

Evolution or revolution for human factors?

Occupational safety and health & digitalisation

Digitalisation is a major driver of the changes in the current world of work. Work systems without digital technologies are hard to imagine nowadays. The key question the human factors discipline are facing, is to what extent the digital transformation influences working conditions and requirements. Furthermore, the consequences for a human-centred design are considered. The question that arises repeatedly is to what extent the emerging challenges are new in a disruptive or rather evolutionary way and how existing knowledge is useful or can at least be transferred.

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Technologies driving the digitalisation of work systems

The technological developments are leading to changes in almost all tasks in all occupational segments and on all company levels, and are accompanied by new design requirements (BMAS, 2017). Despite the rapid and expected fundamental changes, there is a consensus in the scientific discourse that people will continue to take a central stage in the world of work (Matuschek et al., 2018; Hirsch-Kreinsen, 2018). This world has always been in a state of flux, and some current reports drawing threat scenarios for the future of work are very similar to corresponding headlines on automation in past decades. What is probably new, however, is the speed at which the changes emerge and the impact on design of work (Rothe et al., 2019).

The choice of a specific technology also influences all work activities as well as the resulting demands. Therefore, in order to identify chances and risks, it is firstly necessary to consider the specific technologies. New generations of software programs can automatically put data into meaningful contexts while the external appearance can vary greatly. The underlying system determines the interaction with, for example, a robot or mobile device. Thus, in consideration of a distinction between evolutionary or revolutionary aspects of digitalisation, a differentiation between the hardware or front-end visible to the user and the invisible back-end, i.e. the software, is contributory. Modern mobile information and communications technology (ICT) and interactive robotic systems are essential front-end innovations to be considered. On the software-related side, big data, network connections anywhere in nearly real-time and self-



learning algorithms are the main innovations. This distinction is not only important for a classification in more revolutionary or evolutionary technologies, it also helps to decide to which extent scientific knowledge concerning occupational safety and health (OSH) might already exist and how it can be used or transferred accordingly.

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When looking at the front-end of technologies, existing selection processes along input, output and interaction with the technology like those found in the ISO standard 9241 parts 300ff (displays), 400ff (input hardware), and 900ff (human-machine-interaction) might be helpful discriminating technologies due to their disruptive potential. The development of front-ends is relatively slowly and evolutionary. The first light-weight robot was presented in 2012. To this day, this collaborative technology is still mostly implemented in pilot areas and spreads slowly. In the same year, a smart glass was introduced widely to the consumer market. Again, to this day, this technology is

still spreading slowly. In addition, due to currently missing uniform functional standards, the inclusion of current scientific findings is limited. Nevertheless, front-end technologies have also had disruptive aspects, for example when thinking of the first smartphone and its spread in society and the world of work.

A more disruptive development can be seen in the innovative back-end technologies (Robelski & Wischniewski, 2018). The extensive collection and real-time analytics of data has a major impact on working conditions and has not been possible before. Network connections provide new chances and risks for working anywhere and anytime and self-learning algorithms have emerged and pose new questions for the human factors discipline. These might be disruptive developments for the world of work. Again, a look towards existing concepts like the dialogue principles also written down in the ISO standard 9241 part 110 (2006) can be helpful: “suitability for the task (the dialogue should be suitable for the user’s task and skill level); self-descriptiveness (the dialogue should make it clear what the user should do next); controllability (the user should be able to control the pace and sequence of the interaction); conformity with user expectations (it should be consistent); error tolerance (the dialogue should be forgiving); suitability for individualisation (the dialogue should be able to be customised to suit the user); and suitability for learning (the dialogue should support learning)”. The dialogue principles show that there is a lot of knowledge which might just need a shift in importance of specific principles such as self-descriptiveness and conformity with user expectations (Do I understand what the algorithm is doing and what kind of data is collected?) and controllability (Am I still in charge?). In addition, this is not only the case when designing dialogues but also when allocating functions in a work system or considering decision latitude. So, there might be disruptive developments but there is also plenty of human factors knowledge ready to be applied or at least transferred.

Conclusion

The scientific discourse can be characterized by rapid, ever-new developments of technological possibilities and their use at work. The attempt to predict the future of work based on the resulting unpredictable dynamics is inevitably flawed. In order to make working in a digitalised world of work human-centred, the human factor discipline must look at its great amount of research results from the past. Comprehensive scientific findings on human-centred design are available. At the same time, values and attitudes towards work organisation and design are subject to change. It has to be identified which characteristics of a human-centred design are gaining importance in an

increasingly digitalised world of work. Existing findings and standards as, for example, the dialogue principles for the interaction with interactive systems must be re-examined regarding their applicability to the new challenges in a digitalised world of work. This constitutes the basis in order to face evolutionary and revolutionary technological developments.

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