

# Older Adults' Experiences and Perceptions of Immersive Virtual Reality: A Protocol for a Systematic Review and Thematic Synthesis

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## Abstract

**Background:** In the current digital age, new opportunities arise to support healthy ageing in older adults as frailty and immobility become more prominent. Immersive virtual reality, which can be defined as a fully computer-generated environment that is displayed through a headmounted display, is one of these technologies. Recently, there has been an increase in the number of qualitative studies exploring the potential for immersive virtual reality in assisting older adults—providing opportunities in health promotion and tackling social isolation and loneliness. With this in mind, the current review aims to explore the following research questions: (1) What are older adults' experiences and perceptions of immersive virtual reality? (2) What are the specific barriers and facilitators to older adults' use of immersive virtual reality? (3) Do older adults find immersive virtual reality acceptable? The objective of the current study is to systematically review and synthesize qualitative data exploring older adults' experiences and perceptions of immersive virtual reality. **Methods:** A systematic review and thematic synthesis will be conducted. Two reviewers will complete title and abstract screening, full-text screening and, data extraction and quality appraisal. A thematic synthesis will be conducted by the lead author, after which the research team and other key stakeholders will discuss the findings and make any necessary changes. Thematic synthesis is derived from the qualitative method, thematic analysis. It involves three key steps: initial coding and grouping of these codes, the formation of descriptive themes from these codes and finally, going beyond the data to form novel insights and theories known as analytical themes. The following protocol has been written following the Preferred Reporting Items for Systematic review and Meta-Analysis Protocols (PRISMA-P) guidelines.

## Keywords

qualitative meta-analysis/synthesis, methods in qualitative inquiry, qualitative evaluation, secondary data analysis, virtual environments

## Introduction

### Rationale

The World Health Organisation (WHO) has projected that the number of people aged 60 or older will rise from 900 million (12% of the global population) in 2015 to 2 billion (20% of the global population) by 2050 (WHO, 2015). With this projected rise in life longevity comes a set of new problems to solve to support the population into old age. Chronic conditions, particularly non-communicable diseases, pose a serious threat to the quality of life of older adults which is why proactive steps must be taken to ensure health and wellbeing are maintained throughout the life span (Beard et al., 2016). In the current

digital age, new opportunities arise to support healthy ageing in older adults (Direito et al., 2016; Schoeppe et al., 2016).

One technology in particular that is beginning to receive more attention is immersive virtual reality (VR). Based on

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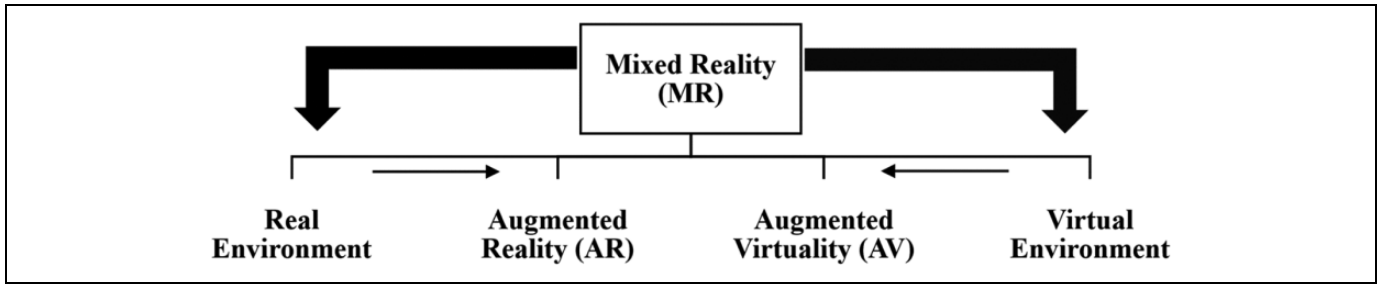
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**Figure 1.** Milgram et al. reality-virtuality continuum.

Milgram et al.' (1995) reality-virtuality continuum (Figure 1), immersive VR is defined as fully computer-generated environments that are displayed through a head-mounted display (HMD). This definition refers to the virtuality end of the reality-virtuality continuum, with the reality end of the continuum referring to the real environment where no computer-generated content is overlaid. Examples of displays found between these two ends include augmented reality-based displays where digital information is overlaid on the real environment through devices such as see-through HMDs, mobile phones or computer monitors. In their review examining how immersive VR can enhance our lives, Slater and Sanchez-Vives (2016) discuss how the specific characteristics of immersive VR, as defined here, can enhance the lives of people through domains such as education, science and training.

Hughes et al. (2017) specifically discuss the potential for immersive VR to assist older adults in their everyday lives—providing opportunities in health promotion and tackling social isolation and loneliness. Immersive VR can be utilized to connect users to typically inaccessible resources and learning experiences with other users. With the emergence of new, high-quality immersive VR technologies that are now available to the general public in higher-income countries, researchers have begun to examine older adults' experiences and perceptions of immersive VR.

