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ORIGINAL PAPER

AGEING AND ITS CONSEQUENCES – THE USE OF VIRTUAL REALITY (VR) AS A TOOL TO VISUALIZE THE PROBLEMS OF ELDERLY

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Abstract

Background: The population ageing phenomenon is mainly attributable to the increasing proportion of people >60 years of age. This demographic situation requires more attention to the needs of the elderly. Given the lack of effective methods to expand the knowledge of and increase sensitivity to elderly people's problems, especially among the younger generation, an attempt has been made to use virtual reality (VR) to prepare an educational tool focused on these problems. This paper will focus on the use of VR in depicting fundamental problems in the daily live of older people. **Material and Methods:** For project purposes, a questionnaire (26 questions) was developed, concerning data on socio-demographic situation, health and physical conditions, social, living and housing support needs. Additionally, qualitative interviews were conducted with elderly people regarding their needs about housing arrangements and daily activities. It was distributed to 100 people, 34 completed questionnaires were obtained from 30 women and 4 men. The study results were intended as information that would provide the basis for developing VR scenarios, not for the epidemiological purposes. **Results:** The mean age of the respondents was 73.7 years (SD = 7.5 years) (60–86 years). Different situations, as heavy housework, lifting/carrying heavy objects, lifting hands above the shoulder level, bending and squatting were identified that pose problems for elderly people. Based on these results, 3 scenario proposals were prepared, including situations: in the bathroom, in the supermarket, on a trip to the city. These scenarios were used to prepare the exercises in VR in the frame of European project – the Mixed Reality on Universal Design's Secret Service (Mr. UD) project. **Conclusions:** The use of immersive technology such as VR can be beneficial for young people to be able to see perspectives of the elderly. Students from various fields (medicine, nursing, future engineers, designers, sociologists, etc.) may feel like the elderly and experience their daily challenges. Med Pr. 2023;74(3):159–70

Key words: ageing, physical activity, virtual reality, elderly people, old-age-simulating equipment, psychological problems of elderly

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INTRODUCTION

According to the definition in the PWN (Polish Scientific Publishers') Encyclopedia, ageing is a biological process involving progressive involutional changes in cells and organs associated with weakened regulatory functions of the nervous and endocrine systems, causing a decrease in basal metabolism, reduced muscle strength and nerve impulse conduction, as well as memory disorders, mainly including an impaired ability to memorize recent events [1]. A Wikipedia definition is similar, indicating that "Ageing is a reduced ability to respond to environmental stresses, which occurs in organisms over time, and a natural and irreversible accumulation of intracellular damage that exceeds the organism's ability to repair spontaneously" [2]. Ageing causes a loss of the body's internal balance, which increases the risk of disease. It leads to impaired cellular, tissue, organ and system functions, increasing susceptibility to diseases (e.g., cardiovascular and nervous system diseases, and cancer), and ultimately leading to death. The physiological process of normal ageing is determined by genetic factors and modified by co-morbidities, lifestyle and environmental events [2]. Kahn et al. also believe that biological ageing is associated with a reduced repair and regeneration potential of tissues and organs [3]. This is manifested by a reduced physiological reserve in responding to stress (homeostenosis) and by the disruption of complex molecular mechanisms

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progressing over time, which results in general physical or mental impairment [3]. In elderly people, even healthy ones, physical and mental abilities tend to decline. More specifically, their abilities to perform physical activities, especially those involving large muscle groups, deteriorate; sensory organ functions are impaired; information processing is slower, and the abilities to memorize things and concentrate are reduced, and so is divided attention. A meta-analysis based on 469 studies involving 54 000 people aged 30–70 years has revealed that the efficiency of individual systems declines with age at different rates. For instance, the efficiency of the nervous and musculoskeletal systems declines by 0.5% annually, and physical efficiency decreases by 1.6% annually [4]. In consequence, elderly people, even healthy ones, experience a decline in their physical capabilities and a deteriorated ability to tolerate physical effort. Muscle strength also decreases – in men aged 50–55 years, it is 22% lower, and in women of the same age, it is 26% lower, compared to their maximum. This mainly affects the large muscle groups (muscles of the spine and lower limbs) [5].

