How does technological progress affect workers' health? **Melanie Arntz, Sebastian Findeisen, Stephan Maurer** and **Oliver Schlenker** explore the effects of digitalisation and find evidence of worsening health among manual workers, due to the stress of performing increasingly complex tasks.

# The unequal health effects of smart tech in the workplace

Technological progress comes with profound transformations in the workplace. It can affect wages (Autor and Dorn, 2013), increase economic inequality (Acemoglu and Restrepo, 2022), displace workers (Graetz and Michaels, 2018), change the types of jobs that workers do (Bárány and Siegel, 2020) and shift the tasks that they perform within a given occupation (Spitz Oener, 2006). While these effects have been well-documented, the role of technology in shaping workers' health has received less attention.

Technological progress can affect workers' health in different ways. Automation through the introduction of industrial robots decreases the repetitiveness of tasks and injury rates (Gihleb et al, 2022). But more recent advances in digital production technology, such as the interconnection of industrial equipment using cloud platforms known as the Internet of Things (IoT), risk creating "technostress". This is a phenomenon that Tarafdar and co-authors (2015) define as a "situation of stress experienced by the individual because of an inability to adapt to the introduction of new technology in a healthy manner". The increasing digital complexity of the workplace due to modern technologies has the potential to overstrain workers and, through that, affect their health, particularly for individuals with less experience of complex tasks.

## Cutting-edge technologies

In recent research, we study the health effects of digitalisation with a unique, novel dataset from Germany. The Digital Transformation of Work dataset combines administrative information about firms and employees from social security records with firm and employee surveys that collect detailed information about the adoption of digital production technologies both at the firm and worker level.

Workers affected by new digital technologies find their jobs less repetitive but more intense

Employees were surveyed in 2019 and asked about their work environment in the present as well as in 2011. Crucially for our purposes, respondents were asked about their self-assessed health status in both years and for the number of days spent on sick leave in the year before the interview in 2019.

The richness of the survey allows us to create worker-level measures of technology adoption. It further makes it possible to differentiate between two different waves of technological progress: computerisation, that is, the increasing use of already mature computer-based tools; and digitalisation, which refers to the increasing use of "smart", intelligently connected means of production (sometimes also referred to as 4.0 technologies).

Workers who report an increased digitalisation of their workplace also report increased use of cutting-edge technologies such as virtual augmented reality, big data, artificial intelligence, and the Internet of Things and Services.

