

CHANGING WORKPLACE

Digitalization and cognitive ergonomics

Digitalization, automation and Industry 4.0 are impacting intralogistics. The digital transformation underway in numerous businesses is subjecting employees to huge changes. The relatively young discipline of cognitive ergonomics is studying the impact.

by Herbert Lechner



The various changes in purchasing behavior and customer expectations that are being driven by digitalization are directly reflected in intralogistics processes. Examples are smaller lot size, a larger number of format changes, shorter product cycles and tougher requirements regarding delivery speed and flexibility. At the same time, robots, wearables and radio-frequency identification (RFID) tags are establishing themselves in storage, picking and shipping operations. All these developments are altering the workloads of employees. As a result, their tasks are becoming more complex and subject to greater time pressure.

Ergonomics is the process of designing or structuring workplaces, products and sys-

tems so they fit the people using them. It aims to reduce strain and improve performance. Environmental factors that can contribute to workplace stress range from adverse climatic conditions, poor lighting, dirt and noise to smoke, dust and even the use of protective clothing. Another factor is physical exertion such as having to stand while working, lifting, carrying heavy loads or using one's hands extensively.

As the use of digital systems increases, more attention is being paid to psychological stress. Veronika Kretschmer, a psychologist at the Fraunhofer Institute for Material Flow and Logistics (Fraunhofer IML), specializes in cognitive ergonomics. She argues that people

working in warehouses are subject not only to physical, but also to psychological strain, such as meeting deadlines, dealing with disturbances and interruptions, multitasking and coping with monotonous processes.

The different types of stress caused by digital transformation are the focus of the Dortmund-based Performance Center of Logistics and IT, an initiative of Fraunhofer IML in collaboration with other research institutes. The interdisciplinary group is investigating to what extent digitalization facilitates or impedes one's work performance.

Manual systems still important

The flow of information in the cost-inten-



Above: Demonstrating augmented reality in intralogistics at a trade show

Below: Conventional bar code scanning in the packaging line





Group of surgeons using augmented reality holographic hololens glasses

Worker in warehouse with bar code scanner

Virtual reality technology in Industry 4.0



sive and time-consuming area of picking has risen substantially in recent years due to the increased use of electronic aids such as handheld scanners and pick-by-light, pick-by-voice and pick-by-vision methods. Yet, despite rising automation, manual systems continue to play a major role during picking because they are far more flexible. According to current estimates, around 80 percent of picking processes are performed manually.

In addition to being cost- and human resource-intensive, picking can also affect a company's reputation, because customers are quick to notice faults in a system. If the focus up to now has primarily been on cost efficiency, it is increasingly becoming necessary to establish more ergonomic working environments and processes.

A growing number of "smart devices" can help. Among them are augmented reality (AR) systems, which link reality with displayed information. Compared to paper lists and tablet computers, AR glasses could someday prove to be a far more effective tool but their usability will need to be improved first. Kretschmer also points to other problems such as weight, costs and software diversity. But she sees potential use for the technology in training employees and helping them maintain systems.

Serious games and virtual worlds

Another area of research by Kretschmer and her team is the use of virtual reality (VR) techniques for training seminars in the form of "virtual serious games." VR-supported

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psychologist at the Fraunhofer Institute



simulations for instruction and training make it possible to provide a realistic picture of situations that are either too difficult or too costly to convey in real life. This game-based learning method can increase learning success, according to a study conducted by Kretschmer's team.

In these games, the logistics activities involved in a packaging process are realistically simulated. The results show a high level of

user-friendliness, a positively assessed user experience and moderate strain. "Bringing together serious games with virtual worlds gives rise to the new field of cognitive ergonomics research, to which we should pay increased attention in the future," Kretschmer says.

The main objective of cognitive ergonomics is to optimize the strain that people face when using Industry 4.0 ("smart factory") systems. Changing work processes will also

lead in the future to an increase in the psychological and cognitive demands in intralogistics. In addition to the well-known physical strain, Kretschmer recommends paying greater attention to psychosocial job characteristics and the conditions pertaining to work organization.



Cognitive ergonomics

Ergonomics aims to ensure people's health and optimize the overall interaction between man and machine. The subdiscipline of cognitive ergonomics addresses the performance and resilience of human information processing processes, such as perception, attentiveness, memory and decision-making, as well as motoric preparation and execution in interaction with technical systems. One aspect entails mental demands – in other words, mental overload or underload when dealing with technologies. In this context, usability deals with the extent to which, for example, employees can use digital-assistance systems. User experience makes it possible to evaluate attitudes, expectations, trust and well-being in interaction with digital aids.