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The impact of artificial intelligence on knowledge work: Implications for educating future graduates (0412)

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Abstract

This paper considers the impact of artificial intelligence (AI) on knowledge work, and what are the implications for how we educate future graduates. It presents an initial conceptualisation of the relationship between AI and knowledge work, which suggests that educators should focus on craft skills; creativity; collaborative skills and multi-disciplinarity; the ability to conceptualise and theorise at an abstract level; and the ability to read and react to context. The paper concludes by proposing a programme of ethnographic research to observe longitudinally how artificial intelligence is impacting the nature of knowledge work in the professions of Accountancy, Law and Medicine.

Paper

The success of the human species depends upon the ability to coordinate brain and hands, and in particular to develop tools and technologies which complement labour. It is inherent in the nature of machines to disrupt labour markets. Whereas the first industrial revolution sought to replicate manual labour, it is widely believed that we are entering a 'second machine age' in which intelligent machines will increasingly supplant cognitive labour (Brynjolfsson and McAfee, 2016). With digitisation comes the ability to codify cognitive processes, and to programme machines with 'artificial intelligence.'

The rise of AI presents both an opportunity and a threat. The UK government recently published plans to capitalise on AI and the 'data-driven' economy (HM Government, 2018). Clearly there are great opportunities for universities and graduates with the expertise to develop relevant technologies, particularly in the fields of machine learning, and data & behavioural analytics. However in this paper we are concerned with the impact that such technologies might have on cognitive labour or so-called 'knowledge work.' This is of particular interest to universities, as the rise of 'knowledge-intensive' organisations requires a well-qualified graduate-level workforce (Alvesson, 2004). It also comes at a time when some are questioning whether 'graduate work' really requires a degree-level qualification (Matthews, 2016).

In an influential paper Frey and Osborne (2017) examine how susceptible jobs are to computerisation, and predict that 47% of total US employment is at risk. In their analysis they use three criteria (discussed later) to identify professions which are more at risk than others. They found that accountancy has the highest risk of automation, whereas nursing and teaching are the least susceptible. While their paper may provide a broad characterisation of which professions might be most impacted by AI, we are still lacking insight into how professional work will change around the use of new technologies. The world still needs accountants, but how is the profession of accountancy changing, and what are the implications for the knowledge and skills required of accountants? In a recent report The Institute of Chartered Accountants in England and Wales (ICAEW, 2017) calls on the profession to embrace the opportunities for AI to enhance decision-making and fraud detection. Thus the question becomes not only how does AI replace accountancy tasks, but how does it change the work of the professional accountant? The distinction between the

threat of *automation* and the opportunity for *augmentation* is an important frame in this debate (Davenport and Kirby, 2015).

There is therefore a need for research to understand the changing world of work in the context of AI, in particular the cognitive processes and tasks associated with different professions and roles. This is necessary for understanding what labour can be replicated or augmented by AI, and how it affects the skills and expertise needed to be effective in knowledge work.

In order to conceptualise what AI is good for, there are some important distinctions to draw. First, there are two broad applications: AI which seeks to mimic or replicate human decision-making processes, and 'machine learning' where dynamic algorithms enable computers to constantly reframe the questions used to interrogate large data sets and thus mimic human learning. Second, the two key technologies reframing the world of work (AACSB, 2017) are a) 'recognition' (the ability to recognise voice commands, images and natural language); and b) 'logic-based reasoning' (understanding the relationship between cause and effect). AI is therefore good at tasks which are a) routine and repetitive (easily codifiable); b) need a high degree of accuracy and quality; and c) involve large quantities of data.

This implies that routinised tasks involving information processing (surveillance, sorting, retrieval) may be easily replaced by machines, whereas higher-level cognitive processes involved in problem-solving and decision-making (correlating, comparing, evaluating, concluding) may be augmented by machine learning. This is particularly the case in analysis of big data, where machines are able to identify trends that humans cannot, as shown in the speed of algorithms to diagnose illnesses quicker than a medical specialist (BBC iPlayer, 2015).

In considering the limitations of AI, it is important to remember that machines do not have practical consciousness – they cannot think or perceive their environment. The susceptibility of the task to either automation or augmentation reflects not only the ability of a programmer to codify the task and achieve economic returns, but also the value and differentiation of the underlying expertise. A useful theory of knowledge work (Davenport, 2005) identifies two key dimensions a) the extent to which roles are systematic, routinised, and over which the individual has little discretion vs. roles where the individual has a high degree of judgment and autonomy over how it should be performed; and b) the extent to which roles are carried out individually vs. those performed in collaborative relationships with other knowledge workers. Frenkel et al (1995) further characterise knowledge work as involving the predominant use of a) contextual knowledge and b) theoretical knowledge. This is often associated with a 'tacit' dimension to knowledge work, where the inherent skill of the expert is difficult to articulate or transfer (Sanzogni et al, 2017). Both Brynjolfsson and McAfee (2016) and Frey and Osborne (2017) differentiate human intelligence along three key dimensions: a) the level of creativity (entrepreneurship, scientific discovery, writing); b) the level of social skill (emotional intelligence, leadership, caring, identification with shared culture, morality and ethics); and c) the degree of physical dexterity and mobility required.

As for the implications for how we prepare our graduates, this brief analysis implies the importance of

- Craft skills
- Creativity
- Collaborative skills and multi-disciplinarity

- The ability to conceptualise and theorise at an abstract level
- The ability to read and react to context

In order to take the research forward we are planning longitudinal and observational studies of how knowledge processes are changing around the use of AI. Case-studies will focus on three professions likely to be impacted: Accountancy, Law and Medicine. We will report on progress at next year's conference.

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