# VR experiences as tools for building empathy and awareness towards universal design challenges

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Empathy has become a central component of design, manifesting itself loudly in frameworks such as universal design, inclusive design, and human-centred design. Designers and engineers are among the many stakeholders who require an expansion of their "emphatic horizon." The advancement of immersive technologies such as virtual or augmented reality may aid in the development of empathy. Extended Reality (XR) combines virtual reality and reality. As a result, XR technologies enable us to simulate a variety of physical states, health issues, and human body limitations. The work was carried out as part of an Erasmus+ project (Erasmus+ Strategic Partnership Higher Education Sector) aimed to increase competencies in universal design of future engineers, educators and designers by providing them with a set of practical educational tools based on extended reality to understand the different accessibility needs. This study created five independent XR scenarios that put potential users in the shoes of people with special needs. Elaborated tasks address vision impairments (Figure 1), autism spectrum disorder, mobility impairments, pregnancy status, and some elderly problems. All exercises take place in a well-known supermarket setting, as shopping is a common daily activity for most people.

The XR experience reflects the everyday problems of people with various disabilities and was developed using information gathered through interviews, questionnaires, and emphatic research. XR provides a high level of immersion in the situation, allowing the user to not only learn about potential accessibility issues but also experience them first-hand. In the developed XR scenario, participants move through a modern supermarket, making purchases based on a shopping list.

The VR application is designed for the Oculus Quest 2 platform and is supplemented in some cases with tangible equipment (geriatric suit, pregnancy belly simulator, wheelchair) (Figure 2). Experts validated the proposed simulations by evaluating the quality of the proposed tasks as well as the possibility of simulating selected limitations or issues in XR. The XR application's ongoing development and testing will provide more in-depth perspectives on its usefulness, acceptance, and impact in increasing empathy for the challenges faced by the personas portrayed.

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**FIGURE 1**
Simulated visual impairments in the virtual supermarket. A: Without visual impairments. B: Simulation of visual acuity deterioration. C: Simulation of tunnel vision. D: Simulation of colour perception disorders.

**FIGURE 2**
External equipment used in VR applications. On the left: pregnancy belly. On the right: geriatric suit.