In consequence, the mobility of elderly people, defined as the ability to move freely in the environment, is weakened. This, in turn, is associated with a loss of independence and an increased risk of morbidity and mortality [6].

Sensory functions also deteriorate with age. The abilities of the eye to accommodate and adapt to darkness are reduced and so is the transparency of the lens; visual acuity decreases; increased light intensity is demanded; and hearing deteriorates. There is also a 25% reduction in speech comprehension above the age of 60 [7,8].

In addition to the physiological changes that are associated with ageing, the prevalence of chronic diseases increases with age, approx. 2/3 of people >50 years of age are diagnosed with at least one chronic disease, the most common being musculoskeletal diseases (osteoarthritis, lumbarspinalstenosis, osteoporosis, and rheumatoid arthritis) and cardiovascular diseases (hypertension, coronary heart disease or previous acute myocardial infarction, atrial fibrillation, postural hypotensive syncope) [9,10]. These conditions can lead to functional deterioration and even disability, and they may also cause falls (an incidence of 0.2–1.6 falls/person/year, with approx. 0.7 falls/year among people >65 years of age). The increased incidence of these conditions is observed among both men and women.

The population ageing phenomenon is, to a large extent, attributable to the increasing proportion of people >60 years of age. In Poland, this number reached 9.7 million in 2021, a 0.2% increase compared to 2020. The proportion of elderly people in the population has reached 25.7% and is expected to grow further. As projected by Statistics Poland, the population aged ≥60 in Poland will have grown to 10.8 million by 2030 and to 13.7 million by 2050. Elderly people will constitute approx. 40% of Poland's total population [11,12].

This trend is also observed globally. Between 2000 and 2050, the proportion of the world's population aged ≥60 will double, whereas the proportion of those aged ≥80 will almost quadruple [13].

This demographic situation poses new challenges for the economy (a growing proportion of post-working age people), healthcare, and inter-generational relations within society and in families. It also calls for a more thoughtful and old-age-oriented design of products, packaging, information technologies, means of transport, private spaces (housing), and public spaces. The younger generation's awareness of the problems encountered by elderly people in daily life also plays a vital role. To date, there has been little data on the possible ways of making a wider population of young and healthy people – including architects, designers of public spaces (shops, pharmacies, libraries, banks, etc.) and students – aware of the problems faced by the elderly, both in and out of home. An attempt to develop a program aimed at raising students' awareness of the health-related needs of elderly patients was undertaken by Davis et al. [14] as part of the Longitudinal Elder Initiative (LEI) project. During the project, students were matched with and took care of elderly people. This gave them a chance to gather hands-on experience of the needs and problems of elderly people, as well as the factors that influenced their well-being and welfare. Unfortunately, the scope of the project was limited.

Given the lack of effective methods to expand the knowledge of and increase sensitivity to elderly people's problems, an attempt has been made to use virtual reality (VR) to prepare an educational tool focused on these problems. This will make it possible for students, designers and decision-makers to see for themselves what difficulties elderly people encounter in both private and social spaces. They will be able to step into elderly people's shoes to experience different life situations.

Virtual reality refers to a computer-generated three-dimensional environment where users can experience and immerse into virtual surroundings. The environment is simulated through the use of interactive devices such as goggles, headsets, special controllers, gloves, or even suits. Technologies based on VR have gained great popularity over the past decade, mainly due to their key feature – the effect of immersion that is obtained thanks to visual,

auditory, and tactile feedback [15]. Users can experience an imaginary situation and perform actions that are out of their scope in reality. Therefore, there are many existing and potential VR applications in different sectors, including gaming and entertainment, education and training, industrial uses, healthcare, and wellness. What is more, VR immersive technology can be implemented as a tool to raise awareness of the challenges of people with disabilities and special needs [16–18], including the elderly. Such VR simulation refers to "an approach to modifying attitudes regarding people with disabilities and special needs, by placing people without disabilities in situations that are designed for them to experience what it is like to have a disability and special needs" [19–21]. This paper will focus on the use of VR in depicting fundamental problems in the daily life of older people.

