Virtual Reality and Its Use in Care Homes and Beyond

Věra Suchomelová, Renata Tetourová, Lenka Lhotská,
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Table of Contents

Introduction

The rapid technological development of the last decade has enabled the use of a relatively new technology – virtual reality – to flourish in many fields of human activity, including the social sphere. Virtual reality technology allows its user to experience the feeling of almost physical existence in an imaginary world or a world representing reality. For example, professionals providing help can use virtual reality to "see" the world through the eyes of a person with dementia, practice client care,[1] or "age" themselves.[2]

In recent years, many virtual reality applications aimed specifically at older adult users have been developed. The reasons are obvious. For the current but especially future older adults, digital or assistive technologies[3] are a normal part of life. The focus of development on the target group of older adults responds to the societal need to maintain the autonomy and quality of life of the oldest generation for as long as possible. The prices of technical solutions have fallen significantly over the last few years, making it easier to implement them in practice. Moreover, in the context of the isolation of older adults during the Covid-19 pandemic, the importance of these technologies in the lives of the oldest generation has increased exponentially, not only as a means of communication with family and friends but also as a source of entertainment and escape from what may be a monotonous reality. This trend can be expected to continue in the future.

Virtual reality can be used as a source of entertainment for so-called "active older adults", but its potential is particularly clear in the case of older adults with limited mobility, psychological and social deficits, or lack of stimuli in the natural environment. This was the basis for the development and execution of the Virtual Reality in Keeping the Elderly Active (VIREAS) project, the results of which include this conceptual manual.[4] The benefits of the use of virtual reality by older adult users stem from the key characteristics of this technology, which are immersiveness (the feature of the virtual reality environment that makes the user feel "immersed" in the action) and interactivity (the user and

1 VR Edie speaks Czech. Available from: https://www.austrade.gov.au/local-sites/czech-republic/news-and-events/australsk-vzd-l-vac-program-virtu-ln-realita-demence-vr-edie-v-r.

2 An app developed by researchers at Reichmann University in Herzliya, Israel, allows students to see and "experience" their hands as an old person's hands. One of the authors of the conceptual manual had the opportunity to become acquainted with the app during an internship in Israel.

3 Digital technologies are often referred to as assistive technologies, i.e., aids that help to improve the physical or mental functions of people who, for various reasons, have reduced functions.

4 Other results are the VR Experience Kit software and the technical articles listed in the final list of references.

the virtual environment interact). These characteristics allow a person to experience the feeling of almost physically being in an imaginary world or in places presenting reality. The virtual reality user feels at the center of the action (literally at the center of three-dimensional space) and, depending on the type of experience, has the option of actively influencing the action. Even an older adult in a wheelchair or bed can explore domestic and foreign cities, climb to the top of a mountain, or walk through a forest. Thus, the virtual reality experience can to some extent replace experiences unavailable in the real world of the older adult for various reasons.

What is the aim of the conceptual manual and for whom is it intended? The aim of the conceptual manual is to provide readers with the knowledge, skills, and attitudinal basis for the comprehensive use of virtual reality as a meaningful activity. Primarily, the conceptual manual is aimed at managers of geriatric facilities and activity workers who work with older adults, but home care workers can also draw from it. The procedures are suitable for use with older adults with mild cognitive impairment or (according to individual assessment by the activity worker) with a milder form of dementia.[5]

What benefits can be expected from the use of virtual reality in keeping residents in care facilities active? The effects of the method can be expected especially in the area of the general well-being of older adults. Provided that the correct procedure is followed during all phases of the virtual experience, which we address in detail in the method, virtual reality can bring benefits to the older adult user in the physical domain (thanks to the activity in virtual reality, the user moves naturally, exercising fine and gross motor skills) as well as the psychological (memory and other cognitive functions are exercised and the client's motivation to learn new things is enhanced), social (social contacts and belonging are promoted), and spiritual domains (specific needs related to the dignity and value of the person, life balance, and the meaning of life are fulfilled).

As this is a new method, it is not possible to quantify the potential financial effectiveness of using virtual reality in a residential facility for older adults. The total cost of including virtual reality in the program of activities of a given facility results primarily from the price of the specific application and the selected technical solution.[6] The financial intensity is further influenced by the marketing of the companies offering virtual

5 There is not yet enough valid data in the literature to sufficiently justify the suitability of virtual reality as an activation activity for older adults with moderate or severe dementia. Therefore, we generally do not recommend the use of virtual reality with such a specific target group in this conceptual manual.

6 In this conceptual manual, we work with a solution that includes a virtual reality kit and an additional computer. This allows the activity worker to see where the senior is in the virtual reality and to share, guide, or motivate them through the experience.

reality,[7] the requirements for possible further training of the activity staff,[8] or the option of using financial resources from subsidy programs.

What sources do we draw on in the conceptual manual? The main expert sources are the findings of three research studies that we conducted in retirement homes for older adults under the VIREAS project between 2019 and 2021. In the first study, we investigated the preferences of older adult users (what they would like to experience in virtual reality), in the second study we focused on the attractiveness of the experience, and in the third study we looked for what needs of older adults can be fulfilled through virtual reality. The development of specific virtual experiences for this target group and the creation of this conceptual manual were continuously consulted and commented on by the application guarantors of the VIREAS project, especially the activity workers and the heads of the social care department of the Dobrá Voda Retirement Home. The whole conceptual manual is thus the result of the collaboration of "technicians and non-technicians", academics, and those who work with the residents on a daily basis and prepare activities for them.

The recommendation to use virtual reality in keeping the residents active is based on the findings of numerous foreign and domestic studies that compare the effects of virtual reality stimulation with "traditional methods". Virtual reality appears to be a suitable tool for training cognitive and psychomotor functions. Senior citizens using virtual reality showed higher levels of motivation, enthusiasm, and satisfaction than the control group (Fernández, 2017; Eggenberger, 2015). The use of virtual reality appears to be an effective way to reduce social isolation (Lin et al., 2018; Khosavi et al., 2016), and as a tool to prevent mental disorders or to reduce negative emotional tuning or feelings of pain (Benham, 2019). Lin et al. (2018) focused their study directly on residents of a residential facility. Over the course of two weeks, a group of the residents was allowed to "travel and relax" in a virtual reality environment, while a control group of residents was presented with identical content via a television screen. The virtual reality users reported a reduction in feelings of social isolation and depression and experienced more positive emotions and a stronger sense of satisfaction compared to the control group. The use of virtual reality also appears to be beneficial in reminiscence. In studies by Saredakis and colleagues (2020, 2021), a positive effect was found especially in apathetic clients. The positive effect is undoubtedly influenced by the attractiveness of the virtual experience. In this sense, studies consistently report a preference for experiences related to travel,

7 The offer may include, for example, the possibility of renting or hiring virtual reality equipment, etc.

8 Training in the technical operation of virtual reality equipment should always be provided by the company offering the virtual reality. A continuing education course, focusing mainly on the effect of the method and the use of virtual reality in follow-up activities, will be offered in the second half of 2023 on the website of the Faculty of Theology of the University of South Bohemia.

natural scenery, or contact with other people (Roberts, 2019; Suchomelová & Diallo, 2019; Hodge, 2018; Benoit, 2015).

In considering the use of virtual reality by older adults, some risks cannot be overlooked, such as discomfort during prolonged stays in virtual environments, which may be associated with feelings of nausea or dizziness (Somrak, 2019), or difficulties with the way of controlling movement in virtual reality (Lee et al., 2019; Suchomelová, Lhotská, & Husák, 2021). With appropriate procedures, which are also addressed in this conceptual manual, these risks can be significantly eliminated.

Where are we heading in the conceptual manual? In the following chapters we try to answer the following questions:

- What is the life situation of the older adults who will use virtual reality and what are their needs?
- What are the technical aspects of virtual reality and the requirements for its use?
- How can older adults with a health limitation use virtual reality?
- What are the risks associated with the use of virtual reality and how to eliminate them?
- What factors determine whether the virtual experience will be rated as attractive?
- How to guide older adults through the virtual experience?
- What demands does this method place on activity workers?
- What needs of older adults can be met through the use of virtual reality?
- How to use the virtual experience in follow-up activities?
- What ethical principles are involved in the use of virtual reality?

The **first chapter** of the conceptual manual is devoted to the process of adaptation to life in a residential facility and the importance of leisure activities in this process. In the **second chapter,** we present the technical aspect of virtual reality, types of individual virtual experiences, and specifics of the use of virtual reality by older adults with sensory and motor difficulties. The **third chapter** focuses on the content and form of the virtual experience and the role of the activity worker before, during, and after the experience. **Chapter four** discusses the key needs that can be supported through the virtual experience and the areas of virtual reality that are essential for the meeting of these needs. The areas identified provide inspiration for the design of follow-up group or individual activities that will significantly extend the benefits of virtual reality in the "real" world of the older adult. In **chapter five,** we provide specific examples of the use of virtual experiences in memory training and reminiscence. Both chapters are accompanied by video demonstrations. **Chapter six** summarizes the ethical and competence tenets related to the use of virtual reality by residents of a residential facility. In the appendix of the conceptual manual, readers will find worksheets and recording sheets that facilitate the preparation and evaluation of the virtual experience.

1. Older Adults in Residential Care: Selected Specifics

The application of virtual reality in keeping residents active, like any kind of activity, requires a good knowledge of the target group, i.e., the life situations, specifics, and needs of the people for whom it is intended. Therefore, in the first chapter, we will discuss the specific stress situations that are associated with living in a residential facility and define the needs the meeting of which is crucial for a person of advanced age.[9] Keeping the residents active can contribute to coping with all phases of adaptation to life in a retirement home. Knowledge and acceptance of the key needs of older adults are essential to make the use of virtual reality meaningful to them.

1.1. Life in a Care Home

Moving to a care home can help a person live the final phase of life with dignity, satisfaction, and maximum autonomy, but on the other hand it can lead to isolation, reinforcement of negative attitudes, and resignation.

Life in a regular – albeit high-quality – residential facility confronts people with specific situations that require a cognitive-emotional reconstruction of their own identities. They have to adapt to a new environment and a new daily rhythm, and sometimes there is becoming accustomed to living with a roommate with whom they have nothing in common; they may feel, on the one hand, a lack of privacy and, on the other, "loneliness in a crowd". Often, they cannot fully pursue their interests, their autonomy is limited; they experience their own and their fellow resident's illnesses, and there may be contact with dying and death. Negative life changes are often associated with feelings of insecurity, sadness, inner emptiness, boredom, confusion, rejection, fear, uprooting, or futility.

