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The robots aren't coming... they're already here

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Stantec lead design engineer Dan Causley looks at advances in technology and their role in boosting productivity in the water sector
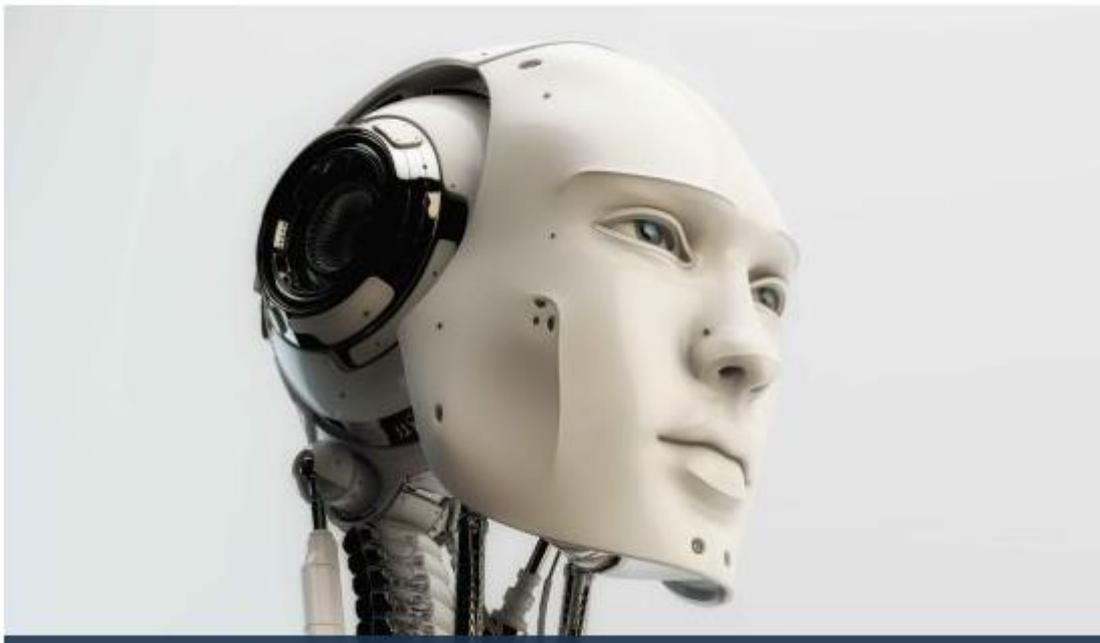
'The robots are coming!' It's a phrase that has entered common usage not just from post-war sci-fi films and school playgrounds but also with modern-day economists, scientists, humanitarians and engineers among others. Even some politicians seem to understand the significance of the saying.

There is little doubt that they are coming, and in many cases they have arrived. A natural response to this is to draw the human brain into perhaps primitive behaviour where, if a potential threat is identified and we don't fully understand it, it's 'fight or flight'.

Even Professor Steven Hawking, one of the most respected minds of the 20th century, is on record as stating that artificial intelligence could destroy civilisation, saying: "Computers can, in theory, emulate human intelligence, and exceed it […] Success in creating effective AI could be the biggest event in the history of our civilisation. Or the worst. We just don't know. So, we cannot know if we will be infinitely helped by AI, or ignored by it and sidelined, or conceivably destroyed by it."

However, as an engineer and an eternal optimist, I interpret AI as an exciting opportunity both personally and professionally, not a reason to unplug HAL-9000.

Even before the release of the epic 2001: A Space Odyssey in 1968, the perceived threat to humanity from technology had captured the imagination of the entire world. In the 19th century, it was weaving machines threatening jobs and cars taking over from horse transport. Leaping forward to the 1950s, a variety of technologies emerged that initially were feared but now, many would argue, we can't live without – the microchip, the passenger jet, the remote control, the washing machine and dishwasher.

During the 1980s, the word processor entered mass production and, yet again, most writers were initially resistant. Indeed, Herbert A. Simon, a respected economist, predicted in 1965 that "machines will be capable, within 20 years, of doing any work a man can do".

Boosting productivity

So, for more than 200 years we have overwhelming evidence that the Luddites were wrong. In a 2015 Guardian article, economists at the consultancy Deloitte sought to shed new light on the relationship between jobs and the rise of technology by trawling through Census data for England and Wales going back to 1871. Their conclusion is unremittingly cheerful: rather than destroying jobs, technology has been a "great job-creating machine".

Their findings, such as a four-fold rise in bar staff since the 1950s, indicates that technology and innovations have consistently led to increases in productivity. This results in increased overall wealth and spending power, creating new demand and new jobs.
Isn't that great? However, what does that mean for someone like a water treatment plant operative, whose role is potentially at threat from automated systems?

I joined the engineering profession as a mechanical engineering graduate in 2002, and one of my first tasks was to stand up a ladder at a sewage works in the freezing December cold, measuring the level of liquid in a pipe every 15 mins for the best part of six hours. The development of sensor technology, combined with a drastically reduced cost of supply, means I can now, in theory, sit in a cosy coffee shop, drinking a flat white (from coffee beans picked by automation) and carry out the same task. Simultaneously, I can access near real-time data from thousands of sensors on a water plant and use my engineering experience to determine how best to use and share that data. The technological advances in industry allow humans, with real-life experience, to make smarter decisions, while freeing up time to collaborate with peer groups and co-workers to develop the next technological advances.