MATERIAL AND METHODS

In order to gather information on the problems associated with elderly people's functioning in and out of home, a questionnaire was developed based on data from literature and previous research [22–25]. The questionnaire was also designed using a generally available questionnaire for seniors from the Rzeszów Functional Area and 1999 NSW Older People's Health Survey [26,27].

The questionnaire, once developed, was accompanied by information for the participants about the purpose of the survey. The survey was anonymous.

The study procedure was approved by the Commission on the Ethics of Scientific Research from the Lodz University of Technology (No. 2/2021).

The questionnaire included 26 questions concerning:

1) socio-demographic data: age, gender, education, marital status, occupational activity/old-age, pension/disability pension, place of residence (city, town, rural area), number of people in the household, housing, financial situation;
2) data on health and physical conditions;
3) data on social, living and housing support needs;
4) data on available/expected services.

This was not an epidemiological study. Its results were intended as information that would provide the basis for developing VR scenarios.

In addition, qualitative interviews were conducted with elderly people regarding their needs in terms of housing arrangements and daily activities. The questions concerned inconveniences of daily living and access to public places (pharmacies, outpatient clinics, banks, post offices, etc.). The respondents were asked whether they experienced problems – and if so, what kind – when using the toilet, washing, dressing, bathing, cooking, taking medications, cleaning, and shopping, whether they enjoyed walks, and whether they generally felt self-sufficient. Urban infrastructure facilitating or inhibiting access to certain places (institutions) by the elderly was also inspected and photographed.

RESULTS

The questionnaire was distributed to 100 people from different backgrounds, and 34 completed questionnaires were obtained from 30 women and 4 men. The mean age of the respondents was 73.7 years (SD = 7.5 years) (ranging 60–86 years). Due to the very low proportion of men, the results were analyzed and presented jointly for both groups.

The group was composed of widowed (47%), married (35%), divorced (12%) and single (6%) persons.

Most respondents had higher education (73%), 24% had secondary education and 3% – vocational education. All of them lived in a city.

The majority of the respondents (N = 27) were no longer occupationally active. Only 3 had full-time jobs, 3 had part-time jobs, and 1 respondent was looking for a job. A total of 24 respondents received old-age pension benefits, and 10 received disability pension benefits, including due to physical disability – 3, chronic internal diseases – 5, and partial loss of sight – 2. There were 3 respondents with a severe degree of disability and the rest had a moderate degree of disability.

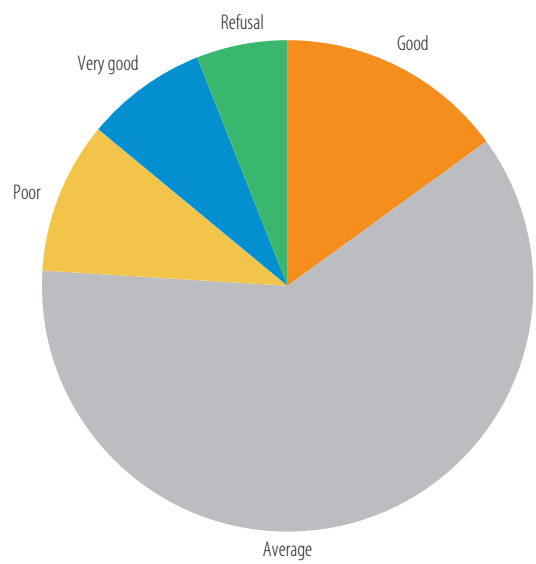

Figure 1. Health conditions of the examined people

Table 1. Problems with performing the following activities ("yes" answer to the questions "Do you have problems with…")