The handling of stressful situations will differ in the case of a dominant active extrovert, an introvert who stands out among the residents of the home because of age, education, origin, or interests, a person who has planned the move to the home by choice, or a person who has been forced to move by circumstances. When preparing any activity

9 Ages over 85 are sometimes referred to as the "fourth age" or "old age".

that we offer to an older adult (including a virtual experience), it is important to **respect the adaptation phase that the resident is currently in**. According to Vágner (2000, pp. 500–501), if the move to a residential facility is the result of a rational decision by the older adult, he/she goes through two adaptation phases:

- **Phase of uncertainty and the creation of a new stereotype.** The resident, upon arriving in an unfamiliar environment, first needs to become oriented and gain necessary information. Such a person may be hypersensitive, comparing his/her current situation with the living conditions experienced up to then, and pre-existing difficulties may be aggravated. It is important that the first experiences are pleasant in order to develop a positive relationship with his/her new home.
- **Phase of adaptation and acceptance of the new lifestyle.** The resident gradually comes to terms with the change in environment, role and lifestyle, integrates into the community of residents, and accepts the culture of the home. His/her satisfaction depends on many circumstances; optimally, the resident identifies with the facility and considers it home.

If an older adult is moved into a care home without his/her active participation and decision, adaptation takes place in a different way. Vágnerová (2000, pp. 499–500) describes three phases:

- **Phase of resistance.** Some residents can be negative, hostile, sometimes even aggressive, not only toward staff but also toward fellow residents. They express dissatisfaction, rejection, and they are critical. This behavior serves as a defensive reaction or a protest against a violent change in their life, which they consider unfair and unchangeable.
- **Phase of despair and apathy.** The resident is resigned, withdrawn, shows no interest in anything. Some residents remain in this phase until the end of their lives. Excessive stress and the inability to adapt can often lead to premature death.
- **Phase of creating a new positive attachment.** Some residents manage to establish new relationships with staff or other residents of the home with whom they can share their situation. They gain positive experiences and come to terms with a new phase of their lives.

The process of adaptation is significantly complicated when a resident comes into a situation of social isolation, for example, due to the closure of his/her home because of a flu epidemic or the Covid-19 disease. Other circumstances can also be the cause of isolation: the resident stands out among fellow residents because of his/her interests, education, sexual orientation, lack of any family background, being completely immobile, etc. **Appropriately chosen and designed activity supports the adaptation of the older adult to the existing living conditions, contributes to social inclusion, and thus plays an important role in preventing social isolation.**

1.2. Aspects of Meaningful Activities for Older Adults

All activities for older adults should be meaningful to them. The activities offered should be related to their life history, respect the stage or situation they are in right now, promote self-esteem and self-acceptance, develop their hidden potential, and lead to harmonious personality development and fulfillment of needs in all areas: physical, psychological, social, and spiritual (Vojtová, 2014; Klevetová & Dlabalová, 2008; Janečková, Kalvach, & Holmerová, 2004). This also applies to virtual reality as a modern source of experience.

Any pursued activity should **evoke an experience of success, well-being, and positive expectation** with respect for the individual's physical and mental state and personality. **Therefore, it is always necessary to accept personality differences but also the person's current setting, which co-determines what activity will be enjoyable and beneficial for him/her.** A naturally active, dominant resident, who can always find an activity or is happy to accept invitations, will approach leisure time differently from a passive, indecisive person who accepts that others make decisions for them. While the introvert's activity will probably take place alone – in the mind, in the imagination, in individual creation – the extrovert will seek the company of people and an "action-packed" environment. Individual and group activities should always be associated with appreciation from others and with feelings of belonging and cohesion (Janečková, Kalvach, & Holmerová, 2004, pp. 438–450). Otherwise, especially if the resident is forced into the activity, it can lead to humiliation, reinforcement of any sense of inability, and anticipation of failure.

Appropriate activities **build on the previous interests of the residents**, developing their (sometimes hidden) potential and bringing benefits that are understandable to them themselves. Themes that support the fulfillment of the need for meaning and continuity of the person's life stories are related to the original (orientation) family and the family proper (procreative) in which the residents raised their children, to their productive life, their interests, and their profession. Meaningful activities enable the person to **compensate**, at least in part, **for physical or psychological discomfort** and, where appropriate, to "rise above" the difficult life situation they are experiencing.

One should always **look forward** to the activities on offer. Vágnerová (2007, pp. 344–347) points to the decreasing need for stimulation and openness to new experiences in older age. The residents prefer the more established and quieter activities to which they are accustomed and are more likely to look to the past. On the other hand, they benefit from an adequate level of **stimulation with new stimuli** that awaken their curiosity and keep the brain active. Meaningful activities provide the residents with themes and experiences that can be further explored and reflected upon, both alone in private and with others.

The residents need to have a sense of belonging among their peers who have similar life experiences and find themselves in similar life situations. However, some residents find it difficult to establish new friendships. Meaningful social activities provide a **space to establish and strengthen relationships among residents of the home**. The **activity worker** can play an important role here in bringing people together. Older adults need to experience understanding, comfort, respect, and empathy, regardless of their "usefulness"; they need someone to share their difficulties with. On the other hand, they also need to know that they themselves are important and needed by someone.

Virtual reality is an example of an activity that – when used appropriately – encourages sharing and social contact. It allows older adults to pass on their experience and knowledge to others, to experience a sense of usefulness and belonging.

2. Virtual Reality as a Technology

Virtual reality is a technology that allows its users to find themselves in an artificial environment[10] displayed in special glasses. Ideally, the wearer of the glasses can interact with this environment (mutual interaction). In virtual reality, an illusion of the real world (such as a city tour, a nature walk, a certain real situation) or a fictional environment (in the case of computer games) can be created. The basis of the technology is a **visual experience**, which can be accompanied by auditory (sometimes tactile) perception. A subjective impression of reality is created by a headset[11] connected to a computer or other device with sufficient computing capacity to generate realistic sensations for the user. Another component is one or more controllers comprising sensors for sensing the position of these controllers.

Development in technology is constantly advancing, just like in computing. In the conceptual manual, we present the possibilities of technical solutions that are currently available. In specific examples, we refer to tested devices that we worked with during the VIREAS project, the suitability of which having been verified with the residents of the retirement home.

2.1. Technical Parameters of Virtual Reality Devices

- Virtual reality headset with controllers and headphones
- Powerful computer (desktop or laptop, "VR-ready" category)

VR headset – virtual reality glasses

Currently available virtual reality solutions can be divided according to two basic criteria: firstly, the location of the control unit, and secondly, the technology that allows the glasses to move in space.

Depending on the location of the control unit that calculates the virtual experience, there are two basic groups of headsets:

10 In the text, we use the word "environment" in two basic meanings: the "physical environment", i.e., the one in which the user is actually located (e.g., a room, a therapy room), and the "virtual environment", i.e., the scenes that are displayed to the user in the glasses. In Section 2, we will therefore consistently add the adjective "physical" for the first meaning.

11 A stereoscopic imaging device in the form of glasses.

- The first type of glasses is connected to an external computer, which allows the system to work with more power and more comfortable, better graphics than the second type. On the other hand, however, it is bigger and heavier overall and less comfortable to handle. The difference in performance is significant – when using a powerful gaming computer, high display quality and fast response can be achieved.
- The second type of glasses is not connected to an external computer, the glasses are a stand-alone device and have an integrated control unit. This results in greater comfort in handling, which, however, means lower performance (comparable to the difference between a mobile phone and a gaming computer) resulting in lower display resolution and/or slower response.

Depending on the technology that allows the glasses to move in space, we again distinguish two variants of the solution:

- The more widespread technology is that which uses cameras on the virtual reality glasses to monitor the surrounding environment and uses computation and integrated GPS to know what the user is turning their head toward and what should be displayed in the glasses. The disadvantage of these glasses, which calculate the position themselves using the cameras, is that the image in the glasses sometimes "floats" (when the position is not calculated correctly), which can be uncomfortable for the wearer and the resulting sensations can lead to feelings of nausea. In this arrangement, the control unit can be integrated directly into the headset and an external computer is not needed. However, the disadvantage is the lack of computing power, which results in slower response times and lower display quality.
- The second technology is more complex to use, but it is also more accurate. In order to use it, at least one external beacon needs to be placed in the surrounding space to locate the glasses in the space. This solution is more challenging in terms of installation, requiring one extra step, but allows for more targeted localization. The external position tracking is more accurate and does not cause a "floating" effect as in the previous option. In this arrangement, an external computer is necessary. A wired connection of the headset to the computer is recommended as it allows faster transmission of image data and therefore more faithful images.

Currently (2022), virtual reality headsets produced by several major manufacturers are on the market: HTC, Oculus, Retrak, Acer, etc. The basic differences are in some technical parameters such as image resolution, refresh rate, audio output to headphones, motion controllers, integrated sensors, and wireless connectivity. The suitability of other add-ons must always be verified for each application or set of experiences being developed. At the same time, it is always necessary to check the ease of use from the user's perspective.

With the current state[12] of technology, the use of a headset connected to an external computer seems to be the most appropriate, because, among other things, it allows the workers to view the same scene on the computer monitor that the user is viewing. The worker can thus help the user to navigate or operate the application.

Computer technology

Accurate imaging places higher demands on computing technology, which must be equipped with a high-quality graphics card to avoid unwanted and unnatural slowdowns in display and the subsequent disappointment of users due to poor functioning of the application.[13] **It is therefore always necessary to consider the technical parameters**: memory size and image resolution, disk speed and capacity, size of operating memory, presence of connectors (e.g., HDMI 1.4).

We do not recommend using virtual reality kits with a standard office desktop or laptop computer, which are usually not equipped with a powerful processor and a high-quality graphics card. In this respect, desktops and laptops labeled as gaming or "VR-ready"[14] meet the basic requirements. The minimum is a quad-core processor (Intel Core i5, i7), operating memory of at least 8 GB, and NVIDIA GeForce RTX or GTX graphics card (minimum 6 GB).

In practical terms, the minimum configuration of "VR-Ready" laptops is:

- **Graphics chip:** the NVIDIA GeForce GTX 1060.
- **Processor:** Intel Core i5-4590.
- **RAM:** 8 GB.
- **Ports:** 1× HDMI, 3× USB 3.2 Gen 1 (formerly USB 3.1 Gen 1).
- **OS**: Windows 10. (Since the support of Windows 7 OS has been terminated as of January 14, 2020, it is preferable to install the latest version of the OS – Windows 11, so that it is not necessary to install the operating system again in a short time.)

In this configuration, a wired connection of the VR headset to the computer is expected because of the fast transfer of data from the computer to the glasses. This arrangement is necessary if photos, videos, or computer graphics are to be of high-resolution quality.

If it is for some reason necessary to use a wireless connection between the VR headset and the computer, the resolution of the image information must be reduced to a reasonable degree to maintain a sufficient transfer rate from the computer to the glasses. Slowing down the transmission results in interrupting the smoothness of the motion in

12 In the year 2022.

13 The difference in the purchasing price of a PC is in the order of hundreds of crowns to thousands, but the difference in display quality and response time is substantial.

14 These laptops have an Nvidia or AMD graphics card from Series 10 and a mini-display port. Currently (September 2022) only the newer 20 and 30 series cards are available on the market.

the image, which negatively affects the perception of the experience, and also negatively affects the actual control of the application. **In such a case, adjustments to the experience sets must be made by the expert who created the sets.**

2.2. Spatial and Technical Requirements for Equipment

To run virtual reality glasses that require a connection to a computer, it is necessary to select a **computer that has sufficient computing power** to run the specific virtual application (see the previous section). In addition to computer performance, it is important to check that the computer will communicate with the selected VR headset and that it has the appropriate connectors.

