Horizon Scanning Series

The Effective and Ethical Development of Artificial Intelligence: An Opportunity to Improve Our Wellbeing

Employment and the workforce

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THE EFFECTS OF ARTIFICIAL INTELLIGENCE ON EMPLOYMENT

Artificial Intelligence was originally defined in the 1950's as 'the science and engineering of making intelligent machines'(John McCarthy). More recent definitions focus on computational intelligence and rationality embedded in both machines and cyberspace. There has been much debate on the impact of automation and robots on employment, much of it forecasting massive job loss and disruption (Ford 2015, Turner 2018). Very recent developments in computational intelligence, involving deep learning, big data, cloud computing and platform-based systems, move us well beyond the impact of robots on routine manual and clerical employment. The contemporary prospect is that of a more radical impact of artificial intelligence (Eurofound 2018). This extends to occupations requiring more complex non-routine and cognitive tasks, including the professions (Susskind and Susskind 2015).

There is a long history of cultural anxiety and socio-political speculation about machines dominating human beings (Mokyr, Vickers and Diebarth 2015). Much of this has been speculative, rushing to develop new policy responses to technological change before the direction of change has been accurately discerned. Recent, empirically-focussed research has begun to provide an evidence-based approach to the impact of robotics and artificial intelligence on employment. Findings on employment in the USA by Frey and Osborne (2013, 2017), replicated by Haldane on the UK and Durrant-Whyte et al on Australia (CEDA 2015), suggest between 40 and 50 % of current jobs are vulnerable to replacement by new technology

The transformationist scenario is however dubious for a range of historical, methodological, and conceptual reasons. These are summarized in Borland and Coelli (2017), and Boyd and Holton (2017). They boil down to three inter-connected arguments.

The first major objection is historical. Technological innovation from the Industrial Revolution onwards has created new forms of employment as well as undermining others. To simply enumerate examples of likely job displacement is insufficient to establish a net decline in the amount of work available. Aggregate employment increased during past episodes of rapid technological change, as it has in the recent epoch of computer-based technologies (Borland and Coelli, 379). These technologies have undermined much routine manual and clerical employment, but have complemented and helped stimulate more complex cognitive, interpretive and abstract work. The demand for those performing abstract rather than routine work in Australia has grown steadily over the 50 years to 2016 (ibid 385).

The counter-argument is that machine-learning may undermine much of the more complex employment too, but that is as yet unproven. Supporters of this argument typically assume 'this-time-is-different'. This assumption, however, lacks plausibility. No empirical case has been made that the contemporary Fourth Industrial Revolution/Industry 4.0 (Schwab 2017) is a more profound and more radical transformation than previous technological changes associated with steam-power, and electricity. Part of the difference claimed for transformational technologies associated with robotics and artificial intelligence rests on dubious rhetorical assumptions that today's technologies generate exponential growth (Brynjolfsson and McAfee 2014). These are again not sustained by evidence of medium-term trends. Moore's Law where computing power doubles every 2 years no longer applies (Simonite 2016, Boyd and Holton 2017)

A second problem relevant here is that computer-technology impacts on tasks rather than occupations per se. Tasks, in a broad sense, involve both single repetitive as well as complex process-based series of inter-connected tasks. Machines are programmed to perform discrete tasks, and thus those that are easiest to codify are most likely to be the tasks automated. Where a *series of tasks* are involved, the occupation is far less likely to be automated as such. To take one example, precision medicine may be transformed by the application of machine-learning to genomics, clinical imaging, and radio-therapy (Mesko 2017). But this does not simply replace physicians, surgeons, medical scientists, and researchers, tasked with decisions involving interpretation, therapeutic intervention, and professional responsibility. Occupations may continue, even where a proportion of tasks previously associated with them are automated.

As with previous historical phases of technological innovation the balance of human and machine involvement in tasks evolves into new patterns. These are determined not by technology alone, but by a range of economic, social, cultural, and governance influences. Continuing use of human labour may occur where it is cheaper or more efficacious than machines and computer applications, where there are cultural objections to the automation of human services like child and elderly care, or where cyber surveillance and intrusion is resisted politically (Holton 2018). Research into evolving mixes of human-machine employment is at a relatively early stage, much of it based on intensive case-study. Two prominent examples are Mindell's (2015) work on robotics in extreme environments such as space or the sea-bed, and a study by Compagni et al (2015) on the take-up of surgical robotics in the Italian health system. These feature various evolving human-machine combinations rather than radical employment loss. This more qualitative research agenda is still at an early stage.