In digital technology development and design, qualitative feedback from the user can be invaluable as it provides the developer with rich information to work with when designing digital technology content (Yardley et al., 2015). Although a number of recently published systematic reviews and systematic review protocols aim to synthesize quantitative literature on this topic, (Corregidor-Sánchez et al., 2020; Kor et al., 2018; C. Snoswell & Snoswell, 2018; A. J. Snoswell & Snoswell, 2019), to our knowledge none have yet synthesized qualitative studies.

In recent years, we have seen an increase in qualitative studies examining older adults' perceptions of and experiences with immersive VR (Baker et al., 2019, 2020; Liu et al., 2019). However, there has been no systematic synthesis of these studies to inform the design of new, more accessible immersive VR technologies, as defined by Milgram et al. (1995) that can potentially enhance health and wellbeing. Using the SPIDER tool (Table 1), (Cooke et al., 2012), the following research

questions were formed to guide the review and synthesis of the existing literature:

- What are older adults' perceptions of and experiences with immersive virtual reality?
- What are the specific barriers and facilitators to older adults' use of immersive virtual reality?
- Do older adults find immersive virtual reality acceptable?

### Objectives

The objective of the current study is to systematically review and synthesize qualitative data exploring older adults' experiences and perceptions of immersive VR.

The current protocol has been completed following the Preferred Reporting Items for Systematic review and Meta-Analysis Protocols (PRISMA-P) guidelines (Moher et al., 2015). The systematic review and thematic synthesis will be completed following the enhancing transparency in reporting the synthesis of qualitative research (ENTREQ) guidelines (Tong et al., 2012).

### Method

#### Eligibility Criteria

Studies will be included if they examine older adults' perceptions of and experiences with immersive VR. As there is no generally accepted definition of older adults, we will broadly define older adults as adults where the mean sample age is over 60 years as this is a commonly used cut-off in ageing research (Shenkin et al., 2017). Only studies where complete visual immersion is facilitated by the use of, at least, a head-mounted display (HMD) will be included. Studies will be included if a qualitative method is used for both data collection and analysis, they are peer-reviewed publications and, they are written in English.

Older adults with a diagnosed neurodegenerative disorder will be excluded as there is evidence that their experiences with virtual reality—as well as the application of virtual reality in this cohort—differ considerably to neurotypical individuals' experiences (Hodge et al., 2018; Hughes et al., 2017). Additionally, a separate systematic review and thematic synthesis

**Table 1.** SPIDER Tool for Defining Research Questions and Search Terms.

| SPIDER Construct       | Construct Description  |
|------------------------|--|
| Sample                 | The term “sample” is used as it is deemed more representative of the small groups of participants recruited in qualitative studies. In this review, the sample of interest is older adults aged 60+ years.   |
| Phenomenon of interest | This term allows for behaviours, decisions and individual experiences recorded in qualitative studies to be captured. The phenomenon of interest in this case is older adults’ perceptions of and experiences with immersive VR. The experience of “presence”, described by Slater and Sanchez-Vives (2016) as the feeling of being present in the virtual world with the belief that the events occurring there are really happening, is a key characteristic of immersive VR that enables the enhancement of the virtual experience. As you remove the sensory substitutions that enable this sense of presence, such as an HMD and haptic devices, the experience changes drastically for the user, making it more challenging to link the qualitative experience. Therefore, as each of the technologies across the reality-virtuality spectrum provide different experiences for the user, it was decided that adhering to Milgrim and colleagues’ definition of immersive VR would provide a more meaningful and translatable qualitative synthesis. |
| Design                 | As there are no inferential statistics in qualitative studies, the theoretical framework and additional qualitative methods employed in these studies can provide more insight into the “robustness” of the study and its analysis (Cooke et al., 2012). The study designs searched for in this review include qualitative research methods such as focus groups and semi-structured interviews.   |
| Evaluation             | This term allows for the mostly subjective constructs in qualitative research to be recorded and interpreted, such as attitudes and views. As this review is dealing with individuals’ experiences with interacting with an object, terms such as “acceptability” and “usability” will be included to identify studies.  |
| Research type          | This refers to the type of research studies included in this review. In this case, qualitative and mixed-methods studies will be searched for.   |

**Table 2.** SPIDER tool for Defining Research Questions and Search Terms.

| SPIDER                         | Description   | Search Terms   |
|--------------------------------|---|--|
| S: Sample                      | Older adults, aged 60+  | “older adult*” OR “young old” OR senior* OR “elder*” OR ag\$ing OR “old age”   |
| P of I: Phenomenon of Interest | Older adults’ perceptions and experiences of immersive virtual reality  | “virtual realit*” OR vr OR “virtual environment*” OR “mixed realit*” OR mr OR immersive OR audiovisual   |
| D: Design                      | Qualitative research methods, including interviews, focus groups, and open-ended questions  | Interview* OR “focus group*”   |
| E: Evaluation                  | Acceptability, usability, feasibility, perceptions, perspectives, attitudes, views, beliefs, barriers, experience, facilitators, opinions | accept* OR usab* OR percept* OR perspect* OR feasib* OR attitude* OR belie* OR believe* OR view* OR barrier* OR experienc* OR facilitat* OR opinion* |
| R: Research type               | Studies with a qualitative design or including qualitative results that are reported separately to quantitative results                   | qualitative OR “mixed method*”   |

examining key stakeholders’ experiences and perceptions of virtual reality for older adults living with dementia is currently underway (Flynn et al., 2020). Reviews, conference abstracts, opinion pieces, grey literature and editorials will be excluded.