It is also necessary to **select the appropriate space where** virtual reality will be used. Virtual experience can be implemented in a room that is also designed for other activities or – in the case of immobile residents – in their own room. The location should always be protected from direct sunlight to avoid disturbances when using the glasses. It should not be surrounded by windows and mirrors, as the localization of the glasses in the surrounding physical environment may not work properly. Last but not least, safety must be taken into account. The user of the glasses is focused on the virtual reality and does not perceive the physical environment around him/her, leading to the possibility of self-injury or to someone nearby, or potentially breaking something. Therefore, it is necessary to choose a place where the risk is minimized (no sharp edges nearby, no obstacles on the ground, no objects that could be dropped). The preparation of a specific space for the virtual experience is discussed in detail in section 3.4.1. The resident can also sit in a wheelchair or semi-sit in bed, enabling partial turning of the head at least.

A desktop computer with a monitor or a laptop can be used in a room that will be consistently dedicated to this type of activity. It is always essential that the activity worker has a clear view of the monitor and can watch the viewing experience or assist in operating the application.[15] A **headset with a portable laptop** is suitable for the option of using virtual reality by clients at the bedside. This can be either a variant where the laptop is connected to the headset by a cable or by wireless transmission. The "wireless solution" appears to be more convenient, however, its negative features (see Section 2.1), which may mean a reduction in image quality and viewing fluency, need to be considered. If the virtual reality user does not move around the room during the experience but is seated or semi-seated (which is to be expected for older adults in residential settings), even a wired connection does not interfere with their comfort.

15 According to the findings obtained during the experimental validation, it increases the user's comfort if the activity worker has his/her own remote control to help the client.

Photo: VIREAS, 2022.

Hygiene of virtual reality and computing devices

As VR headsets are passed between users when working in groups, it is essential that hygiene standards are maintained. We recommend treating the VR headset, controllers, and all equipment with UV emitters and disinfectants using paper towels after each use. As neither virtual reality nor computing technology is waterproof, disinfectants must be handled very carefully. In addition, all of these devices feature a predominance of plastics that may react undesirably with certain chemicals.[16]

It is always necessary to **follow the instructions of the manufacturer or supplier of the equipment** regarding the care for the individual elements of the VR headset, controllers, and computer technology.

2.3. Basic Types of Virtual Experiences According to Processing

Several types of experiences can be used in work with older adults, which differ in their way and difficulty of creation, the degree of interactivity, or the way reality is portrayed. It is always necessary to be clear about the purpose that the use of virtual reality is to serve, but also about other factors such as the profile of the users, the available financial

16 The equipment used in the project was disinfected using UV lamps, which reliably kill viruses without damaging the equipment. Moreover, the VR headsets are not unpleasantly wet after disinfection. Similar to the headset, neither the controllers nor the computing equipment are waterproof.

resources, etc. The following section serves to give readers an understanding of how a virtual experience is created and all that the creator needs to take into account. While some experiences require a high level of professionalism to create and edit, other experiences can be created by a skilled amateur photographer. In general, virtual experiences can be divided into those created by computer graphics or those using 360° photographs or videos of the real world.

2.3.1. Computer Graphics

Experiences created by computer graphics allow creators to create virtually any scene with any number of interactive elements. However, creating them is very challenging and requires knowledge of programming, scene design, and sequencing. In principle, images can be created in 2D and 3D graphics. There are two basic approaches to 2D graphics: vector and raster graphics. **Vector graphics** stores precise geometric data, such as coordinates of points, connections between points (line segments and curves), and the filling of shapes. Most vector graphics systems allow the use of standard shapes such as circles, squares, etc. The basis of **raster graphics** is a regular grid of pixels, organized as a two-dimensional matrix of points. Each pixel carries specific information, such as brightness, color, transparency of a point, or a combination of these values. An image in a raster graphic has a limited resolution, which is given by the number of rows and columns. Today, raster and vector graphics are often combined in file formats such as PDF or SWF.

3D graphics are related to 2D vector graphics. It also works with point coordinates and information about lines, curves, and surfaces, but the data is stored in a three-dimensional coordinate system. A 2D image is then generated from this three-dimensional data representing solids. In 3D graphics, various techniques can be used to create very realistic-looking images by faithfully simulating light and optical phenomena such as shadows, reflections, and light refraction. Advanced development tools also allow for realistic animations, including movements of clothing, hair, water levels, and simulations of physical phenomena such as gravity and reflections.

The creation of computer graphics also places relatively high demands on both hardware and software. A computer with a sufficiently fast processor, large memory, and a high-quality graphics card is essential as well as a large monitor. A scanner, a digital camera, and the Internet are essential for obtaining images, and a high-quality color printer is also needed. Of course, we also need graphics software for our own VR creations. There are both paid and free products available. Commercial software is usually priced in a higher range but offers features that free software does not. Examples of graphics software include Adobe Photoshop, Paint Shop Pro, Zoner Callisto, CorelDRAW, Gimp, Zoner GIF Animator, Adobe Illustrator, etc. The aforementioned programs are used to create images that are integrated into the virtual reality environment in the

next stage. This requires knowledge of programming languages (e.g., VRML) and game environments (most commonly Unity).

The **advantage of computer graphics** is the possibility of creating any environment (real or dream-like) with many possible user interactions within individual scenes. The **disadvantage** is the need for professional knowledge of scene creation and programming, and, depending on the complexity of the graphics and interactions, the creation is also highly time-consuming. At the same time, a greater or lesser degree of stylization must be taken into account, with the lesser possibly being distracting for an older user.

2.3.2. 360° Photos and Videos

The least technically demanding, yet very effective solution is to **create a virtual experience as a 360° photo gallery**. Such an experience has several advantages. Its creation is undeniably easier than PC graphics. The photographs reflect the reality that the older adults know or may know, and, moreover, they can be arranged in a set that makes viewing it feel like a walk through a given location, allowing the user to look around in all directions. However, one cannot move around in the environment: it can only ever be viewed from the one place from which the picture was taken. The image gallery can be combined with the environment created by PC graphics to add interactivity (see the video experience entitled Travel in Chapter 5).

Another option for creating experiences is the **shooting of video sequences** (both real and fiction). The execution of such an experience requires a good technical and personnel base as well as the preparation of scenarios with multiple options to allow at least partial user interaction.[17]

Principles of 360° photography

360° photos can be taken with an amateur camera or even a mobile phone, but the **quality of the resulting photo depends on the technical equipment and the experience of the photographer**.[18] Therefore, here are some brief guidelines to follow when taking 360° photos for (not only) older adults.[19]

It is advisable to use at least the manual settings for aperture, time, ISO (sensitivity), and focus. It is recommended to place the camera on a tripod to keep it at the same height for all shots. The rotation of the camera around the non-parallax point (the point around which the camera has to rotate to produce a true 360° photo from a single point)

17 In the VIREAS project we did not create or work with videos for this reason.

18 At present, there are computer programs that are used to combine photographs into a panorama, but they do not take into account all the nuances mentioned above.

19 Brief instructions for taking 360° photographs are given in Appendix No.3, and detailed instructions are given in publications such as *Advanced Photography: a detailed guide for enthusiasts and professionals*. 2019. Slovart.

and its correct adjustment are provided by the additional panoramic head. 360° photos capture the entire space around the photographer on all sides, thus occupying a field of view of 360° horizontally and 180° vertically. It is best to use a wide-angle lens, as a wider field is covered in one shot. An even wider field of view can be taken with a "fisheye" lens.

For the use of photography primarily and by less mobile older adults, it is important to **adjust the height of the tripod**. Since older adults often complete the virtual reality experience seated, the height from which shots are taken should match the view of a seated person. A **height mismatch** creates an uncomfortable feeling of "floating" or hovering above the terrain for a seated person. The **lack of a natural change of perspective** can be similarly uncomfortable. Because the user cannot move in space, there is no change in perspective for nearby objects due to head movement. When taking photographs, it is necessary to **test** at what distance a change of perspective occurs for closer objects. Nausea and dizziness can also be caused by an **inappropriate shot type**. Shots taken, for example, from a lookout tower without a sufficiently high **railing or protective netting** being visible in the frame are completely inappropriate.[20] The quality of the experience can be significantly impaired by poorly focused glasses or a sound system that is too loud (or too quiet).

All types of technical solutions for virtual reality have their advantages and limitations; it is always necessary to consider the purpose of the use and to assess whether the health limitations of older adults are a barrier to the use of virtual reality, or to adapt virtual reality to these difficulties. When creating a virtual experience, it is important to follow recommended procedures and consult with experts on the design and implementation of the solution.

2.4. Virtual Reality Solutions for Users with Specific Difficulties

When assessing the appropriateness of using virtual reality for older adults with sensory or motor difficulties**, it is always necessary to take into account the subjective feeling of the individual**. Each individual perceives his/her impairment differently and will undoubtedly also perceive how that impairment affects their experience of virtual reality differently.

20 Obtaining the right aerial shot for a particular user who suffers from vertigo can also be a problem. The risk can be eliminated by clearly marking the direction of the virtual walk with the name of the viewpoint or hill (e.g., "To the Black Tower") so that the older adult can decide in time whether he/she wants to see the "height shot". On the other hand, it is not a requirement that a user suffering from vertigo in everyday life will necessarily have a problem in virtual reality.

2.4.1. Fine Motor Skills and Motor Coordination Difficulties

One of the basic prerequisites for an intense virtual reality experience is interactivity, i.e., the ability to influence the storyline of the experience. In practice, this means that the user can press the buttons of the controllers in their hands to determine the direction of movement or select the virtual environment they want to move to.

The standard controllers used to control the virtual experience are not practical for clients with severely limited hand mobility – they require users to hold the controller firmly in their hands while using the buttons in a controlled manner. In the case of older adults in general, it is advisable to use controllers that hold themselves in the palms of the hands using a fastening.

A suitable solution is the aforementioned **parallel assisted control** provided by an additional controller in the hands of the accompanying activity worker. In the event of difficulties, the activity worker can help the older person "invisibly" (similar to a driving school instructor), without repeated manipulation of the older person's hands, which could make the older person feel incapable. The ease of use, together with a suitably interactive scenario and proper communication during the experience, allows the older VR user to be in full control of the situation and storyline, thereby enhancing self-confidence and dignity.

Another solution is to have agreement between the activity worker and the user, where the activity worker completely takes over control of the user's movement in the scene. However, this is not an ideal solution given the potential of virtual reality.

2.4.2. Eye and Hearing Defects

Eye defects

If a user wears glasses to correct an eye defect, then it is possible to use them in virtual reality. The standard frame sizes fit into the VR headsets used without any problems.

As for age-related visual impairments (macular degeneration, cataracts, etc.), it is always necessary to **test whether and how the images projected in virtual reality can be seen by the user beforehand**. It is not possible to generalize completely that a particular defect makes the use of virtual reality impossible or "problem-free". It always depends on the subjective feeling of the user.

Hearing defects

The most common defect in older age is hearing loss, which is usually compensated to some extent by hearing aids. Two basic problems can occur here:

- If the virtual experience is accompanied by sound, then the user may not hear the sound well. Similarly, the user may not hear the activity worker's instructions properly.

