Does History matter for Engineering?

©Copyrights Abbas El-Zein
24 August 2010

It is great to see such a large number gathered to celebrate a digitisation event. I have had the privilege of getting brief access a few weeks ago, with Tina Reedman and Helen Campbell, to the storage part of the Fisher library where the hardcopies of the serials are buried: unsurprisingly, you have to go down steep stairs to get to that area, as if you were accessing some ancient, recently uncovered Pharaonic tomb. Luckily at the bottom of stairs, were no mummies: two smiling library staff instead, full of life, I am pleased to report. I saw first hand what an act of resurrection is digitisation, not only bringing to life the journals but making them virtually accessible to anyone, anywhere with a computer and an internet connection. Clearly, 'collective memory' is becoming synonymous with 'electronic memory' in the West—what doesn't exist in Google or Wikipedia doesn't seem to exist to all. I am not sure whether this is good or bad. I feel ambivalent about it. However, it certainly makes projects such as this one doubly important.

On the face of it, it is tempting to give a depressingly brief answer to the question of whether history matters for engineering. Engineering is a group of professions and scientific disciplines concerned above all with technological change. We tend to look to the future rather than the past. We are focused on moving forward, to plagiarise our Prime Minister's unfortunate turn of phrase. Very few of us, whether in engineering practice or academia, deal with history on a day-to-day basis. The writer Leslie Hartley famously opened his novel, The Go-Between, with the statement that "The past is a foreign country, they do things differently there." And we probably all feel the same to some extent about the past. It is for many of us, let's face it, odd and irrelevant. However, this would be a superficial approach to the question and I would like to argue that there are at least two reasons why history matters in a fundamental way for engineering.

To illustrate the first point, I would like to bring up the man who is probably the most famous engineer of all time. He was a bastard, literally, and lived at a time when being an illegitimate child, born out of wedlock that is, carried a high social cost. He was very likely homosexual and was once charged with sodomy with a male prostitute although the charge was later dropped for lack of evidence. In case you haven't guessed who the engineer in question is, another minor detail is that he is possibly the most famous painter of all time, author of the Mona Lisa and the Last Supper. I am thinking of course of Leonardo da Vinci. Now, da Vinci, who lived between 1452 and 1519 in Italy and France, was an astute scientific observer, and had a powerful intellect and an abiding interest in mathematics, especially geometry. This combination of qualities allowed him to reach a number of discoveries in hydrodynamics, optics, anatomy, and aeronautical and mechanical engineering. He invented the first parachute and a machine for testing tensile strength; he attempted to produce solar power; suggested an urban model for Milan which had people living on one level and the traffic of carriages and animals diverted to underground tunnels. He made astonishing observations about blood circulation, plate tectonics and evolution, well before the term was invented.

Da Vinci happened to be a copious notes taker and left us a monumental amount of drawings and notes which remained buried for a long time. The first major work of his to be discovered, but only in the late 17th century, was the document later named the Codex Leicester (famously acquired by Bill Gates for the largest sum of money ever paid for a book). Some of his other surviving work remained unknown until the 19th century. Amazing as this may sound, someone discovering da Vinci's writings in the 18th or 19th century, more than 300 years after he died, would still have learnt much from them, in all the scientific fields I mentioned earlier. This is my first point: history matters for an entirely functional reason. It can be useful in advancing science and technology. This is because although we like to believe that progress happens in a linear or exponential fashion—that we keep piling up discoveries, making things better all the time, that today we are collectively wiser than yesterday—in fact, there is plenty of evidence to suggest that science and technology actually move in fits and bursts, backward and forward, before bringing up progress.

A Scottish surgeon called James Lind discovered in the mid-18th century, through staged experiments, that citrus can cure scurvy—endemic among sailors in those days—but the British navy did not 'discover' and implement his advice until many decades later (and it wasn't because he kept silent: he published it all in a book in 1752); what's more astonishing is that it was only in the 20th century, more than 150 years later, that vitamin C deficiency was found to be the cause of scurvy. Many cities, including London, which had dismantled their electric tramway circuit in the fifties and sixties, replacing them with buses came to rue the decision, with some cities reintroducing a new version of them in the nineties and later. The F117-Stealth Bomber that the American army developed in the 1970s, flying it first in 1981 is another such example. This is the strange-looking aeroplane many of you will have seen on TV—black, with sharp angles rather than the smooth curves we have come to associate with aeroplanes, a mix of Frankenstein and Mad Max. This shape was designed to deflect and absorb, rather than reflect, the waves emitted by radars so that the F117 could remain undetected and go and do whatever nasty things it wanted to do. In the 1970s, a Lockheed scientist found the mathematical basis for the future design buried in a paper from 1964 by a Russian mathematician called Pyotr Ufimtsev. Ufimtsev showed that the magnitude of the signal reflected by a flying object depended on its shape, not size and that therefore, a large aeroplane could conceivably escape detection. Now, Ufimtsev and the Russians had no practical use for the theory. Lockheed, on the other hand, did because by the time the paper was discovered, the US engineers had access to powerful computers and could turn the theory into a number-crunching algorithm. What I am trying to say is that, occasionally, the past is more advanced, more visionary, than the present and we would ignore this at our own cost.

