Acoustics and the Engineering Team

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ABSTRACT

This paper shares some insights into how the role of engineers in general, and acoustical engineers in particular, is changing. The paper covers the changing nature of engineering work, the influences of globalisation and technological change on the way we work and the role of innovation and collaboration. While the number of professional engineers in Australia has increased over the last 10 years, fewer and fewer work in traditional fields. Major shifts in the world economy and technological change has meant more and more engineering services can be supplied from anywhere in the world. This has a much greater impact on less complex engineering services than on high value, creative engineering. It is important therefore for graduates to think about the skills needed to be a 'great engineer' in this environment. Attributes like creativity, project management skills, communication skills and experience in working with diverse groups will become increasingly important.

INTRODUCTION

This paper isn't a technical paper on acoustics, but a chance to share some of my insights and experiences since winning the Australian Young Professional Engineer of the Year award from Engineers Australia a little over a year ago.

The award was a big surprise to me. I had always thought that working in acoustics wouldn't be seen as 'real engineering' by most engineers. And even then, actually performing acoustic calculations probably takes up less than 1% of my time these days, so I wasn't even sure I still counted as an engineer. This award has therefore challenged some of my perceptions about engineering and engineers. And it has made me think more deeply about what makes you a 'good engineer' in a world where the shifting world economy and the role of innovation and technology is really changing the way we work and the role of engineers.

WHAT IS AN ENGINEER?

One of the things that this award really brought home to me is the gap between the community's perception of what engineering is and the reality of most jobs post-graduation. Like most of us these days, I juggle a lot of different roles, including some 'engineering', but also crossing into project management, people management and business development. My official role is Workgroup Manager Environmental Advisory Services at AECOM, overseeing three teams delivering services in the areas of Risk, Air Quality, and Sustainability and Climate Change. The teams are an interesting mix of scientists and engineers, with a Doctor of History and Politics and another of Bushfire and Public Safety Risk Management thrown in for good measure. So engineering, and even managing engineers, is only a small part of my job these days.

My job has evolved a lot, from my graduate days filled with measurements, calculations and models, to my role now which is much more about my ability to communicate and influence, solve problems and manage resources than it is about running calculations. And my company has evolved as well from a small Australian company of 80 mostly mechanical and electrical engineers, to become part of AECOM's 45,000 strong worldwide group covering everything from engineers, scientists, planners and architects to archaeologists and historians. It's hard to reconcile what I do now with what I thought engineers and scientists did when I was growing up.

Recent statistics show that I'm not alone in this. Australia actually has more engineering graduates per capita than the United States, Canada, the United Kingdom and Germany (Finch, 2012). More of our top students choose engineering than law (Finch, 2012). However a recent survey conducted by Engineers Australia found that only 59% of the 246,000 people in Australia with engineering qualifications actually work in areas classified as 'engineering' (Kaspura, 2012). Moreover, the average graduate today is expected to have 10-14 completely different careers before the age of 40 (Fisch, McLeod & Brenman, 2008), so the likelihood of working in your same core area of engineering your whole life is slim.

So despite many perceptions to the contrary, we actually have a pretty great cohort of engineering graduates in this country. And the number of professional engineers in Australia has increased by 50% over the last 10 years (Kaspura, 2012). But I think fewer and fewer really fit the stereotypes, or do the kind of work we'd have called 'engineering' 50 years ago. Changes in the technology and the way the world works is really changing what it means to be an engineer, and what skills an engineer now needs to be great.

ENGINEERING AND GLOBALISATION

Major shifts in the world economy have changed both the way we work, and the global market for our solutions (Schaffer, 2012). More and more, it is not about how well you work with the person sitting next to you, but how well you can connect and work with people all over the world.

We are already at a point where we are working across countries and across borders more regularly. I've recently been working on a project in the Solomon Islands for a client in Japan, with some of the AECOM team in Brisbane and some in the Philippines.

But on the flip side, many engineering services required for Australian projects can now be supplied from anywhere in the world. And this is likely to increase while Australia remains expensive, and areas like India, China and East Asia

rapidly develop the capacity to supply similar engineering services (Schaffer, 2012).

We've already reached a point where almost half of the engineering workforce in Australia was born overseas (Kaspura, 2012). But it isn't just the workforce in Australia we are competing with. Increasingly, the competition for engineering work doesn't just come from other companies in Australia. And increasingly competition for jobs isn't just graduates from Australian universities. The number of students graduating with honours degrees in India outnumbers the entire student population in the US (Fisch, McLeod & Brenman, 2008). The top 1% probably outnumbers the student population in Australia. Smart, capable people are graduating from universities all over the world, all the time. And it's easier than ever for them to work anywhere without leaving home.

TECHNOLOGY – WHAT DOES IT MEAN TO ENGINEERS?