- If the amplification of the hearing aid is set to a higher value, unwanted feedback may occur, causing amplification of environmental sounds (speech, music) or whistling.

Here again, the setting of the hearing aid must be done sensitively so that the user can hear well and at the same time no unwanted whistling occurs. At older ages, higher frequencies are usually particularly unpleasant.

3. The Content and Form of the Virtual Experience

As we mentioned in the introduction of the conceptual manual, the benefits of the virtual experience are particularly evident in the case of older adults who are in stimulus-limited environments. Virtual reality can offer an experience that is unavailable to them in real life for many reasons. This does not have to be an exotic experience such as scuba diving or a trip to space. For many residents of retirement homes, a simple walk in the woods or a visit to the town where they come from or where they have spent an active part of their lives is out of reach.

In order for an older adult to perceive the experience as beneficial and "enjoy it", the content, form, and degree of interactivity of the experience, as well as the manner of controlling it, **must be meaningful to the individual, and must be relevant to his/her interests as well as cognitive and sensorimotor level**. The virtual experience must be a source of positive emotions and naturally stimulate the user with sufficient sensorimotor stimuli.

In the following text, we will focus on the aspects that are essential for the positive acceptance of the experience by older adults and increase its attractiveness.

3.1. Preferences of Older Adult Virtual Reality Users

Based on the findings of the studies mentioned in the introduction of the conceptual manual and our own experience, we can summarize that residents of retirement homes prefer the following themes:[21]

- Natural scenery,
- Domestic and foreign cities,
- People and the contemporary world in general.

In the first year of the VIREAS project, we conducted a questionnaire survey in several retirement homes – a survey of interest in virtual reality. Data was collected in fifteen residential facilities among 146 respondents over the age of 60. The selected

21 The general statement does not exclude the specific preferences of particular users seeking, for example, a Formula 1 driving or airplane flying simulation or a dive among dolphins.

environments were represented by cards with corresponding color images. At the end of the survey, the older adults could indicate their "three current greatest wishes" and express whether they would like to try virtual reality. The aim was to map residents' interest in virtual reality as well as their preferences in relation to the content and to define three environments for developing virtual experiences.

The result basically replicated foreign studies. The majority of respondents preferred a **forest** (nature, landscape) and **travel**. More than half of the respondents who chose a card with a picture of a forest as the most attractive one justified their choice with positive associations and emotions that the forest (or nature, landscape) evokes in them. The environment of a forest evokes peace, privacy, a place to contemplate, to experience gratitude for the beauty one is surrounded by. A walk in the woods, even if only virtual, provides an opportunity for a momentary "escape" from the age-homogeneous environment of a retirement home. The forest evokes memories of youth and the loved ones with whom the older adults used to visit. Cards symbolizing travel were chosen especially by those who reported a past or present interest in tourism.

The older adults involved in the study also expressed a desire to be in contact with **people and the outside world**. Appropriate scenarios and graphics of a virtual environment (for example, the **City Centre** scene) can "transport" the older adults to people in ordinary life situations, allowing them to observe them, reflect on their potential lives, and relate these situations to their own memories and experiences.

However, contact with people must not remain only on a virtual level. Senior citizens should be able to share their experiences from virtual reality with other people, either during the experience itself or later, for example, in an activation or reminiscence group, chatting with friends or family.

3.2. Aspects of the Attractiveness of the Virtual Experience

What other aspects play a role in whether the older adult will perceive the virtual experience as attractive and whether staying in it will bring the anticipated benefits? We investigated the answers to this question through a trial qualitative study in the Dobrá Voda Retirement Home. Our findings can be summarized as follows:

- **The appropriate virtual experience corresponds to the personal preferences of the individual and relates to his/her life.**
- **In virtual reality, older adults want to encounter the "real world", something they used to know, something that looks and sounds the way they remember it.**
- **They want to have life around them, to see not only the buildings but also what is behind the doors. In virtual reality, they want to see the things that are related to their personal life, professions, or interests.**

- **They want to move around freely and easily, and the way they control it has to match this.**
- **In order for them to enjoy the virtual reality experience, it is important to choose a time for the virtual experience that suits them.**

In the following text, we will look at the different aspects. The claims are illustrated by authentic statements of the older adults who participated in the above-mentioned trial study in a retirement home.

Experience personalization

The content, the form, and the degree of interactivity of the experience and the manner of controlling it must make sense to a particular person and correspond to his/her interest. The virtual experience must be a source of positive emotions (experience of success, joy, and satisfaction) and naturally stimulate with enough sensorimotor stimuli. During the study, we verified that the degree of satisfaction in virtual reality corresponded with the degree of **personalization of the experience**. When the experience did not match their interest or expectations, the older adults rated it generally positively in their immediate reaction but expressed disinterest in trying the virtual reality again after two days as opposed to those for whom the virtual experience reminded them of their real world. It seems that, at least in their first experiences with virtual reality, older adults clearly prefer experiences close to what they already know, which is connected to their real experiences. Then they like to return to them. However, appropriate intervention can support the motivation to leave the "comfort zone" and **explore and learn new things**. The content and form of the experience should respect the person's habits and stereotypes but at the same time train their mental flexibility.

Reality

If the scenario is to represent the real world, older users expect and appreciate as much reality as possible, both in animated scenes and in scenes created with 360° photos. Participants in the first VIREAS studies were particularly negative about overly stylized or completely alien elements in the animated forest scene. They expected a forest that they could actually walk into, know, and navigate. They were disturbed by the inadequate flora and fauna and the rather "fairy-tale" representation of the forest. During the trial study, Simona (75), a woman with great insight and rich travel history, evaluated the first version of the virtual forest: *"I would say that this is such as expressly for children, or maybe if not even for people older than me."* In experiences built around a gallery of 360° images, the older adults were perturbed if the images were not meaningfully ordered as they might see them on a real trip, i.e., geographically. In further testing, the more realistic edited scenes better prompted memories and references to real-life situations.

When choosing an experience for older adult users, it is necessary to clarify the purpose of the experience and its further use. If the purpose is for one-off entertainment or relaxation, commercially available experiences such as "dolphin feeding" or "underwater world" can undoubtedly be used. For a comprehensive use of virtual reality, including the use of the experience in follow-up activities, scenes that refer to real life seem to be appropriate.

Life and movement

Most of the clients of residential facilities suffer from mobility difficulties, and some of them lose physical contact with the environment outside the facility for various reasons. Life and movement are essential elements of a virtual experience designed specifically for these users. In the animated forest, the older adults appreciated the movement of branches in the wind, birds flying, water flowing, or anthills swarming. In a 360° scene, they demanded natural movement – people in everyday situations, pets, or farm animals. The sense of natural movement in a static scene is also supported by interactive elements, such as the possibility of entering shops or historical landmarks. The impression of a realistic, lively scene is also emphasized by realistic sounds.

Easy motion control in virtual reality

The form and content of the virtual experience should respect the limitations as well as the potential and abilities of the individual older adult. **Freedom of movement and decision-making**, along with the ability to actively influence the action, are among the most important benefits of the use of virtual reality in keeping the residents active. The form of the experience should therefore support the autonomy of the older user as much as possible. Users should be able to control what is happening in virtual reality on their own, despite possible difficulties in motor coordination or fine motor skills (see Chapter 2.4.1.).

The clear **interactive elements** in the scene, together with the simple controls, allow the older user to experience being the real "master of the situation". Conversely, difficulties with autonomy in the virtual experience can create a lingering sense of frustration and embarrassment. Jakub (90), a man with an admirable cultural and political outlook and technical knowledge, in an interview with an activity worker immediately after the experience, assessed: *"I liked it, except that I had trouble with the weight or tactility in my right hand being a bit reduced after the stroke (...). How there's the scrolling of the pictures, the handle."* The control difficulties were due to a technical error rather than a motor problem, which was explained to Jakub, but the feeling of "failure" persisted even after two days: *"Well, and I have the added problem that my hand is a bit paralyzed from a stroke twelve years ago, so I could only control the knob quite badly."* Virtual reality should always eliminate any physical, sensory, or cognitive difficulties that an older user has and support the person's sense of ability, autonomy, and freedom as much as possible.

Timing the virtual experience well

An important aspect that influences the acceptance of virtual reality by older users is the **correct timing of the virtual experience**. It is always necessary to consider the following factors: the current health and psychological state of the person and his/her mood (positive mood/depression/apathy/fatigue), the time interval after taking certain medications affecting the psyche (hypnotics, neuroleptics, antipsychotics), and the daily routine of the older adult (whether he/she is not used to any other regular activity or rest at that time). During the testing, in two cases we observed some discomfort in the participant, which was explained by the activity worker or the participant by the following circumstances. Karolina (100) was used to sleeping at this time, while Simona (75), suffering from a severe form of Parkinson's disease, used VR at a time when her medication that was mitigating uncontrolled body movements was beginning to lose efficacy.

3.3. The Role of the Activity Worker in Virtual Reality

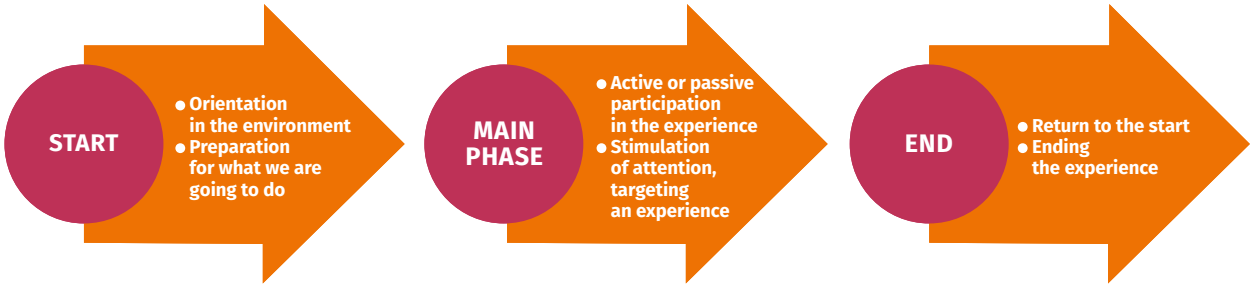
As in other types of guided activities, the activity worker plays a crucial role in the adoption of virtual reality. Let us recall the principles of communication preferred in the field of older adult education (Špatenková and Smékalová, 2015). They are **respect, authenticity, empathy, active listening, trust, and credibility**. Communication between the activity worker and the virtual reality user should be based on these principles throughout the preparation and implementation of the virtual experience and during other activities that follow the virtual experience. The following important elements using the principles of good communication are integral to carrying out the activities.

- The activity worker is primarily a **safe and attentive guide** for the user in virtual reality, which includes adequate communication before, during, and after the virtual experience. However, the choice of a specific approach depends on the personality and preferences of the user. Users may vary in their level of initiative, their need to lead, be led, or share their experiences, but all need **sufficient time to become familiar and "comfortable" with both the headset and the controller in order to** feel comfortable in the virtual experience.
- In virtual reality, the activity worker also plays the role of a **guide**. The user knows some facts or their history better than the activity worker, comments on the image of reality in the virtual world, or adds other information. This aspect is particularly important in an institutional setting where the resident is otherwise predominantly the object of help and care.
- The role of the activity worker is to **create a space for the residents to share**, develop, and build on **their experiences** in follow-up individual or group activities.