But the second reason for which history matters is perhaps a more fundamental one and brings me to the collection we are celebrating today. One of the papers I came across in the digitised University of Sydney Engineering collection, is titled 'Linking Sydney with North Sydney' by a certain JJ Bradfield. I would like to quote from it:

"In 1880 negotiations were opened between the Government and Mr. J.E. Garbett, representing a company which was prepared to construct a high-level bridge to the North Shore at a cost of £850,000 upon condition that the Government guaranteed, for a period of thirty years, an amount equal to 3.5% upon the cost of construction. On the 26th October, 1881, the late Sir Henry Parkes, then Premier. signed a Cabinet Minute to the effect that "the Ministers (nine) present agreed that Mr. Garbett's proposal, as explained in his letter, be accepted by the Government ," and in March, 1882, Mr. Garbett deposited a sum of £5,000 as security. Owing to a change of Government, however, nothing further was done, and the deposit was returned in the following year."

(Clearly, nothing has changed in New South Wales in more than a 100 years, except that I am not sure Mr Garbett would have got his deposit back—lawyers would have had to battle over it first—or whether he would have paid one in the first place; in fact this may have been a good outcome for Mr Garbett by today's standards since if the project had gone ahead instead, and judging by our own cross-city tunnel, he would have gone bankrupt two years later). The article went on to describe the pros and cons of the various possible routes, types of bridges or tunnels that could link Sydney to the North, including some valuable costing and insights into the politics of the day that hampered or encouraged the development. The article was an eye opener for me: it gave me a whole new perspective on that iconic part of Sydney. By looking at the genesis and the labour pain of the Harbour Bridge, I took it a little less for granted. I could picture in my mind a whole set of other possibilities, other links across the harbour, other "Sydneys" altogether. There was nothing inevitable about Sydney as I knew it, with both its flaws and qualities; it could easily have been otherwise. A comforting thought when we look at the state of public transport in our city today!

Likewise, if we'd like to understand why we live in overstretched suburbs with all their unaffordable environmental costs, we must seek the answer in history and need look no further than decisions made by the US government to invest heavily in road transport in the 1950s, a decision that many Western governments later emulated and from which, in some ways, we are still trying to recover today. This is after all what made possible the suburban way of life, with its spaciousness, convenience, wastefulness and unsustainable energy costs.

Another article I came across, also by Bradfield, was titled 'Some notes on Australian timber'. It contained a great description of various types of trees in various parts of Australia; the relationship between the genesis of trees, on the one hand, and climate and soil on the other; the engineering strength and suitability of timber and so on. Bradfield displayed an impressive array of geology, ecology and engineering knowledge. The article was a great illustration for me of how powerful the scientific methods we often brought to bear upon nature are, and how devastating they could be at the same time. Here was a sensibility which saw nature in purely instrumental terms: trees were nothing more than construction material, soil was just a foundation for our buildings, water was there to be harvested for our crops and so on. No sense of ecosystem or ecological interdependence. No other animals, organisms, plants, human cultures, worldviews or rival claims to nature seemed to have a place in this vision. We are all guilty of such reductionism of course (and there are some good reasons for this, arguments for and against) and although we are more aware of it today, it remains powerful and pervasive.

These two articles, I hope, go a long way in showing how history can help us understand our own world. It can bring our present into sharp focus and help us change for the better. Engineering is as far from history as any applied science is. However, if we hope to ask the right questions and solve the right problems or, more ambitiously, if we'd like to be more than problem-solving robots, if we'd like that is to be intelligent agents of technological, environmental and ultimately social change, somewhere, sometime, some of us ought to keep the historical imagination of our profession alive. Otherwise, our collective intellect would be much impoverished.

Thank you.