

“Back to the future...if I knew then what I know now. Six things I’d tell my primary school self about what it means to be an engineer...”

George B. Anderson, University of Southampton

The word *engineering* is derived from the Latin *ingenium*, meaning "cleverness", and *ingeniare*, meaning "to contrive, devise"; an apt definition, I feel, of a field that is complex, varied and touches every aspect of the modern world. In this essay I have distilled my thoughts and feelings about my chosen profession into six salient points, which I believe capture what it means to be an engineer.

Making The World A Better Place

My first point is that engineering is about making the world a better place. Through their work, engineers have revolutionised the world, bringing communities together through communication networks and transport infrastructures. These have allowed goods and services to be moved to wherever they are needed quickly, enabling society to function smoothly and efficiently. Through the work of engineers, emergency services are now able to traverse almost any obstacle to ensure the safety of a community, and governments can coordinate thousands of entities in real time to safeguard the wellbeing of its citizens. Engineers have enabled the prediction of natural disasters and the mitigation of their effects, and even when part of civilization is damaged through these phenomena engineers work tirelessly to ensure that the critical infrastructure is re-established so that humanitarian aid can get to where it is needed most.

Engineering is one of few professions that touch every aspect of human life. From the seemingly mundane domestic appliances in everyone’s home, to the thousands of satellites orbiting the earth that enable people to communicate and share ideas almost instantaneously, the fingerprints of engineers cover every aspect of our existence and culture, and in doing so they benefit society in innumerable ways. The underlying motive of engineering is that of improvement: of building a better world for everyone. In this way it can be seen that engineering is a facet of human optimism, a tool by which humans can make dreams come true, explore new worlds, and build new realities in ways never before considered.

As the world moves forward, engineers will continue to stand at the forefront of humanity, enhancing the lives of people everywhere. Being an engineer means working for the betterment of society and civilization, constantly striving to solve the world’s troubling problems and in doing so, making it a fairer and happier place.

Personal Development

Engineering is as much about the process as it is the final outcome. At primary school I spent much time trying to learn new skills and different ways of going about things. Good engineers are constantly doing and such personal development is my second point.

Technology is a fast developing, ever-changing field and one to which engineering is intrinsically linked. In order for an engineer to remain on the cutting edge of the field, it is essential that they continually incorporate new innovations and techniques into their work. In much the same way that I made sure that the latest action figure was incorporated into my playtime in primary school, an engineering team has to make certain that they are using the latest software packages and tools. A good example of this is 3D printing. While this technology may seem fairly new to the public, engineers have been using 3D printers for many years as they continue to adopt useful processes into their workflow. For many, this required learning new 3D modeling programs and techniques. However the innate skill-acquiring nature of engineering meant that this transition, and many like it, was smooth and straightforward. Engineers can see how technologies like this will allow them to produce better solutions quicker than ever before; it is therefore imperative to adopt them. This is central to the way in which engineering develops in both academia and industry, constantly iterating on the latest ideas and technologies in order to create the best possible versions of whatever is being worked on, whether it is sustainable energy, trains or skyscrapers.

Engineers are always in relentless pursuit of new knowledge and skills. This desire to learn is entrenched within the heart of engineering, and a love for it is a central tenet of what it means to be an engineer – and one which would have deeply resonated with my primary school self as, like everyone of that age, I was undergoing a similar process of intellectual development and exploration myself.

Reward from hard work

The desire to acquire new skills is redundant unless one is willing to work through difficult problems. Underlying every part of all the fascinating projects upon which engineers work, there is hard work and meticulous hours spent trying to solve tricky technical problems. The joy of engineering is that this work is not without its reward, and this is my third point.

Unlike those in many other STEM disciplines, engineers get to see real material results from their hard work. An engineer works not just to prove a theory but also to actually put that theory into action. The result of the engineering process is an airplane flying through the sky, men walking on the moon, and energy being harvested from the sun. The tangible results of the hard work of engineers can be seen all around us and they will continue to be evident on the physical level but also on a deeper, less palpable one.