- On the one hand, the activity worker should **ensure the comfort of the resident in the virtual experience** and, on the other hand, should be able to **motivate the resident to** discover and live new experiences that can be beneficial for everyday life.
- The activity worker must be able to **assess the possible risks or limits of the experience** and respond appropriately (e.g., end the virtual reality experience in a timely and appropriate manner). It is essential to spend sufficient time familiarizing the user with the virtual reality technology, including how to operate it, to ensure that the headset is comfortable to wear, and to continuously monitor or, if appropriate, actively enquire whether motion sickness, dizziness or any other unpleasant condition occurs during the experience.
- It is essential for the activity worker to **have a sufficient understanding of virtual reality technology**, including basic maintenance and hygiene of the headset and controller, which needs to be ensured by quality training. Further, the retirement home must have appropriate space and technological facilities.
- The activity worker **must personally try out** all the experiences he/she will be guiding the older adults through. Through personal experience with a particular virtual experience, he/she can better empathize with the feelings of the user who is wearing the virtual glasses. Each of the experiences has different pitfalls that can be avoided in this way. For this reason, we strongly recommend the **use of a VR headset connected to a computer** so that the activity worker can see where the older adult is.

3.4. Implementing the Virtual Experience

In this chapter, we will discuss the different phases of the virtual experience, that is, its preparation, communication with the user during the experience, and the end of the experience. The following diagram shows the dynamics of the virtual experience:



Author of the diagram: Hana Vojtová (2019)

In the following text, we use the word "resident" and the word "user" to speak about the resident using virtual reality.

3.4.1. Preparing for the Experience

The resident's contact with virtual reality must be carefully prepared. The way the resident feels during the first experience largely influences his/her future relationship with this method.

The first offer of a virtual experience to the resident

Prior to the **first visit**, the activity worker considers where the resident will be introduced to the technology and content of the virtual reality experience. It should be a place where the resident feels comfortable and that makes them feel safe. This could be his/her room, a space for planned activities, a reminiscence corner, etc.

The activity worker explains the nature of virtual reality to the resident, what this technology can bring and how it can be enriching. It is essential that the activity worker is fully familiar with the technology and aspects of its use. This is the only way to speak with confidence and persuasiveness and to motivate the older adult appropriately. After introducing the resident to the technology and its possibilities, the activity worker introduces the available virtual experiences and gauges his/her interest in trying one of them. If the resident expresses interest in the experience, the activity worker arranges a suitable time and place, and clarifies any preferences regarding the theme of the experience.

The first offer and also the virtual reality experience itself later should take place at a time when the resident feels comfortable, safe, does not suffer from acute pain or illness, and is not in a hurry (hygiene tasks, doctor visits, hairdresser's visits, rehabilitation, etc.).

Space preparation and VR equipment (for more general principles see Chapter 2.2.)
The virtual experience can take place either in the user's room or in a designated room to which the resident is accustomed. The activity worker checks the location of the sockets or arranges for an extension cord. The room is to be ventilated and sources of light are to be adjusted so that the room is dim.

The activity worker ensures that **the room is quiet and calm**, for example, a radio or TV is not playing, and any mobile phone is in silent mode. Even distractions from the environment can affect the quality of the experience. Sounds that do not belong to the virtual reality confuse the user; the VR user would have no way of knowing where they are coming from – they are outside their experience.

The activity worker prepares a **swivel and height-adjustable chair**. The chair should be equipped with armrests to ensure comfort, security, and anchoring, not least so that the user can rest the hand holding the controller.

In the case of a user in a wheelchair, the activity worker first offers the option of moving to a swivel chair. The chair allows for greater freedom of movement for the user can turn and look around as he/she would if walking outside. The transfer makes sense if the resident is able to bounce or turn the chair in any way.

The activity worker adjusts the height of the chair so that the user's feet are on the ground and he/she can sit comfortably, feel confident, and move freely in virtual reality. After this, the activity worker introduces the VR headset and controller, and explains how both devices work. Then the activity worker will find out **which hand the user will find it easier to control** the controller with (dominant hand, hand paresis, etc.), and reminds him/her how to control it. Finally, **the activity worker lets the user try the remote control in peace**.[22]

The activity worker then takes the controller back and demonstrates the VR headset (virtual glasses) **attachment system** to the resident.[23] While putting on the VR headset, the activity worker asks the resident to hold the glasses on his/her eyes, then secures the VR headset with Velcro on the top of the head and tightens the sliding wheel at the back of the head as needed. He/she continuously asks if the user is comfortable with the tightening and seating of the VR headset. Next, he/she asks about the **sharpness of the image** and adjusts the sharpness, if necessary, with the sliding wheel according to the width between the eyes. If the headset includes headphones, it is advisable that they do not fit tightly over the ears so that the resident can hear the activity worker during the experience. The activity worker comments on the whole preparation process and explains everything to the user in a calm manner.

3.4.2. The Course of the Experience

Especially **during the user's first virtual experience,** the role of the activity worker is irreplaceable and crucial for whether the user accepts this activity and is willing to repeat it. If the user has confidence in the activity worker, it gives him/her a sense of security and safety. It is essential that the **activity worker is sensitive to the needs of the particular user**.

The way each user experiences being in virtual reality can be very different. Some people are "captivated" by the virtual environment and want to explore it completely on their own. These users should not be disturbed during the experience. Other users, on the other hand, are unsure of what they "can and cannot" do, not knowing what to do during the experience and how to take full advantage of any interactivity. These users need to be guided through the virtual reality experience, encouraged to explore, with the

22 During our testing, we were surprised many times by how well even a very old person could handle the controller if they had the time they needed to become accustomed to it.

23 The way the VR headset is put on may be different for different types of glasses.

activity worker pointing out, for example, where something particularly interesting can be seen. It is useful to motivate them with appropriate questions and, where appropriate, to repeat how to navigate the virtual environment. It is important to make sure that each user of virtual reality has enough time to experience and see everything that may interest them.

Once a particular image is exhausted or the user's interest in virtual reality has waned, it is appropriate for the activity worker to enter the experience by offering another image or, if the type of virtual experience allows, by offering to shorten the recommended route of the experience to a location that is appealing to the user. The user needs to be warned in advance of this move and to carry it out slowly, or to suggest that the resident closes his/her eyes for it ("Close your eyes and we'll move to another place."). As in the real world, both **eyes and brain need to prepare** for **a radical change of location**. Moving too quickly or in a confused manner may cause dizziness or nausea.

As we have already mentioned, for some users the activity worker is more of a **silent observer and companion**. At other times, he/she is a **guide for the resident**, and it is left up to him/her to decide where to go and what to see. This is fine also. However, it is necessary for the activity worker to **involve the engagement and cooperation of the user to the maximum extent possible through targeted and appropriately chosen questions**. Most of these users do not have a clear idea of what to expect from the virtual reality experience. Therefore, it is not appropriate to ask: "What would you like to see? Where would you like to go?", etc. It is more appropriate to offer options: "If you go to the left, you will reach a bridge and you can continue to the park. And if you go to the right, you will get to the post office and then you can go to the square."

When communicating with users, it is desirable (unless their personality preferences prevent it) **to accompany the words with touch,** so that they can better orient themselves and recognize where the activity worker is.

If the virtual experience includes sounds, it should be understood that the user of virtual reality perceives the sounds from the real environment less well. It is therefore necessary for the activity worker to speak to the user a **little louder** than he/she normally does, or to use a pre-arranged signal such as three taps on the shoulder or raising the headset slightly, if the message is important (for example, to check that the user feels comfortable in the virtual reality experience).

As mentioned in the introduction to Chapter 3, an important aspect of the attractiveness of the experience is the freedom of movement. Therefore, the activity worker should allow the user to have **the maximum sense of independence**, while always keeping him/her comfortable. It is important to take into account factors such as the following.

- If the user undertakes the experience in a wheelchair and is unable to bounce or turn it in any way, the activity worker is sensitive to the movement of the user's head and turns the wheelchair or controller himself/herself.

- If the user is unable to turn around in the swivel chair or wheelchair, the activity worker instructs the user how to move around in the scene using only the controller.
- If the user is not able to operate the controller independently and the device allows it, the activity worker can help with a parallel controller (see Chapter 2.3.1.).
- In certain situations, it is advisable not to encourage the user to be independent, but to take control completely. Difficulties with control can increase the resident's insecurity and have a major negative impact on the experience.

The activity worker **must "free" himself/herself from his/her fears but also from preferences, stereotypes, or assumptions**. Let us recall the already mentioned example of "teleportation" to a viewpoint or lookout tower. It would be a mistake for the activity worker to assess in advance that this experience could be risky for the resident or to give a warning in advance that a particular sight could cause dizziness. Nor should the activity worker instruct the user to inform him/her if feelings of sickness were beginning. Indeed, a generally articulated **fear of heights does not necessarily translate into the same problems in virtual reality**. However, it is always necessary to prepare the resident for a view from a height. If, for example, the user desires to see a "tower", he/she should be told that the scene will be from a viewing platform above the city. The activity worker can, for example, ask: "Did you used to like lookouts? You'll find yourself right at the top, on the observation deck above the city." The user knows from personal past experience that a lookout means looking at the world from a height, and also knows the risks that can come with it.

Especially during the first encounter with virtual reality, when the user is becoming familiar with motion control, the activity worker must be attentive to all the nuances. The user is often fully concentrated on the controls and can easily miss, for example, the context that "tower" really means height.

3.4.3. Ending the Experience

According to the recommendations, the duration of the virtual reality experience should be approximately 10–20 minutes, but the basic guideline here is the **interest and subjective feelings of the resident**. If the user announces that he/she wants to end the experience, or the activity worker assesses that it is appropriate to finish it due to user fatigue or theme exhaustion, the **ending should be done slowly and smoothly**. The activity worker must allow the user time to allow the experience to wind down before putting the headset away. The process of ending the experience should follow the steps below.

- The activity worker advises the user to return to reality or to the room where they are.
- He/she requests the user to hand over the controller.

- The activity worker prompts the user to close his/her eyes before taking the headset off. This eliminates the possibility of possible nausea from a sudden change in environment.
- If the user is unable to remove the headset independently, the activity worker asks the user to hold the glasses after closing his/her eyes and loosens the clamping system himself/herself.
- The activity worker stands in front of the user and removes the glasses from his/her head.
- Only after the headset is removed should the activity worker ask the user to open his/her eyes and look at him/her.
- The activity worker and the user make eye contact. **A touch again helps to anchor the user "back" in the real world.**
- Before the user stands up again, **it is advisable to focus his/her eyes a few times on something close** (e.g., on his/her own hand in front of the eyes) **and something else far away** (e.g., on a distant door).

