted for publication. One of the papers has qualified as a lead article, as savings of \$575,000 were certified by the corporate director of accounting. On the basis of a lead article and three other applications of queueing, soon to appear in *Interfaces*, I feel that Professor Byrd's article and invitation make good sense indeed. You might even say that it has (excusing the pun) borne fruit.

Finally, I would like to point out that the *first* customer-verified application to appear in *Interfaces* was "A Queueing Study of Drive-In Banking" by B.L. Foote, which appeared in the August, 1976 issue.

Letter To: The Editor

From: Richard Swersey

As an ancient graduate of the Berkeley OR Program I have been more than amused by your crusade to put the "operations" back into OR. But after we all chuckle at your anecdotes and apocryphal tales, I wonder whether it isn't time to deal with some realities.

First, you have set up a lively straw man in the characterization of Stanford and Berkeley as examples of the ultimate program designed to graduate the teachers of OR teachers. Based upon my years of graduate study (1960-65) at Berkeley I remember the curriculum and focus of research as much more balanced between theory and practice. I

wonder whether your current vision of these schools hasn't been colored by the general drift of our profession towards more theory and less practice. Without knowing a great deal about the curriculum at your own school, your writing leaves me with the obviously false impression that your students take courses in only two subjects - polemics, and production-inventory control.

It is relatively easy to write case studies about real life situations where simple OR tools, nay even plain common sense, shine as eternal wisdom. Or more plainly, it's easy to show great improvement over a poor base case. But, I suggest that the industrial-commercial world is filled with rather more complex problems than removing snow from streets, or the need to color code bins of parts. I wonder where we will get the blend of theory and practice needed to solve these more complex problems. Your position seems to be that we have to choose between the esoterica of San Francisco Bay and standing knee deep in a grease pit as a means of analyzing and solving problems. I suggest that our choice is hardly that extreme. We obviously need more emphasis on (and academic reward for) practice; but we also need people who can think rigorously and who can adapt tools that arise from ideal models to fit reality.

Finally, if the purpose of your OR/MS program is to "graduate those people who will endow the chairs" for theoreticians, then you ought to ensure that they are equipped with the intellectual skills to make the leap from the production floor to the executive suite. It is not clear that either you or other leading academicians have articulated just what those skills are, and how they fit into an OR/MS curriculum.

I remain hopeful that your crusade will lead to a constructive change in the attitudes and objectives of the OR/MS professionals. Now that you have our attention, how about enlightening us with some substance.

Comments by the Editor:

I would be the first to agree that my vision of the mentioned schools *is* colored (as you put it) "by the general drift of our profession towards more theory and less practice." I must confess that I still believe the golden age of OR/MS in this country was when Churchman, Arnoff, and Ackoff were together. Reading their book, I still get the feeling that OR/MS can be problem-oriented and purposeful. My "crusade" is to try to encourage a return to a curriculum (again as you put it) "much more balanced between theory and practice." I will cheerfully admit that we use Hillier and Lieberman here at Mines. We also use Henderson and Quandt in the microeconomic theory course that I teach. I *do* also teach the production and inventory control course along with integer and geometric programming. Polemics is, alas, only taught by example and is not a formal part of the curriculum.

I must also agree that every problem cannot and should not necessarily be solved with Q&D methods. I do feel strongly that students should be trained to *start* with these. Our goal should be the best method that the customer will accept, working from the most elementary models with bad answers to more complex ones with better answers. This process was well defined by Geoffrion when he titled an article in *Interfaces* "The Purpose of Mathematical Programming Is Insight, not Numbers" (Vol. 7, No. 2, p. 81, Nov. 1976).

I am as concerned as you are that my students are "equipped with the intellectual skills to make the leap from the production floor to the executive suite." I just argue that

they will, in this program, spend some real time on the "production floor." I require that all theses and dissertations signed by me to have been done for a firm or agency that paid for the work and *used* it. If confirmation of use is not forthcoming, *neither is the degree*. You must remember that my thinking is greatly colored by where I sit, at a School of Mines in a Department of Mineral Economics. The minerals industry has had, since time out of mind, an unwritten rule regarding certain promotions. When a young person approaches the upper reaches of management in the mineral industry and is being considered for promotion, someone will always be heard to say: "How many days has this person had underground, or at pitside, or in the oil patch, or crawling around a refinery, or kicking pumps?" If the number of days is not sufficient, that person's *line* promotions are over. I just propose to give them a start on those days, *while still in school*.

To conclude, I would like to quote what I said in 1972 in *Operations Research* (Vol. 20, No. 3, p. 861); I believed it then, and still believe it now: "Again there is no disagreement as to a good mix of theory and practice being present on any good faculty of OR/MS. The only thing worse than a faculty of theoreticians is a faculty of Woolseys."

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