

Machines on the march threaten almost half of modern jobs

September 23 2013, by Carl Frey & Michael Osborne



“Oh hi, Mike from accounts. I believe we have a 10.30 strategy briefing?”.

Credit: Honda News

Computers have been an important part of many industries for decades already and have replaced humans in many jobs. But a new wave of technological development means that even positions that we once saw as immune to computerisation are now under threat.

In 1930, as the Great Depression spread across the Atlantic, John Maynard Keynes famously predicted that the discovery of technological means would outrun the pace at which we can find new uses for labour, resulting in widespread technological unemployment. Keynes, however, was optimistic and predicted that this would only be a temporary phase. In the long-run, he argued, [technological progress](#) will solve mankind's "[economic problem](#)", that is our need to work, and release us from our traditional purpose of subsistence.

Commentators today are less optimistic. [How Technology Wrecks the Middle Class](#), a recent *New York Times* Column by David Autor and David Dorn, captures an observation made by several commentators: technology has turned on labour.

In the modern world of work, low income service jobs have expanded sharply at the expense of middle-income manufacturing and production jobs. There are many more [security guards](#) and pharmacy aides while the rate of growth has slowed in professions such as chemical plant operators and fabric patternmakers. Meanwhile, computers have increased the productivity of high income workers, such as professional managers, engineers and consultants. The result has been a polarised [labour market](#) with surging [wage inequality](#). [Research](#) has shown that this polarisation between "lousy" and "lovely" jobs is happening in Britain as well as the US, implying that there has been a hollowing-out of the middle class.

The threat of computerisation has historically been largely confined to routine manufacturing tasks involving explicit rule-based activities such as part construction and assembly. But a look at 700 occupation types in the US suggests that 47 per cent are at risk from a threat that once only loomed for a small proportion of workers.

The likelihood of a job being vulnerable to computerisation is based on the types of tasks workers perform and the engineering obstacles that

currently prevent machines from taking over the role.

These technological breakthroughs are, in large part, due to efforts to turn non-routine tasks into well-defined problems. The automation of these occupations is made possible by big data and advanced sensors, giving robots enhanced senses and dexterity, allowing them to perform a broader scope of non-routine manual tasks. For the first time, jobs in transportation and logistics are at risk. Take the autonomous driverless cars being developed by Google. They are the perfect example of a new way in which a human worker, such as a long-haul truck driver, could be replaced by a machine in the modern age.

Desk dwellers are no longer immune either. Algorithms for big data are now rapidly entering domains reliant upon pattern recognition and can readily substitute for labour in a wide range of non-routine cognitive tasks. Those working in fields such as administration could once feel comfortable that a computer would never be able to do their job but that will no longer be the case for many.

More surprisingly, the bulk of service occupations, from fast food counter attendants to medical transcriptionists, where the most job growth has occurred over the past decades, are also to be found in the high risk category. This reflects technological development too. The market for personal and household service robots is already growing by about 20% annually. As the comparative advantage of human labour in tasks involving mobility and dexterity will diminish over time, the pace of labour substitution in service occupations is likely to increase even further.

This first wave of computerisation in the big data era marks a turning point. Nineteenth century manufacturing technologies largely substituted for skilled labour in jobs, such as weaving and the production of tools, by simplifying the tasks involved. Next, the computer revolution of the

twentieth century caused a hollowing-out of middle-income jobs. The next generation of computers will mainly substitute low-income, low-skill workers over the next decades.

So, if a computer can drive as well as you, serve customers as well as you and track down information as well as you, just who is safe in their job these days?

Careers at low risk of computerisation are generally those that require knowledge of human heuristics and specialist occupations involving the development of novel ideas and artifacts. Most management, business, and finance occupations, which are intensive in generalist tasks requiring social intelligence, are still largely confined to the low-risk category. The same is true of most occupations in education and healthcare, as well as arts and media jobs.

Engineering and science occupations are also less susceptible to the phenomenon, largely due to the high degree of creative intelligence they require. It is, however, possible that computers will fully substitute for workers in these occupations over the long-run.

This means that as technology races ahead, low-skill workers will need to train in tasks that are less susceptible to computerisation – that is, tasks requiring creative and social intelligence. If you want to stop a computer taking your job, you'll have to hone your creative and social skills. Mercifully, it will be quite a while before the machines outpace us in that respect.

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Source: The Conversation

Citation: Machines on the march threaten almost half of modern jobs (2013, September 23)
retrieved 20 April 2024 from

<https://phys.org/news/2013-09-machines-threaten-modern-jobs.html>

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