When leaving the virtual experience, the activity worker can accompany the user, saying, for example, "I will take the remote controller from you and we will return to reality (your room, the dining room, etc.). Close your eyes, I'll take off your glasses, look at the floor, at me, and again at the floor and at me. Welcome back to..." The activity worker then summarizes the experience with the resident, highlights the resident's "achievements", and motivates him/her for the next virtual reality encounter.

If this is the **resident's first encounter with virtual reality**, it is advisable to note the areas that are important for his/her comfort. The **Record Sheet** (Appendix 1) can be used, in which the activity worker records the user's reactions, his/her technical skills, and any specifics (compensatory aids, dominant hand, etc.). The activity worker records information about the completion of the experience or the user's preference for the next virtual reality experience in a form that is **usual for the social service provider** (e.g., in the care records under individual planning).

Audiovisual demonstration of communication with a user before, during, and at the end of the virtual experience
https://www.youtube.com/watch?v=YaaTYA6ws-k

4. Virtual Experience as a Way to Meet Selected Needs of Residents

In this chapter, we will focus on a selected area of needs that can be supported through the virtual reality experience: **the need for awareness of one's own dignity and worth, the need for meaning and continuity in one's life story, the need to be part of a community** (which includes the need to be with people and the need for contact with the outside world), and the **need for transcendence in everyday life**. We see the defined needs and the areas that are essential for their fulfillment as important for the choice of an experience for a particular older adult, and especially for the design and management of the activities that follow the virtual experience.

The chapter summarizes the findings of a qualitative study conducted under the VIREAS project at the beginning of 2021 in a home for older adults.[24] The subchapters are illustrated by excerpts from interviews with participants.

4.1. The Need to Know One's Own Dignity and Worth

The virtual reality experience can greatly enhance the awareness of the user's own dignity and worth. Three factors are key: an appropriate scenario, easy control of movement in the scene, and interaction with the activity worker who accompanies the older adult in the virtual reality experience.

The very **possibility of choosing an experience** is itself a significant factor supporting self-worth and dignity. Otherwise, the resident may feel manipulated and obliged to "enjoy" the activity, for example, to please the activity worker.

Awareness of dignity and worth is supported by visiting a **familiar environment**, even if it is virtual. In the "Travel" experience, the participants primarily chose trips to places that were familiar and close to them. In neither case did the participant, who had a choice between the familiar environment of southern Bohemia and a foreign country,

24 Twelve older adults (8 women and 4 men) aged between 72 and 100 years with different cognitive and sensorimotor levels were included in the study. Five were fully mobile, five with significantly reduced mobility, and two were wheelchair users only. Participants included both older adults who had already experienced virtual reality and those who encountered virtual reality for the first time during the actual testing.

choose exotic destinations first. In a familiar environment (e.g., one's hometown) it is the resident who "guides" the activity worker, and who knows more and adds information: "*Well, that is Gomel, that's clear.*" (Roman, 73)

As mentioned in Chapter 3.2, if an experience presents reality, older users expect it to **look real**. "Imposed" elements of imagination and stylization can undermine the dignity of the older user, in the same way that infantilizing activities can.

An important source of awareness of one's own dignity and worth is the **ability to move freely** in the scene and **actively influence the plot.** Participants positively evaluated the option to "look" where they want, to focus on details that are relevant to them, and to stay in specific places as long as they want. Roman (73) often wanted to make sure where he could go, and often explained something to the activity worker: "*Well, you see here...*"

4.2. The Need for Meaning and Continuity of Life Story

The virtual experience can also support another of the key psycho-social needs of older adults. Participants in the study expressed the need to work with their life stories, and especially to share them. Through the **places** they see or visit in the scene, the users can share the events of their lives. The addressee of such sharing is not only the activity worker – the resident often talks "to himself/herself", adding comments stemming from the past on what is being viewed. Virtual reality evokes forgotten stories, as Simon (75) assessed in a follow-up interview: "*You remember things that somehow...*" During the virtual experience and in follow-up interviews, the residents expressed joy and excitement when they found facts in the scene that resonated with their life stories. The connection appears to be threefold:

- **Places directly linked to childhood or productive life.** These places are associated with the original family the resident was born into and the new family that was started, family events, spending time with family in the past and now, and one's own values. The older adult adds information, and compares the image of the location in memory and in virtual reality.

  Activity worker: *"So, did any memories come up?"*

  Simona (75): *"Yes, all of them, all of them, that was Hosín and there was Hluboká, right, Bezdrev, everything. That's all my memories. I walked around those areas plenty times."*

- **Places that could not be visited** may be associated with previous restrictions for political reasons, attitudes toward the past regime, position at work, family and financial situation.

  "I haven't been there, I wasn't for the comrades so..." (Jakub, 90)

- **Places associated with a particular interest or profession.** The resident adds to the information, comparing but also "guiding" the activity worker in the environment that he/she understands better.

  Vaclav (72): *"The red cattle, this here, it's not normal, it's new now."*

  Activity worker: *"It's now red like this or, on the contrary, I often see white ones as well."*

  Vaclav (72): *"These are the ones that are used to the cold."*

Neutral places can play a similar role as triggers of memories, which can associate the older adult's past activities without further specification (forest, interior of a vehicle).

4.3. The Need to be Part of a Community

The need to be part of a community, to be with people and among people, was already evident from a quantitative study among residents of homes for older adults at the beginning of the project, when we were ascertaining what the older adults would like to experience in virtual reality (Suchomelová & Diallo, 2019). In an open-ended question at the end of the survey, the respondents expressed their current wishes. In addition to their own health, wishes that related to other people, whether family and friends or people in general, clearly prevailed (e.g., wishes for peace and happiness for all people, for people to like each other, etc.). The need to be part of a community includes the need for social contact with other people, contact with the outside world.

The need to be with people

The attractiveness of the experience **is greatly enhanced by the presence of people in the frame**. The immersiveness of the virtual experience (the feeling of being "immersed" in the action) gave the participants the impression of being in close proximity to the people they saw in the scene. Although these were not videos but still images, participants waved at the people waving, smiled at the people smiling, and perceived life. Simona (75) described it two days after the experience, *"It was nice when I was here at the square in Budějce and there was a little tree and a family with two children came and waved, so it was so nice."*

During the experience, Stana (83) repeatedly expressed the hope that she would see someone she knew. In an interview after the experience, she returned to this: *"Yeah, I kept looking for someone there... if I see someone familiar."* The unfulfilled longing persisted two days later, *"They used to go there, they used to always go there on Thursdays like we did and I would at least say hello."* But she is no longer interested in virtual reality: *"If only it really was like that with someone else who was there where I know the people, with somebody else, but not by myself."*

Buildings and places were also associated in the participants' minds with experiences with specific people (typically the ceremonial hall of the town hall and shops; one could consider that a picture of a cemetery could also have a similar function).

The need to be with people, with a specific person, can be fulfilled through the **very interaction of the resident and the activity worker** who accompanies the resident in virtual reality. At times, an almost intimate atmosphere can arise between the worker and the older adult. As we have mentioned several times, it is important for older adults to be able **to share their virtual reality experiences**.

The need to be in touch with the outside world, to be "in the know"

Virtual reality has awakened in the older adults an **interest in the world around them**. They wanted to know what had changed in the world, they asked questions; if they did not recognize something, they expressed surprise like Roman (73): "*Well, I was struck by the square, like, the covered walkway, I don't know now, yeah, it's changed a lot there, yeah, the shops, and now I saw the Přemysl Otakar II restaurant, the entrance to the restaurant, and what is it? What side is it on, actually?*"

The residents spontaneously or, when asked, suggested what else they would like to see in virtual reality (for example, atypical areas that tourists do not normally visit, modern buildings, sports halls, animals). They clearly preferred to **see the real world and life**; no one directed their wishes to imaginary, dream worlds or unreal experiences.

Wherever possible in virtual reality, the residents expected **life, action, and**, again, especially the **presence of people or animals**. The virtual stay in empty streets seems to enhance the feeling of being closed off, isolated. Although Vaclav (72), a former farmer, was engaged and delighted by the details during the experience (tractors, a hay wagon, "grown cut trees", rearing, watering troughs, a pile of gravel, muddy roads, a cowshed), nevertheless, in an interview two days later he assessed virtual reality as a "*bit of a shady deal*" that he would no longer be interested in. He explained while saying so:

> Vaclav: *"Well, it was supposed to be a village life, but there were no people there at all, and the cowshed where it was grown, it wasn't there at all, it was out of the way."*
>
> Activity worker: *"So to make it livelier, yeah?"*
>
> Vaclav: *"Well, so that there would be life as it is in that nature (...). Well, at least there was a kindergarten."*

4.4. The Need for Everyday Life Overlap

Dependence on the help of others, living in institutionalized conditions, and often feeling "alone in a crowd" of other residents reinforces the need to "rise above", to experience

feelings that are out of the daily routine and that go beyond everyday reality. Virtual reality, especially owing to the immersiveness of the experience, can meet this need on multiple levels.

In virtual reality, one can literally **immerse oneself in** beauty, which awakens **gratitude**.[25] The reaction to some moments in the scene was from awe to amazement. Karolina (100), who otherwise seemed rather resigned and did not comment on what she saw, was amazed by the massiveness of the pine trees in the virtual forest.[26] Participants commented on the images with expressions such as "miracle", "wonderful", "beautiful". This was not only an evaluation of the audio-visual perception but also an appreciation of the technology and its possibilities. This is documented, for example, by Jakub (90) in an interview immediately after the experience: *"Well, these are shots that you don't even notice when watching live in Prague. So I would somehow rate this as a novelty, it's such a miracle of technology that I was pleasantly surprised by the possibilities it offers nowadays."* The feeling of amazement and gratitude persisted in Jakub even after two days. Other participants appreciated the opportunity to tour a sacral space (the church in Hosin). The environment of the church evoked associations related to their own faith as well as memories of church festivals and ceremonies they remembered from their childhoods.

Bohuslava (91), suffering from a noticeable cognitive disorder, also expressed positive emotions, joy, and gratitude intensely. The degree of fulfillment can be illustrated by Bohuslava's comment: *"It's beautiful, I'll take this to my grave, the experience."* In the interview immediately after the experience, she could not quite distinguish between her actual feelings and those she had experienced in the virtual world moments before, and the setting of the sunroom in which the interview took place blended with her experiences in the virtual world. After two days, she no longer remembered having had the experience.[27] However, the cognitive impairment did not diminish the **positive emotional mood** that the virtual experience had evoked at that moment.

The virtual experience provides the possibility of a momentary "**escape from reality**" (e.g., monotony, pain, or sadness): *"Well, that we are not just locked in here, that we will have a look, that the pictures will be different from the same ones here."* (Vaclav, 72) Intense

25 Koenig (1994) includes the need for gratitude among the fourteen basic psycho-spiritual needs of older adults. Positive psychology also sees gratitude as an important factor in an optimistic life attitude.

26 Erichsen and Büssing (2013) defined the desire to "re-immerse oneself in the beauty of nature" as a key psycho-spiritual need of residents based on research in several north German facilities. Therefore, we expected strong emotions from the study participants when testing a virtual walk through the forest, however, the trigger for emotions and memories was 360° images of real locations rather than a computer-generated scene, albeit a very faithful and impressive one.