Technology is helping to facilitate this collaboration of global teams, and is still developing at a rapid rate (Schaffer, 2012). The computer in your mobile today is a million times cheaper, a thousand times per powerful and about a hundred thousand times smaller than the first computer built at MIT in 1965 (Fisch, McLeod & Brenman, 2008). What used to fit in a building now fits in your pocket, and what fits in your pocket now will probably fit inside a blood cell in 25 years (Fisch, McLeod & Brenman, 2008). Predictions are that by 2049, a $1,000 computer will exceed the computational capabilities of the entire human race (Fisch, McLeod & Brenman, 2008).

Google started as a university project in 1996. By 2006 it was carrying 2.7 billion searches a month (Fisch, McLeod & Brenman, 2008). It now carries 31 billion searches every month, and has expanded to include more and more complex services – Google Maps, Google Docs, Google Translate, Google News.

At the moment, a lot of what we do in the acoustic profession can't be easily replaced by a computer. But that won't always be the case. The rate of change in the digital economy is so rapid and can be so disruptive it is hard to predict what changes future technologies might bring (Schaffer, 2012).

You have to think – what will computers be able to do in 10 years? What will Google be able to do? And what can you do that a computer can't?

INNOVATION

I think part of the answer lies in our ability to innovate. Technology and globalisation has a much stronger impact on the less complex end of the engineering services spectrum (Schaffer, 2012). High value, idea intensive, creative engineering is much harder to offshore or replace with a computer program (Schaffer, 2012).

Engineers have an important role to play as a driver of innovation, and are often at the forefront of product and system innovation (Schaffer, 2012). But in this context, innovation is not about sitting in a laboratory waiting for a 'light bulb' moment. It's much more likely to come through collaboration and the slow evolution of ideas.

We all know that the light bulb was invented by Thomas Edison right? Well, sort of. Actually he built on 75 years of work by dozens of others with similar designs (Bryson, 2003). His was just the first commercially practical light bulb, and he had to go through a six year legal battle to prove his design was different enough to these others to even warrant a patent (Bryson, 2003).

Steven Johnson has written a great book called *"Where Good Ideas Come From"* (2010). In it he discusses how most ideas take a long time to mature before they become useful. He calls it the 'slow hunch' followed by a 'collision', where ideas burn in your mind for years as a 'hunch', until they collide with another 'hunch', often burning in someone else's mind, to turn into something really new and exciting.

Edison's light bulb didn't become useful until they figured out a cheap, long lasting filament based on carbonised bamboo. The idea came from fishing trip he'd recently been on with another scientific team (Bryson, 2003).

A more recent version of this was the development of the World Wide Web. It was based on a project Tim Berners-Lee developed in 1980, but he didn't build a working web until 1990 (Johnson, 2010). And what he actually managed to do was connect internet technology being developed by one group, with hypertext technology developed by another (Johnson, 2010). This is not brainstorming, but the connection of half formed ideas from separate groups to form something greater than the sum of the parts.

So this tends to happen more when like minded people are working together. This is why we often end up with hotbeds of innovation when like-minded people end up in one spot, like Paris in the 1920s, or Silicon Valley more recently. This was supported by recent research by Professor Graham Schaffer of the University of Queensland on engineering knowledge hubs (2012). He found that the type of knowledge required to produce high value, idea intensive, creative engineering is not easily transmitted over long distances, leading to a tendency for knowledge intensive industries to cluster together, and to become centres of excellence.

WHAT DOES THIS ALL MEAN TO ME?

The point of this isn't to scare you about people overseas trying to take your job, or intelligent computers that will take over the world. But to make you think about how the world is changing, and what role you want to play in it.

I actually think this is a fantastic time to be an engineer or scientist. The world is facing a lot of problems and needs smart, innovative, people to address them. Engineers will play an important role in the growth of the 'knowledge economy'. More than half of the gross domestic product of the OECD economies is now knowledge based. Engineers are central to this knowledge economy and therefore critical in driving economic growth in developed countries (Schaffer, 2012). For you personally, research has shown that higher-educated people tend to do better in the current climate, where the economy is increasingly driven by technology and information (Schaffer, 2012). Engineers in particular are often more resilient to changes in the global business climate as their skills are more transferrable across industries (Schaffer, 2012).

But you do need to think about what skills you will need to thrive in this new world. Being technically competent isn't enough. You need to be able to contribute ideas and solutions that have an impact on a local and a global scale. As the global marketplace for engineering solutions changes, attributes like project management skills, communication skills

and experience in working with diverse clients and stakeholder groups will become increasingly important (Schaffer, 2012).

So think about how you can start building these now. Get connected with your industry, your colleagues and the broader world. Find ways to get involved in groups that will challenge you and give you experience dealing with diverse groups of people.

Don't be constrained by other peoples' views of what role acoustic specialists should play. My role has kept expanding and evolving as my career progressed, mostly by being open to anything and willing to jump on any opportunity completely. And by not assuming that the only thing I can contribute to a group is acoustical engineering advice.

Read widely and maintain your thirst for knowledge throughout your life. Further study can be great, but do it because you find it interesting, not just for the job at the end. Broad knowledge and regular connection to diverse groups of people is more likely to lead to innovation, and more likely to help you build the types of skills that will make you the kind of engineer or scientist that thrives in a globally connected world.

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