When an engineer finally solves that pressing problem, they are not just simply publishing a journal paper but also changing man's understanding of the world and creating a new reality upon which the next generation can dream. An engineer plays a vital role, through their hard work, in propelling mankind towards the next frontier. In this way, every engineer can be proud, appreciating the results of the hard work undertaken by previous generations and knowing that they too will be immortalised through their contribution to the future devices and systems of their own generation's creation.

New Challenges

My fourth point is that being an engineer is about confronting new challenges. Throughout every discipline of engineering, there will always be an innumerable number of projects to work on and problems to solve. As the world becomes more technologically advanced through the work of engineers, new fields are born and with them more engineering challenges become apparent.

A good example of this is the renewable energy industry. Strongly tied to the environmental movement, the industry did not exist in any significant capacity until the 1960s and yet is now a booming industry employing millions of engineers all over the globe. These engineers are working in an area never conceived of by the previous generation and one that will only grow in size over the next several decades. This is just one current example, of which there are many, of engineers expanding their reach within society, taking on new tasks, and solving new problems – the fundamental basis of engineering.

Searching out new challenges is a central part of what it means to be an engineer. In order for society to evolve, engineers must be willing to take on tough problems in subject areas ranging from well established, classical ones such as the combustion engine, to ones which have only just opened up such as quantum computing. To be an engineer is to have an underlying drive to dive into these pressing problems and then, once they are solved, move onto the next ones, ever continuing to change the world.

Being Inclusive

My fifth point concerns inclusivity. Engineering is a truly global discipline; its work encircles every continent of the globe and affects everyone in it. It is a profession open to everyone regardless of where they were born, or the family that they were born into. As an engineer one may work with colleagues of every walk of life and of every mother tongue. This is an essential asset of the profession, because to operate in such a vibrant and diverse world it must itself be open and egalitarian.

Whilst it cannot be overlooked that there is a continued need to encourage diversity within the recruitment of engineers, especially that of young women, there can be no doubt that engineering attracts people from all over the globe to come together and solve international problems. Being an engineer means to be part of this global network. The yearning to improve the world and

explore is something that transcends all boundaries, territorial and geographical, and is strongly manifested in the engineering profession. A prominent example of this collaboration is the International Space Station; the 420-ton station is the result of a partnership between 15 countries spread throughout the world. This is just one example of the many international engineering efforts, and it is particularly poignant because this collaboration remains unadulterated despite the political belligerence between two of the major players in the project, the United States and Russia. The alliance remains because it is understood that international facing engineering should transcend geopolitics and that through its work people are brought together in a sustained effort to revolutionise the world for the better. To be an engineer means to understand and interact with this global community. It is to appreciate that engineering is intrinsically tied to internationalism.

A Sense Of Wonder

My final point is somewhat less tangible than the others and is the fact that being an engineer means to have a deep sense of wonder and curiosity about the world.

In a wider sense, the profession teaches one to absorb information as part of the scientific and creative process. From exam questions at university to complex, real world problems in industry and academia, it is vital that engineers try to understand in detail all aspects of the problems they face. This enviably creates a culture of curiosity and inquisitiveness within engineering that can be applied both within the profession and outside it. This interest in everything is a fundamental part of what it means to be an engineer and it enables them to enrich their lives through a deep immersion with the many aspects of the cultures that inform so much of the modern world.

As illustrated in my second point, engineers develop many skills in a professional capacity and many of these can be used outside the field of engineering. Being an engineer means being adaptable, having the ability to extrapolate and use the skills one has to excel in any situation. In this way it can be seen that the same ideas that allow an engineer to study the wear on a piece of machinery or visualize the airflow characteristics over a fighter jet can be used to appreciate a plethora of other things from the sublime workmanship exhibited in the Trevi Fountain in Rome to the vivid allegories of Plato's *The Republic*. While an engineer is not directly taught to admire these pieces of culture, it cannot be denied that every engineer, through their sense of wonder and excitement that is the basis of every engineering endeavour, is an unmistakable part of what it means to an engineer, and is given the tools they need to explore and understand the world at a deeper level. It is through this compassionate understanding of the past and present that they can then focus on how to revolutionise and create a better world.

Overall, to be an engineer means to be a pioneer; one who leads the way as humanity moves into the future.