27 As mentioned in Chapter 2, we did not initially plan to include seniors with more severe forms of dementia in the study; Bohuslava was approached by the activation workers as a substitute for another participant and brought in without knowing her medical history.

experience can provide rich material for further reflection and processing in moments when one has a heavy heart. Simona (75) in an interview after two days states, *"Exactly, that's sure, it brings back all the memories and that's just nice."*

5. Use of Virtual Experiences in Follow-up Activities

Virtual reality opens space not only for sharing the experience itself but especially for using this experience in other types of activities, such as cognitive training or reminiscence. In this chapter, we, therefore, provide concrete examples of two types of such activities: memory training and reminiscence sessions.[28] The virtual experience can also be part of a themed evening (e.g., Europe, Italian Evening) or a lecture (Important Places of Pilgrimage, Sacral Architecture). It depends only on the creativity of the activity staff and the number of headsets.

For group activities, it is necessary for residents to complete the experience either at the same time (if there are multiple headsets in the device) or within a short period of time. The follow-up activity should then take place as soon as possible so that the experience is fresh in the participants' minds. If the headset and a computer, or an interactive whiteboard or screen, are connected, it is possible to take advantage of the fact that others can see where the user is in the scene. Bystanders can encourage the person wearing the glasses, interact with them, comment on the action, and laugh together.

When using the virtual reality experience in follow-up activities, it is always important that:

- the activity worker ensures an undisturbed course of the activity, prepares the space and has the goal and direction of the activity thought through in advance;
- the activity worker has a perfect knowledge of the virtual environment he/she is to guide the user through (see Chapter 3.2.1.);
- users have had previous experience with virtual reality, know how the VR headset and controller work and what the basic procedures are (see Section 3.3.1.), and can focus on the experience itself;
- the users are comfortable with the chosen time and feel mentally and physically well (see Chapter 3.2.).

28 Readers will find worksheets that can be used and modified according to their own needs in the appendix of the conceptual manual.

5.1. Memory Exercises

Virtual reality offers a space for broad-spectrum cognitive exercise.[29] Virtual experience can be a space to train sensory, short-term, and long-term memory (episodic, semantic, and procedural). In virtual reality, visual and acoustic memory is further activated. The virtual reality experience can be used as a classic thematic springboard. That is, a "trip" to the countryside or to a particular city is followed by memory training using thematically related tasks and quizzes, which are, however, not directly related to virtual reality. In this case, the virtual experience has a motivational and warm-up function. However, the potential of virtual reality can be better exploited by having the activity worker work directly with what the person has seen and heard in virtual reality, and by using targeted questions to train specific cognitive domains with the residents (see Table 1).

Training memory and other cognitive functions based on virtual experience can be done either **individually or in groups**. The choice of the form should take into account the user's personality traits, personal preferences, cognitive level, verbal ability, etc. (see Chapter 1). The following procedures are common to both forms.

The activity worker allocates suitable and sufficient **time**. He/she sets the **objective of the meeting**. This may be cognitive (what type of memory or other cognitive functions the older adult will exercise) but also affective (strengthening self-esteem, supporting the older adult's self-expression). The activity worker will prepare the **content of** the activity, i.e., appropriate questions or follow-up exercises. At the end of the virtual experience, the activity worker asks the participants **warm-up questions**, e.g., "What did you find most interesting, what did you like most?" The activity worker leads the exercise with **stimulating questions**. In the following table, we give examples of questions stimulating each cognitive domain after an experience like a walk in the city or in the forest**.**

The "storytelling" part can be complemented by other activities, building on the virtual experience, such as various types of concentration exercises, quizzes, singing a thematically related song, engaging tactile or olfactory stimuli, etc.

The Worksheet form (Appendix 1) can be used to prepare the structure of the exercise and notes about the course of the virtual experience. The information about the completion of the experience or the resident's preference for the next experience is further recorded by the activity worker in the form usual for the social service provider (e.g., in the care records in the individual planning).

29 Table No.1 shows the individual domains to be practiced.

Table No.1 **Types of cognitive domains trained and examples of appropriate questions**[30]

The domain of cognitive functions	Questions
Episodic memory (emphasis on one's own experience, situation, feeling, association, etc.)	What attracted you to the square? Is there anything that was different from what you remember from your youth? How was the virtual forest different from the one you remember from your youth?
Short-term memory	What was the number of the bus outside the station? Were you in any shops there? Was the forest mostly coniferous or deciduous?
Sensory memory	Did you hear the water running? Was there an announcement at the station? Was it a woman or a man? Were birds singing in the forest?
Semantic	Which means of transport did you see and what other types of transport were missing? What were the names of the red flowers and what others might be blooming in the forest?
Reasoning	We were at the station. Do you remember any stop from České Budějovice to Prague? What didn't belong in the forest?
Ideomotorics (motor actions performed in the imagination)	Can you describe the path we took? Did we see the cave before we stopped at the creek, or after?
Short-term visual memory (after visual exposure)	Could you describe the woman who was standing by the fountain? What was on the tapestry in the ceremonial hall? What was sold in the shop? How much was a kilo of apples? What types of trees were in the forest?
Visual imagination	Could you describe a sculpture or other work of art you saw? What was your favorite scene in the forest, could you describe it?

Individual memory training

Individual memory training is especially suitable for residents who are unable to move from their beds or introverted residents who do not seek group activities. Almost any type of virtual experience can be used for individual memory training according to the resident's interest.

Time limit: The optimal length of the experience is 10–15 minutes. If the experience consists of only one 360° photo, the optimal length is 5 minutes to allow the user to capture all the details.

Interaction during the experience: The activity worker welcomes the resident and introduces the chosen topic and the course of the experience. During the experience, the resident is supported according to his/her interest and reactions. At the end of the

30 The table is adapted from H. Štěpánková and D. Stein (2009, pp. 18–19).

virtual experience, the activity worker ensures that the technical side of the experience is completed properly.

Memory training:

- Warm-up questions ("How did you like it in the forest? What interested you most?");
- Stimulus questions (according to the cognitive domain being trained);
- Other activities such as quizzes, etc.

The duration of the activity depends on the attractiveness of the virtual experience, the user's interest, and his/her physical and mental condition.

Conclusion of the meeting: the activity worker points out what the user has done well and offers motivation to continue the experience. The activity worker offers the user the opportunity to go back into virtual reality to places where he/she was not sure of the answer or where mistakes were made. In addition, the activity worker offers and possibly agrees with the user on possible topics for further virtual reality encounters.

The activity worker adds notes to the activity preparation form (specifics of the experience, preferences for the next one, etc.). The information about the completion of the experience or the user's preference for the next experience is further recorded in a form that is usual for the social service provider (e.g., in the care records within individual planning).

Group memory training

For group memory training, it is ideal if a retirement home owns more than one VR headset with accessories. If only one VR headset is available, invite a maximum of 4 users per group for the same time and location. When selecting group participants, it is important always to take into account what their personal preferences are, whether they share common interests, have similar cognitive levels, etc. Unless the facility has a larger number of sets (computers and headsets), group members must switch. The interval between each user's virtual experience should be as short as possible so that the first user is not disadvantaged by a long wait. If the virtual experience is longer, it is advisable to have one activity worker dedicated to the virtual reality user and another to the other participants in the meeting. That activity worker can entertain them with a hushed conversation, perhaps accompany them to the toilet, give them a drink, etc. It is important to tone down louder conversations that might be distracting for the actual VR user.

When working in a group, **one type of virtual experience must be specified within a clearly defined scope so that it is the same for everyone** (e.g., the same square in the city, an identical path they all walk). The activity worker plays the role of a guide who controls the virtual reality experience or works with the controller or computer.

For beginners, it's a good idea to start with one specific 360° photo as part of group memory training, eliminating the possibility of any one user seeing different content in

the shots than the others. In follow-up sessions, it is possible to choose a more challenging path in the virtual experience, e.g., a specific route with multiple images. The **activity worker guides all users through the same route**. It is necessary to avoid having the residents who are waiting for the headset being able to see the current user's situation on the computer screen or additional whiteboard, which would thus provide them with an advantage.

Time limit: if there are fewer headsets in the group, the optimal time for the experience is a maximum of 10 minutes, so that those waiting do not become bored. If the experience includes only one 360° photo, the optimal time in virtual reality is 5 minutes, which is sufficient for the user to capture all the details. It is always advisable to alert the user when half of the set time for the virtual reality experience has elapsed.

Interaction during the experience: The activity worker introduces the user to the purpose and goal of the encounter and characterizes the specific environment in which one is to move within the virtual reality. The activity worker will also set a timeline for viewing the slide, which will be the same for all users in the group. The activity worker provides support to the users during their stay in the virtual reality according to their interest and reactions. The handover of the VR headset and controller to the next user is preceded by **disinfection** of the device (see Chapter 2.2).

Memory training: The activity worker proceeds with respect to the cognitive domain being trained and asks the participants prepared questions. Of course, efforts are made to motivate them positively and to create equal space for all participants in the meeting to express themselves. To do this, the activity worker uses:

- Warm-up questions ("How did you like it in the forest? What interested you most?"),
- Stimulus questions (according to the cognitive domain being trained),
- Additional activities (e.g., quizzes).

Conclusion of the group meeting: The activity worker summarizes the course of the training with an emphasis on the positive aspects. The information about the completion of the experience or the user's preference for the next experience is further recorded by the activity worker in the form usual for the social service provider (e.g., in the care records within the individual planning).

Audiovisual demonstration of memory training after the virtual experience
https://www.youtube.com/watch?v=NZPP1P5DvmM

5.2. Reminiscence

The VIREAS project has confirmed a fact that other studies have demonstrated (see the overview of studies in the introduction): virtual reality gives users stronger recall cues than, for example, presenting pictures. Virtual reality motivates older adults to recall memories in a new and intense way and thus opens new possibilities for its use in reminiscence.[31] The essence of reminiscence is working with memories. When reminiscing, a person can relive the events of one's life, reassess them, and place them back into one's life story (Janečková & Vacková, 2010, p. 14).

The added value of using virtual reality in reminiscence is undoubtedly the user's feeling of being at the center of and literally "immersed" in the experience. The **personalization of the virtual experience** is essential. The experience to be used in reminiscence must correspond to the life story of a particular resident, to one's personal preferences, experiences, hobbies. Thanks to virtual reality, older adults can return to places they have known and to which they have related (see Chapter 4.1.1.). The use of virtual reality in reminiscence can contribute to a more intense self-awareness, inclusion in social life, and improvement in the cognitive functions of older adults.[32]

Just like memory training, reminiscence using virtual reality experience can be implemented in both **individual** and **group** forms. The form of reminiscence is chosen by the activity worker while taking into account the personality traits, adaptation phase, preferences, and cognitive level of the resident.

Individual reminiscence

As well as individual memory training, reminiscence with an individual is used mainly with bedridden people who do not seek company. Reminiscence with an individual can also be used with a resident who is less able to express himself/herself, lives with impaired hearing, etc. When choosing this activity, it is important to set aside a longer period of time and provide a quiet, undisturbed environment to **establish a relationship of trust and safety**. Individual reminiscence, including a virtual experience, usually takes place in the user's room.