Activity	Respondents (N = 34)	
	n	%
Daily shopping	4	11.8
Handling finances (e.g., keeping track of expenses, paying bills)	4	11.8
Light housework (washing, dust removing)	4	11.8
Bathing	4	11.8
Moving around the room	2	5.9
Bending over	7	20.6
Crouching	13	38.2
Lifting weights of about 4.5 kg	10	29.4
Reaching or stretching your arms above the shoulders	7	20.6
Walking about 1.5 km	6	17.6
Writing or holding small items	4	11.8
Doing heavy housework	15	44.1
Dressing and undressing	4	11.8
Using the toilet	2	5.9
Getting out of the bed and moving to the armchair	3	8.8
Unassisted eating	2	5.9
Controlling physiological functions	4	11.8
Preparing food	2	5.9
DIY/needlework/washing	2	5.9
Preparing and taking medications	3	8.8

The majority (60%) of the respondents assessed their health as good. Detailed results are shown in Figure 1.

As many as 18 respondents lived alone, 14 lived in 2-person households (with their spouses), and 3 in 3-person households (with their spouses and children).

Few respondents reported that they encountered difficulties in performing basic activities. Detailed results are shown in Table 1. The most problematic activities were doing heavy housework (N = 15, 44%), squatting (N = 13, 38%), lifting/carrying a weight of about 4.5 kg (N = 10, 29%), bending (N = 7, 21%) and lifting arms above the shoulders (N = 7, 21%).

The survey questions also included psychological problems of elderly people. The detailed results are shown in Table 2. One-third of the respondents did not report any problems; 9 reported that they forgot names and surnames of people, or names of objects; 8 reported general memory problems (poor memory) and 6 complained about short-term memory problems (e.g., forgetting what they did a moment ago, where they put their glasses, or why they left their home); general weakness was reported by 13 respondents, a lack of enthusiasm for action by 6 respondents, and 5 respondents complained about feeling unwell.

Scenario proposals

Based on the survey results and interviews with elderly people, 3 scenario proposals of critical situations encountered by elderly people were prepared, including situations: 1) in the bathroom, 2) in the supermarket, 3) on a trip to the city.

The aim of these VR scenarios was to make the user aware of the problems that an elderly person must face in the bathroom, in the supermarket and in the city. The educational goals were to identify certain elements in these contexts that may prove troublesome for the elderly, and then propose appropriate solutions. The user had to choose the better ones.

Before starting the exercise, the student/user should put on an old-age-simulating equipment. This external

Table 2. Subjective symptoms experienced by the surveyed persons

Symptom	Respondents (N = 34)	
	n	%
Poor memory	8	23.5
Short-term memory problems (e.g., forgetting what you did a moment ago, where you left your glasses or why you left your home)	6	17.6
Forgetting names and surnames, or names of objects	9	26.5
Communication problems	1	2.9
Lack of enthusiasm for action	6	17.6
Weakness of the body/frailty	13	38.2
General reluctance	3	8.8
Malaise	5	14.7
Dependence on other people's assistance	2	5.9

Multiple-choice questions; more than 1 option could be selected.

simulator consists of several components such as a main suit, a cervical collar, knee wraps, elbow wraps, gloves, special weights on hands and legs, and noise-canceling headphones. Instead of simulation glasses imitating poor vision, VR glasses are used (such as VR Oculus Quest 2). Those external elements provide an effect similar to the impairments of the sensomotoric skills that are experienced in old age. There is a limited range of movements and some activities are more difficult to perform (Figure 2).

Scenario 1. In the bathroom

The aim of this VR scenario was to make the user aware of the problems that the elderly face in a bathroom which is not adapted to their needs. In a simulated situation an elderly person with mobility problems enters the bathroom. The bathroom is small, there is no classic shower cubicle, only a shower tray with a curtain. Person tries to enter the shower tray, but the threshold is quite high which makes it difficult, there is no handrails in the shower to hold. There is no shelf in the shower where he/she can put sponge, shower gel, shampoo etc. If the person puts the gel on the floor, he/she will have trouble reaching it. In a small space of the cabin it is difficult to turn, there is nothing to lean on or hold on to, there is no seat to wash the feet. Due to the fact that only the curtain limits the spilling of water, the entire floor in the bathroom is flooded, it is wet and slippery, and this may result in a fall. The problem arrives, how to safely leave the shower, reach for a towel, and move on a wet and slippery floor (Figure 3).

