

The Economist

WANT
to pay

QualPro's
Art Hammer
On MVT™

THE HELL
OF WAR FILM

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Grin and bear it



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The numbers man

Should managers consult algebra before they redesign their factory or launch a product?
A mathematician from Tennessee thinks so

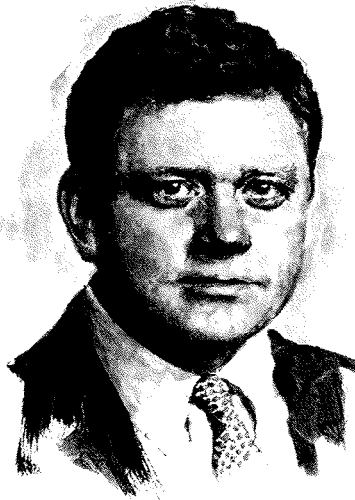
IN ACTION films there is usually a moment when a fast-talking boffin is summoned from the depths of the CIA to explain exactly why Bruce Willis has to retrieve the multiversatile decoder (or whatever). Art Hammer is a little burly for the boffin part; and his southern accent is a little thick. But he has the right qualifications (a spell in nuclear-weapons design), and some engaging eccentricities (his office is in Tennessee, but he lives in Idaho and the Philippines). As for explaining complicated algebra quickly, he is hard to beat. He scribbles formulae upside down on a piece of paper on his lap in a convincingly logical way that only in retrospect seems, well, slightly incomprehensible.

Mathematicians are now commonplace in dealing rooms, but Mr Hammer is applying algebra to "normal" business questions, such as "How should I change my factory?" or "What is the best way to sell my products?" He helps to run QualPro, a small consultancy started by another cold-war mathematician, Charles Holland. Mr Hammer has aided companies such as Du Pont and Monsanto to redesign chemical plants, helped long-distance telephone firms to improve their marketing and even told the *National Enquirer* what to put on its cover.

These are precisely the sort of examples managers give to demonstrate that they practise an instinctive art, rather than a logical science. Yet they are too hasty. The modelling of real-world situations (such as, say, the conversion of climate change into numbers) is now commonplace in laboratories. And number-crunching exercises such as "data mining" (sifting through customer information) are on the rise in business too.

Anyhow, the "instinctive" way of taking decisions actually involves much trial and guesswork. A manager might be able to think of 30 plausible ways to speed up an assembly line. In practice, he will guess which handful matter most, play with them and see what happens. He will not experiment with more variables, because it would be too time-consuming.

Mr Hammer's "multivariable testing" (MVT) allows a more systematic approach. To demonstrate it, he shows how the managers of a hospital-products firm thought they might improve sales of surgical trays. To find the best possible combination for the seven options they identified, one should run 128 experiments (or 2 to the power of 7). However, Mr Hammer's technique, based on maths that was invented in the 1930s and was first used to work out how to shoot down German aircraft, requires only seven trials. Three variables are changed each time (shown in the table by ticks) and the average effect of each variable is then calculated; in an eighth trial, for comparison, none of the op-



tions is attempted. MVT offers a way to combine variables and deduce a result.

Here the maths suggested that only training, cash commissions and holiday incentives would have much effect on sales. The employees' pet suggestion—tailoring the tray to each customer—actually cut sales. The company duly increased holiday and commissions, increased training and ditched a plan to customise the trays. Sales soared.

Mr Hammer claims that if a firm uses MVT alone, its tests will show about 70% of the theoretically possible improvements. So he suggests that, having used MVT to find the two or three main variables, clients should fine-tune the process by concentrating on all the combinations that involve those.

Some of Mr Hammer's "optimum solutions" look obvious. Even when they do not, he never tries to explain why a variable matters. Such mathematical impartiality conveniently allows him to work for competitors; but he also claims that those who know a business well (like the sales people at the hospital-product firm) still get it wrong three times out of four.

Under the slide rule

Mathematical testing has long been used in the military installations where Mr Hammer used to work; it has also been used on the research side of agribusiness, to test the effect of pesticides. Many of QualPro's first clients were big chemical firms tinkering with their manufacturing. This year, however, most of Mr Hammer's work is no longer about manufacturing processes such as producing better ethylene, but about selling services.

Surely guessing what consumers want has always been something of an art—more of an art, indeed, than stimulating sales of surgical trays? In reply, Mr Hammer says that his maths has helped the *National Enquirer*, at a cost of hundreds of thousands of dollars, to examine more than 500 variables for the design of its covers and decide which would work best.

Despite such successes a doubt remains: consumers vary so much that deductive number crunching runs the risk of missing something. Above all, it can test only what is there, not what might be there. Often consumers say they do not want a product, but when it is offered to them, they discover its charms. The

robotic techniques of Mr Hammer and other number-crunchers may make some management decisions more logical. On the other hand, if such methods become widely used, they will increase the value of people who have an instinct for something surprising. Far from fearing the ascent of Mr Hammer and his like, mavericks should welcome it: they will rise with him.

A tricky operation

Ways to boost sales of surgical trays

Treatment combinations	1	2	3	4	5	6	7	8	Effect on sales*
Train sales force	✓	×	×	✓	×	✓	✓	×	\$5,387
Cash commission for sales force	✓	✓	×	×	×	✓	×	×	\$3,225
Holiday incentive for sales force	✓	✓	×	×	×	×	×	×	\$10,668
Letter to doctors	×	✓	✓	✓	×	×	✓	×	-\$498
Letter to operating-room supervisor	✓	×	✓	✓	✓	×	×	×	\$560
Letter from CEO to CEOs at hospitals	×	✓	×	✓	✓	✓	×	×	\$1,110
Customise tray	×	×	✓	×	✓	✓	✓	×	-\$728
Average sales, \$'000	21	16	11	8	5	18	8	1	

Source: QualPro

*Sales in ✓ trials minus sales in × trials divided by number of ✓ trials