Time limit: The virtual experience should be 10–15 minutes (decided by the user), and the follow-up activity approximately 30 minutes (according to the activity worker's time schedule and the user's willingness to share).

Introduction: The theme of the virtual experience should be one that the user likes to remember and with which he/she is familiar. Since the user should be able to choose

31 The British geriatrician Robert Woods defines reminiscence as "the loud or silent (hidden, internal) recollection of events in an individual's life, either alone or with another person or group of people." (Quoted in Janečková and Vacková, 2010, p. 21).

32 The benefits of reminiscence are described in ibid. (p. 80).

from a wide range of experiences, thorough preparation by the activation staff is necessary before starting the activity.

Interaction during the virtual experience: Reminiscence often takes place during the virtual reality application by reminding the user of his/her own experiences and the user starts talking about them. At this point, it is desirable for the activation staff to **let the user take over the role of guide**.

Interaction after the virtual experience: It is useful to link the virtual reality experience to the user's previous experiences (e.g., "When you were walking across the footbridge a while ago, you said you liked the water..."). The activity worker actively listens to the user's narrative and recollections or asks sensitive questions. The role of the activity worker is essential to ensure that the resident wants to return to the virtual reality and continues to find it enjoyable.

Ending the individual reminiscence: The activity worker summarizes the content of the meeting, thanks the user for the trust shown and invites or supports the user to the next reminiscence meeting or agrees on its topic. The information about the completion of the experience, or the preference for the next experience, is recorded in a form that is usual for the social service provider (e.g., an entry in the care records in the individual planning).

Reminiscence group

Before inviting participants to a reminiscence group, it is important to choose a **topic that unites and interests everyone**. This can be, for example, a passion for travel, originating from the same city, an interest in history, nature, gastronomy, etc.

As with group memory training, it is ideal for service providers to own more than one VR headset with accessories. If only one VR headset is available, the ideal number of people in a group is three. In group work, the activity worker **takes the role of a guide** who directs the virtual reality experience or manipulates the controller or computer.

Time limit: If it is a city walk or a thematic excursion, it is appropriate to choose a time limit of up to 10 minutes, taking into account the waiting members in the group. It is again desirable that one activity worker is dedicated to the user in virtual reality and another to the other participants (hushed conversation, escorting to the toilet, serving drinks, etc.). It is recommended that the user is reminded during the virtual experience that half of the set time has elapsed. The activity worker provides support to the user during the virtual reality experience according to one's interest and reactions. When passing the VR headset with the controller between users, care must be taken to **disinfect the device** and to end the experience in a proper technical manner.

Introduction and interaction during the experience: The activity worker recapitulates the theme of the meeting and sets a timeline for the experience (series or one 360° slide), which will be the same for all users in the group. The activity worker reminds all

participants that the main space for sharing the experience will be after everyone has completed the experience. While one resident is going through the virtual experience, others can watch the actions on an additional screen or interactive whiteboard.

Interaction after the virtual experience: After all residents have completed the experience, the activity worker asks prepared introductory questions that are related to the virtual reality experience. It may start with a question like "How did you feel in the forest? Is this forest different from the one you remember?", etc. The activity worker then continues with questions about the topic (in this case, asking about being in the forest). The activity worker gradually becomes more of a **silent observer** in the natural conversation between the residents. The activity worker intervenes in the communication, for example, when there is a need to **support a particular member** of the group and ensures that **everyone** has **space** to express memories and sensitively encourages the group members to do so.

Closing the group meeting: The activity worker thanks everyone for their participation and for sharing their experiences and memories with others and optionally arranges the next topic of a meeting. The activity worker records the information about the completion of the experience or the preference for the next experience in the usual form for the social service provider (e.g., in the care records of the individual planning).

6. Ethical and Competency Principles for the Use of Virtual Reality in a Nursing Home

Ten ethical principles

- Virtual reality is not a therapy or a means of therapy.
- It must be respected that virtual reality may not be suitable or attractive for every person.
- The form and content of the virtual experience must always support the dignity, self-esteem, self-confidence, and self-sufficiency of the user.
- The form and content of the virtual experience must match the cognitive and sensorimotor level of the user.
- The choice of a particular experience must always be up to the residents and must make sense to them.
- There is no "one general goal" of being in virtual reality. It is always necessary to take into account the individual needs, desires, and ambitions of a particular resident.
- The virtual experience must be a safe environment and a source of positive emotions.
- The virtual experience is a tool for socialization; it does not enclose the resident in a virtual world.
- The timing of the experience must respect the resident's daily schedule and habits.
- The activity worker must have the opportunity for good training.

Ten competencies of an activity worker

The activity worker:

- Is capable of the handling and maintenance of technical equipment;
- Is sensitive to the needs of the resident before, during, and after the experience;
- Is able to support the user's needs through a virtual experience;
- Is able to access the possible risks of a user's stay in virtual reality and estimates when to end the virtual experience;
- Is able to appropriately motivate activity in virtual reality;
- Is open to new technologies and their application in practice;
- Is able to navigate the offer of commercially and non-commercially offered virtual experiences;

- Is able to assess the advantages and disadvantages of commercially and non-commercially offered virtual experiences;
- Has personal experience with virtual experiences in the given facility;
- Can use the virtual experiences in follow-up "real" group and individual programs.

Conclusion

In the conceptual manual, we have presented the ways of using virtual reality in keeping older adults active and we have provided recommendations on how to work with this method in a residential facility (or daycare or home environment). In doing so, we have drawn particularly on the studies we have conducted under the VIREAS project (Virtual Reality in Keeping the Elderly Active).

When used properly, the virtual experience brings positive emotions, new impulses, and fulfillment of a range of needs to older adults. The key is undoubtedly the promotion of the awareness of residents' dignity and value. Therefore, both the content and the form of the virtual experience must match the interest, sensory, cognitive, and motor level of the individual. Infantilizing or confusing content or an overly complex controller can make an older user feel embarrassed and discourage one from virtual reality. Appropriate communication with the activity worker before, during, and after the experience is equally important. The virtual experience can help older adults to perceive the continuity and uniqueness of their own life story. Returning to places associated with one's childhood, work, and family life (or traveling to places impossible to visit for financial or political reasons) evokes a range of memories and new connections. A virtual experience can support older adults in realizing that they are still part of a community. Through virtual reality, the user can be in touch with the outside world, experience the hustle and bustle of people, and see what is new in the world. The virtual experience gives a person the opportunity to become aware of the transcendence of everyday life. The residents in our study appreciated the beauty of nature or man-made works, expressed gratitude that this beauty exists, and marveled at the possibilities of technology. For some, the virtual experience provided at least a momentary "escape from reality". It provided them with stimuli that they later reflected on and to which they returned. Despite all the benefits mentioned, however, this method may not suit every resident or every activity worker.

The aim of the conceptual manual was not to present virtual reality as "the best way to activate", but as an increasingly accessible method with great potential but also with risks and limits if the virtual experience is created poorly or used in an inappropriate way. We can summarize that **four factors are essential for fulfilling the potential of this method: high-quality content, user-friendly form, the presence of a trained activity worker, and the creation of a space to share the virtual reality experience in follow-up activities**. If virtual reality is used only as a one-off source of entertainment,

there is a risk of rapid saturation and loss of interest in the activity by both older adults and activity workers.

What do we consider essential? Virtual reality should never represent a kind of happy world where the user is "put away" without further attention from the activity worker. As we have shown in this conceptual manual, the potential of a virtual experience is not only in the content and form of the experience but equally in the opportunity to work with the experience further and share it with other people. With a little exaggeration, we can say the virtual experience becomes real only through such sharing.

In the near future, we can expect further development of the technology toward a wireless solution while maintaining a high visual quality of experience or more subtle headsets, which will undoubtedly simplify the use of virtual reality for immobile older adults. Some of the technical details in the conceptual manual may soon become outdated, but we believe that the main contribution of the conceptual manual lies in the detailed explanation of how to use virtual reality in a meaningful way to the satisfaction of older adults and activity workers or home caregivers. Understanding the possibilities and limitations of this technology is essential to ensure that its use is not perceived by older adults – like Vaclav in our study – as merely a "*bit of a shady deal*".

More information about the project VIREAS

https://vireas.cz/

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Appendices

1. Sample Worksheet

Name of attachment:

Virtual experience theme:

Form: individual/group

Date:

Participant(s):

Meeting objective(s):

Introduction:

Stimulating questions:

Additional activities:

Notes on the virtual experience:

Choice the next experience, inspiration for the next meeting:

2. Sample Memory Training Worksheet

Name of attachment: Example worksheet for memory training

Virtual experience theme: Walk through the city

Form: individual/~~group~~

Date: 20 September 2022

Participant(s): Anezka Lanska

Meeting objective(s): short-term memory training, sensory memory, ideomotor skills

Introduction: What interested you the most, what did you like the most, what is your impression of virtual reality?

Stimulating questions:

- What was the number of the bus outside the station?
- Have you been to any stores?
- Did you hear the water running in the fountain?
- Was there an announcement at the station?
- Was it a man or a woman doing the announcement?
- Can you describe the path we took?

Additional activities:

Quiz: How many people were in the square? 5, 10, 15?

Concentration exercise: an anagram of the name of the shopping center – RYMERUC

Categorization: Fill in the following categories with what you have seen in the city...

- Shops
- Means of transport
- Animals

Notes on the virtual experience:

AL wanted to talk more on her own, she found it hard to concentrate on the next exercise. She wanted to go back to the places where she had erred. She forgot how to work the controller; it is always necessary to demonstrate it again.

Choice of the next experience, inspiration for the next meeting: a foreign city or some exotic place.

3. Brief Instructions for Taking 360° Photos

A brief procedure for taking 360° photos

Always place the tripod on a solid base in a horizontal position to prevent the tripod from moving spontaneously during photography and thus shifting the horizon. For less stable tripods, it is not advisable to use the extreme positions of the telescopic elements, where there is a higher probability of vibration transmission and thus – especially with longer exposures – of image blurring. The camera should be mounted on a tripod to take a portrait format image, thus ensuring a wider angle of view. With a wide-angle lens, it is necessary to choose the correct focal length to keep spherical distortion to a minimum. For the actual photography, it is recommended to use the aperture preference mode and set the lens to a higher aperture number because when creating a panorama, we are working with a space in which we need to achieve a large depth of field.

Three basic rules of tripod photography:

- Turn off the stabilizer, either in the lens or in the camera. The stabilizer is the only element not anchored at the time and moving it can blur the photo.
- Set the ISO as low as possible. Since the correct light level is matched by the length of the exposure, and the tripod provides fixation during the exposure, it is not necessary to shorten the exposure time with a higher sensitivity.
- Use the remote control or self-timer. Pressing the shutter button with a finger may cause the tripod to shake and result in a reduction in sharpness.

Subsequent processing of photographs

Before using photos in virtual reality, it is usually necessary to make adjustments in a photo processing program. The most commonly used tools are Adobe Photoshop and Zoner Photo Studio X. Specific adjustments will always be based on the quality of the original images.

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