

Horizon Scanning Series

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

Work Design

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AI and Work Design

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In this short statement, I advocate the importance of considering work design issues in the context of AI and other digital technologies¹.

Rationale for a work design perspective

The accelerated introduction of digital technologies in work including AI, and the associated potential for radical societal change, has had a vast amount of attention in the media. Most of the focus is on how many people, and which people, will lose their jobs as a result of this technological change. Certainly, this is an important issue going forward. Also crucial is understanding the new skills and capabilities that people might need to prepare themselves for the changing job opportunities.

However, these perspectives – the eradication of jobs and the associated need for people to reskill - are too simplistic. These ideas disregard the fact that it is tasks that are automated, rather than whole jobs (see McKinsey², 2017). Tasks exist within a broader job or role, alongside many other tasks that won't be automated. For example, in the case of automated radiology, someone or some system must order the x-ray; identify the right body part to x-ray; explain what the outcome is to the patient, family, or other doctors; invoice the insurance company; reschedule follow-up appointments; and so on.

The implication of the automation of tasks not jobs is that **it is essential to give more attention to how automated tasks fit within the wider work role, and indeed within the whole system**. Example questions include: how tasks might best be shared between humans and machines? What might be the consequences – including unintended ones - of different choices in this respect? How do human workers interact with the technology and shape it to achieve their goals? How can people and machines best co-ordinate their activities, or work as a team, to achieve the system goals? These questions about the effects of automation also need to be considered alongside the wider implications of digital technologies that are transforming business models, where and when people work, the costs of production, and many other aspects of work (Cascio & Motealegre, 2016).

A key perspective within which to view these questions is that of '**work design**', an area of research and practice concerned with "*the nature and organization of tasks, activities, responsibilities and relationships within a work role or job, or group of roles or jobs*" (Parker, 2014). Work design is concerned with physical, cognitive, biomechanical, and psychosocial aspects of tasks³. From a psychosocial work design perspective, positive aspects of work design include a job with: autonomy over work timing, methods, and decisions, a variety of tasks, the opportunity to make a difference/have an impact, job feedback, the chance for social contact and support, and a moderate or reasonable levels of job demands (e.g, work load, emotional demands, time pressure).

¹ It is relevant to note that I discuss new technologies in general, rather than purely AI, partly because there is relatively little research on AI specifically, and partly because the issues I raise apply to multiple types of technology. Indeed, many of the issues raised below are likely to be more acute with AI because, even more than other technologies, AI blurs the social and material and shifts control from humans to technology.

² <https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/where-machines-could-replace-humans-and-where-they-cant-yet>

³ <https://www.safeworkaustralia.gov.au/doc/handbook-principles-good-work-design>

A vast amount of evidence show that work with these characteristics is physically and mentally healthier, more motivating and engaging, and often more efficient and high performing (for a summary of this research, see Parker, 2014). The importance of work design, for example, is shown by its incorporation in health and safety guidance for employers (e.g., see Safework Australia); its inclusion in guidance for 'decent work' by international bodies (e.g., International Labor Organisation, 1999, 2015) and considerable interest in this topic from other such stakeholders (e.g., insurance companies facing rising workers' compensation costs due to mental ill health; governments wanting greater innovation; industries seeking to be competitive in a global world., etc).

Whilst there is a long history of work design research advocating the need to consider human and technological issues together (see, for example, the sociotechnical systems perspective reviewed by Clegg, 2000), scholars have called for renewed attention to how contemporary technologies affect, and are affected by, work design (e.g., Parker et al., 2017). At the same time, research about new technologies needs to give more consideration of work design. With respect to the latter point, it is common for technologies to be designed and implemented by technical professionals (e.g., engineers, software developers), with **little or no attention to how the technology will actually be used by humans**, or how it will fit within the broader work system. For example, there is often a focus on 'replacing humans' through technology, seeking to completely automate the work, with "left over" tasks being allocated to people. Such an approach can result in poor work designs, with dire consequences for employee health and well-being, as well as for outcomes like safety and productivity (Grote & Kochan, 2017). We need to move away from such a technocentric approach (Orlikowski, 2007), and acknowledge the inadequacy of the so-called "substitution myth" in which designers focus on substituting machines for human labour, with little attention to how work systems operate as a whole.

