Management and Mathematics

A persistent piece of management lore holds that, for the sake of continuity and stability, large organizations should try to be as independent as possible of special gifts of individual employees. (See, for instance, "The Organization Man" by William H. Whyte, 1956.) As a result, large organizations still follow that advice, even high-technology industries for which the price may be heavy. In fact, large corporations repel (and sometimes even actively reject) the employee with special gifts, even if those gifts are highly relevant for the company's business. The large corporations have to make do with the left-overs from those sections of society that are not afraid of relying on personal excellence, such as the academic world and some smaller companies.

Everybody is uncomfortable about this regrettable state of affairs and people silence their feelings of uneasiness in different ways. They may try to convince themselves that second-rate intellects are good enough for the industrial enterprise. This is the tacit justification for many a university's graduation policy and for many a company's hiring policy, but since the advent of the high-technology industry, the argument has become less and less convincing. Alternatively, industrial mediocrity is raised to the level of a Law of Nature and companies console themselves by the consideration that they are no worse of than

their competitors. (The belief in that supposed Law of Nature is so strong that, if a competitor performs better, he will rapidly be accused of "unfair competition": of course, for how else could he have outperformed them! The alternative -also practised- is to consider competence an unfair advantage.)

The practice of recruiting managers from the technical ranks strengthens in management the industrial tendency towards mediocrity because, in general, the best professionals are the least inclined to switch to a managerial position.

The organizational love of mediocrity has severely hampered all sciences in their effort of contributing to the industrial effort, and mathematics has been hampered most of all. There are several reasons for this.

Firstly, rightly or wrongly, more than their counterparts in other sciences, successful mathematicians are aware of the rarity of their personal gifts and abilities – the divine spark, etc. – ; they are weak at suffering fools gladly and are most easily repelled by the ubiquitous mediocrity of the industrial world.

Secondly, by an unfortunate accident of history, the rise of industry and technology coincided with a decline of the status of mathematics as an integral

part of our culture, a decline that has been faithfully reflected in the change of the general education curriculum. This is not the place to decide which party is to be blamed for this cultural isolation of the mathematician; here we should recognize the fact that today the mathematician has been relegated to his intellectual ghetto and that the public at large, including scientists like physicists and chemists, is no longer at ease with mathematics.

Thirdly, around World War II, the general perception of mathematics has been further distorted by the spectacular applicability of a few very special mathematical theories, such as linear programming, the theory of games and economic behaviour, and the finite-element method, to mention just a few. In the industrial mind —and also in the egalitarian mind of the socialist— mathematics was reduced to a (small) number of useful methods to be applied by who cares whom, provided he has been trained to apply the method. The view of mathematics as the art and science of effective reasoning has been completely lost in the process.

The distorted picture of mathematics as a collection of methods is widespread. From a managerial point of view it is of course a nuisance that trained people are still needed to apply these methods and the next goal of

management has become to have all that mathematical competence safely canned in a number of software packages. The high expectations of such software are widespread; but the popularity of the idea is the fruit of managerial misunderstanding of what mathematics is about and says nothing about the merits of the idea.

The distorted picture also affects the class-room: many students don't want to be shown effective patterns of reasoning, they want to be told what to do. They have been trained to expect another mathematical cookbook, automatically read general guidelines as recipes that are supposed to suffice for the next exercise (something they - of course - rarily do). They expect a so-called "complete methodology", with each next exercise carefully tailored to the potential of the preceding example and complain when they don't get what only the quack can provide. [We just addressed a bunch of industrial computing scientists, and the above phenomenon was alarmingly pronounced.]

* * *

I think there are two morals to be drawn.

The first moral concerns the interface between society as user and the educational business as supplier of trained intellect. Prior to the advent of

the high-technology industry there may have been a period during which that interface was relatively stable, society knew what to expect from university graduates and the universities knew what to aim for. Whatever that interface may have been, one thing is certain: since the advent of the high-technology industry that old interface is no longer adequate. In the high-technology industry now emerges the need of quality standards way beyond what educational practice has ever envisaged. (To give but one example: the grading of student papers is done along an elaborate scale of error levels, whereas in many a new technology the grading is simply binary, viz. flawless or flawed.)

In adjusting the interface there is the danger of deadlock, viz. of industry ignoring the required quality standards because they are considered "unrealistic" in view of the level of the average university graduate and of the university receiving only disincentives to raise the quality. I see no way out before industry takes its technical troubles seriously; the courage to rely on competence will then come almost unavoidably.

The second moral pertains to the academic enterprise, which is sometimes tempted to apply "acceptance in the real world" as yardstick for the significance of scientific work. The second moral is that the application of that yardstick is lethal. As long as the "real world" sticks to the manager's dream

– and even continues to do so long after that dream has turned into a nightmare – that mediocrity suffices, its values had better be ignored on campus. When what society asks for coincides with what society needs and academia can provide it, the latter's position is easy. Today we have a conflict: society needs competence and asks for quackery (automated or not); in a sad way, academia has the last word: it can provide both.

In any large organization, mediocrity is almost by definition an overwhelming phenomenon; the systematic disqualification of competence, however, is the managers' own invention, for the sad consequences of which they should bear the full blame.

Nuenen, 14 June 1986

prof. dr. Edsger W. Dijkstra
Department of Computer Sciences
The University of Texas at Austin
Austin, TX 78712 - 1188
USA