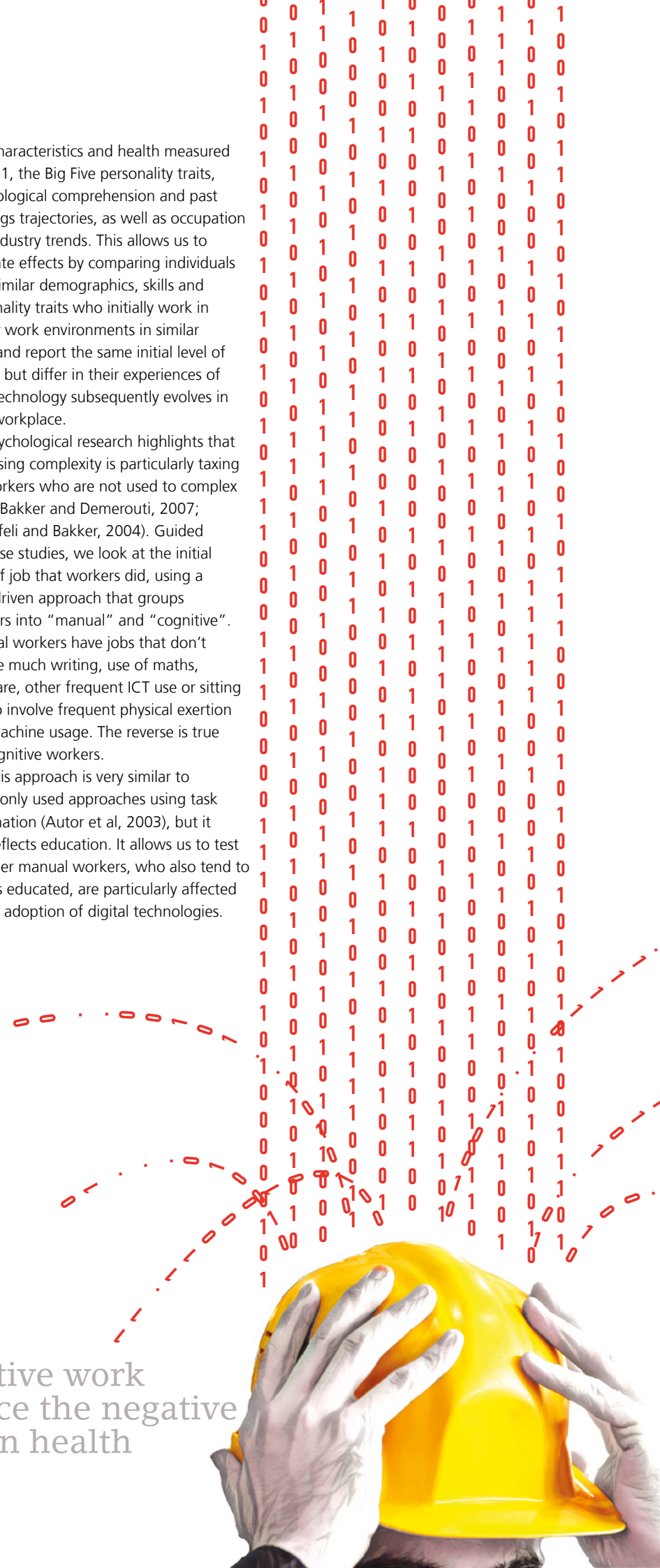
## Increasing intensity

New tools bring about important changes in workers' tasks. Workers affected by digitalisation report more customer contact and an increasing use of complex mathematics. They find their jobs less repetitive but more "intense" overall in the sense of facing more deadlines or performance pressure. In this, digitalisation differs from traditional, mature computerisation, which does not affect work intensity and complexity, and is mostly associated with increased use of basic and specialised software.

To estimate the effects of digitalisation on health, we relate a worker's change in their subjective health assessment to digitalisation in their own workplace. The richness of the underlying survey makes it possible to control for initial job and firm characteristics and health measured in 2011, the Big Five personality traits, technological comprehension and past earnings trajectories, as well as occupation and industry trends. This allows us to estimate effects by comparing individuals with similar demographics, skills and personality traits who initially work in similar work environments in similar firms and report the same initial level of health but differ in their experiences of how technology subsequently evolves in their workplace.

Psychological research highlights that increasing complexity is particularly taxing for workers who are not used to complex tasks (Bakker and Demerouti, 2007; Schaufeli and Bakker, 2004). Guided by these studies, we look at the initial type of job that workers did, using a data-driven approach that groups workers into "manual" and "cognitive". Manual workers have jobs that don't involve much writing, use of maths, software, other frequent ICT use or sitting but do involve frequent physical exertion and machine usage. The reverse is true for cognitive workers.

This approach is very similar to commonly used approaches using task information (Autor et al, 2003), but it also reflects education. It allows us to test whether manual workers, who also tend to be less educated, are particularly affected by the adoption of digital technologies.



Training and a supportive work environment can reduce the negative effects of technology on health

# Manual workers exposed to a more rapidly digitalising workplace report a higher number of sick days

## Digital tools widen health gaps

What do we find? Overall, digitalisation has no effect on workers' health, both for changes in self-assessed health and the number of sick days in 2018/19. But the effects on the two groups of workers are very different. While cognitive workers seem unaffected in terms of health, manual workers exposed to a more rapidly digitalising workplace report lower subjective health and a higher number of sick days.

These results remain unchanged when accounting for broad industry or occupation trends and for the organisational structure of the firm. This indicates that it is not larger trends, but the changes at the individual workplace that are driving the effects we find.

Do manual workers get "compensated" for their worsened health through higher earnings or better employment prospects? The analysis of administrative social security records indicates that this is not the case, leading us to conclude that digitalisation exacerbates existing inequalities across groups of workers. Better-educated people tend to have better health outcomes than those with lower levels of education (Meara et al, 2008). Our research finds that by widening the health gap across education groups, digitalisation adds another dimension of inequality to the well-documented widening of income inequality caused by automation technologies.

Nevertheless, our results also provide cause for some optimism: we find that the negative effects of technology on health can be attenuated when the firm provides technology training and a supportive work environment.

This article summarises 'Are We Yet Sick of New Technologies? The Unequal Health Effects of Digitalisation' by Melanie Arntz, Sebastian Findeisen, Stephan Maurer and Oliver Schlenker, CEP Discussion Paper No. 1984 (https://cep.lse.ac.uk/pubs/download/dp1984.pdf). A version of it first appeared as 'The Increasing Complexity of Digitalisation May Hurt Manual Workers' Health' on *LSE Business Review* (https://blogs.lse.ac.uk/businessreview/2024/04/26/the-increasing-complexity-of-digitalisation-may-hurt-manual-workers-health/).

**Melanie Arntz** is Leibniz Professor of Labour Economics at Heidelberg University and deputy head of the Labour Markets and Social Insurance research unit at ZEW Mannheim. **Sebastian Findeisen** is professor of economics at the University of Konstanz. **Stephan Maurer** is an assistant professor in economics at the University of Edinburgh and a research associate in CEP's labour markets programme. **Oliver Schlenker** is a doctoral researcher at the University of Konstanz and at ZEW Mannheim.

## Further reading

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