The task-focus discussed above helps identify a third set of problems with the methodology for calculating employment vulnerability utilised by Frey and Osborne. Their procedures inflate the scale of job vulnerability and loss of employment (this discussion draws heavily on Borland and Coelli). These assessments are made by subjective methods depending on matters such as the degree of routine or manual skill or level of social intelligence or creativity involved. This leads to some arbitrary identifications - with surveyors, tax and revenue agents, and marketing specialists - all predicted to be very vulnerable. Such occupations are nonetheless all growing in Australia. In addition, where an occupation is deemed highly vulnerable, all those employed in the sector are regarded as having jobs to be destroyed. The example given is that driverless vehicles will lead to the loss of all driving jobs. This procedure also clearly exaggerates employment vulnerability

In the light of these methodological problems, an alternative task-focussed methodology developed by Arntz, Gregory, and Zierahn (2017), is available. This yielded estimates of 6-12% job across a range of OECD countries. Borland and Coelli, (391-2), using the same methodology, found that around 9% of Australian workers are at high risk of job-loss due to innovation. These data suggest a significant but not overwhelmingly dramatic loss of employment, which, of course, still needs to be set against new job opportunities.

Correctives to estimates of the extensive scale of job loss are not however the only matter of debate. There is undoubtedly a danger of replacing the notion that 'this-time-is-different', with the complacent assumption 'everything is the same', a position associated with Gordon (2000, 2014) and Cowen (2011). These authors argue that the IT revolution has already occurred and has not yielded sufficient productivity gains to counter current economic headwinds (they list a number including; an ageing population, falling standards of education, rising inequality and high levels of consumer and government debt). They conclude that new technologies are having nowhere near as profound an impact on economic productivity as steam, electricity or the internal combustion engine (Boyd and Holton 2017).

One way of reconciling conflicts between transformationists and those who perceive continuity and stagnation is to distinguish between short-term and medium-term effects of artificial intelligence. This theme links discussion of impacts on aggregate employment, with the skills and incomes of those effected. In the first phase of change it was routine manual and cognitive work that was most under-threat. The proportion of jobs of this kind in the Australian economy has certainly fallen, though this may be due to factors like globalization as much as automation. In the medium-term future, if claims about new forms of machine learning are to be believed, it will be higher-skill employment that will be more threatened. A more thoroughgoing application of AI may finally generate hoped-for productivity growth by cheapening service tasks and rendering them more efficient in terms of cost/benefit. This argument is however highly speculative.

Meanwhile trends in employment continue to see a major shift into non-routine manual and cognitive work. A good deal of this is in the health care and social services sector. Martin Wolf (2018), following the analysis of Adair Turner (2018), suggests that a shift in employment from relatively high productivity and high-wage manufacturing to lower productivity lower paid human service work, may explain the current paradox of technological innovation and stagnant productivity.

A final linkage between artificial intelligence and employment trends involves the platform economy and the growth of precarious casual employment in the 'gig economy'. Digital platform technology may be defined as algorithmic structures in code inhabiting cyber-space (Kenney and Zysman 2016). Here users can interact and transact in diverse ways. Consumer goods platforms such as Ebay, Amazon and Alibaba bring together buyers and sellers. Other platforms such as Github, Job Rooster and Wannalo variously offer software tools in applications such as human resources. Meanwhile UpWork and Innocentives operate as virtual labour-exchanges. Platforms typically transform forms of employment that mediate between buyers and sellers. The key issue here is whether the trend is to undermine secure work and other employee benefits.

Kenney and Zysman, using mainly US evidence, argue that this may eventuate where the private governance structures of the platform economy escape public regulation. The picture, however is mixed. Those directly employed by platforms such as Google or Facebook generally retain traditional employment conditions. Those working in under-regulated areas such as taxi driving through the Uber platform, or those competing for episodic contracts to produce apps, are in a far less secure position. Flexible decentralized work is not however intrinsically problematic. Eurofound, argues that alternative forms of decentralized co-operative labour have emerged on the basis of open-source software.

A leading example is the 'makers movement' of 3D enthusiasts and artisan-hackers (Anderson 2012).

Artificial intelligence did not of course create the gig economy. So, while there are some examples of negative impacts on employment conditions, there are equally counter-examples of opportunity. Once again most current debate here is limited to a series of case-studies that present a complex rather than clear-cut picture.

Conclusion

There is a good deal of uncertainty in knowing quite how artificial intelligence, digitalization, and robotics are affecting future employment. But one conclusion is very clear. The argument that huge job losses are imminent, whether in Australia or elsewhere, is not sustained by the evidence. The rhetoric of economic transformation, disruption, and the Fourth Industrial Revolution have distorted and exaggerated the threat to employment. This means we should not be preparing for a world without work. Two alternative responses are justified. The first is to focus on those types of employment most vulnerable to change to help facilitate retraining and income support. The second is to focus on the design of regulatory arrangements that are well-informed and sufficiently agile to anticipate and respond to challenges in the restructuring of employment tasks.

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