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Letter to the Editor*

As an industry watcher I offer this tongue in cheek commentary on the robotics, automation and manufacturing scene.

A decade ago we were all over the moon with the new and evolving industry of robotics. Many promises were made, though few, if any, were realised. Careers and reputations were made and lost, and the fledgling indigenous UK robot-manufacturing industry died soon after birth. So what happened?

Robotics was the 'sign of the times' for the early to mid 1980s. Many companies that traditionally specialised in special purpose machines and automation quickly became robot manufacturers and/or jumped on the robotics band-wagon in one form or another.

Today, a decade after the hype of robotics, who is left? Many of the small successful robot companies were acquired by larger companies. Some of the larger companies went bust trying to maintain their presence in the robotics industry, whilst other companies somehow survived as members of, what is now, a very low-key and probably declining industrial sector.

I find that many 1990's 'robotics' books and articles are to do with the maths of some subset or other of the robotics entity. Rarely does one see any comment or revelations associated with research into the application of robotics and/or some economic justification for real implementations. One wonders, where are the descendants of those economic and sociological papers of the early to mid 1980s?

Another question is why are robot researchers still bothering with the peg-in-hole problem? There are very simple design and mechanical means of removing the hassles of this activity.

Ten years ago we witnessed the first of the Assembly Automation conferences together with the various Automan and Industrial Robot exhibitions. Today, the number of conferences pertaining to robots and assembly are few in number, and those extant are extremely academic in nature. Further, at the last Automan I do not recall seeing any robots at all; it was predominately an exhibition of component manufacturers and suppliers.

It was great fun to be involved with the rise, decline and fall of the UK's (applied) robotics industry. Now as then, robots are inaccurate, slow moving, and are from being a rigid mechanism. Their primary attributes have not changed but remain those of flexibility of motion and elasticity of task specification. In the late 1980s the obvious and inevitable happened with robots in that they became merely 'a sub-system' within an (often) complex process. Years ago it was thought essential to differentiate between manipulators and robots. Nowadays, the term manipulator is preferred to that of 'robot'. In fact, the term 'manipulator' encapsulates exactly what industry needs to solve its 'flexible handling tasks'.

The experience of the UK robotics industry is not unique. Consider the almost parallel experience of expert systems. Like the 'science of robotics', the 'science of artificial intelligence' has remained virtually unchanged over the past decade. However, applied *AI* in the form of expert systems and (remember these) intelligent knowledge-based systems have (like applied robotics) become much more mundane over time. The computer-based expertise is still there, but it is buried deep down. Consequently, it is transparent to the user and is simply an element of a greater entity. In addition, the increasing ratio of 'computing power per buck' together with the rapidly decreasing cost of software means that introducing a simple 'expert system' is cost-effective to almost any conceivable project.

As with robots the usage of an expert system is merely a means to an end. Even though today's applications (of robots and expert systems) are rarely spectacular or newsworthy, the results generally yield acceptable returns on the investment, a sharp comparison to many investment policies (follies?) of a few years ago.

In the mid 1980s the cry was Automate or Die. I believe that the case against 'automate for the sake of automation' has been proven as a fallacy. Moreover, my guess is that Technology Transfer and Innovation (TT&I) are the keys to successful implementation of 'modern technology'. In fact, I go so far to say that TT&I is the lifeblood of industry, since if industry does not innovate and/or cannot successfully transfer technology then they fail.

> Innovation is defined as being *all of the activities necessary to produce profitable new or improved products, processes, services or ways of doing business; technology development and design, marketing and sales, training and new management information systems.*
>
> Technology Transfer is defined as being *the transformation of an idea into a new or improved saleable product or operational process in industry and commerce or a new approach to a social service.*

Technology for its own sake is fascinating only to its *initiates* and *cognoscente*. It has little benefit to 'society' until it has been tried, tested and moulded by experience and market forces. On reflection, I guess that this has always been true. For instance, the early automotive, aerospace and telecommunication pioneers were enthusiasts. It was years before their 'tinkering' benefited society in the widest sense.

One well known problem with today's technological revelations is that time is not on the implementor's side. The transfer of technology from a vague concept to a 'product' gets shorter and shorter. So society and industry have to catch the technology before it has been fully assessed and rationalised. Take, for instance, computers; I bought the latest thing in computing in 1983. It was an Osborne Executive (portable) computer costing £1,800 with 124k RAM and two floppy discs drives with disk storage of 185K – wow! A year later the CP/M operating system was dropped in favour of MS–DOS. In 1985/6 a 10MB hard disk was considered large, nowadays a 'reasonable' word-processing pack has about 10MB of programs and that is before you start using it.

The available 'off-the-shelf' computing power of the early 1990s means that 386 computers are commonplace, 486s are nothing special and 286s are positively prehistoric. Similarly, hard disks of 40MB are 'basic' and those of 100MB are common.

To conclude these reflections let's look at the theories of

* It is hoped readers will voice their views in Letters to the Editor (Editor)

'Manufacturing Systems' in the early to mid-1990s. There has been a lot of talk about new concepts such as Total Quality Management, Design for Manufacturing, Quality Circles and much much more.

To me these philosophies are not new at all. Maybe they have not been formalised before, but in my early days as a designer I certainly thought how an item was to be made (and the quality implications of the various options) before the drawings were given to manufacturing. I also considered, from my experience, the cost of manufacture and made some effort to balance the cost of manufacture to the application. This, of course, depends upon the company and project. Sometimes function over-ruled cost because there was no choice; for example, at one time a very thin-walled thimble *had* to be made of carbon, another time a component *had* to be gold plated aluminium—fortunately, in both cases we had the skills of the 'machinists/toolmakers' to make them. In other jobs cost of manufacture was of the utmost importance with costs being calculated to 1/1000th of a dollar. So every care was taken to take cost out of the items—before manufacture.

I do not claim to be unique, but rather the product of an 'earlier age' when engineers/designers had practical experience of how things were made and what could or could not be achieved on various types of machines. It is an interesting thought that Prof. Harry West of MIT feels that today's engineering students are selected only for their scholastic achievement. He states that about half of his students have never designed anything and some arrive not knowing a nut from a bolt! Therefore, in an attempt to restore the balance to that of earlier days when many students grew up on farms, Prof. West has introduced his 'design and build' competition. This (now worldwide) competition recreates the missing understanding of the relationship between engineering science and 'real things'. As many of you will have seen on the BBC programme QED ('The battle of the bottle snatchers' – 12th February 1992) this year's project was to design and build a garbage collection machine from a large cardboard box full of 'junk'.

I've said enough, its all personal, but maybe it will stir some embers.

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