Giant 'fatbergs' have made headlines in recent times and, for all the technology available today, the solution to these is for some lucky souls to manually dig out the congealed 'berg, in a pretty hazardous and unwelcoming environment.

AI and other technical solutions combined with social awareness could soon prevent these 'fatbergs' in the first place. This would allow water utility companies to deploy the sometimes-limited operational budgets elsewhere to optimise their systems, rather than committing much-needed funds to reactive maintenance.

The knowledge of the operational workers is still needed to help 'teach' the AI and to pass on the contextual experience they have gained over years of commitment. The same experience can then be better deployed elsewhere, eventually leading to the next technical innovation.

Context is key

One of the fundamental differences between humans and AI is the ability to understand context.

For many years, we have been able to access data from site control systems showing trends, informing us of patterns in operation allowing us to understand and act upon problems. It is relatively easy for an artificial system to come to the same conclusion, based on the same data.

However, could a robot come to the conclusions I regularly heard in my early career, like 'this is the wrong type of sludge' or 'Stuart knows the history of why that particular screen blocks'? The use of AI will allow the same decisions to be made, but faster and with less chance of error. It takes out the monotony of data interpretation.

We are all familiar with automated call centre conversations, some of them incredibly realistic. However, simply changing the nature of your response or giving an unexpected answer can make the system fail the Turing test – a machine's ability to exhibit intelligent behaviour equivalent to, or indistinguishable from, that of a human.

We will always live in communities, where people come together, share ideas and live their lives. The fundamentals of economics suggest that productivity needs to equal consumption. If a factory owner installs robots to make widgets significantly faster than a human, therefore making the human redundant, someone still ultimately needs to buy the widget. Factor this up millions of times and, if the whole population didn't have jobs, how could they buy anything? If they can't buy anything, where would be the driver to make 'more' widgets? This is a great example of why the general population will not be made redundant by technology.

In the engineering sector, 3D modelling of solutions is not new. But there is still some reluctance to fully embrace this approach, with some still preferring to look at and 'red pen' a printed 2D drawing. This still works, but the ability to view, comment and collaborate on an accurate and visually pleasing solution in a live environment is bringing drastic improvements in delivery efficiency.

Virtual reality and more recently augmented reality are now used extensively to immerse the user in an extraordinarily life-like but safe new world. This new technology hasn't taken away the role of the engineer, the CAD technician, or the site operative. It enhances the ability of the stakeholders to collaborate and to investigate potential issues that were perhaps not obvious from a 2D drawing or photo.

Some studies have shown that using VR and AR to simply imagine doing a certain activity activates the same parts of the brain as if that person were physically carrying out the role. This has amazing potential for all elements of life. The key to this change is that humans will still engage with each other – they will simply use automated information or visualisation to make smarter and more informed decisions.

Freeing minds

Previously, a professionally trained engineer would have had the unenviable task of trawling through thousands of lines of data in Excel looking for, and potentially missing, some key anomaly. Now, this can be done automatically, more accurately and more quickly. Engineers can now apply their expertise and experience where it matters, using their 'old grey matter' to think around a problem.

Multiple data analytic systems are now used extensively to do the mundane tasks that used to make engineers groan with despair. Engineers can now spend more time communicating with colleagues, armed with sensible conclusions, in a user-friendly format. This allows smarter investment choices, alternative approaches, less construction, lower fines for water companies, better customer engagement, improved network management, reduced asset maintenance costs – the list goes on.
Perhaps most importantly in my work, digital rehearsals mean that site activities can be meticulously planned to foresee the unexpected and ultimately improve health and safety, which sadly still blights the construction industry.

One good example of technology enhancing our lives is mobile phones. Originally designed to simply make a phone call, human inventiveness and intuition have led to millions of apps, each one with a business behind it and real people working on optimising the user experience. Now, I can almost fully work as a professional engineer from my phone – I can check email, submit expenses, mark up a live digital twin of a site, change set-points on a pumping station and even practice dismantling a valve. So a simple concept has led to a vast array of new capabilities and ideas.

There are multiple challenges facing the adoption of technology, including ethical decisions involving altering behaviours, DNA manipulation, cyber security etc. Currently, though, the single biggest threat to humanity is not the robot or technology taking jobs – it is climate change. Only by adopting and embracing new technology will we have any chance of countering it. Maybe this literal burning platform will give technological advances the digital catapult required.

Culture shift

In terms of employment, it is true that jobs will go, but this might include jobs we don't want humans to do anyway, and with technological advancements a wider range of jobs will arise. The rate at which new careers and services are emerging, creating new jobs and roles, appears at present to be rapidly increasing, not slowing.

In some sectors, including medicine, education and professional services, technology has raised productivity as well as allowing easier access to information.
Similarly, the accelerating pace of communication has revolutionised most knowledge-based industries. Obvious US examples include tech start-ups generating mind-bogglingly large businesses from ideas originally developed in universities or even garages. The UK's education and research prestige, combined with engineering expertise, needs to be drawn upon to bridge that link between idea and thriving business, generating a wider range of occupations.

UK water companies need to embrace the culture shift. With strong leadership at CEO and board level, and effective communication of the benefits of technology, we will not be left ploughing the fields.

Developments in technology and AI should be welcomed by leaders of industry in order for its benefits to be successfully utilised. We need to embrace advancements that can positively shape the future of the sector, advancements that are possible to accept without forcing us to compromise on social needs for human interaction.
Instead of 'the robots are coming', maybe the key message should be: 'come with us'.

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