In a nutshell, we need to **better understand how to minimize the risks, and maximise the opportunities of, digital technologies through effective work design**. This means being willing to consider – not only changing humans to fit the new technologies, such as via skill development – but changing technologies and how they are designed, implemented, and managed to fit human workers and organisational systems.

Example issues and questions

The questions arising from a deeper consideration of the interface between technology and other aspects of the people and organisational systems, are immense. Examples follow of some of the (inter-related) questions:

Question 1: What is the effect of new digital technologies on the quality of work design, such as the level of employees' variety, skill use, and job autonomy?

Anecdotal examples of **positive effects of AI** on professional work abound (such as how chatbots can be used to remove uninteresting and routine work⁴). A survey of digital experts also identified as a key theme of new technologies the potential for greater worker autonomy because of the transfer of information and the possibility of using digital tools for worker participation (Schwarz Müller, et al., 2018). Research on older technologies likewise supports the idea that technology can improve work designs, such as studies showing that electronic monitoring systems can enable people to monitor and improve their own productivity (Osman, 2010), and that technology enhances job autonomy because greater information availability decentralizes power and supports localized decision making (Davenport & Short, 1990; Leonard, 2007).

Crucially, however, there can also be **negative consequences** for work design, which flow through to affect the health, well-being, and performance of workers. For example:

- New technologies can result in reduced autonomy, changes in work meaning, and deskilling. As an example, Eriksson-Zetterquist et al., (2009) described an example of how new global purchasing

⁴ <https://www.forbes.com/sites/jeannemeister/2018/01/11/ai-plus-human-intelligence-is-the-future-of-work/#4e27ae392bba>

technology radically altered the professional roles of purchasers in a major automotive company in Scandinavia, from roles in which purchasers had a high level of responsibility, autonomy, social contact, and a strong professional identity to roles in which purchasers mainly followed standard operating procedures with reduced need for skills, yet also increased bureaucracy and workload.

- The way technology is designed and used can result in the erosion of skills amongst workers, with consequences for outcomes such as safety. A classic example is that pilots can “forget how to fly” as a result of excess use of autopilot, which can cause accidents, which has resulted in the US Federal Aviation Administration making various recommendations to ensure pilots manually fly the plane a certain proportion of each flight (see FAA Report, 2016).
- New systems such as electronic health records can have unintended side effects because users stop thinking and start clicking⁵.
- Electronic monitoring systems can result in excess surveillance, invasion of privacy and reduced job autonomy. As a consequence, employees experience high levels of stress, and sometimes fail to comply with organizational rules or engage in deviant behaviors (Alge & Hansen, 2014).
- In theory, allocating tasks to robots/ machines should leave operators free to do other tasks. However, the way that jobs are designed can result in a number of problems, such as decreased situation awareness; distrust of automation; misuse, abuse or disuse of the machines; complacency; reduced vigilance; and impaired performance (Redden et al., 2014; Grote & Kochan, 2018).
- There are many further examples of how technologies can negatively affect work, workers, and outcomes of work (e.g., safety, performance, productivity). Currently, rigorous evaluations tend to focus on older technologies, whereas the effects of contemporary technologies tend to be mostly based on anecdotal evidence.

Question 2: What factors influence the effect of new technologies on work design and outcomes? Or, put differently, how can negative consequences (such as deskilling, “automation bias”, etc.) be reduced, and positive consequences be enhanced?

The evidence of mixed effects of technologies on work design and hence outcomes (Question 1) raises the question as to what factors shape the implications of technology.

