

## **18. THE IMPACT OF EXTENDED REALITY TECHNOLOGIES ON THE USERS' WORKLOAD**

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The impact of extended reality technologies on the workload of users is examined in the paper. The analysis of the workload for performing activities, mediated by extended reality technologies and implementation of activities without any technologies is presented.

Extended reality (XR) technologies are among the most notable new developments in the field of information systems, processing and management. XR is a universal term inclusive to virtual reality (VR), augmented reality (AR) and mixed reality (MR). VR is a computer-generated world that can be accessed using immersive devices - helmets, gloves, headphones. The virtual environment completely replaces the real world without reacting to its changes, while the user can influence it by immersing, for example, in a video game. AR just adds layers to the real world. That is, people can still interact with the physical environment by getting additional information from their augmented reality devices or applications.

XR technologies exist to enable people to either do things they have not done before or do familiar things more efficiently. Also XR allows students to develop important practices, that is why it has become one of the key emerging technologies in education. Extended reality allows users to create new forms of immersive telepresence, but it can also make everyday tasks easier. Such technologies facilitate our work, education, healthcare, consumption and entertainment. However, at the same time, extended reality brings a lot of problems. As a result, the question arises whether XR technologies increase or decrease the workload of users. Some scientists have investigated this problem and have presented the results of their studies to the reader.

To begin with, it is worth considering the concept of the user's workload. In the field of information systems, a workload is defined as the overall ease of use of an information system within a given task [1]. In this paper, the workload is viewed as the effort or cost (e.g. physical, mental, emotional) that a person spends on completing a task. However, the workload is multidimensional and may depend on various factors.

In their study, scientists conducted an experiment in which they measured the workload of consumers using XR technologies. In this research the participants faced a shopping-related task (including navigating, movement, hand-interaction, information processing, information searching, storing, decision making, and simple calculation) to examine a proposed series of hypotheses. The results show that AR technologies substantially affect the overall workload of users, especially a mental workload. However, VR technologies do not have an essential impact on the workload of users. The results of the interaction effects analysis show that the combination of AR and VR compared to one technology will not increase the complexity of tasks (for example, the overall workload) and may even reduce the complexity (for example, physical activity).

It was revealed how XR affects specific workload parameters. It was found out that for AR, the level of mental need will be higher compared to a purely physical environment or virtual reality. It turned out that there would be no significant difference in mental workload between virtual reality and perceived current reality. The scientists have hypothesised that augmented reality has a positive effect on physical need [2].

Based on the assumption that XR can generate both higher mental and physical demands, it seems reasonable to assume that interacting with XR will also require more effort compared to performing a task in conditions other than XR. Moreover, interacting with virtual environments and objects in XR can be perceived as more stressful and frustrating. In accordance with the understanding of the aspects of effort and frustration, the scientists hypothesise that both AR and VR can lead to a higher perception of effort as well as disappointment [3]. According to workload theories, productivity can remain the same even if people have to put in more mental or physical effort. Some studies also show that XR can actually increase the user's performance.

In conclusion, it should be mentioned that with the development of information technology our daily activities are closely connected with technologically mediated environments. The results of a detailed analysis show that AR is largely associated with the overall workload, while VR does not have a significant impact on any of the workload parameters. These results imply that the resources and cost of operating XR-mediated realities are different and higher than physical reality.

#### References:

1. The challenges of entering the metaverse: An experiment on the effect of extended reality on workload [Electronic resource]. – Mode of access: <https://link.springer.com/article/10.1007/s10796-022-10244-x#notes>. – Date of access: 28.03.2023.
2. What is Extended Reality – XR Explained [Electronic resource]. – Mode of access: <https://sensoriumxr.com/articles/what-is-extended-reality>. – Date of access: 28.03.2023.
3. The impact of multisensory integration and perceptual load in virtual reality settings on performance, workload and presence [Electronic resource]. – Mode of access: <https://link.springer.com/content/pdf/10.1038/s41598-021-84196-8.pdf>. – Date of access: 28.03.2023.