Figure 2. A GERT age-simulating suit used with the Mr. UD VR app

Figure 3. Shower tray – high threshold, no handles, no seat, no shelf for cosmetics

All these problems could be virtually recognized and tested and, on that basis, the user should find an appropriate solution.

Scenario 2. In the supermarket

The aim of this VR scenario was to make the user aware of the problems faced by the elderly when shopping in a supermarket. In a simulated situation, an elderly person (a student wearing old-age-simulating equipment) with poor eyesight (strong glasses), mobility problems (a cane) and hearing problems goes to the supermarket. Before shopping, the student should decide what kind of a bag they should take, if they should use the shopping bag or their own cart. All this depends on the shopping list. The student then gets a list of different products from which, for instance, 5 products are chosen at random. Depending on the choice made, the student picks up a shopping trolley or not. The shopping trolley may provide support for an elderly person, but it is heavy and difficult to maneuver.

While in the supermarket, elderly people encounter a number of difficulties (Figure 4). These relate to

a)

b)

Figure 4. In the supermarket: difficulty reaching: a) the bottom shelves, b) the top shelves

Figure 5. Problematic situations for elderly: a) no handrails, no shelf for placing a bag at the ATM, b) stairs with no handrails, no ramp, c) unpredictable obstacle – a scooters lying on the sidewalk

moving around the store, having to travel long distances, finding the right way in a crowded shop, reaching products from the lower, upper or deep shelves (especially heavy goods), or reading labels written in small print (impossible to read, especially for a person with poor eyesight). The elderly also had problems with understanding speech, e.g., the staff or accompanying persons in the store, especially in loud surroundings. An additional communication difficulty during the pandemic was connected with the need to wear masks.

Based on the experience during the VR test, the student/user could get acquainted with different problems, empathize with the situation of an elderly person and prepare proposals for solutions which may help to improve the quality of shopping by the elderly.

Scenario 3. On a trip to the city

An elderly person, with poor eyesight (strong glasses), with mobility problems (a cane) and with a shopping bag, goes to the town on various errands (a visit at the doctor's, pharmacy, bank, small purchases). The facilities are located on a street where there is no car traffic, so the distance must be covered on foot. Therefore, the following problems faced by elderly people have been identified: entrance to the bank, pharmacy, etc. via stairs without a handrail, unpredictable obstacles, e.g., a scooters lying on the sidewalk, long distances between the objects to be reached (Figure 5).

The proposed scenarios were used to prepare the exercises in VR in the frame of European project – the Mixed Reality on Universal Design's Secret Service (Mr. UD) project.

DISCUSSION

Based on the survey and interview results, certain situations were identified that pose most problems for elderly people. These include heavy housework, lifting/carrying heavy objects (e.g., shopping), lifting hands above the shoulder level (e.g., reaching high shelves), bending and squatting (e.g., when reaching low shelves).

These problems are due to the natural changes occurring in the body through ageing, as discussed in the Introduction. The results obtained in this survey are consistent with literature but there are only few publications on this topic. Chen et al. conducted an experimental study which found that the maximum allowable weight that women >50 years of age could lift was 24% lower compared to younger individuals <30 years of age. This is associated with decreased muscle strength (by 24%) and lower cardiac reserve (by 18%) [28].

Difficulties in raising one's arms above the shoulder level and reaching for objects, quite frequently reported in the survey, were also analyzed by Khanafer et al. [29]. These authors conducted a study on a group of 18 young people (age M±SD 24.28±2.89 years) and 18 elderly people (age M±SD 72.11±2.39 years), including various tasks requiring reaching for objects. The participants were asked to reach for an object with their dominant and non-dominant hands, with their eyes closed, simultaneously with trunk movement, at a preferred and fast pace. The authors found that the extent of elbow and shoulder movements was smaller and less consistent in the elderly participants compared to the younger ones, which may be due to impaired coordination of multi-joint movements during reaching.