In fact, there are a broad array of factors affecting the design of work, from national institutional regimes, employment policies, organization’s culture, local leadership, and more (Parker, van den Broeck, & Holman, 2017). These factors can also shape the impact of technology on work design. In the specific area of computer-based monitoring, for example, Alge & Hansen’s (2014) review showed that the effects of electronic monitoring systems tend to be negative, resulting in reduced job autonomy, greater demands, and higher stress. But, when the organizational culture is a highly supportive one, employees are more likely to be involved in the design of the monitoring system, the systems tend to focus on groups not individuals, and the focus is on fostering employee development rather than control, with the result that employees see the system as fairer and less stressful. Other factors – such as how the data is collected and the accuracy of the data – also shape how employees perceive and react to monitoring systems (Alge et al., 2010).

A further set of factors relate to the design of the technology itself. Human-centred design approaches (which have to some extent always been sidelined in the design of technology) remain crucial for the design and application of AI. There is emerging research on the design of human-centred robots, for example (Sosa et al., 2018).

Question 3: What tasks and decisions should be carried out by AI/ machines and which should not?

It is clear that technology can assist workers in performing their tasks and in making decisions, but when would allocating tasks to machines not be appropriate? For example, big data analysis can be used to

⁵ <https://www.theguardian.com/society/2015/nov/29/five-ways-work-will-change-future-of-workplace-ai-cloud-retirement-remote>

simplify personnel selection, but it is not likely to be a good substitute for leadership functions such as inspiring employees, nor some of the other highly complex and cognitively demanding tasks in managerial jobs (Cascio & Montealegre, 2016).

Likewise, discussions have emerged around when algorithms should replace human judgement, and when they should not. For example, in the discussion of the use of algorithms in financial decision-making, Bhide (2010) argued that “predictions of human activity based on statistical patterns are dangerous when used as a substitute for careful case-by-case judgment”. Bhide described how on-the-ground financial decisions are replaced by the “robotization of credit”, which can result in poor decisions (see also Allam and Kendal, 2017, who discussed the multiple risks of excessive reliance on AI).

Generally, research is lacking on this topic. Studies are urgently needed in which the effects of various allocation decisions on workers, the work system, and outcomes are systematically evaluated, including over longer periods of time.

Question 4: How do workers adapt and shape AI technologies, and what needs to be in place to ensure optimum use of new technologies? How can machines and humans work as a team?

It is well known that workers shape how technology is used, and that technology is often not actually employed in the ways that designers anticipate. One reason for this is that workers often do not trust the technology and hence do not use it effectively. If workers are to interact effectively with robots, for instance, they need to trust the robots, communicate effectively with them, and co-ordinate their actions with them. Emerging research shows that the level of trust in AI is affected by factors such as the transparency of algorithms (Dietvorst et al., 2016), having positive experiences with AI (Alan et al., 2014), and the responsiveness of the technology to humans (Bickmore et al., 2011). The degree to which workers have control over the technology can also shape their interactions with it.

More generally, attention needs to be given to how workers and machines co-ordinate their activities and work holistically as a team (Redden et al., 2014).

Recommendations

1. **Research.** There is an urgent need for more research on the above questions (Barley, 2015; Cascio & Montealegre, 2016; Parker et al., 2017). Although earlier applications of technology have been rigorously investigated, it is crucial to identify the unique effects on work and workers of contemporary and emerging technologies. This research will often require collaboration across multiple disciplines such as organisational psychology, human factors, engineering, IT/IS, sociology, industrial relations, medicine, and economics.
2. **Guidance and training.** Organisations need guidance as to how to make decisions about work roles, what is good work design, and what considerations should be made when introducing new technologies. Those people who make decisions about work design (which can be managers, but also human resource personnel, consultants, IT staff, etc) need education and training about “people” and work design aspects, such as sociotechnical systems theory approaches to the design of work systems.
3. **Policies that support human-centred approaches to design and implementation of technology.** Technological applications need to be designed with the human in mind. The design and implementation of work systems must be addressed as a socio-technical problem, requiring the joint design of the social (human) and technical systems with detailed attention to their interdependencies. Policies are needed to support such approaches.
4. **Broader considerations.** The work design issues arising from AI and other technologies need to be set in the context of wider changes occurring in work, including threats to “decent work” from precarious employment, an ageing workforce, new business models, changes in employment protections for workers, and more. Research, practice, and policies regarding AI need to take into account these broader developments in work.

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