### Information Sources

The current state-of-the-art in virtual reality technology emerged in 2012 with the founding of Oculus, followed by other companies, marking what is known as the “second wave” of virtual reality technology and the most commonly used virtual reality systems both in research and in public domains today (Anthes et al., 2016). As a result, a search of the following databases will be conducted for relevant studies published in English from 2012 to 2020: Scopus, Embase and Compendex. If it is not possible to access a paper or if relevant data is missing from the paper, the author(s) of the paper will be contacted.

### Search Strategy

In collaboration with a university librarian, a search strategy was developed, with key terms from this strategy tested in a scoping search of the literature. Relevant keywords and phrases will be used in each database. Keywords and phrases include older adults, virtual reality, perceptions and experiences. The search strategy, available in the additional Online Supplemental files, was developed in Embase and will be adapted as necessary in the other databases. In order to identify studies meeting these criteria, search terms were defined using the SPIDER tool (Table 2; Cooke et al., 2012).

### Study Records

Titles and abstracts will be extracted from the chosen databases and combined in EndNote X9. Duplicates will be removed using

the Remove Duplicates function in Endnote X9. Records will be manually screened for remaining duplicates in Endnote X9.

Title and abstract screening will be conducted by one reviewer (DH) using the Rayyan data screening tool (Ouzzani et al., 2016). A random sample of 20% will also be screened by a second reviewer (AF). A kappa statistic will be calculated to assess inter-rater reliability (Viera & Garrett, 2005). Where disagreements arise, unresolved cases will be discussed with a third reviewer (JW, OC or JMS, depending on expertise required) until an agreement can be reached. Full text screening will be completed by two independent reviewers (DH, AF). Where disagreements arise, unresolved cases will be discussed with a third reviewer (JW, OC or JMS, depending on expertise required). Forward and backward citation searching will be completed for all studies included after full text screening. This search will be conducted by DH. Title and abstract, and full-text screening of the studies identified through forward and backward citation searching will be completed by two reviewers (DH, AF). Two reviewers will perform data extraction (DH, AF), extracting the following data: citation, country of publication, study setting, study design, study aims and/or objectives, recruitment strategy, sample size, participant characteristics (age, sex, place of residence, mental status, work status, health status, technology experience), immersive virtual reality hardware and software systems, data analysis technique, all data (quotes, themes and author interpretations) reported in the results section relevant to the review question. This data will be organised for analysis using NVivo (QSR International Pty Ltd., 2020).

### Data Items

All data pertaining to older adults' perceptions of and experiences with immersive VR will be synthesized. No outcome variables have been specified prior to analysis.

### Risk of Bias in Individual Studies

The Critical Appraisal Skills Programme (CASP, 2020) tool for qualitative research will be used to appraise the quality of individual studies. No studies will be excluded based on this appraisal. However, the outcomes of the appraisal will be noted for each study.

### Data Synthesis

A thematic synthesis (Thomas & Harden, 2008) will be conducted. Thematic synthesis is derived from the qualitative method, thematic analysis (Braun & Clarke, 2006). Thematic synthesis involves three stages: the first and second stages are dedicated to coding the data taken directly from the included studies and organising them into descriptive themes, where finally the third stage goes beyond these data to create new interpretations or theories (analytical themes) of the combined studies.

### Confidence in Cumulative Evidence

The Confidence in the Evidence from Reviews of Qualitative research (CERQual), (Lewin et al., 2015), will be used to assess the confidence that can be attributed to the evidence informing each individual review finding.

### Reflexivity

As qualitative research is considered a subjective process (Braun & Clarke, 2013), it is essential to be reflexive throughout—considering what perspectives, experiences and world-views each of the contributors bring to the research and how they influence its process. Three authors have backgrounds in social science, all of which are in health psychology, (D.H., J.W., J.M.S.), and two of which are experts in their fields (J.W., J.M.S.), one author has a background in occupational therapy (A.F.) and one author is an expert in computer science (O.C.). Throughout the review process, authors' preconceptions about the topics being discussed will be taken into consideration when making key decisions relating to the review and analysis. A reflexive journal of the review and analysis processes will be kept as a record of the critical evaluation of the authors' influence on the review.

### Acknowledgment

I would like to thank the university librarian, Rosie Dunne, for providing feedback on the search strategy and assisting in identifying the appropriate databases to conduct the search in.





### Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

### Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was conducted with the financial support of the Science Foundation Ireland Centre for Research Training in Digitally-Enhanced Reality (D-REAL) under Grant No. 18/CRT/6224.

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### Supplemental Material

Supplemental material for this article is available online.

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