Problems with bending over in elderly were reported by Harun et al. [30]. Based on the interview conducted in a group of 16 people (75% of whom were women) with a mean age of 76.0, the authors found that most respondents experienced problems while bending over. According to the authors, these problems could be associated with vestibular impairment.

Frailty is a problem increasingly affecting elderly people. According to Cesari et al. "Frailty is a clinical state characterized by a decrease of an individual's homeostatic reserves and is responsible for enhanced vulnerability to endogenous and/or exogenous stressors" [31].

Frailty appears to be one of the most serious threats to the health and well-being of elderly people. It has significant public health implications and should be of concern to healthcare providers. According to a meta-analysis performed by Veronese et. al. [32], based on 57 studies involving a total of 56 407 elderly people (58% of whom were women), with a mean age of 78.6, the overall prevalence of multidimensional frailty was 26.8% (95% CI: 22.1–31.5). The prevalence of pre-frailty was 36.4% (95% CI: 33.1–39.7). In this study, the risk of frailty was not assessed using the multidimensional prognostic index (MPI) but was based on the respondents' self-assessment, which might have resulted in a higher incidence reaching nearly 40%.

Wang et al. proved that frailty is connected with increasing age, lower weight, female sex, living alone, low levels of exercise, polypharmacy, higher education, smoking, drinking, malnutrition, and lower vitamin D levels [33].

In this study, memory problems were quite common in the surveyed group (N = 25, 73%). They can cause difficulties in daily life and, in consequence, contribute to an increased demand for healthcare. Previous research has shown that approx. 60% of primary care patients aged >74 reported memory impairments [34].

For the reasons discussed above, there is a growing interest in coping strategies for elderly people. A review of such strategies was conducted by Ross et al. [35]. It only included publications that discussed coping strategies for everyday difficulties using publicly available resources. Publications on the use of modern technologies (artificial intelligence, VR, robots) were excluded. External, internal and behavioral strategies were identified. External strategies are all kinds of notes, calendars, to-do lists, etc., while internal strategies refer to attempts at remembering things to be done, repeating them in one's memory and practicing concentration. Finally, behavioral strategies mean lowering one's expectations concerning daily life in order to avoid frustration. The review has found that most elderly people, whether reporting memory problems or not, used the external strategies. In contrast, those who expressly reported having such problems often used the behavioral strategies [35].

Unfortunately, elderly people's problems are often neglected by younger generations, including students, architects, designers of sanitary facilities and furnishings (including bathrooms), designers of packaging, surfaces and shop fittings, etc. This project was, therefore, aimed at creating a tool to sensitize these social groups to the problems that elderly people face and to target actions to adapt the environment to their needs [36].

As already mentioned in the introductory section, this is an innovative approach, as VR techniques have not been used for such educational processes to date. While there are some general guidelines on how to design objects for people with visual and hearing impairments or musculoskeletal limitations, these represent theoretical knowledge and cannot be practically verified.

Various efforts are currently being made both to increase young people's sensitivity to elderly people's problems and to prevent ageism [36]. Ageism can be a barrier to inter-generational solidarity and to creating elderly-friendly environments. It can also limit personal relationships between young adults and seniors. One of the concepts to address this issue is to create age-diverse groups of people who, through face-to-face contacts, can better understand each other. Unfortunately, such programs have many limitations and distractions, including anxiety, mutual fears of revealing one's feelings, embarrassment, etc., which can affect the results. It is probably due to these limitations that the positive impact of such inter-generational programs on ageism and negative stereotypes has not been clearly demonstrated [37]. It seems that the use of VR and universal design (UD) could bring a number of benefits.

The understanding of elderly people and their perspective is a demanding task. In some fields such as nursery or medicine in general, it seems to be more obvious and needed to be empathetic towards this group of people. In the case of designers and engineers, empathy is not taken into consideration, to a large extent, in their education. Nevertheless, the concept of universal

design and "design for all" is getting more and more popular in wider areas.

There are several ways to get the real insights about the elderly, including questionnaires, interviews, observations in their daily life and environment, and immersion. Immersion should be understood as a deep-level involvement of the researcher with the study object [38]. A good example of immersion is Patricia Moore's experiment from the early 1980s.

Patricia Moore, a pioneer in universal design and American industrial designer, conducted a long-term empathic experiment and discovered the reality of an 85-year-old woman. The researcher's aim was to experience the difficulties and challenges of people of older age. For 3 years, she disguised as an old woman. Every day she did make-up, wore old-fashioned clothes, and used bandages to limit her movements to simulate mobility problems of elderly people. The researcher wanted to see the different perspective of daily activities, such as shopping, walking, climbing the stars, commuting, grabbing kitchen utensils (can openers, peelers, handles, etc.). Her findings were a great breakthrough in the field of design and showed the power of immersion. Deep immersion may lead to a more empathic attitude and a better understanding of the point of view of the elderly [39].

Since it provides immersive experience by its definition, VR can be considered a tool to improve the awareness, sensitivity and empathy towards elderly people. Taking into consideration the experience gathered from the European Mr. UD project [40], VR may help in developing an important approach and highly desirable competences. Moreover, this technology is thought to be interesting and appealing to younger generations [41].

Currently, VR applications are mainly used in the context of the elderly as entertainment, learning tools, training or rehabilitation aids. According to Qian et al. [42] and Skurla et al. [43] VR-based exercises can have a positive impact on physiological, psychological and rehabilitative outcomes of an individuals. The VR technology supports learning process among both younger [44] and older learners [45]. Immersive exercises have great potential for training the cognition of elderly, mainly because of possibility of individual approach (adjustment to each person), elderly's feeling of autonomy, fun and motivation aspects.

In the case of VR used as a tool to raise awareness, there are still many possibilities that can be explored and expanded. To the best of the authors' knowledge, it is hard to find well-developed VR applications or complex studies on the use of VR in universal design, especially in the context of elderly people. However, there are many scientific confirmations that any form of "simulators" can improve the empathy and attitudes towards older persons. According to the results presented by Sari et al. [46] and Elena et al. [47] the use of the age simulation suit is an effective educational tool with a very positive contribution nursing students' empathy development. Students feel more confident and prepared in their ability to work with older patients [48–50]. Healthy young people may experience the possible state of being "old" during the wearing of special suit that influences gross motor, fine motor and cognitive performance of the user [51]. Simulation-based learning is common in medical sciences and proved the power of visualization and tangible elements in gaining new skills and competences [52,53].

A special VR app has been developed as part of the Mr. UD project (Erasmus+). One type of VR exercises concerns the elderly and their perspective. The users can put themselves in the shoes of an elderly person and experience their problems during ordinary activities such as shopping. The VR app is described in detail in the paper by Zwoliński et al. published in this issue [54]. Additionally, the immersion effect is supported by an age-simulating suit GERT presented in Figure 2, and described in the Results (scenario proposals). The combination of the immersive virtual environment and the supplementary simulator will provide a better understanding of an elderly person's behavior and their everyday problems.

CONCLUSIONS

Survey and interviews with elder people have shown that they generally do well in their daily activities, but certain situations pose particular problems. Young people do not notice such problems. The use of immersive technology such as VR can be beneficial for young people to be able to see different perspectives, including that of the elderly. Thanks to the VR app, students from various fields (medicine students, nursing students, future engineers, designers, sociologists, etc.) may feel like the elderly and experience their daily challenges. Their empathy and positive attitude towards elderly people with special needs will improve. Therefore, this progress may be of benefit to the broader society.

Author contributions
Research concept: Alicja Bortkiewicz
Research methodology: Alicja Bortkiewicz, Zbigniew Jóźwiak, Anna Laska-Leśniewicz
Collecting material: Zbigniew Jóźwiak
Statistical analysis: Zbigniew Jóźwiak
Interpretation of results: Alicja Bortkiewicz, Zbigniew Jóźwiak, Anna Laska-Leśniewicz
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